

MEMORANDUM

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Educational Homogamy in Norway -trends and patterns

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EDUCATIONAL HOMOGAMY IN NORWAY
– trends and patterns

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Abstract

This paper focuses on trends and patterns in educational homogamy over time. A number of previous studies have documented a fairly high level of homogamy in Norway. Most of these studies, however, have been local and ethnographic, or based on national data measuring homogamy within a limited time period. Based on a 10 percent sample of the 1980 Census, we are comparing patterns of educational homogamy across six cohorts, where the oldest is born between 1900-1909. The results show a decline in educational homogamy over time, both in absolute terms and when controlling for the general increase in educational level during the period.

Key words: Educational homogamy, log-linear models, time trends

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Introduction

For most people, the first group they are affiliated with, is the family. The family is a vital institution, since it mediates between the individual and society. Patterns of family formation and choice of partner are therefore important topics of investigation, comprising both the societal and the individual level of analysis.

Marital homogamy usually refers to marriage between partners of the same social group. Homogamy based on group affiliation may be – and indeed has been – defined in various ways; either by social background, by ethnic group, by religious group, by regional, demographic or social dispersion, by educational attainment, by status group or present social class. Homogamy indicates few intimate and profound relations between members of different social groups. On the other hand, high rates of intermarriage are expected to reduce the ability of the family to pass on to its offspring group specific values and world views. Thus, intermarriage can be assumed to be a cause, as well as an indicator, of social and cultural openness and integration (Merton [1941] 1972; Blau, Blum and Schwartz 1982; Labov and Jacobs 1986; Pagnini and Morgan 1990; Hout and Goldstein 1994; Botev 1994; Kalmijn 1991b,1998; Smits, Ultee and Lammers 1998).

Studies of marital homogamy, and its counterpart intermarriage, also give insight into social inequality and differentiation. Since income and other resources are related to the household, marital homogamy could imply larger inequalities between households than between individuals.

In this paper we will explore some elements of these features, focusing on educational homogamy in Norway, covering six cohorts, born between 1900 and 1959. Couples with similar level of education are defined as homogameous, whereas couples with different levels of education are not.¹ The task we will investigate here is whether there in Norway are any trends over time in educational homogamy, and if so, what patterns can be detected.

Previous studies of homogamy

Most people in the Western world today marry for love. However, "love, which we trust so much, does not operate quite in accordance with the statistician's principle of randomisation", and this is not surprising (Øyen 1964:179). According to popular held beliefs, 'similarities attract'.²

¹ Given that many women, in particular in the oldest cohorts, have not been gainfully employed, education is a more convenient measure of homogamy than for instance occupationally based class or stratification schemes.

² Popularly held beliefs have, however, a tendency to be ambiguous. In addition to the idea that 'similarities attract' (in Norwegian: 'krake søker make'), another popular held wisdom is that 'opposites attract' (Øyen 1964:179). Thus, whatever research results the social sciences bring forward, these results may be regarded as trivial, confirming already well-known and established 'truths'.

Thus, people "tend to fall in love with others with similar backgrounds, with similar levels of educational attainment, and with the same ethnic and religious heritage." (Jacobs and Furstenberg 1986:715).

Earlier Norwegian studies of marital homogamy include ethnographic studies of rural areas (Sundt 1866, Øyen 1959, Dyrvik 1970); studies of regional, demographic and social dispersion in Oslo (Petersen 1949, Øyen 1964, Ramsøy 1966, Ramsøy and Iversen 1967); and studies of homogamy based national data (Birkelund 1987, Kravdal and Noack 1989, Hansen 1995, Birkelund and Goodman 1997. See also Eriksen and Wetlesen 1996).

Although the measure of homogamy in these studies differs, they all confirm a fairly high level of marital homogamy in Norway. Øyen, for instance, found a correlation of .77 between the husband and wife's occupational prestige-groups within a sample of newlywed in Oslo in 1962/63 (Øyen 1964).

Given the fairly high levels of homogamy documented in these studies, we would expect to find high levels of educational homogamy in Norway using the Census data. However, these earlier studies of homogamy do not explore trends over time in patterns of homogamy. Would there be reason to expect an increase or a decline in educational homogamy over time, or, perhaps, should we expect stability over time?

Previous studies give a differentiated picture of trends in homogamy over time: Some countries show an increase in homogamy, such as the USA (Mare 1991, Kalmijn 1991a) and Germany (Blossfeld and Timm 1997, referred in Kalmijn 1998). Other countries show stability over time, and a Swedish study (see Henz and Jonsson in this book) shows a decline in educational homogamy over time.³

Comparative analyses have also shown a mixed cross-country pattern. In a study of 64 countries,⁴ Smits, Ultee and Lammers (1998) argue that educational homogamy is related to the level of economic development: "As the level of development increases, educational homogamy increases, subsequently peaks, and then decreases." (Smits, Ultee and Lammers 1998:281). They have, in other words, found a non-linear relationship between the two variables 'educational homogamy' and 'economic development'.

Their study is based on a number (albeit large) of countries at different levels of 'economic development', not diacron data. We do therefore still not know the association between educational homogamy and economic development over time within each particular country. But since this study might be our best guess, we might predict a decline in educational homogamy in Norway in the twentieth century, since Norway in this period went through a process of economic development from a fairly low level to a more advanced level of industrialisation.

³ A common feature in the (western) societies analyzed "has been a decline in the importance of social background for marriage choice", indicating that in younger cohorts, parents have less control over their children's choices, as well as the increasing importance of new marriage markets, such as the schools and universities (Kalmijn 1998:411).

⁴ Including a Norwegian survey from 1972.

All in all, earlier studies of educational homogamy do not give us clear expectations as to what trends and patterns we might find in the Norwegian data. Some (most) national studies show an increase in marital homogamy over time, others show a slight decline. A common feature of most previous studies has been their descriptive character, documenting patterns of homogamy within specific time and space constraints. As argued by Kalmijn (1998), there is less emphasis on the mechanisms that generate these patterns of marriage. Let us briefly consider theoretical arguments about marriage selection.

Theoretical arguments

At the individual level, two factors are important. First, marital selection is related to *the preferences* of individuals. It is generally the case that individual preferences are formed during the socialisation process, and since social groups influence these processes, members of different social groups are expected to differ in their preferences. People with similar cultural backgrounds share a "common universe of discourse" (DiMaggio and Mohr 1985) and are therefore more likely to confirm each other's behaviour and worldviews (Kalmijn 1994).⁵

Individuals are seen as agents who try to maximise (or satisfy) their future family income and social status by searching for what they regard as the most attractive partner. Since preferences reflect social and cultural values, the notion of attractiveness is also expected to vary - not only among members of different social groups, but also over time.

This is the case, not only for social classes, etc., but also for gender: the traditional gender division of labour would imply gender specific roles: a male provider and a female caretaker. Based on these family values, for women, an attractive man would be expected to be a good family provider. Whereas for men, an attractive woman would be expected to be a good mother and housewife. Educational attainment would therefore be more important for a woman than a man in their choice of partner.

More modern values, not based on a traditional gender role system, would imply, at least partly, different sets of preferences. Today, women take longer education and also participate in the labour market. Thus, educational attainment is important to women as well as men. When women take more part in the labour market, their human capital are more important, also for the men who marry them.⁶

Second, marital selection is related to and constrained by the opportunity structure; the *marriage market*. The structure of the marriage market influences the chances of

⁵ Marriage may also be analysed from an exchange perspective, where spouses bring different resources and capacities into the marriage (Becker 1981).

⁶ In a similar vein: When men take more part in care work at home, their potential as a good father is also of importance for the women who marry them. Therefore, women would be expected to prefer men who could both be a good provider and a good father. (See Wærness 1987; Thagaard 1997; Ellingsæter 1998; Crompton 1999). Value systems, such as modern gender values, are also differentiated across social groups, such as generations and social classes.

individuals to realise their preferences. Marriage markets can be defined in terms of the overall demographic composition of the population as a whole, or in a more local fashion, such as educational institutions, workplaces, etc. (England and Farkas 1986; Mare 1991; Blossfeld, Timm and Dasko 1998).⁷

Competition in the marriage market determines who gets who: “The outcome of this competition is that the most attractive candidates select among themselves while the least attractive candidates have to rely on another” (Kalmijn 1998:398).

In his study of educational homogamy in the USA, Mare found some evidence of increased homogamy, which might be the result of “increasing competition in the marriage market for wives with good prospects in the labor market.” (Mare 1991:15).⁸

At the societal level, competition on the marriage market for the most attractive partner (as measured by socio-economic resources) leads to an aggregate pattern of homogamy.⁹

Let us now summarise our expectations. Earlier studies show high levels of marital homogamy in Norway. Some of these studies are from the nineteenth century and some are more recent. We would, therefore, expect a fairly high level of educational homogamy in Norway. Since new gender roles imply that women’s educational attainment is increasingly important, we would expect an increase in educational homogamy over time, i.e. across the cohorts we will investigate.

However, Norway has developed over the twentieth century from a fairly low level to a high level of economic development. In line with the arguments found in Smits et al. (1998), we would expect a decrease in educational homogamy over time. This expectation would also be in line with the Swedish paper.

Our expectations would therefore be a bit uncertain.

Data and variables

The data set we use is a 10 percent sample from the Norwegian 1980 population census of people born between 1900 and 1959.¹⁰ The sample was equipped with the variables age, gender, education (type and highest achieved level by 1980), marital

⁷ Institutions of higher education are important both as marriage markets and as institutions that might affect the students’ preferences. Workplaces are important, for the same reasons, etc.

⁸ Mare (1991) has also shown that the timing of the transition out of school and into marriage is important.

⁹ Dagsvik has developed a model for aggregation in matching markets, which can be utilized both for labour markets and marriage markets. See Dagsvik 2000 and Dagsvik, Flaatten and Brunborg 1998.

¹⁰ Due to a different method of data collection, the 1990 Census does not include sufficient information on partner/spouse. We have therefore used the 1980 Census for these analysis, and will later return to a new study of educational homogamy, using the 2001 Census, in order to be able to include cohorts born after 1949.

status, and for married and previously married people also the age and education of their present or last spouses. First spouse and education level at the time of marriage would be preferable but were not available. Kalmijn (1991a) pointed out that stability of inhomogameous couples is lower than stability of homogameous couples and that the degree of homogamy therefore will increase by time causing bias. However, in the cohorts we study (except possibly the youngest one), divorce rates were low. Furthermore, in our oldest cohorts where most people had a low level of education they would have completed their education by the time of marriage.

We have constructed a *cohort* variable, with six 10-year cohorts: the oldest cohort consists of individuals born between 1900 and 1909, and the youngest cohort comprises individuals born between 1950 and 1959.

Educational level is measured by the Norwegian Standard Classification of Education 1973 (Statistisk sentralbyrå 1973), with a few modifications¹¹ (see Børke 1984:131, Vassenden 1987:48). Level 1: compulsory education (years 1-9, not including pre-school education). Level 2: second level I (10 years). Level 3: second level II (11-12 years). Level 4: college/university level I (13-14 years). Level 5: college/university level II (15-16 years). Level 6: high university level (17 years or more).

Marital status is a dichotomy, where individuals who are married at the time of the census, or who have been married before, are classified as married. Thus, those who are not and never have been married are classified as unmarried.

Before we consider the patterns and trends in educational homogamy across these cohorts, we will explore the relationship between gender, education, cohort and marital status.

Who gets married?

Table 1
Unmarried men and women by cohort.

	Men	Women
1900-1909	12,2	16,4
1910-1919	10,7	10,4
1920-1929	10,8	7,0
1930-1939	10,4	4,7
1940-1949	14,3	7,6
1959-1959	56,8	36,3

Data: Census 1980.

Table 1 shows the percentage unmarried by cohort and gender. In the oldest cohort, 12 percent of the men and 16 percent of the women never married. In the following cohorts, approximately 11-14 percent of the men are unmarried, compared with 5-10

¹¹ The changes are related to old types of education (undertaken before 1973) which was not classified in 1973; education that was classified with other types of education in 1973, but later given a separate code; education that did not exist in 1973, but did so in 1980, and finally, education undertaken abroad. (Vassenden 1987:48).

percent of the women.¹² We also notice that in the youngest cohort, 57 percent of the men and 36 percent of the women are unmarried. This is to be expected, since this cohort was 20-29 years at the time of the census.

Figure 1

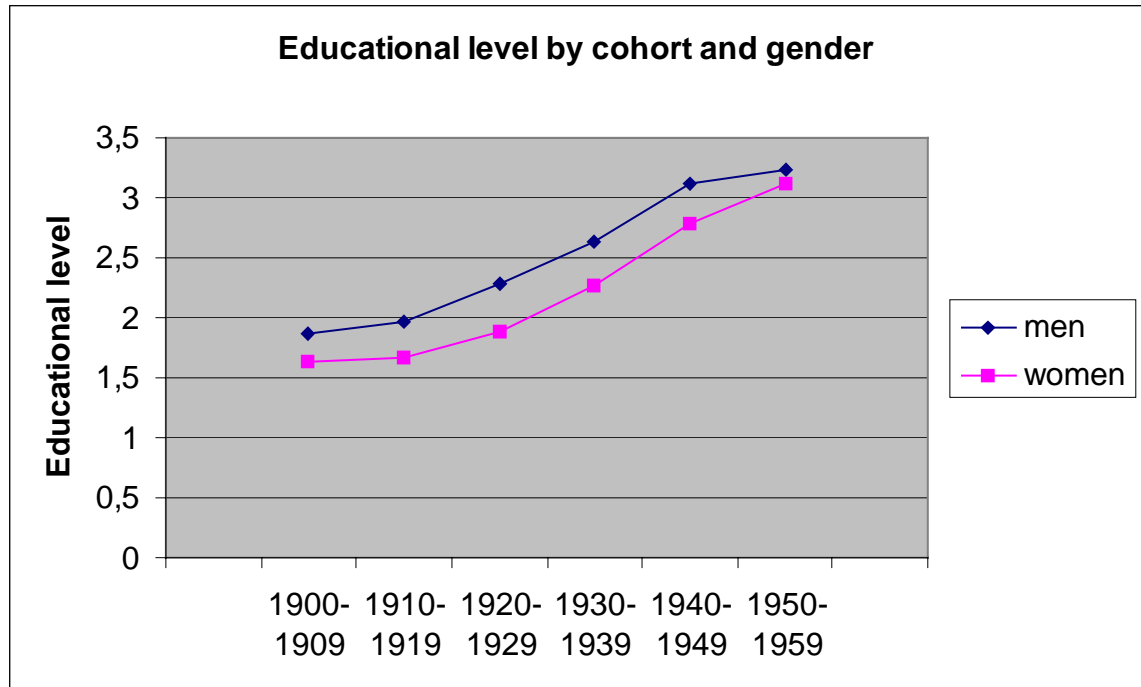


Figure 1 shows the overall increase in the average level of education across these cohorts. We notice that the gender gap in education is fairly stable across cohorts, except for the last cohort (i.e. individuals who were in their twenties in 1980), where the gender gap in education has been closed. This development is well known in many countries (see Shavit and Blossfeld 1993).

It is well established knowledge that men with low education and women with high education have a lower propensity to marriage than others (Blom, Noack and Østby 1993; Skrede 1999).¹³ Our data allow us to explore whether this relationship between gender, education and marriage has changed across cohorts.

Table 2 shows the interrelationship between level of education, cohort and marriage separate for men and women. The reference groups in these analysis are men/women with the lowest level of education (compulsory schooling) in the oldest cohort (1900-1909). Compared with men in this reference group, no group of men have a lower probability of marrying (i.e. odds ratios lower than 1.000), except men with low education in the 1940-49 cohort and **all** men in the youngest cohort (1950-59).

¹² Interestingly, the percentage unmarried women within these cohorts fluctuates substantially. It will be beyond the scope of this paper, however, to explore why this is the case.

¹³ As argued above: Given that men traditionally were breadwinners and women caretakers, education has had a different meaning to men and women with regard to marriage. A man with a low educational level might be regarded as a less good provider compared with a man with a higher education. Whereas women with low education might be more in need of a provider than women with higher education.

Table 2
Marriage by cohort, education and gender. Logistic regression. Oddsratios.

Cohort and education	Men	Women
1900-1909		
Level 1	Ref.group	Ref.group
Level 2	2.201 **	.759 **
Level 3	3,024 **	.504 **
Level 4	2,867 **	.365 **
Level 5	1.301	.221 **
Level 6	3.881 **	.491
1910-1919		
Level 1	1.139 **	1.676 **
Level 2	1.988 **	1.638 **
Level 3	3.907 **	.833
Level 4	3.863 **	.451 **
Level 5	2.139 *	.438 **
Level 6	4.892 **	.720
1920-1929		
Level 1	1.050	2.620 **
Level 2	1.781 **	2.773 **
Level 3	3.313 **	1.950 **
Level 4	3.482 **	.809 *
Level 5	3.566 **	.838
Level 6	4.095 **	.811
1930-1939		
Level 1	1.043	4.119 **
Level 2	1.797 **	3.863 **
Level 3	2.406 **	3.052 **
Level 4	3.272 **	1.748 **
Level 5	2.591 **	1.433 *
Level 6	3.185 **	1.237
1940-1949		
Level 1	.785 **	2.678 **
Level 2	1.093	2.439 **
Level 3	1.315 **	1.975 **
Level 4	1.311 **	1.289 **
Level 5	1.032	.990
Level 6	1.277 **	.811
1950-1959		
Level 1	.174 **	.668 **
Level 2	.109 **	.308 **
Level 3	.091 **	.160 **
Level 4	.111 **	.209 **
Level 5	.225 **	.272 **
Level 6	.273 **	.282 **
Likelihood Ratio Chi-square	22365.191	13064.895
Degrees of freedom	35	35
Percent correctly classified	81.32	85.48

* significant at 0.05 ** significant at 0.01

Looking at women, we get a mostly reversed pattern. Compared with women in the oldest cohort with the lowest level of education, all women within the same cohort had a lower probability of marrying. In each of the following cohorts, we see that women with low levels of education have higher probabilities of marrying (i.e. odds ratios above 1.000). This also applies to women with medium level of education for

cohorts 1920-29, 1930-39 and 1940-49. We also see that women with higher levels of education have lower probabilities of marrying (though not significantly different from the reference group). The youngest cohort (1950-59) of women differs from the others, reflecting the fact that women in this cohort were in their twenties at the time of the census.

We have seen that education, gender and cohort do have an impact on marriage, and these analyses have confirmed the old 'wisdom' – men with low education and women with high education have the lowest probabilities of marrying. The general increase in educational level for both men and women across cohorts, see figure 1, does not seem to have altered the gender specific impact of education on marriage.

Patterns of educational homogamy

We will now proceed to look exclusively at those who are married or have been married – what pattern of educational homogamy can be detected? The first part of our analysis is based on all individuals who were married in 1980 or had been married earlier, and who were born between 1900 and 1959. People who had never been married were excluded from the sample, as were people with missing information on their educational level, or their partner's educational level. This made a sample of 78653 men and 78602 women.

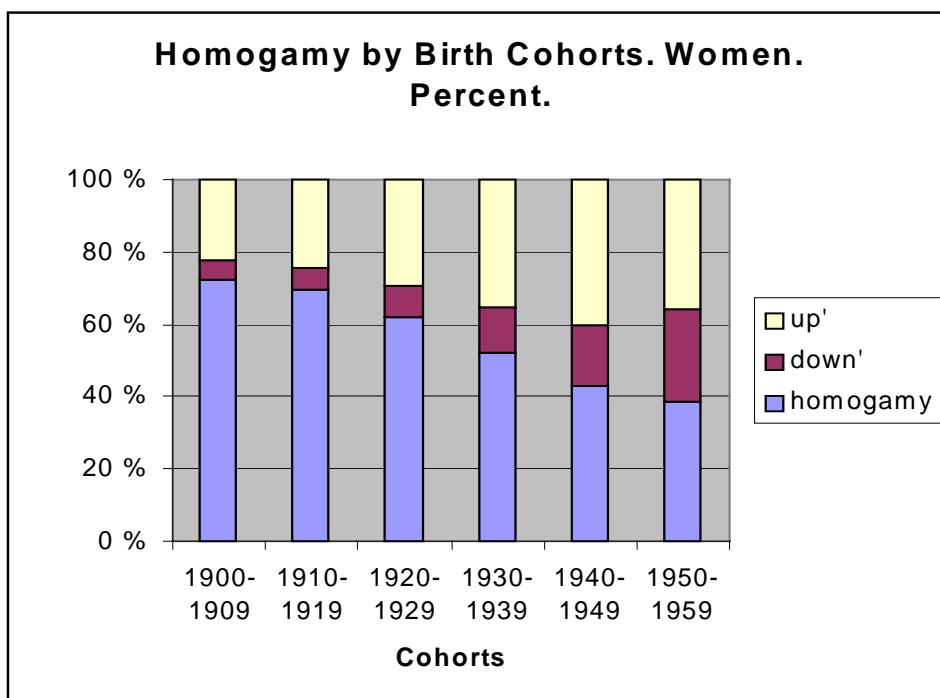
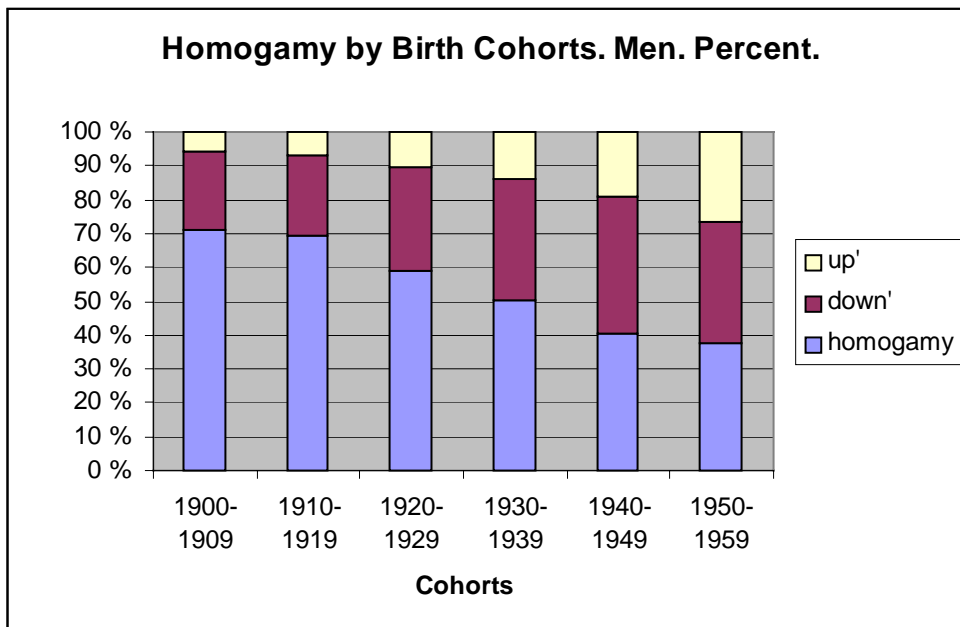
There may be selection bias in the sample, if for some of these cohorts the propensity to homogamy was different for couples where no one survived until 1980 than for couples where at least one survived. Approximately 10 percent of the women and 10 percent of the men in the original sample whose spouses were still alive will also have their spouse in the sample, thus generating duplicates. The actual extent of the duplication has not been estimated, but it can be anticipated that less than 4 percent of the sample have 4 other percent as their duplicates with a higher percentage for the younger cohorts than for the older. This duplication has taken place randomly but generates an overrepresentation of survivors, which has not been accounted for in the analysis.

When we study the association between couples' educational levels, we may distinguish between two categories of marriages: in a homogameous marriage the spouses have the same level of education, in a heterogameous marriage this is not the case. These marriages may be characterised as 'marrying down' or 'marrying up' – depending upon one's point of view. A women with low education who has married a man with a higher education has 'married up', whereas the same man has 'married down'. This is a fairly common pattern, reflecting the different educational level of men and women in general; i.e. the opportunity structure differs for men and women.

Figure 2 shows educational homogamy by cohort, separately for men and women. We see an overall decrease in educational homogamy across cohorts. In the oldest cohort, approximately 70 percent of all marriages were homogameous, compared to less than 40 percent in the youngest cohort. We also see that for both men and women, there is an increasing percentage across cohorts who 'marries up' – more so for women than men. In a similar vein, there is also an increasing percentage across cohorts who 'marries down' – more so for men than for women.

Thus, for cohorts born between 1900 and 1959, we see a fairly strong decline in educational homogamy, from approximately 70 percent in the oldest cohort to less than 40 percent in the youngest cohort. In the same period, however, there has been a general increase in the level of education for both men and women. The results documented above might therefore be affected by relative group sizes, making comparisons across cohorts difficult. The next paragraph therefore develops a model of homogamy that controls for these structural changes.

Figure 2
Educational homogamy. Norway.



A model for homogamy

We are here primarily interested in how the propensity to educational homogamy has developed over time when controlling for the general increase in the level of education for both men and women. An over-all measure of homogamy in nominal classifications based on log-linear models is proposed below. This measure is a generalised odds ratio and can be described by a set of contrasts for log linear parameters.

Consider an $I \times I$ table for two categorical variables X and Y which in our application are the her and his educational level in a randomly selected married couple. X and Y take values $x, y = 1, \dots, I = 5$. The expected cell frequencies are μ_{xy} . Consider the measure

$$H = \frac{(\prod_{i=1}^I \mu_{ii})^{1/I}}{(\prod_{x \neq y=1}^I \mu_{xy})^{1/I(I-1)}}$$

If X and Y are independent, $H=1$. A tendency to concentration on the diagonal makes $H > 1$. It is easily seen that H is not affected by multiplication of some row or column by a constant. H is therefore not affected by purely marginal changes of the table. Formulating the log expected cell frequencies in log-linear terms, that is

$$\log \mu_{xy} = \lambda + \lambda_x^X + \lambda_y^Y + \lambda_{xy}^{XY},$$

$\log H$ is seen to be a contrast in the two-way parameters λ_{xy}^{XY} 's only:

$$\log H = \frac{1}{I} \sum_{i=1}^I \lambda_{ii}^{XY} - \frac{1}{I(I-1)} \sum_{x \neq y=1}^I \lambda_{xy}^{XY}.$$

In $\log H$ each of the I diagonal cells have been given a weight $1/I$ while each of the $I(I-1)$ off-diagonal cells have been given a weight $-1/I(I-1)$. So the weights sum to zero across row and across each column and thus across all cells in the table. This is essential for making $\log H$ dependent of the λ_{xy}^{XY} 's only and independent of the row and column marginals.

Studying the variation of H or $\log H$ over time or cohorts is equivalent to studying this quantity in each layer of a three-way table μ_{xyc} where the c dimension represents the cohort variable C . The log-linear representation of such a three-way table is

$$\log \mu_{xyc} = \lambda + \lambda_x^X + \lambda_y^Y + \lambda_c^C + \lambda_{xy}^{XY} + \lambda_{xc}^{XC} + \lambda_{yc}^{YC} + \lambda_{xyc}^{XYC}.$$

In log-linear terms the k -th layer $\log H$ can be expressed as

$$\log H_c = \frac{1}{I} \sum_{i=1}^I (\lambda_{ii}^{XY} + \lambda_{iic}^{XYC}) - \frac{1}{I(I-1)} \sum_{x \neq y=1}^I (\lambda_{xy}^{XY} + \lambda_{xyc}^{XYC})$$

$c = 1, \dots, C$. The hypothesis of no change in the over all propensity of homogamy, that is the hypothesis

$$Hyp_0 : H_0 = H_1 = \dots = H_C$$

can be expressed as the hypothesis that C contrasts in the $\ln H_c$'s are zero:

$$\ln H_c - \ln H_0 = 0, \quad c = 1, \dots, C,$$

or equivalently

$$\frac{1}{I} \sum_{i=1}^I (\lambda_{ii}^{XYC} - \lambda_{ii0}^{XYC}) - \frac{1}{I(I-1)} \sum_{x \neq y=1}^I (\lambda_{xy}^{XYC} - \lambda_{xy0}^{XYC}) = 0,$$

$c = 1, \dots, C$. This clearly only depends on the third-order effects. Particularly, if the homogeneity model indicating constant cross-ratios across layers hold, (all $\lambda_{xy}^{XYC} = 0$), the hypothesis H_0 will also hold.

Based on the dataset we could construct an approximate 10 percent sample of all legally married couples where *both spouses* were born between 1900 and 1959 and for which at least one of the spouses was alive in 1980. The 10-year cohort variable is based on average age/birth year of the spouses. This made a sample of 152106 couples where at least one of the spouses was still alive at the census time in 1980.

Table 3 shows the estimated contrasts (1) for the six 10 years age cohorts being analysed using the cohort 1900-1909 as reference. The estimates have been based on the fits from a saturated model.

Table 3

Cohort	$\log(H_k / H_0)$	Standard Error	Wald	p-value
1900-09	0			
1910-19	-0.0006	0.1048	$2,9 \times 10^{-5}$	0.9957
1920-29	-0.1094	0.0994	1.211	0.2711
1930-39	-0.1202	0.0981	1.503	0.2203
1940-49	-0.1579	0.0965	2.678	0.1017
1950-59	0.0315	0.0971	0.105	0.7460

Table 4 shows the estimated generalised odds ratios for each cohort and their 95 percent confidence intervals

Table 4

Cohort	H_k / H_1	Lower bound	Upper bound
1900-09	1		
1910-19	0.9994	0.8139	1.2272
1920-29	0.8964	0.7377	1.0892
1930-39	0.8867	0.7316	1.0747
1940-49	0.8539	0.7068	1.0317
1950-59	1.0320	0.8531	1.2483

As is seen from tables 3 and 4 none of the five contrasts are significantly different from zero although the data may indicate a slightly decreasing trend in direction of lower propensity to homogamy. However, other runs have shown that the increase in the estimates from the 1940-49 cohort to the 1950-50 cohort is very significant. The increase can however stem from the fact that far from all individuals from the 1950-59 cohort had yet completed their education or found their partner in 1980. Data from the coming census in 2001 will show if the seemingly slightly decreasing propensity to homogamy continued for the 1950 and 1960 cohorts.

It would be desirable to test directly the model that the five contrasts are jointly equal to zero or at least that the first four of them are. Unfortunately those models can not

be formulated directly within the framework of our software. However, it is possible to test the stronger model that

$$\lambda_{xyc}^{XYC} = \begin{cases} \beta_{xy}c, & c = 0, 1, 2, 3, 4 \\ \lambda_{xy5}^{XYC}, & c = 5 \end{cases}$$

having 48 degrees of freedom. The model (2) says that for each combination of his and her education level, there is a linear trend over time in the log-odds ratios for each specific combination of his and her education level. The model also says that this trend is broken for the youngest cohort. Model (2) implies a linear trend in the generalised log odds ratio for homogamy.

Model (2) fits the data with

$$X^2 = 53.64, \quad p\text{-value} = 0.2668, \quad G^2 = 54.036, \quad p\text{-value} = 0.2548$$

which is a remarkably good fit with so many degrees of freedom and such a large sample. The estimates of the beta matrix is given in table 5.

Table 5 β_{ij}

$i \setminus j$	1	2	3	4	5
1	-0.2321	0.2034	0.0884	-0.1061	0
2	0.0043	0.1306	0.1491	-0.1039	0
3	0.0845	0.1850	0.1700	-0.0468	0
4	0.0716	0.1497	0.1486	-0.0511	0
5	0	0	0	0	0

The number 0.1850 in cell (3,2) in table 5 can be interpreted by saying that the logarithm of the odds that a man (or woman) with education level 3 finds a spouse with education level 2 rather than one with education level 5 (reference category) compared to the same odds for a man (or woman) with education level 5, has, in average, been increasing with 0.1850 per decade through the first five decennial cohorts of the twentieth century. The odds ratio itself has been increasing with a multiplicative factor of $\exp(0.185) = 1.203$ each decade. The numbers in the other cells can be interpreted similarly.

The corresponding change in the generalised log odds-ratio per decade is

$$\log H_c - \log H_{c-1} = \frac{1}{I} \sum_{i=1}^I \beta_{ii} - \frac{1}{I(I-1)} \sum_{x \neq y=1}^I \beta_{xy} = -0.0379, \quad k = 1, \dots, K$$

In words: the change is the average of the diagonal betas minus the average of the off-diagonal betas. Table 5 shows that this estimate is significantly different from zero with a p-value of 0.0006. The dominating contribution to this result is the reduction in propensity of men and women in the lowest educational category to find a spouse in the same category expressed by the negative number -0.2321 in cell (1,1). It should be noted that none of the negative numbers in column 4 of table 4 are individually significantly different from zero.

Accepting model (2), table 3 looks:

Table 6

Cohort	$\ln(H_k / H_0)$	Standard Error	Wald	p-value
1900-09	0			
1910-19	-0.0379	0.0110	11.823	0.0006
1920-29	-0.0759	0.0221	11.823	0.0006
1930-39	-0.1138	0.0331	11.823	0.0006
1940-49	-0.1517	0.0441	11.823	0.0006
1950-59	0.0394	0.0416	0.899	0.3432

Table 4 changes to

Table 7

Cohort	H_k / H_0	Lower bound	Upper bound
1900-09	1		
1910-19	0.9628	0.9422	0.9838
1920-29	0.9276	0.8877	0.9679
1930-39	0.8925	0.8364	0.9523
1940-49	0.8592	0.7881	0.9369
1950-59	1.0402	0.9588	1.1285

A model with no time trend (the homogenous odds-ratio model) for the first four decades (80 degrees of freedom) does not fit the data. It should be noted that some models lying in between might also fit the data well. The model saying that there is no difference in trend (in table 3) between educational category 4 and 5 for women would most likely not be rejected but was not explicitly tested.

It can be of interest to fit the quasi symmetry model for the trend parameters in table 3 to answer the question: Will data reject the hypothesis that the trends in table 3 are the same for men and women? This hypothesis has not yet been tested. However, the quasi-symmetry model of gender symmetric changes in preferences for partners education level when compared (but no defined trend assumptions)

$$Hyp_2 : \lambda_{ijk} = \lambda_{jik}, \quad i, j = 1, \dots, I, k = 0, \dots, 5$$

has been tested. It gave Pearson's $X^2 = 68.11$ and the likelihood ratio $G^2 = 68.57$ with 30 degrees of freedom, which clearly rejects the model of quasi-symmetry. A model for symmetry in the time trend was also rejected. A model for gender symmetry in the trends β_{xy} was also rejected.

An modification the measure H or $\log H$ to weight the off diagonal cells differently with weights $v_0 \geq v_1 \geq \dots \geq v_{I-2} \geq v_{I-1}$ (with at least one strict inequality) according to how far it is from diagonal is possible to construct. Such a measure would present a more nuanced measure of homogamy. However, it is not possible to construct it to be completely independent of the marginals in the two-way table and it will not be considered here.

Conclusion

The general level of educational homogamy has decreased in Norway among cohorts born in the first half of the 20th century. Much of this can be attributed to the general increase in educational level for both men and women. At the beginning of the century few people had more than compulsory school (6 years). Therefore, both men and women with this level of education, and men in particular, had to settle with a spouse with the same low level of education. When the distribution of educational level became more dispersed, a more diversified marriage market developed, leading to a decrease in the general level of homogamy.

In particular, we wanted to explore to what extent the observed decrease in homogamy was an effect of the dispersion in the general level of education or whether this trend is maintained when controlling for the general change in educational level. For this purpose a particular measure of over-all homogamy is developed. Estimation of the trend in this measure shows that a decrease in homogamy persists even when controlling for the changes in education level.

We have, however, seen that the youngest cohort (1950-59) differs from the older cohorts, and we have not been able to include even younger cohorts. These are the cohorts in which the gender gap in education has been closed (cfr. Figure 1). It might therefore be the case that as more women undertake higher education, more men with high education will find their spouse at a similar educational level, resulting in an increase in high-level educational homogamy. This question will be addressed later with data from the Census 2001. The results presented here, however, show that both in absolute and relative terms there has been a decline in educational homogamy in Norway for cohorts born between 1900 and 1949.

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