

**Educational Assortative Mating in the Czech Republic, Slovakia and Hungary between
1976 and 2003**

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The reproduction of society – the continuation of the social structure from one generation to the next – is a topic that has been central to sociology from its very foundation.

To state that in the traditional society, privileges and handicaps were passed on through marriage and the family is the obvious. For a personal relationship – one based on negotiation, emotions, mutual affection, and romantic love – to precede marriage was the exception rather than the rule in traditional societies (Shorter 1975; Laslett 1977; Flandrin 1979, 1991). The consequences that entry into marriage had, not only for the young couple but also for their relatives, were so serious that the extended family could not leave the selection of a spouse in the hands of the person who would be married. Moreover, an unwritten law forbade marriage between people of different backgrounds in terms of wealth, status, education, religion, ethnicity, or geographic origin. This convention was among the basic rules governing the “rationality” of the traditional individual and the social order of traditional societies. In this way, the social structure of the traditional society remained stable for centuries.

At the dawn of the modern society, the influence of the extended family weakened, while the influence of young people as individuals strengthened. Ever since, it has been individuals who make the choice of a spouse. Emotions, mutual affection, and romantic love have become established reasons for entering into marriage. As a consequence, the institution of the affective relationship has evolved. Young people meet each other and share emotions, wishes, and desires – in short, they share to a greater or lesser degree a close relationship that precedes marriage and family formation. Thus, what was arranged by parents and other relatives in traditional societies is in modern societies entrusted to the sons and daughters themselves. They take on an active role: find a partner, enter into a relationship with him/her, and maintain that relationship. Only if they succeed in this do they enter into marriage and start a family.

It is paradoxical that, in the end, partners selected on the basis of personal affection and emotions in most respects do not differ from those that parents following the traditional guidelines might have chosen for their children anyway. Even in modern societies, people do not select just any partner but a partner who is similar to them in status, as well as in economic, educational, religious, ethnic, and regional terms. Thus, although the method of negotiating marriages changed in the transition from traditional to modern society, the final shape of marriages has not changed significantly. Marriage and family continue to form the foundation on which lies the survival of the social structure from one generation to the next.

Marriage between partners with similar backgrounds is termed “marital homogamy”. Once sociologists and demographers had identified marital homogamy as a part of the social structure of the modern society – first by observing patterns of marital homogamy and somewhat later by identifying it as a common reason for the selection of a certain partner – the phenomenon became a focus of much research. This interest was strengthened by the observance that a society’s degree of marital homogamy not only reflects its mating patterns but also indicates the societal openness (Ultee, Luijkx, 1994; Smits, Ultee, Lammers, 1998a; 1998b). For example, high educational homogamy indicates that people perceive significant gaps between individual educational levels, and this in turn is reflected in their marital behaviour. Likewise, low religious homogamy indicates that people see small differences between members of religious and non-religious groups, and this also is reflected in marital preferences.

This paper analyzes educational homogamy in the Czech Republic, Slovakia and Hungary in the last quarter of the 20th century and considers its development and the transformation of its pattern between 1976 and 2003. The paper aims to demonstrate the degree to which the Czech Republic, Slovakia and Hungary are similar in terms of educational homogamy and explore whether the political, social, economic and cultural transformation that began in 1989 in all the three selected countries had the same impact on the development of educational homogamy in each of them.

Identifying the rule of homogamy

For a long time, social scientists did not question the incompatibility of romantic love and rational calculation in partner selection. However, at the end of the first half of the 20th century, the first research and analyses that identified the rule of homogamy appeared (*e.g.* Hunt 1940; Burgess and Wallin 1943; Winch 1958; Girard 1964). This rule shocked not only professionals but also to a large degree the lay public, and it became the basis of a new approach to studying modern society. According to the rule of homogamy, the majority of young people do not select partners by chance, but on the basis of social similarity. Economically, socially, or culturally disadvantaged people select their partners from among the economically, socially or culturally disadvantaged; likewise, people of higher social status choose partners among those with good social standing. Young people select young partners; old people old ones; believers select believers; the disabled or physically handicapped tend to partner with disabled or physically handicapped people. In short, partner selection is not an equal opportunity process, though it may appear so to the individual, and is presented as such

in public and in mass media. The choice of a partner is structured by social criteria that define the likelihood of meeting and pursuing a relationship with a given individual. Love that transcends these social barriers seems to exist only in fairy tales.

In response to the first research on marital homogamy, numerous similar studies have been conducted from a variety of perspectives and on various populations in the second half of 20th century. As findings accumulated, knowledge of homogamy developed and matured until the number of criteria that determined homogamy became consistent. Today we know that it is above all age and geographical proximity, ethnicity, religion, education, and social status that structure the choice of a partner. Relationships are most often formed by people who are roughly of the same age, do not live too far away from each other, belong to the same ethnic group, are of a similar religious belief, and have the same education and similar social status. This has led social scientists to adopt the metaphor of a “marriage market”, which denotes the space, defined by certain rules, that influences choice.

Measurement and analysis of homogamous marriages

As with social mobility, marital homogamy refers to social barriers that exist among individual social strata and groups. High social mobility indicates high heterogamy and low homogamy: the social structure is open because people overcome social differences relatively easily. Low social mobility goes hand in hand with low heterogamy and high homogamy: the social structure is closed, as social barriers at the level of everyday practice are more difficult to overcome.

Because of this correlation between mobility and homogamy, social scientists in the second half of the 20th century primarily measure intergenerational and geographical variation in marital homogamy as a supplement to stratification research. The growth in works that compare degrees of marital homogamy over time within one country corresponds with the developments in logarithmic-linear modelling from the mid-1970s, which constitute the prevalent statistical apparatus used in these analyses. In the United States, homogamy determined by education, job, and age has been analyzed *e.g.* by Rockwell (1976), Kalmijn (1991a), Mare (1991), Qian and Preston (1993), Kalmijn (1994), and Qian (1998). Sixma and Ultee (1984) and Poppel, Liefbroer, Vermunt and Smeenk (2001) conducted similar analyses in the Netherlands; in Hungary, Uunk, Ganzeboom and Róbert (1996) and Bukodi (2001) mapped the development of educational homogamy. Lancaster (1987) conducted the same analysis in Australia. Homogamy defined by religious belief and education was intergenerationally analyzed in the United States by Johnson (1980) and Kalmijn (1991b);

Kalmijn (1993), Qian (1997, 1999), Fu (2001), Qian, Blair and Ruf (2001), Rosenfeld (2002) and Sherkat (2002) analyzed homogamy based on ethnicity, age and education. The goal of these works was to depict a trend in the development of homogamy and thus determine whether the social structures of the individual societies in their respective studies were opening or closing.

Works that measure and compare the levels of homogamy between countries emerged at the beginning of the 1990s. Ultee and Luijkx (1994) and Smits, Ultee and Lammers (1998a) in their extensive comparisons of homogamy (Ultee and Luijkx compared 23 countries; Smits, Ultee and Lammers as many as 65) worked with data collected at one or two points in time, and were less concerned with intergenerational trends within individual countries. Their aim was to identify groups of countries that were similar with respect to homogamy. Other works that either built upon these comparative projects or criticized them measured homogamy on a significantly smaller sample of countries, but balanced this by introducing another dimension: intergenerational change in homogamy within each country (Boguszak 1990; Smits, Ultee and Lammers 1998b; Raymo and Xie 2000; Smits, Ultee and Lammers 2000; Park 2001). These works integrate two types of previous analyses. They compare homogamy over time within one country to determine an intergenerational trajectory. They also compare this trajectory with those in other countries. The aim is to identify differences among countries with respect to their intergenerational homogamy trends.

Educational homogamy in the Czech Republic, Slovakia and Hungary

Educational homogamy itself was not researched in the Czech Republic, Slovakia or Hungary yet. Before November 1989, Czechoslovak and Hungarian societies were studied only as part of some comparative research projects on educational homogamy.

Ultee and Luijkx (1994) included the Czech Republic and Hungary in their analysis of educational homogamy when they tested the hypothesis of socialism's positive influence on relative mobility opportunities.² They found that the effects of socialism on partners' educational heterogamy were the opposite of what they had expected: state socialism had acted against an increase in educational heterogamy.

Boguszak (1990) arrived at the same conclusion when comparing relative homogamy in the Netherlands, Czechoslovakia, and Hungary. His analysis showed that the relative chances of an educationally heterogamous marriage were lower in socialist countries than in the Netherlands. The socialist ideology of egalitarianism, in combination with state measures

that pre-1989 governments had implemented to homogenize the society, equalize opportunities, and democratize, did not reach the level of everyday practice and did not influence the selection of a husband or wife according to education. They thus did not lead to an increase in educational heterogamy.

In the second half of the 1990s, Smits, Ultee, and Lammers (1998a) continued working with Czechoslovak and Hungarian data from 1980. Their analysis showed that the rate of educational homogamy was economically, politically, and religiously determined. Among the European countries studied, Czechoslovakia belonged to the group with the lowest educational homogamy and Hungary belonged to the group with the highest educational homogamy.

Before the 1990s educational homogamy was not measured in a comparative framework in the Czech Republic, Slovakia and Hungary.³ It remains a question how educational homogamy developed following 1989 in these post-socialist countries. Can we expect – at a time of economic and social changes – the same trend in educational homogamy in all these countries? And how did educational homogamy develop before 1989 in these countries? These are core questions in respect of the following analysis.

Data and absolute educational homogamy

In order to map the development of educational homogamy in the Czech, Slovak and Hungarian societies I analyzed all the marriages entered into by men's and women's education (elementary, vocational training, high school and tertiary) in the years 1976 to 2003.⁴ In aggregated form the data consist of three three-way tables (or one four-way table), which I arranged by countries and over years of entry into marriage in ten two-way sub-tables, which indicate the number of marriages by men's and women's education in the individual countries and years (c.f. Appendix, Tables 5-7).⁵

The marginal row in each this two-way sub-table shows the educational structure of men entering into marriage and the marginal column shows the educational structure of women entering into marriage in the given year and country. The main diagonal represents educationally homogamous marriages. The figures above the main diagonal indicate marriages in which the woman attained a higher education than the man (the woman marries

² More about this hypothesis cf. Grusky and Hauser (1984) or Ganzeboom, Luijkx and Treiman (1989).

³ In the case of Hungary the development of educational homogamy was explored by Bukodi (2002) in the first half of the 1990s.

⁴ I opted for the period of 3 years within the chosen time scope. Thus I analyzed marriages entered into in the years 1976, 1979, 1982, 1985, 1988, 1991, 1994, 1997, 2000 and 2003.

a man with lower education, from her viewpoint it is a hypogamous marriage, the man marries a woman with higher education, from his viewpoint it is a hypergamous marriage). The figures below the main diagonal represent marriages in which the man attained a higher education than the woman (from his viewpoint it is a hypogamous marriage as he marries a woman with lower education, from the woman's viewpoint it is a hypergamous marriage as she marries a man with higher education).⁶

Figure 1 shows the sum of total (joint) frequencies on the main diagonals in each sub-table, above and under them by country and over years. Educationally homogamous marriages make up more than half of all marriages entered into in the selected countries (apart from the years 1976 to 1991 in Hungary). In the remaining less than half of marriages in all the countries those marriages dominate in which the woman has lower education than the man (man's hypogamy and woman's hypergamy) over marriages in which the woman has higher education than the man (man's hypergamy and woman's hypogamy). However, in the course of the 1980s and above all the 1990s the ratio changes: in the Czech Republic, Slovakia as well as in Hungary among the educationally heterogamous marriages those in which the woman had higher education than the man (man's hypergamy and woman's hypogamy) began to dominate over those in which the woman had lower education than the man (man's hypogamy and woman's hypergamy).

<Figure 1 about here>

Figures 2 and 3 demonstrate the development of the individual types of educationally heterogamous marriages by countries. Figure 2 shows the development of all marriages that belong into the group of marriages in which the woman has higher education than the man (man's hypogamy and woman's hypergamy). Figure 3 demonstrates specifically the development of all marriages in which the woman has higher education than the man (man's hypergamy and woman's hypogamy). Figure 2 demonstrates a decrease in man's hypogamy and woman's hypergamy between the years 1976 and 2003 (c.f. Figure 1) which is caused mainly by a fall in marriages between men with vocational training and women with elementary education (man-VT+woman-EL) in all the three selected countries (this decrease

⁵ The data were processed by national statistical offices.

⁶ The greater the distance of each number in each table from the main diagonal in the direction of the woman's or the man's higher education, the greater the educational disproportion between the spouses.

is most extreme in Hungary). In contrast, Figure 3 shows that the increase in men's hypergamy and women's hypogamy during the same period (again c.f. Figure 1) is caused above all by an increase in marriages between men with vocational training and women with high school education (man-VT+woman-HS) as well as by a growth in marriages, in particular between 1994 and 2003, between men with high school education and women with tertiary education (man-HS+woman-TE).

<Figure 2 and Figure 3 about here>

Figure 4 shows the transformation of the educational structure of men and women who entered into marriages in the individual countries.⁷ This transformation is similar in all the countries. Since 1976 we can see, on the one hand, a decrease of the proportion of marriages entered into by men with elementary education (man-EL) and women with elementary education (woman-EL). Since the beginning of the 1990s the proportion of marriages entered into by men with vocational training (man-VT) and women with vocational training (woman-VT) decreased as well. In contrast, in all the countries the proportion of marriages entered into by individuals with high school and tertiary education increased.

These changes can be explained by changes in the educational structure (in the period under study and in particular in the 1990s in all the selected countries the proportion of people with elementary education and vocational training was on the decrease while, in contrast, the proportion of people with high school and tertiary education was on the increase) and these changes can also be equally understood as a cause of the decrease in the number of marriages in which the man had higher education than the woman and, on the contrary, the increase in the number of marriages in which the woman had higher education than the man. When the number of men with vocational training and women with elementary education decreases in a population, the number of their marriages also decreases. Due to the fact that in 1976 this type of marriages dominated among heterogamous marriages (in these the man has higher education than the woman), yet in the 1980s and 1990s it decreased rapidly, the share of man's hypogamy and woman's hypergamy (c.f. Figure 1) decreased as well. On the contrary if the proportion of people with high school and tertiary education increases in a population, there is also an increase in the number of marriages that they enter into with each other. And

⁷ These changes in the educational structure of men and women entering into marriage reflect, on the one hand, the changes in the educational structure in socialist and post-socialist countries during the last quarter of the 20th century and, on the other, they mirror the gendered distribution of education in each country.

due to the fact that since 1976 the number of women with high school education entering into marriage was on the increase in all the selected countries (in the 1990s also the proportion of women with tertiary education entering into marriage increased) also the proportion of marriages in which the woman has higher education than the man grew (again c.f. Figure 1).

<Figure 4 about here>

Relative educational homogamy and statistical modelling of trends and pattern

Educationally homogamous and heterogamous marriages are to some extent structurally determined by the gendered distribution of education in all three countries. For instance we have seen (c.f. Figure 3) that a typical structurally forced marriage can be expected between a man with vocational training and a woman with high school education in all countries. The proportion of men with vocational training entering into marriage is about 10% higher than the proportion of women with the same level of schooling entering into marriage in each country (c.f. Figure 4). Similarly, the proportion of women with high school education entering into marriage is on average 10% higher than the proportion of men with high school education entering into marriage in each country (again c.f. Figure 4). Because the disparities in educational attainment between men and women entering into marriage change somewhat over time, I analyze the data about marriages using log-linear and log-multiplicative analyses that study the associations in frequency tables net of marginal distributions. The results then do not describe absolute homogamy but relative homogamy which gives a more accurate account of the intentions, motivations, and the conduct of people entering into marriage (for more on these analyses c.f. Hout, 1983; Yamaguchi, 1987; Xie, 1992; Goodman and Hout, 1998, 2001; Powers and Xie, 2000).

Statistical modeling of trends in educational homogamy

Firstly I study the association between wife's and husband's education by country and over years. The equation of the saturated model is as follows:

$$\log(F_{ijkl}^{MWYC}) = \lambda + \lambda_i^M + \lambda_j^W + \lambda_k^Y + \lambda_l^C + \lambda_{ij}^{MW} + \lambda_{ik}^{MY} + \lambda_{il}^{MC} + \lambda_{jk}^{WY} + \lambda_{jl}^{WC} + \lambda_{kl}^{YC} \\ + \lambda_{ijk}^{MWY} + \lambda_{ijl}^{MWC} + \lambda_{ikl}^{MYC} + \lambda_{jkl}^{WYC} + \lambda_{ijkl}^{MWYC},$$

where $\log(F_{ijkl}^{MWYC})$ is the natural logarithm of the expected frequency for row i (M - men's educational level), column j (W - women's educational level), layer k (Y - years) and dimension l (C - country) in the four-way table; λ (lambda) are parameters, while λ is the main mean, $\lambda_i^M, \lambda_j^W, \lambda_k^Y, \lambda_l^C$ are the marginal effects of the variables M, W, Y and C , $\lambda_{ij}^{MW}, \lambda_{ik}^{MY}, \lambda_{il}^{MC}, \lambda_{jk}^{WY}, \lambda_{jl}^{WC}, \lambda_{kl}^{YC}$ are two-way associations among variables M, W, Y and C , $\lambda_{ijk}^{MWY}, \lambda_{ijl}^{MWC}, \lambda_{ikl}^{MYC}, \lambda_{jkl}^{WYC}$ are three-way interactions among variables M, W, Y and C , and λ_{ijkl}^{MWYC} denotes the four-way interaction among variables M, W, A, Y and C .

Since I was interested in the development of the association between men's and women's educational level over year of entry into marriage and by country, I concentrated on the modeling of the two-way MW association and all higher order interactions between the MW association and other variables ($\lambda_{ij}^{MW}, \lambda_{ijk}^{MWY}, \lambda_{ijl}^{MWC}, \lambda_{ijkl}^{MWYC}$). First I estimated the null association model, which is usually used as a baseline model ($\lambda_{ij}^{MW} = \lambda_{ijk}^{MWY} = \lambda_{ijl}^{MWC} = \lambda_{ijkl}^{MWYC} = 0$). Then, I estimated the constant association model, where the MW association is constant over Y and by C ($\lambda_{ijk}^{MWY} = \lambda_{ijl}^{MWC} = \lambda_{ijkl}^{MWYC} = 0$), and the constant association model with blocked main diagonal in each $M \times W$ sub-table.⁸ Furthermore, I modeled the MW association as additive uniform and as log-multiplicative uniform.

The additive uniform layer effect model (Yamaguchi, 1987) means that the MW association is estimated as constant in all sub-tables and its higher order interactions are modeled on the assumption of a specific order of rows and columns in the sub-tables as a sum of this two-way association and an estimated parameter β , which indicates the change in the strength of MW association over Y and by C ($\lambda_{ij}^{MW} + \lambda_{ijk}^{MWY} + \lambda_{ijl}^{MWC} + \lambda_{ijkl}^{MWYC} = \lambda_{ij}^{MW} + ij\beta_{kl}$).

The log-multiplicative uniform layer effect model (Xie, 1992) is constructed on a similar principle as the additive uniform layer effect model. A two-way association of MW is estimated as constant for all sub-tables, and its higher order interactions are modeled as a product of this two-way interaction and an estimated parameter ϕ , which shows the changes in the strength of the two-way interaction over Y and by C ($\lambda_{ij}^{MW} + \lambda_{ijk}^{MWY} + \lambda_{ijl}^{MWC} + \lambda_{ijkl}^{MWYC} = \psi_{ij}\phi_{kl}$). The advantage of the log-multiplicative model is that it

⁸ It is a standard practice to block the main diagonal in tables of marriage pairs, mobility tables, and other frequency tables of this type. The cells on the main diagonal are usually very high relative to the off-diagonal cells. This strong "inheritance effect" usually overrides any other pattern in the data and drives model selection

does not presuppose an ordering of rows and columns in the tables and is more intuitive to interpret. In this model it is also possible to make additional constraints to estimate more parsimonious model which fits the data more accurately, than in the case of additive uniform layer effect model.

Statistical modeling of change in the pattern of educational homogamy

The above models can, if they fit the data satisfactorily, indicate differences in educational homogamy across countries and over time. They are, however, powerless to describe the change in the pattern of association because they keep the MW association constant and only allow for additive or multiplicative deviations of the same pattern over other dimensions of the data. In the next section of the analysis, I therefore concentrated on the change in the pattern of educational assortative mating. Models in this section were estimated for each country separately. I decided to limit the analysis to each country because the use of Goodman-Hout regression type layer effect model (Goodman and Hout, 1998, 2001), which is suggest for modeling pattern of association, as far as I can tell, has so been identified for three-way tables only. I believe that the statistical and conceptual advantages of the Goodman-Hout model far outweigh the disadvantages resulting from the necessity to break the analysis up by country.

The equation of the saturated model in this case was the following:

$$\log(F_{ijk}^{MWY}) = \lambda + \lambda_i^M + \lambda_j^W + \lambda_k^Y + \lambda_{ik}^{MY} + \lambda_{jk}^{WY} + \lambda_{ij}^{MW} + \lambda_{ijk}^{MWY},$$

where $\log(F_{ijk}^{MWY})$ is the natural logarithm of expected frequency for row i (M), column j (W) and layer k (Y). Similarly to the previous saturated model, λ is the main mean, $\lambda_i^M \lambda_j^W \lambda_k^Y$ are marginal effects of variables M , W and Y , $\lambda_{ik}^{MY}, \lambda_{jk}^{WY}, \lambda_{ij}^{MW}$ are two-way association among the variables M , W and Y , and λ_{ijk}^{MWY} is the three-way interaction among the variables M , W , and Y .

In this analysis I also concentrated on constraints on the parameters $\lambda_{ij}^{MW} + \lambda_{ijk}^{MWY}$, which were first modeled as $\lambda_{ijk}^{MWY} = 0$ (constant association model), and afterwards as $\lambda_{ij}^{MW} + \lambda_{ijk}^{MWY} = \lambda_{ij}^{MW} + ij\beta_k$ (additive uniform layer effect model), as $\lambda_{ij}^{MW} + \lambda_{ijk}^{MWY} = \psi_{ij}\phi_k$ (log-

and specification efforts, which is usually undesirable because other, more subtle patterns and associations remain hidden.

multiplicative uniform layer effect model), and lastly as $\lambda_{ij}^{MW} + \lambda_{ijk}^{MWY} = \lambda_{ij}^{MW} + \psi_{ij}\varphi_k$ (regression type layer effect model).

Regression type layer effect model, offered by Goodman and Hout (1998, 2001), is an alternative way for analyzing the trends in association between two categorical variables over a third variable. This model is a combination of the additive uniform layer effect model and the log-multiplicative uniform layer effect model, which are in fact nested in it. Whereas in the log-multiplicative model $\psi_{ij}\varphi_k$ term is used for the specification of both the *MW* association and the *MWY* interaction, in the regression type layer effect model the same term is used only for the specification of *MWY* interaction, and for the specification of *MW* association the λ_{ij}^{MW} parameter is used as in the additive uniform layer effect model. The *MWY* interaction can then be interpreted as a deviation from an overall pattern of association indicated by the parameter λ_{ij}^{MW} . The ψ_{ij} parameter in this deviation represents the part of the association which varies over years and the φ_k parameter indicates the strength of the association in each year. In this model it is possible to make constraints in parameters like in log-multiplicative model.

Findings about relative educational homogamy

Before the estimation of the log-linear and log-multiplicative models, I standardized the overall n in each two-way sub-table of marriages by man's and woman's educational levels to 25,000 marriages. For each country I thus gained a sample of marriages of the size of 250,000 and the overall number of marriages (N) for all the three countries was 750,000 marriages. I employed standardization of the table size in order to make individual sub-tables comparable and to avoid a bias in the model selection process due to different n in each sub-table (Ultee and Luijkx, 1990; Smits, Ultee and Lamers, 1998a; Raymo and Xie, 2000).

Has the trend in educational homogamy changed?

For all data the goodness-of-fit statistics of estimated models are presented in Table 1. Model 1 is the null association model. This model fits the data very poorly – it has positive BIC (Raftery, 1986, 1995), it misclassified more than 25% of all marriages and it has L^2 of 330 510 with 270 degrees of freedom. Model 2 is the constant association model and Model 3 is the constant association model with heterogeneously blocked main diagonal in each sub-table. Both models fit the data significantly better than the null association model. Moreover, Model 3 is statistically superior to Model 2 (L^2 for the contrast is 5 144 with 116 degrees of

freedom, which is a very significant difference). All subsequent models are therefore estimated with heterogeneously blocked main diagonals. Both Model 4 (additive uniform effect) and Model 5 (log-multiplicative uniform effect) are conceptually good tests of trend in association between man's and woman's education level in marriage market and both models fit the data satisfactorily. The estimated trend parameters from both of these models have showed that the trend in educational homogamy could be quadratic over years and by country. To get more parsimonious model I made restrictions on phi parameters in model 6. The first parameter for year 1976 was constrained to be estimated the same as the last parameter for year 2003. The second parameter for year 1979 was constrained to be estimated the same as the second parameter from the end of time period (thus for year 2000), and so on.⁹ By this model I saved 15 degrees of freedom. According to classical statistics the fit of the model is not substantively poor and according to BIC criterion this model fits the data more satisfactory than previous two models. In the last model (7) I modeled the trend in educational homogamy to be quadratic between 1976 and 2003 in each country.¹⁰ This model is more parsimonious than previous model and it fits the data according both the classical statistics and BIC criterion. I interpret the data on the basis of the parameters of this last model, although the substantive conclusions are fairly insensitive to the details of concrete model specification and would not change if we used model 4, 5, 6 or 7 instead.

<Table 1 about here>

Figure 5 shows the estimated parameters of models 5, 6 and 7 over years and by countries. The parameters from individual models can be compared in individual countries vertically as well as horizontally. A vertical comparison of the parameters of individual models shows that we find the highest degree of educational homogamy in Slovakia, a somewhat lower one in Hungary and the lowest educational homogamy can be found in the Czech Republic. For a horizontal comparison I used the quadratic fit for the estimated parameters of Models 5 and 6. On this basis it is possible to conclude that in each country the development of educational homogamy is quadratic in time. Model 7 tests the quadratic trend and supports this finding. As we have seen it fits the data the most satisfactorily. In all the selected countries educational homogamy is the highest at the beginning of the period under

⁹ $\varphi_{1976} = \varphi_{2003}$ & $\varphi_{1979} = \varphi_{2000}$ & ... & $\varphi_{1988} = \varphi_{1991}$

study (in 1976), in the Czech Republic and Slovakia it weakens by about 20% in the course of the 1980s, in the first half of the 1990s the trend reverses and in the second half of the 1990s educational homogamy increases again although in 2003 it does not reach the original values from 1976. In Hungary the trend is very similar, the decrease in educational homogamy in the 1980s, however, is not so marked and its increase in the 1990s is very gradual.

Based on the data it can be concluded that in all the selected post-socialist countries the 1990s represent an interruption in the trend of weakening educational homogamy which is detectable from the second half of the 1970s until the end of the 1980s. In the 1990s educational homogamy again increases rapidly (in the cases of the Czech Republic and Slovakia) or gradually (in the case of Hungary).

<Figure 5 about here>

Has the pattern of educational homogamy changed?

While the previous sub-section of the text has documented changes in the magnitude of the association between the education of wives and husbands over years and by countries, in this sub-section I would like to see if the pattern of association has changed as well. As I have mentioned before I limited models in this analysis to new marriages entered by fiancées in each country separately.

Table 2 summarizes the goodness-of-fit statistics of all estimated models used to disentangle changes in the pattern of educational homogamy. Model 1 is a null association model, which assumes no *MW* association. This model fits the data poorly in each country. Model 2 – the constant association model – fits the data satisfactorily according to BIC criterion, especially in Czech and Hungarian data. Model 3 presupposes the additive uniform year effect on the *MW* association, Model 4 presupposes the log-multiplicative uniform year effect on the *MW* association, and Model 5 presupposes the regression type year effect on the *MW* association. Model 5 fits the data best in all countries according to BIC criterion as well as according to classical statistics. On the basis of this model we can conclude that in each country separately, we can observe not only the change in trends in educational homogamy but also the change of patterns of educational homogamy.

¹⁰ $\varphi_k = (\alpha_k + \beta_k Y + \gamma_k Y^2)$, where α_1 is constrained to 1 (because of identification purposes) and Y is number of years since 1976.

<Table 3 about here>

Panel A of Table 3 shows the λ_{ij} parameters estimated from Model 5 for the two-way interaction of MW separately for each country. These parameters describe the association between men's and women's educational level in the year 2003.¹¹ The association is strongest in the cells on the main diagonal, in particular in the first and the last cell of the diagonal. Educational homogamy was the highest among university graduates and men and women with elementary education in the Czech Republic, Slovakia and Hungary in 2003. As we move farther from the main diagonal, the association between partners' education dwindles proportionately. The highest negative association is between a man with elementary education and a college educated female and a woman with elementary education and a male college graduate in each country. Interestingly, there is a positive association between heterogamous marriages of men and women with elementary education and men and women with vocational training in all tables. Similarly, there is a positive association between individuals with complete high school education and college education. It seems that the secondary school leaving examination is dividing all former socialistic populations into two largely isolated groups. Although within these groups there exists a strong educational homogamy, within them there are also relatively widespread heterogamous marriages. Heterogamous marriages that occur across these groups are, nevertheless, more of an exception than a rule in all investigated countries in 2003.

The parameters ψ_{ij} and φ_k in panels B and C of Table 3 must be interpreted together. Whereas the λ_{ij} parameters in panel A of Table 3 describe the MW interaction in the year 2003 in each country, the ψ_i parameters indicate how the pattern of the MW interaction in the year 1976 deviates from the λ_{ij} parameters in each country, i.e. from the MW interaction in 2003. The φ_k parameters in panel C of Table 4 reveal to what extent the deviations from panel B apply to each particular year in each country.

We can see that the change in the pattern of educational homogamy is not the same in all the selected countries. For example, in the Czech Republic between 1976 and 2003 the mating of men with elementary education and women with tertiary education strengthened most significantly and, on the contrary, that of men with elementary education and women with high school education weakened most significantly. In Slovakia in the period under

¹¹ The figures are in logarithmic form, they fall into the $\langle -\infty; \infty \rangle$ interval, where 0 means that there is no association between the values of variables and the higher the number the stronger the positive association and the lower the number the stronger the negative association.

study the mating of men and women with elementary education strengthened the most significantly and, in contrast, like in the case of the Czech Republic, that of men with elementary education and women with high school education weakened the most. In Hungary between 1976 and 2003 the mating of men and women with elementary education strengthened most significantly while that of men with vocational training and women with elementary education weakened most significantly.

The φ parameters then show (panel C), that the changes in pattern of educational homogamy occurred relatively similarly in the Czech Republic and Slovakia, where it took place in the different direction between the years 1976 and 1982 than between years 1988 and 1997. In Hungary, we can see a slightly different trend: the pattern of educational homogamy has changed rather slowly and gradually here.

<Table 3 about here>

Conclusions

This paper dealt with educational homogamy over years within the last quarter of the 20th century in the Czech Republic, Slovakia and Hungary. All the marriages entered into in these countries between 1976 and 2003 (in three-year periods) were analyzed and the temporal and spatial variations of educational homogamy were explored. The major aim of the paper was to answer the question on how educational homogamy developed in post-socialist countries before 1989 as well as following it and how individual post-socialist countries differ among themselves on the basis of these developments.

In terms of spatial variation both in 1976 and in 2003 relative educational homogamy was the lowest in the Czech Republic, it was somewhat higher in Hungary and the highest in Slovakia. In terms of temporal variation in all the three countries we can observe the same development which has the shape of “U”. From 1976 to the beginning of the 1990s educational homogamy was on the decrease, during the first half of the 1990s it reached its minimum and from the second half of the 1990s it strengthened either rapidly (in the Czech Republic and Slovakia) or only gradually (in the case of Hungary). In all the countries under study the development of educational homogamy also involved the transformation of the pattern of educational assortative mating which, however, is not the same in all the countries.

If we agree that shifts in relative educational homogamy indicate societal openness, as Ultee, Luijkx (1994) or Smits, Ultee, Lammers (1998a; 1998b)¹² demonstrate, we can conclude that the volume of social inequalities in all the societies under study returns to a state in which they were in the mid-1970s. Although Czech society is the most open one (the most egalitarian) out of the countries under study and the Slovak society is, in contrast, the most closed one (the least egalitarian), the development of the volume of societal openness indicated by educational homogamy is in all the three societies similar. Socialism between 1976 and 1989 brought with itself the weakening of social inequalities because educational homogamy weakened, nonetheless, the transformation from socialism to capitalism brings a change in this trend: social and economic inequalities are on the increase in these societies because educational homogamy among individuals in the marriage market is on the increase. This conclusion is in line with findings from most recent mobility research (Gerber, Hout, 2005; Pollak, Müller, 2002) which targeted the transformation of the class structure in the 1990s in the countries of the former socialist bloc. Gerber and Hout (2002) researched intergenerational social mobility in the Russian society between 1988 and 2000 and showed that its class structure is being closed. Pollak and Müller (2002) also arrived at the same conclusion when comparing the development of intergenerational mobility in the western and eastern parts of Germany. Although class structure in the eastern part of Germany was at the beginning as well as the end of the 1990s more open than the class structure in the western part of Germany, in both parts of Germany social fluidity weakened in the 1990s and the class structure of both societies is closing.

¹² Low homogamy goes hand in hand with high social mobility, in such a case we talk about societal openness because people relatively easily overcome social and economic differences. High homogamy is linked with low

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Figures and tables

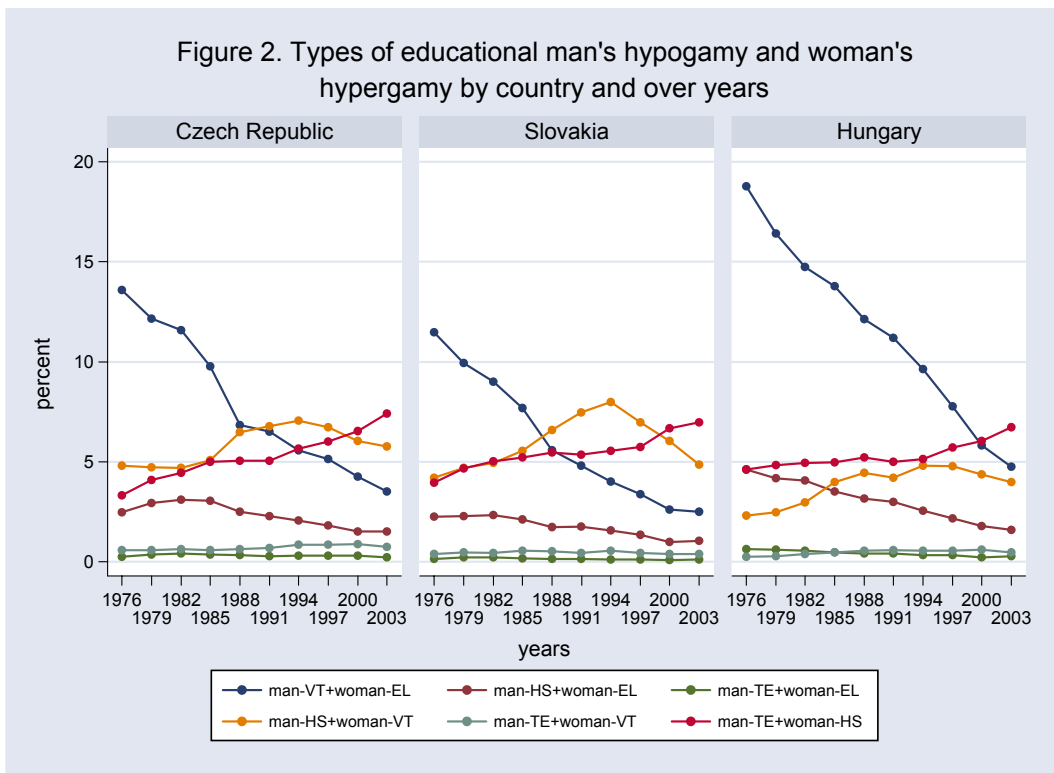
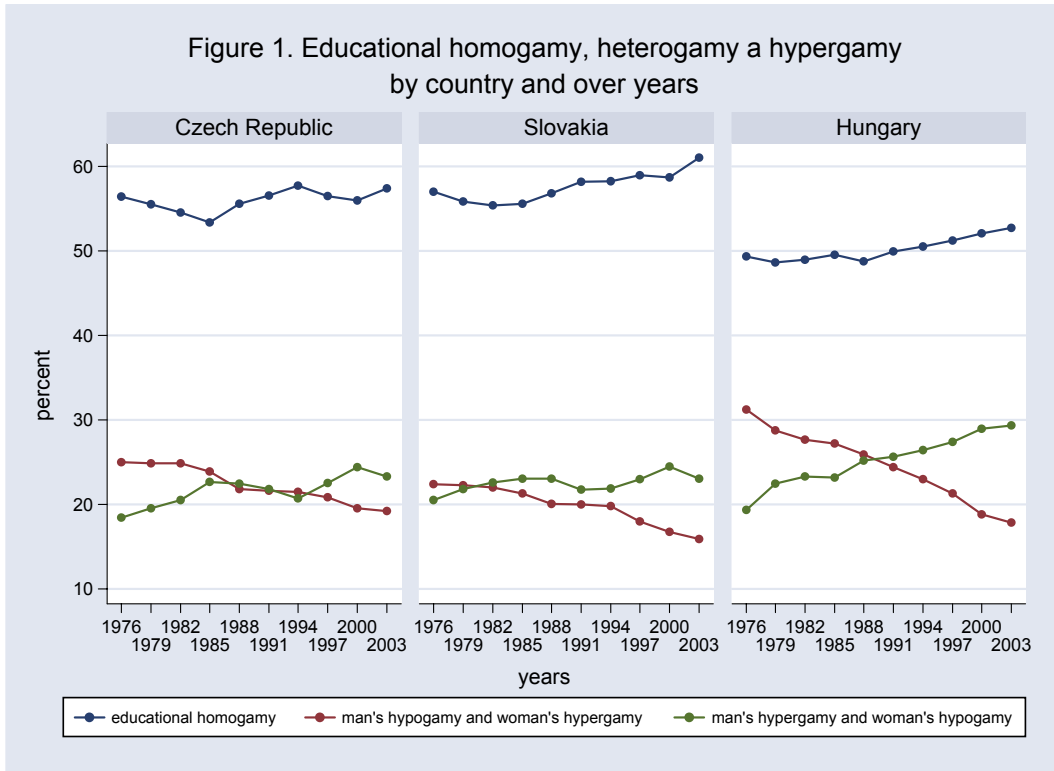


Figure 3. Types of educational man's hypergamy and woman's hypogamy by country and over years

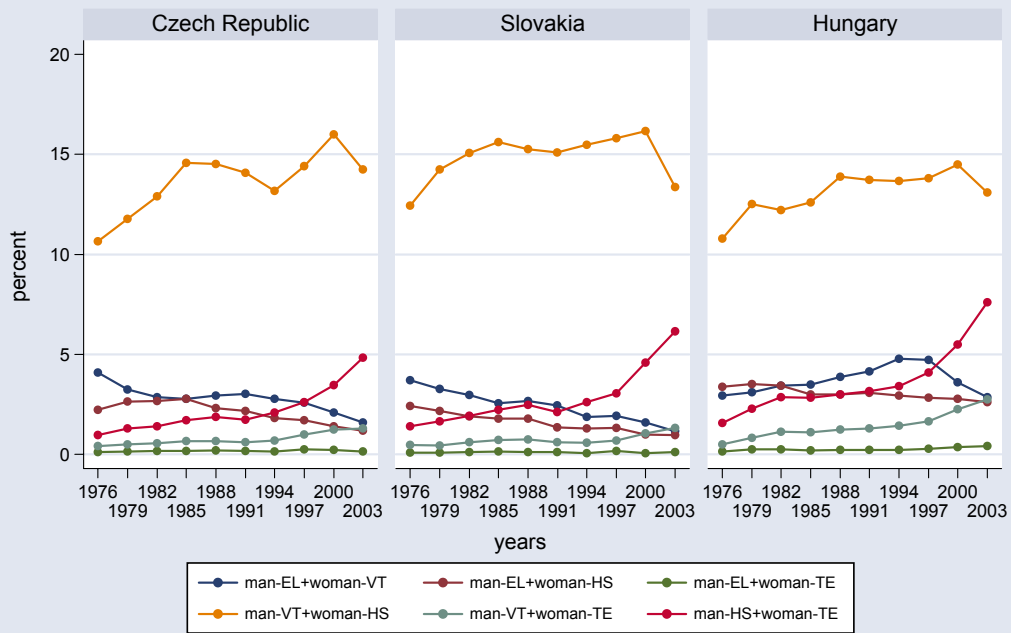


Figure 4. Educational structure of marriages by country and over years

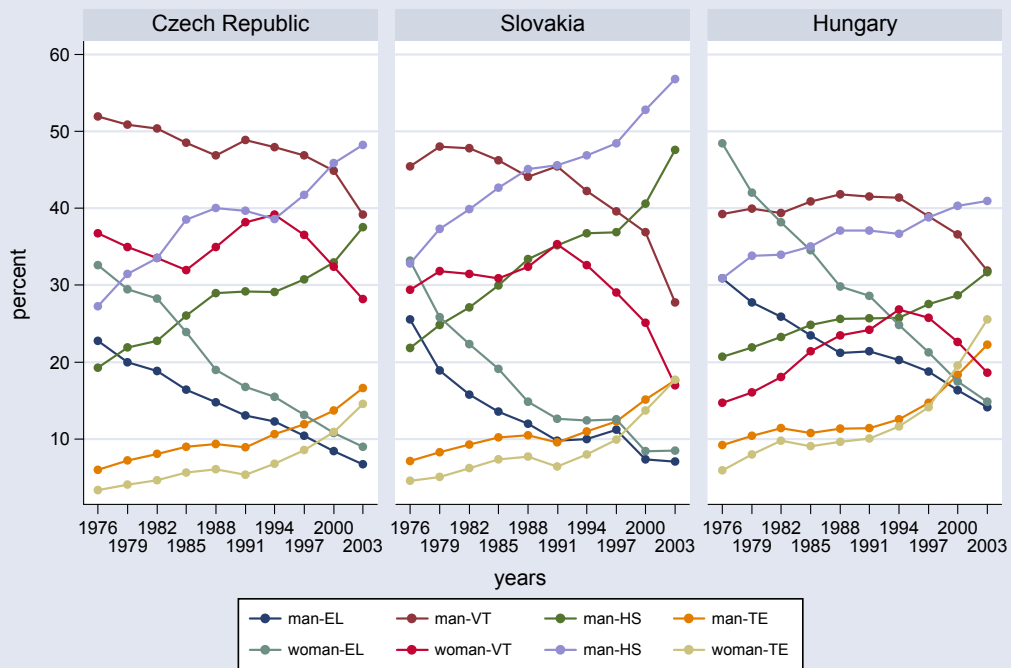


Figure 5. Trends in educational homogamy over years and by countries

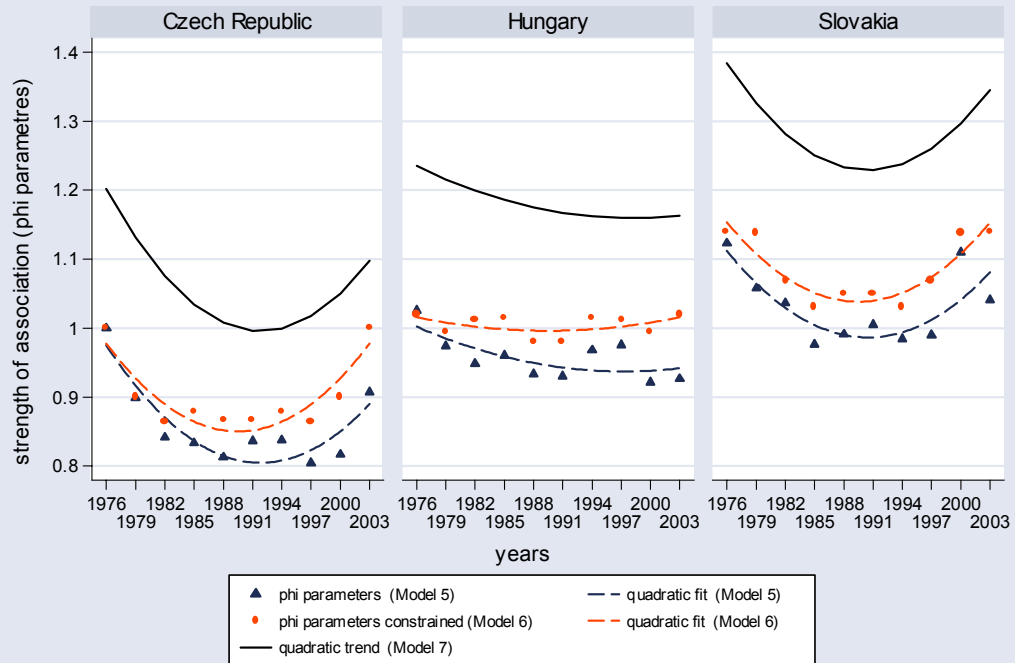


Table 1. Goodness-of-fit statistics of models applied to data on educational assortative mating in the Czech Republic, Slovakia and Hungary between 1976 and 2003.

Model	Description of the model	df	L ²	Δ	BIC
1) CYM CYW	Null association	270	330 509.7	25.64	326 857
2) CYM CYW MW	Constant association	261	5 862.5	2.85	2 332
3) CYM CYW MW D	Constant association, blocked diagonals	145	718.7	0.52	-1 243
4) CYM CYW (MW) _u D	Additive uniform layer effect, blocked diagonals	116	366.3	0.37	-1 202
5) CYM CYW (MW) _x D	Log-multiplicative uniform layer effect, blocked diagonals	116	387.0	0.37	-1 182
6) model 5, φ constrained	Log-multiplicative uniform layer effect, blocked diagonals, constraints $\varphi_{min} = \varphi_{max}$, $\varphi_{min+1} = \varphi_{max-1}$	131	421.9	0.40	-1 350
7) model 5, φ quadratic	Log-multiplicative uniform layer effect, blocked diagonals, φ quadratic trend	137	416.0	0.39	-1 437

Note: *C* – country; *Y* – year; *M* – men’s educational level; *W* – women’s educational level; *D* – blocked main diagonals; subscript *u* – additive uniform layer effect among tables; subscript *x* – multiplicative uniform layer effect among tables; L^2 is the log-likelihood ratio chi-square statistic; *df* are the degrees of freedom; *BIC* is Bayesian information criterion ($BIC = L^2 - (df) \log(N)$), where *N* is the total number of cases (750 000); Δ is the index of dissimilarity, which indicates the proportion of cases misclassified by the model.

Table 2. Goodness-of-fit results of models applied to data on educational assortative mating separately in the Czech Republic, Slovakia, and Hungary between 1976 to 2003.

Model	Description of model	df	L ²	Δ	BIC
Czech Republic					
1) YM YW	Null association	90	100 567.7	25.74	99 449
2) YM YW MW	Constant association	81	554.9	1.38	-452
3) YM YW (MW) _u	Additive uniform layer effect	72	465.3	1.29	-430
4) YM YW (MW) _x	Log-multiplicative uniform layer effect	72	482.4	1.31	-413
5) YM YW (MW) _r	Regression-type layer effect	64	252.2	0.93	-543
Slovakia					
1) YM YW	Null association	90	119 373.6	26.51	118 255
2) YM YW MW	Constant association	81	932.8	1.71	-74
3) YM YW (MW) _u	Additive uniform layer effect	72	703.1	1.56	-192
4) YM YW (MW) _x	Log-multiplicative uniform layer effect	72	663.0	1.66	-232
5) YM YW (MW) _r	Regression-type layer effect	64	198.6	0.73	-597
Hungary					
1) YM YW	Null association	90	110 568.4	24.67	109 450
2) YM YW MW	Constant association	81	419.0	1.24	-588
3) YM YW (MW) _u	Additive uniform layer effect	72	339.6	1.09	-555
4) YM YW (MW) _x	Log-multiplicative uniform layer effect	72	348.9	1.11	-546
5) YM YW (MW) _r	Regression-type layer effect	64	95.6	0.63	-700

Note: *Y* – year; *M* – men; *W* – women; subscript *u* – additive uniform layer effect among tables; subscript *x* – multiplicative uniform layer effect among tables; subscript *r* – regression-type layer effect among tables; *DP* – distance pattern for association in tables; *L*² is the log-likelihood ratio chi-square statistic; *df* are the degrees of freedom; *BIC* is Bayesian information criterion ($BIC = L^2 - (df) \log(N)$), in which *N* is the total number of cases per country (250 000); Δ is the index of dissimilarity, which indicates the proportion of cases misclassified by the model.

Table 3. Estimated parameters by models 5 separately for Czech republic, Slovakia and Hungary

Panel A: Parameters λ_{ij} for baseline pattern of association between men's and woman's education level in 2003

men's education level	Czech Republic				Slovakia				Hungary			
	women's education level				women's education level				women's education level			
	EL	VT	HS	TE	EL	VT	HS	TE	EL	VT	HS	TE
EL	1.82	0.15	-0.82	-1.15	2.43	0.23	-1.04	-1.62	1.85	0.48	-0.69	-1.64
VT	0.11	1.01	-0.08	-1.04	0.13	0.98	-0.03	-1.08	0.23	0.71	-0.11	-0.83
HS	-0.65	-0.11	0.50	0.26	-0.81	-0.03	0.54	0.30	-0.65	-0.11	0.39	0.37
TE	-1.28	-1.05	0.40	1.93	-1.75	-1.18	0.53	2.40	-1.43	-1.08	0.41	2.10

Note: EL – elementary school, VT – vocational training, HS – high school, TE – tertiary education or university.

Panel B: Parameters ψ_{ij} for pattern of deviation in 1976 from baseline pattern of association in 2003

men's education level	Czech Republic				Slovakia				Hungary			
	women's education level				women's education level				women's education level			
	EL	VT	HS	TE	EL	VT	HS	TE	EL	VT	HS	TE
EL	-0.12	0.07	0.23	-0.18	-0.46	0.08	0.26	0.12	-0.33	0.03	0.16	0.14
VT	0.15	0	-0.1	-0.05	0.24	-0.01	-0.12	-0.11	0.20	0.06	-0.07	-0.19
HS	0.09	-0.04	-0.12	0.07	0.18	-0.11	-0.12	0.05	0.13	-0.05	-0.09	0.01
TE	-0.12	-0.03	-0.01	0.16	0.04	0.04	-0.02	-0.06	0	-0.04	0	0.04

Note: EL – elementary school, VT – vocational training, HS – high school, TE – tertiary education or university.

Panel C: Parameters φ_k for strength of deviation over years

years	Czech Republic										Slovakia										Hungary									
	76	79	82	85	88	91	94	97	00	03	76	79	82	85	88	91	94	97	00	03	76	79	82	85	88	91	94	97	00	03
φ	1	1.25	1.15	1.18	0.52	0.69	0.24	0.20	-0.14	0	1	1.03	1.02	0.90	0.8	0.68	0.19	-0.03	0.01	0	1	0.93	0.89	0.66	0.65	0.61	0.57	0.40	0.06	0

Appendix

Table 5. Frequency distribution of all new marriages by education of spouses between 1976 and 2003 in the Czech Republic.

Year	Men's ed. level	Women's educational level					Year	Men's ed. level	Women's educational level				
		EL	VC	HS	TE	Total			EL	VC	HS	TE	Total
1976	EL	15456	3891	2129	103	21579	1991	EL	5518	2185	1573	119	9395
	VT	12894	25892	10112	403	49301		VT	4693	19885	10137	446	35161
	HS	2363	4554	10493	913	18323		HS	1655	4881	13222	1250	21008
	TE	243	561	3166	1753	5723		TE	214	496	3631	2068	6409
	Total	30956	34898	25900	3172	94926		Total	12080	27447	28563	3883	71973
1979	EL	11784	2742	2228	117	16871	1994	EL	4419	1618	1068	92	7197
	VT	10281	22312	9960	416	42969		VT	3259	16636	7707	403	28005
	HS	2488	3986	10950	1091	18515		HS	1206	4125	10457	1228	17016
	TE	311	506	3460	1841	6118		TE	183	506	3305	2228	6222
	Total	24864	29546	26598	3465	84473		Total	9067	22885	22537	3951	58440
1982	EL	10129	2204	2051	127	14511	1997	EL	3415	1491	990	151	6047
	VT	8909	19492	9925	423	38749		VT	2965	15219	8335	577	27096
	HS	2400	3613	10404	1079	17496		HS	1046	3891	11329	1506	17772
	TE	329	486	3431	1962	6208		TE	188	505	3479	2717	6889
	Total	21767	25795	25811	3591	76964		Total	7614	21106	24133	4951	57804
1985	EL	8604	2237	2249	151	13241	2000	EL	2580	1159	782	132	4653
	VT	7894	18942	11756	537	39129		VT	2352	12936	8852	692	24832
	HS	2472	4099	13049	1382	21002		HS	842	3349	12134	1921	18246
	TE	289	477	4037	2469	7272		TE	175	484	3625	3306	7590
	Total	19259	25755	31091	4539	80644		Total	5949	17928	25393	6051	55321
1988	EL	7584	2395	1888	155	12022	2003	EL	1830	790	582	70	3272
	VT	5565	20259	11834	543	38201		VT	1720	9824	6977	639	19160
	HS	2039	5278	14753	1528	23598		HS	749	2830	12413	2371	18363
	TE	278	527	4118	2714	7637		TE	112	367	3635	4034	8148
	Total	15466	28459	32593	4940	81458		Total	4411	13811	23607	7114	48943

Note: EL – elementary school, VT – vocational training, HS – high school, TE – tertiary education.

Source: Czech Statistical Office.

Table 6. Frequency distribution of all new marriages by education of spouses between 1976 and 2003 in Slovakia.

Year	Men's ed. level	Women's educational level					Year	Men's ed. level	Women's educational level				
		EL	VC	HS	TE	Total			EL	VC	HS	TE	Total
1976	EL	8537	1644	1068	36	11285	1991	EL	1919	806	439	37	3201
	VT	5065	9314	5492	207	20078		VT	1576	8155	4941	201	14873
	HS	992	1860	6178	625	9655		HS	582	2442	7793	697	11514
	TE	61	170	1754	1157	3142		TE	50	150	1751	1182	3133
	Total	14655	12988	14492	2025	44160		Total	4127	11553	14924	2117	32721
1979	EL	5692	1392	923	35	8042	1994	EL	1897	531	363	22	2813
	VT	4231	9948	6068	189	20436		VT	1130	6242	4359	166	11897
	HS	976	1998	6910	701	10585		HS	447	2248	6923	737	10355
	TE	102	203	1987	1244	3536		TE	32	160	1560	1338	3090
	Total	11001	13541	15888	2169	42599		Total	3506	9181	13205	2263	28155
1982	EL	4343	1203	768	50	6364	1997	EL	2167	541	374	48	3130
	VT	3638	9323	6080	246	19287		VT	947	5500	4419	196	11062
	HS	942	2000	7222	773	10937		HS	376	1953	7140	852	10321
	TE	88	181	2032	1451	3752		TE	31	128	1609	1674	3442
	Total	9011	12707	16102	2520	40340		Total	3521	8122	13542	2770	27955
1985	EL	3535	999	692	54	5280	2000	EL	1222	417	257	17	1913
	VT	2987	8635	6068	282	17972		VT	676	4416	4189	276	9557
	HS	827	2160	7783	866	11636		HS	256	1564	7506	1190	10516
	TE	71	221	2025	1656	3973		TE	21	103	1727	2066	3917
	Total	7420	12015	16568	2858	38861		Total	2175	6500	13679	3549	25903
1988	EL	2763	1005	677	45	4490	2003	EL	1254	300	252	28	1834
	VT	2087	8456	5717	279	16539		VT	649	2746	3474	343	7212
	HS	654	2472	8458	931	12515		HS	272	1266	9228	1598	12364
	TE	54	203	2054	1638	3949		TE	29	106	1815	2642	4592
	Total	5558	12136	16906	2893	37493		Total	2204	4418	14769	4611	26002

Note: EL – elementary school, VT – vocational training, HS – high school, TE – tertiary education.

Source: Slovak Statistical Office.

Table 5. Frequency distribution of all new marriages by education of spouses between 1976 and 2003 in Hungary.

Year	Men's ed. level	Women's educational level					Year	Men's ed. level	Women's educational level				
		EL	VC	HS	TE	Total			EL	VC	HS	TE	Total
1976	EL	24497	2967	3408	157	31029	1991	EL	8553	2540	1881	138	13112
	VT	18852	9221	10837	509	39419		VT	6856	9337	8401	797	25391
	HS	4653	2332	12187	1595	20767		HS	1839	2578	9355	1942	15714
	TE	643	269	4641	3698	9251		TE	251	357	3069	3302	6979
	Total	48645	14789	31073	5959	100 466		Total	17499	14812	22706	6179	61 196
1979	EL	18185	2719	3077	217	24198	1994	EL	6673	2592	1595	122	10982
	VT	14302	8879	10908	728	34817		VT	5211	8999	7388	770	22368
	HS	3637	2171	11288	1985	19081		HS	1384	2606	8099	1846	13935
	TE	527	252	4217	4076	9072		TE	177	308	2774	3550	6809
	Total	36651	14021	29490	7006	87 168		Total	13445	14505	19856	6288	54 094
1982	EL	14192	2588	2591	188	19559	1997	EL	5142	2218	1332	128	8820
	VT	11144	8530	9239	848	29761		VT	3648	7368	6482	780	18278
	HS	3082	2242	10086	2173	17583		HS	1021	2249	7719	1924	12913
	TE	418	301	3734	4193	8646		TE	157	259	2677	3796	6889
	Total	28836	13661	25650	7402	75 549		Total	9968	12094	18210	6628	46 900
1985	EL	12287	2554	2193	151	17185	2000	EL	4636	1736	1331	172	7875
	VT	10094	9839	9224	802	29959		VT	2805	6730	6975	1083	17593
	HS	2584	2925	10590	2077	18176		HS	865	2100	8191	2643	13799
	TE	345	345	3636	3590	7916		TE	116	299	2901	5513	8829
	Total	25310	15663	25643	6620	73 236		Total	8422	10865	19398	9411	48 096
1988	EL	9279	2559	1970	159	13967	2003	EL	3739	1297	1188	194	6418
	VT	8000	9594	9145	828	27567		VT	2154	5117	5946	1249	14466
	HS	2084	2932	9911	1969	16896		HS	728	1813	8382	3450	14373
	TE	273	372	3447	3385	7477		TE	133	221	3056	6705	10115
	Total	19636	15457	24473	6341	65 907		Total	6754	8448	18572	11598	45 372

Note: EL – elementary school, VT – vocational training, HS – high school, TE – tertiary education.

Source: Hungarian Statistical Office.