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Does Higher Education Expansion Promote Educational Homogamy? Evidence from Married Couples of the Post-80s Generation in Shanghai, China

Anning Hu and

Department of Sociology, Fudan University, 831, Liberal Arts Building, Handan Road, Shanghai 200433, China

Zhenchao Qian

Population Studies and Training Center and Department of Sociology, Brown University Maxcy Hall, Box 1916 108 George Street Providence, RI 02912, USA

Abstract

The expansion of higher education witnessed in many societies influences the pattern of educational assortative mating. Structural transition theory predicts growing educational homogamy due to increasing preference for highly-educated partners who become more widely available. In contrast, social closure theory suggests depressed educational homogamy because the inflation of the education elite circle fosters the openness of marriage market, reducing the preference for a highly-educated mate and increasing the penetrability across social-status boundaries. Capitalizing the survey data that are representative of the post-80s one-child generation collected in Shanghai, China, we test the hypotheses derived from the two theories. Empirical results suggest that, with increasing availability of highly educated individuals, the extent of educational homogamy by birth cohort reveals a U-shaped pattern. This U-shaped pattern demonstrates increasing levels of educational homogamy and lends support to structural transition theory.

Keywords

Educational Homogamy; Higher Education Expansion; Post-80s Generation; China

INTRODUCTION

Educational attainment is associated with many desirable outcomes, such as higher economic status, better health condition, and happiness (e.g., Hartog and Oosterbeek 1998; Hout 2012). It benefits not only the individual, but also his or her partner in a union (Lefgren and Mclntyre 2006). It is not a surprise that an individual's educational attainment is always valued in mate selection. However, the number of highly-educated individuals is finite in a society. This structural constraint, along with the general preference for an educated partner, determines that, educated individuals tend to marry each other, leaving the less-educated

Corresponding Author: huanning@fudan.edu.cn (A. Hu).

either unmarried or married with someone of similar educational attainment. As a result, a pattern of “like marries like,” or educational assortative mating (EAM henceforth), would emerge (e.g., Blossfeld 2009; Blossfeld and Timm 2003; Kalmijn 1994, 1998; Qian and Preston 1993; Qian 1998; Schwartz 2013; Schwartz and Mare 2005; Smits, Ultee, and Lammers 1998; Smits and Park 2009).

The extent of EAM is intrinsically related to men’s and women’s educational compositions. Over the past decades, more men and women have received college education around the world (Carnoy et al. 2013; Schofer and Meyer 2005). This trend has fundamentally altered marriage markets and borne implications for EAM. For instance, educational expansion has been cited by scholars as one important social force in shaping the pattern of EAM in the U.S. (e.g., Mare 2016), Britain and Ireland (Halpin and Chan 2003), South Korea (Park and Smits 2005), Spain (Esteve and Cortina 2006), Norway (Birkelund and Heldal 2003), China (Han 2010), Hong Kong (Zhou 2016), Latin America (Esteve, McCaa, and Lopez 2013), and Eastern Europe (Katrnak, Kreidl, and Fonadova 2006), to name a few. Also, variation in the extent of the expansion of formal education has been serving to account for cross-national variations in EAM, as suggested by Monaghan (2015), Smits (2003), and Smits and Park (2009). Besides these studies, what is especially worth mentioning is the research into the direct relationship between education and marriage. Rauscher (2015), in this regard, illustrates how the effect of the early U.S. compulsory schooling laws on EAM varies between the North and the South. The study of Musick, Brand, and Davis (2012) shows that marital sorting based on non-educational attributes might be strengthened within educational expansion, resulting in a lesser extent of EAM for college-goers with disadvantaged background.

Despite the large volume of studies on EAM, prior literature nevertheless does not reach a consensus pertaining to the relationship between higher education expansion and EAM. Regarding this question, different theoretical arguments have been proposed. Specifically, structural transition theory (STT henceforth) posits that higher education expansion gives rise to the extent of EAM by enlarging the pool of similarly-educated individuals and cultivating the preference for a well-educated partner (e.g., Blau and Schwartz 1984; Blossfeld and Timm 2003; Sweeney 2002; Sweeney and Cancian 2004).[1] In contrast, status closure theory (SCT henceforth) hypothesizes a decline in educational homogamy within educational expansion, due to the increasingly penetrable educational boundaries on the marriage market and declining preference for a highly-educated mate (Smits 2003; Smits, Ultee, and Lammers 1998; Smits and Park 2009).

It is a challenge to understand the connection between higher educational expansion and EAM because educational expansion in most societies is such a comprehensive and gradual social transformation that its social impact often takes decades to unfold. For instance, it took the U.S. 70 years to raise the percentage of tertiary educated individuals among the 25 years old and over from 5 percent to 30 percent (Ryan and Siebens 2012).[2] That is why

[1]Indeed, whether improvement in women’s education facilitates EAM is related to contextual gender role differences. In societies with a more gender-symmetric division of labor within households, women’s improved education could be positively related to EAM (Sweeney 2002).

many prior studies examine the consequences of educational expansion through cross-national comparisons (e.g., Smits and Park 2009),[3] where mixed results are obtained. For instance, Ultee and Luijkx (1990) have documented increases, decreases, and trendless fluctuations of educational homogamy among 18 industrial nations, which provide evidence for neither STT nor SCT.

In this paper, we focus on the post-80s generation (individuals born between 1980 and 1989) in Shanghai, the largest metropolis of China, which enables us to better understand the connection between higher educational expansion and EAM, for the following reasons. First of all, higher education expansion in China was rapid and the centralized administrative system singlehandedly increased the percentage of those with college education at a phenomenal rate *within a very short period of time.* For example, the original objective of China's Ministry of Education was to raise the gross college enrollment rate to 15 percent by 2010, but this goal was accomplished eight years ahead of schedule. As a result, the gross tertiary enrollment rate rose from 7 percent in 1999 to 27 percent in 2011. The unprecedented rapid expansion of tertiary education provides us a valuable opportunity to examine the *temporal* variations across cohorts instead of using a proxy of regional variation.

Second, the post-80s generation is a unique group because they were in college ages during or soon after the onset of higher education expansion in 1999. That is to say, the fact that they were born in the 1980s determines their relatively high likelihood of receiving college education. Meanwhile, this generation, interviewed in 2013, was in the phase of transition from youth to adulthood, and most were already married. An examination of this generation helps us understand the impact of educational expansion on educational homogamy.

Lastly, the data were collected in Shanghai, the largest and the most modern metropolis in contemporary China. This one-city sample, although limited in generalization, alleviates the concern of strong regional heterogeneity in implementation of higher education expansion policies (Morgan and Wu 2011). Shanghai accommodates 68 higher education institutions and has always assumed a leading role in higher education expansion in China. More importantly, gender equality is stronger in Shanghai than in the other parts (Shen 2011; Shu and Zhu 2012). Thus, educational expansion should thus have a significant influence on young women – an important contributive factor for assortative mating.

All in all, this study, by taking advantage of the unique societal transition in China, i.e., the phenomenally rapid expansion of higher education driven by the state, describes a more detailed picture about the association between educational expansion and EAM. Moreover, by specifying and separating the mechanisms of EAM (marriage market structure versus marital preference), this article betters our understanding about how and why the extent of EAM changes in the post 80s generation in China.

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[2]Previous studies based on cross-sectional data over a long period of time in the U.S. document a lesser extent of intermarriage among groups of highly-educated persons (e.g., Mare 1991; Schwartz and Mare 2005). Such longitudinal data are rare in many other societies.

[3]Despite the merits inherent to this "regional variation as proxy for temporal variation" approach, institutional differences across societies have always been a real concern (Raymo and Xie 2000). For instance, the basic classification of educational stages substantially differs from one society to another (Wong 2003).

THEORETICAL FRAMEWORK

As well-documented in the extant literature, a particular pattern of EAM is jointly determined by both *individual preference* and *structural constraints of the marriage market* (Blossfeld 1996; Kalmijn and Flap 2001; Zeng and Xie 2008). For example, a marriage between a college-educated man and a college-educated woman is possible only if (1) there are college-educated partners available for a college educated person to mate; and (2) there is a preference to marry someone with college education. Higher education expansion has the potential to alter the extent of EAM by changing both preference and structural constraints. In this regard, however, STT and SCT propose contrasting theoretical reasonings.

Structural Transition Theory

STT focuses on how expanding educational opportunities alter the pattern of EAM, and argues that both marriage market structure and individual marital preference are influenced by the lowered threshold for attending college.

Higher education expansion influences the structure of marriage market by increasing the availability of highly-educated partners. This change promotes EAM because college serves as a local marriage market, where less educated individuals are blocked out and college-educated individuals meet each other (Blau and Schwartz 1984; Blossfeld and Timm 2003; McPherson, Smith-Lovin, and Cook 2001). Moreover, they reach marriageable ages in college and have a smaller variation in marriage timing due to later school departures than the less educated. This likely gives rise to the likelihood of educational homogamy (Mare 1991). Hence, as more people attend college in the process of educational expansion, the overall EAM should be strengthened.

Meanwhile, within higher education expansion, college-educated individuals may prefer someone just like themselves because common educational experience bestows people with similar values and opinions. Thus, they share a common foundation for conversation and joint activities, and reveal a higher likelihood of favoring each other in the family formation process (Blossfeld and Timm 2003). This mechanism is seen evident in the social psychological literature, where cultural similarity breeds interpersonal attraction and willingness to establish a long-term relationship such as marriage (e.g., Byrne 1971).

It is especially important that the expansion of higher education raises women's educational attainment, which promotes educational homogamy (Diprete and Buchmann 2013; Hou and Myles 2008). Disadvantaged groups, such as women, have been noted to benefit *more* from expanded opportunities of higher education (e.g., Attewell and Lavin 2007). This would balance the sex ratio in the pool of highly-educated individuals and promote EAM. Women's improved educational attainment suggests that wife's earnings are increasingly as important as husband's in a family (Gerson 2010; Oppenheimer 1988). Moreover, the wife's human capital further boosts her spouse's productivity and earnings (Lefgren and Mclntyre 2006; Huang, Li, Liu, and Zhang 2009). In light of growing significance of women's education for family life, the mating pattern is expected to gradually deviate from Becker's traditional model (1981),[4] and move toward a *symmetric* model in which men prefer and compete for highly-educated women the same way as women do on a marriage market (England and Farkas 1986). Educational homogamy is thus strengthened as a result (Rose 2004; Sweeney and Cancian 2004).

In summary, according to STT, expansion of college education changes the structure of the marriage market and people's marital preference, both of which are in favor of stronger EAM.

Status Closure Theory

SCT offers a different perspective of examining the consequence of higher educational expansion on EAM. From this perspective, mate selection is viewed a measure of social openness (Glass 1954), because marriage is in nature a union between two individuals who accept each other as *social equals*. Who marries whom thus reveals which social boundaries are more permeable than others. In modern societies, education is a primary determinant of an individual's social status and the pattern of educational homogamy implies the extent of status closure (or openness) in a society (Goldthorpe 1980; Parkin 1971; Weber [1921] 1972).[5]

Smits and colleagues (Smits 2003; Smits, Ultee, and Lammers 1998; Smits and Park 2009) argue that one key factor that affects education status closure is the *group size* of the education elite. The elite circle is usually small, which makes elite members more aware of their advantaged positions and helps maintain their privilege (e.g., a rewarding college degree). Hence, when higher education is accessible only to a small number of individuals, education elites tend to consolidate education status closure, maintaining a higher level of educational homogamy.

Higher education expansion inevitably increases the size of education elites. As the size of highly educated individuals grows, those with less education gradually make up a small proportion in the population, so the structural opportunity for them to mate with highly-educated individuals would rise (Feld 1982). The major implication of this structural transition for the marriage market is the increasing penetrability across educational boundaries, which opens up the overall marriage market and drives down EAM.

Reduced barriers of marriage markets by educational attainment may also alter marital preference. Since the privileged benefits of education elites are "diluted" by credential proliferation, the preference for homogamy may go down and reduce EAM. Previous studies on cross-national comparisons have provided evidence for this relationship (Smits 2003, Smits, Ultee, and Lammers 1998, and Smits and Park 2009).

As summarized in Table 1, STT and SCT propose different patterns of transition in marriage market structure and preference in mate selection. Specifically, STT assumes higher education expansion to be positively associated with the extent of EAM by increasing the

[4]According to Becker (1981), family gains are optimized when couples form division of labor, with specialty in either market or household work, which leads to a pattern of mating between high-wage men (or women) and low-wage women (or men).

[5]However, this does not rule out the other mechanism of status closure. Besides education, people might adopt other criteria in mate selection, such as occupation or political status.

pool of college educated individuals and cultivating stronger preference for a well-educated partner. This is especially embodied by the strengthened gender balance in educational attainment and the rising role of women in family life. SCT posits that higher education expansion brings about more penetrable educational barriers and reduces the relative attractiveness of highly-educated individuals, which results in weakened EAM. This study tests these hypotheses with the data collected in China. To familiarize readers with the social setting, the following subsection introduces the state of educational assortative mating in Chinese society.

Educational Assortative Mating in China

"Match-door marriage," the door of one's home in a marriage must match that of his/her suitor's, used to be the norm in China. The match-door marriage required meticulous pairing of couples' family background and was often fulfilled by parents through arranged marriage (Xia and Zhou 2003). This tradition, however, was gradually abandoned, especially after 1950 when the Marriage Law regulated that arranged marriage was feudalistic and illegal. Since then, the mating process gradually gravitates less toward individuals' family background and more toward one's achieved attributes (Croll 1981).

During the socialist regime, education was nevertheless not valued as much as individual attributes that were tied to political capital, such as work unit type (e.g., civil servants) or Communist Party membership (Croll 1981). Education emerged to be important in mate selection after the implementation of the comprehensive social reform in the late 1970s.[6] As shown in Han (2010), the extent of educational assortative marriage increased substantially between 1980 and 1995 and then grew at a relatively slower pace in the late 1990s.[7] Yet, few studies extend their investigation to the period of higher educational expansion (that is, after the late 1990s). One exception is Qian and Qian (2014b), who show that highly educated women have a different propensity of marriage relative to highly educated men. In short, how EAM may vary within the comprehensive and rapid credential proliferation in China is still elusive. We aim to investigate this question in this study.

DATA AND METHODOLOGY

Sample and Measures

The data used in this study are the Shanghai Post-80s Generation Survey (Post-80s hereafter), which were collected in 2013 by Fudan University in Shanghai, China. The target population includes individuals born between 1980 and 1989. The Post-80s survey covers 160 neighborhoods in all of the 18 administrative districts in Shanghai. From each neighborhood, 10,000 addresses were randomly selected and the socio-demographic information of households was collected. From each selected household, a maximum of one household member born between 1980 and 1989 was interviewed (if more than one member born in the period, one was randomly selected).

[6]In the past, the pattern of educational matching often follows a pattern of hypergamy, in which wife's education is lower than husband's. This type of educational pairing is largely due to the traditional gender-role. That is, women are homemakers while men are bread winners (Attane 2012).

[7]The traditional gender role is still at play in contemporary China (Qian and Qian 2014a; Zuo 2003).

The response rate of the Post-80s is 71 percent, and the final sample size is 2,357, in which 1,249 were married. Of the 1,249 married respondents, 1,173 have non-missing information about their spouse's educational attainment. The age interval of the respondents is between 24 and 32. Since most Chinese college students graduate at the age of 22, this age interval is sufficiently long to guarantee our respondents, if attending college, to complete their formal tertiary education.

Educational attainment is classified into five levels, 1=elementary school and below; 2=junior high school or equivalent; 3=senior high school or equivalent; 4= junior college or equivalent; and 5= regular college or equivalent. In order to reveal variation in EAM by cohort, we *divide the time span between 1980 and 1989 into three cohorts:* 1980–1983, 1984–1986, and 1987–1989. For each cohort, a 5×5 contingency table between the husband's and the wife's educational attainment is constructed. Note that the sample size of each cohort is large enough to guarantee the statistical power of a 5×5 contingency table, even for the youngest cohort (Stelzl 2000). The grouping strategy of cohorts, by trisecting the period 1980–1989, ensures the relatively same length of time span (that is, 2–3 years) for each cohort. This strategy not only serves the interest of computational convenience, but also makes practical sense because the process of higher education expansion in Shanghai almost follows a linear trend. As shown in Figure 1, the rate of college enrollment in Shanghai nearly *monotonically increased* from 1999 to 2008. Since most senior high school graduates attend college at around 18 or 19 years old in China, this linear tendency suggests that the extent of increase in the opportunity of attending college linearly went up from the cohort 1980 to the cohort 1989. In this regard, a grouping scheme of ensuring a same length of time span for each cohort should not bring about severe biases.

For robustness check, we used a different time span partitioning: dividing the period between 1980 and 1989 *based on the cumulative percentage of population*. Specifically, we set new cutting points respectively at the years where the 33 cumulative percent (that is, 1982) and the 66 cumulative percent (that is, 1984) of sample size are located. This new strategy gives us a new scheme of grouping cohorts: 1980–1982, 1983–1984, and 1985–1989. If the analytical results do not show significant change, our estimates are robust. In addition, the robust analysis serves to test the influences of the unbalanced sample size problem. The trisecting scheme we describe above, as such, inevitably results in unbalanced sample sizes across cohorts since younger cohorts have fewer individuals than older cohorts. This problem is nevertheless circumvented by the cumulative population grouping scheme because the young cohorts now covers more years to compensate for their sample size, ensuring the population sizes by cohort to be balanced.

Analytical Strategies

The log-multiplicative layer model is used to examine the variation in the extent of educational homogamy across cohorts (Xie 1992). This model identifies the shift in EAM by "a common association pattern and a table-specific parameter" (Xie 1992:380). Specifically, taking into account cohort variation, we construct a three-way table, in which husband's education, wife's education, and cohort interact with each other. Following previous practice, we assign a small value (0.01) for empty cells. A saturated model to describe this set of three-way interactions is

$$F_{ijk}=\tau_0\tau_i^h\tau_j^w\tau_k^c\tau_{ik}^{hc}\tau_{jk}^{wc}\tau_{ij}^{hw}\tau_{ijk}^{hwc} \quad (1)$$

In Equation (1), F_{ijk} is the expected number of marriages between husbands with educational level i and wives with educational level j (i, j=1, …, 5) in cohort k (k=1, 2, and 3). The log-multiplicative layer model simplifies Equation (1) and reduces the last two terms to be exp($\psi_{ij}\phi_k$), as follows:

$$F_{ijk}=\tau_0\tau_i^h\tau_j^w\tau_k^c\tau_{ik}^{hc}\tau_{jk}^{wc}\exp(\psi_{ij}\phi_k) \quad (2)$$

In Equation (2), ψ_{ij} describes the common association between the husband's and the wife's educational attainment, and ϕ_k indicates *cohort-specific association strength*. Based on the log-multiplicative layer model, we adopt the following strategies to separate the mechanism of marriage market structure transition from the mechanism of changing marital preference in determining the state of educational homogamy.

Effect of Marital Preference Net of Structural Availability of Partners—We first investigate the effect of marital preference net of the availability of partners, testing the competing hypotheses about the transition of marital preference by STT and SCT.

Following previous studies (e.g., Breen and Salazar 2011; Breen and Andersen 2012), we adopt a counterfactual approach. Specifically, the observed level of educational homogamy for cohort k can be viewed as a joint effect of both availability and preference, which can be expressed as:

$$\phi_k=f(A_k, P_k) \quad (3)$$

where A_k and P_k respectively denote availability and preference for cohort k, and f refers to a function that links A_k and P_k to ϕ_k. Here, the function form of f does not have to be estimated. In this formula, it is appropriate to view ϕ_k to be a type of observed conditional distribution, which is the combination of net association that is captured by P_k, and the marginal distribution that is captured by A_k. With the setup of formula (3), the observed transition of educational homogamy across the three cohorts can be expressed as $f(A_1, P_1) \rightarrow f(A_2, P_2) \rightarrow f(A_3, P_3)$.

Then, to show the effect of preference net of availability, we deploy the iterative proportional fitting (IPF) algorithm (also called the Stephan-Deming standardization or the matrix raking procedure) (Deming and Stephan 1940). The IPF algorithm is a mathematical scaling procedure which has been used by demographers to *standardize* the marginal distribution of a contingency table to some fixed value, while retaining the net association between row and column variables (e.g., Bishop et al. 2007; Breen and Andersen 2012). Since the availability of partners is captured by the marginal distribution of the contingency tables, the IPF procedure enables us to construct *counterfactual scenarios where the marginal distributions of contingency tables for cohorts 1984–1986 and 1987–1989 are fixed at that of 1980–1983*, as expressed to be:

$$\phi_k^{counterfactual} = f(A_1, P_k) \quad (4)$$

With Equation (4), the counterfactual tendency in the extent of educational homogamy would then be $f(A_1, P_1) \rightarrow f(A_1, P_2) \rightarrow f(A_1, P_3)$. Evidently, only the mechanism of preference is at play, so that the cross-cohort variation in educational homogamy under these counterfactual states can be attributed to the variation of marital preference.

One thing that deserves discussing is that, in equation (2), τ_{ik}^{hc} and τ_{jk}^{wc} capture the observed cross-cohort variation in the distribution of husbands and wives of different educational backgrounds, so the log-multiplicative layer model reveals change in EAM *for a given observed variation in marginal counts*. However, the counterfactual analysis is aimed to uncover EAM *with the same marginal counts across cohorts*. In this regard, the IPF is necessary for our research objectives.

Effect of Structural Availability of Partners Net of Marital Preference—The net effect of availability should be examined after controlling for the parameter of preference across cohorts. However, marital preference refers to an individual-level attitude, but the log-multiplicative layer model examines the expected frequencies of different cells of the contingency tables. The discrepancy in the unit of analysis determines that we cannot *directly* add a measure of preference to the log-multiplicative layer model as a control variable. In order to resolve this challenge, we use propensity score weighting (Freedman and Berk 2008).

Weighting has been a popular technique to balance attributes across groups of cases. By propensity score weighting, we refer to a process of weighting analyzed cases according to their estimated probabilities of preferring certain type of partners. Specifically, in the Post-80s data, respondents were asked about their preference for educational credentials and intellectual background when choosing a mate. The option to these two questions is from 1(not important) to 5 (very important). We add up the answers of these two questions and generate a new binary variable where people with responses above the median is coded one and otherwise coded zero. Subsequently, we use cohort to predict the probability of providing a positive answer in a logistic regression model. The predicted probability for each case is the propensity score, which is used to generate analytical weights. Suppose the predicted propensity score for individual i is denoted with p_i, the new weight for those whose answer to the newly generated binary variable is one is $\frac{1}{p_i}$, and that for those with answer being zero is $\frac{1}{(1-p_i)}$.

The merit of propensity score weighting is that people's marital preference, after weighting, is balanced across cohorts. To see this formally, suppose one's marital preference probability is denoted by **π**. This probability is decomposed into two components: one systematical component S that is determined by some observed explanatory variables (e.g., cohort) and one random component R representing some random noise. This relationship is shown in formula (5).

$$\pi = S(cohort) + R \quad (5)$$

As noted earlier, the propensity score is estimated based on cohort, so weighting based on propensity score is tantamount to balancing S. As a result, the systematical component is controlled for and what is left is some random variation of marital preference across cohorts.

Two caveats are necessary. First, propensity score weighting is performed based on observed covariates, and we cannot control for unobserved factors that are related to marital preference (e.g, the random component R). In this light, propensity score weighting only tackles the systematical part of marital preference. Second, propensity score weighting does not produce a particular parameter to estimate the net availability effect. As an alternative, this analytical approach changes the weights of every respondent to generate a new balanced sample. Hence, after weights are applied, we can use the log-multiplicative layers model to analyze the weighted sample and the result of transition in EAM across cohorts would be attributed to the mechanism of availability.

Penetrability of Educational Barriers—One major hypothesis of SCT is the increasing penetrability of educational barriers within higher education expansion. To test this hypothesis, we use the crossing effect model (e.g., Qian 1998; Mare 1991). As shown in Figure 2, we configure three design matrices to denote the extents of difficulty in crossing the adjacent categories of educational attainment in union formation. Specifically, we set our focus on the three educational stages beyond the nine-year compulsory education, that is, senior high school, junior college, and regular college.

RESULTS

Descriptive Findings

Table 2 presents results of the cross classification between spouses' educational attainment for each of the three cohorts. For the oldest cohort, 1980–1983, married couples tend to have similar educational backgrounds, as the cells on the main diagonal always have the largest percentage *for each row* from men's perspective and *for each column* from women's perspective (1.39 percent, 14.09 percent, 9.60 percent, 13.47 percent, and 15.02 percent), except for the least educated women, who had a higher percent being married to a man of junior-high-school education (2.94 percent) rather than to a same education partner (1.39 percent). These findings suggest that educational homogamy is generally a common norm of marriage for those born between 1980 and 1983, despite a certain extent of hypergamy for the least-educated women.

The educational pairing for the 1984–1986 cohort reveals a similar pattern, since the main diagonal percentages (12.84 percent, 11.97 percent, 13.96 percent, and 16.24 percent) are the highest for each row and column among those with an educational level above elementary school. Same as the oldest cohort, the least educated women had a greater percentage marrying men with junior high school (1.42 percent) than marrying those with a same-education partner. Yet, the 1984–1986 cohort witnessed a new finding -- men with elementary school education started to marry more-educated women (0.85 percent). This may well be related to a rise in women's education and a decline in the number of women with only elementary school education.

The youngest cohort, 1987–1989, also reveals strong EAM among those with at least junior high school education, as well as a tendency of the least educated men matching with women with a junior high school degree. Interestingly, hypergamy among the least educated women is no longer evident. Instead, the least-educated women have similar percentages marrying men with elementary school or junior high school education. This pattern is reasonably related to the general improvement in education of the population.

Results of the Log-Multiplicative Layer Models

Following Raymo and Xie (2000) and Song (2009),[8] we specify five log-multiplicative layer models. Model 1 is the baseline model in which educational attainment for both husbands and wives is set to be conditionally independent (Xie 1998). It means that there is no association assumed between the husband's and the wife's education for each cohort. We then specify the association between spouses' education through two design matrices (Raymo and Xie 2000). Models 2 and 3 fit a main-diagonal model, and Models 4 and 5 add the distance parameters to Models 2 and 3 (the design matrices are presented in Figure 3), respectively. Furthermore, Models 2 and 4 set the ϕ parameter to be constant across cohorts ($\phi_1 = \phi_2 = \phi_3$) and Models 3 and 5 allow for cross-cohort variations.

The results of these models for the observed data and the IPF-generated data are presented in Table 3.

The upper panel of Table 3 reports statistics for the goodness of model fit, including the log likelihood ratio chi-square statistic, BIC, AIC, and the dissimilarity index. Model 1 does not fit the observed data well, as shown by the large values of these statistics. Allowing for the interaction of educational attainment of spouses significantly improves model fit, where L^2 decreases from 1000.86 to 374.05, BIC drops from 661.63 to 70.16, and AIC is reduced from 904.86 to 288.05. Moreover, the dissimilarity index is almost halved relative to Model 1. Model fit improves when educational association between spouses is allowed to vary by cohort (Model 3). Adding the distance parameters in Model 4 further improves model fit, indicated by the smaller values of L^2, BIC, AIC, and Δ. Model 5 has the best fit when ϕ_k is allowed to change by cohort.

[8]Raymo and Xie (2000) illustrate the log-multiplicative layer model in a methodological commentary. Song (2009) applies this method to analyze the effect of the Cultural Revolution on the extent of EAM in China, but this study, due to its focus on a different cohort, is not directly related to the current article.

In Model 5, the parameter ϕ_k roughly shows a U-shaped pattern, first decreasing (from 1 to 0.56) and then increasing (from 0.56 to 2.43).[9] This finding indicates that educational homogamy during higher educational expansion in China declined from the 1980–1983 cohort to the 1984–1986 cohort, but then went up in the 1987–1989 cohort.

Robustness Check

The U-shape transition in educational homogamy, as discussed earlier, might be subject to how cohort is classified. In order to examine the extent of sensitivity to cohort divide, we refit the log-multiplicative layer models using a new cohort grouping scheme based on the cumulative percentage of population. The new observed pattern is presented in Table 4, which is almost the same as Table 2.

The results of the log-multiplicative layer models based on data shown in Table 4 are reported in the upper panel of Table 5. As shown by the best fit model (Model 5), the extent of educational homogamy remains a U-shaped trend, changing from 1 to 0.92 and then to 1.81. This lends support to the robustness of the results presented earlier.

Effect of Preference Net of Availability

The U-shaped pattern presented above reflects the joint effects of both availability and preference. Using the IPF algorithm, we standardize the marginal distribution of the contingency tables for cohorts 1984–1986 and 1987–1989 to be that of cohort 1980–1983. This standardization guarantees the *homogeneity* in the marginal distribution of all three contingency tables, enabling us to examine the net effect of preference. The results of the log-multiplicative layer models based on the IPF-generated data are presented in the lower panel of Table 3 and Table 5.[10]

Following the same procedure of model selection, Model 5 is the one with the best fit. The transition pattern of ϕ_k also reveals a U-shaped pattern, where the odds of educational homogamy, under the condition of homogenous marginal counts, declined first (from 1 to 0.81) and then went up (from 0.81 to 2.28). Since this U-shaped pattern is obtained with the marginal distribution “controlled for”, it can be viewed to indicate the effect of marriage preference. That is to say, the extent of EAM was *not driven down* by the transition of marital preference.

Then, the question at issue is, how people’s marital preference changes across cohorts. For this question, Figure 4 presents some descriptive information. As shown, both men and women increasingly emphasize the importance of educational credential when looking for a partner. Especially, men’s preference for highly educated women increased notably from the 1984–1986 cohort to the 1987–1989 cohort. As for women, the preference for a highly-educated man reveals a roughly linear increase by cohort.

[9]This could also be called a V shaped pattern since only three groups are involved. We follow prior literature and describe it to be a U shaped pattern.

[10]Table 4 shows similar results, so hereafter we discuss our results based on Table 2.

In summary, the cross-cohort comparison generally portrays a picture of increasing preference for a highly-educated partner across cohorts. This finding, in addition to the net effect of preference shown earlier, implies that marital preference has been strengthened within the concerted educational expansion in China, and such variation in marital preference does not drive down the extent of EAM as hypothesized by SCT.

Effect of Availability Net of Preference

As noted in the methodological section, we examine the net effect of availability by fitting the log-multiplicative layer model based on the propensity-score weighted sample. For robustness check, we fit the models using two cohort classification schemes. Table 6 presents the results.

The extent of educational homogamy based on the weighted data continues to follow a U-shaped pattern, for both cohort grouping strategies. This pattern suggests that EAM, after controlling for mate selection preference, does not significantly deviate from the observed pattern shown earlier. The increased supply of highly-educated individuals and the concomitant decline in the number of less educated individuals lead to an increase in educational homogamy for the youngest cohort, thus lending support to STT.

To better understand the net effect of availability, we depict the educational spectrum by cohort, as presented in Figure 5.

In Figure 5, both husband's and wife's educational attainment exhibit a cross-cohort growth, for both cohort grouping schemes. The percentage of college educated men declined slightly for the youngest cohort but it was not statistically significant. In addition, the percentage of junior college educated men remarkably increased. For women, the percentage of the college educated steadily increased by cohort. Lastly, the percentage of the lowest educated declined for both men and women across cohorts.

Penetrability of Educational Barriers

To test the hypothesis about the increasing penetrability of educational barriers, we fitted the crossing effect model, with the major findings presented in Table 7.

As shown in Table 7, no evidence for increasing penetrability is detected across cohorts. Specifically, the boundary of mating between senior-high-school graduates and non-senior-high-school graduates is kind of stable by cohort, which is also the case for the educational category of junior college. As for the marital barrier pertaining to the category of regular college, despite a marginal decline from cohort 1980–1983 to cohort 1984–1986, such boundary becomes more rigid as we move to cohort 1987–1989. Hence, the barriers of mating across educational categories do not relax within higher education expansion as predicted by SCT.

CONCLUSION AND DISCUSSIONS

The expansion of higher education witnessed in many societies has influenced the pattern of EAM. Structural transition theory predicts a growing tendency of EAM due to strengthened availability of and preference for a highly-educated partner amid educational expansion. In contrast, social closure theory suggests that increasingly penetrable educational boundaries driven by the expanding size of the education elite circle would promote the openness of the marriage market and reduce the preference for a highly-educated spouse, which accordingly drive down educational homogamy. Using survey data collected in Shanghai, we examine the relationship between higher education expansion and educational homogamy with a focus on a sample of youth born in 1980–1989, many of whom go through courting and marriage during a period of rapid proliferation of college credential in China.

Applying the log-multiplicative layer model, we show that the likelihood of educational homogamy was lower in cohort 1984–1986 than in cohort 1980–1983, but rebounded in cohort 1987–1989. In order to pinpoint social forces behind this observed pattern, we adopt the iterative proportional fitting algorithm and propensity score weighting to reveal the net effects of partner preference and partner availability. Our analyses show that preference for a highly-educated mate has been intensified during higher education expansion in China and EAM under the influences of such transition in marital preference does not show a downtrend. As for partner availability, a continuous increase in the supply of highly-educated persons in the marriage market has given rise to EAM. Lastly, no evidence is documented to indicate a tendency of increasing penetrability of educational barriers in mate selection across cohorts.

Indeed, Shanghai is not representative of urban China and the pattern of EAM found here is likely to *overestimate* the extent of EAM in Chinese urban areas, at least in part due to greater prevalence of college graduates in Shanghai than in other cities of China. For instance, the latest census ranked Shanghai the second after Beijing in percentage of college-educated residents among all major cities. That being said, this study still bears a general implication for change in EAM in Chinese society. Shanghai, as a vanguard in social transitions in the Reform Era of China, is leading the process of higher educational expansion due to its abundant educational resources (e.g., the number of educational institutions, the quality of faculty, etc.). As a result, our findings can be witnessed on a larger scale for the rest of China as more senior high school graduates are able to attend college in the future.

Another implication of this study concerns the alarming income inequality in contemporary China (e.g., Xie and Zhou 2014). As noted above, the barrier between highly-educated and less-educated groups does not become more penetrable within higher education expansion. Prior studies have shown a strong link between educational attainment and income in the Reform Era of China (e.g., Wang 2012). Hence, educational homogamy might serve as a demographic process to *exacerbate* income inequality because people with stronger earning capacities marry each other (Hu and Qian 2015). In this light, higher education institutions in contemporary China may fail to serve as a social equalizer (Hu and Hibel 2014).

The documented extent of EAM relates to the one-child policy in China since those born in the 1980s are exactly the one-child generation. For them, two mechanisms might be at play to strengthen EAM. First, the one-child policy and the concomitant rigid limitation on the number of children encourage parents to raise the "perfect child" (Evans 2010). This may help promote educational attainment of post 80s women. Second, the birth control partly results in a skewed sex ratio among the post 80s (Guilmoto 2010). In this case, men have to confront fiercer competition for highly-educated women on the marriage market. These two factors highlight the potential role of the one-child policy and the uniqueness of the Chinese context.

Lastly, the transition in the extent of EAM in large supports more STT than SCT, since marital preference for a highly-educated partner does not go down and no evidence suggests an increasing penetrability of educational barriers. However, the only three cohorts that are in analysis cannot rule out the possibility that the transition in the likelihood of EAM is driven by some latent cyclical fluctuations. In addition, the U-shaped pattern is not fully aligned with the predicted continuous trend of EAM by STT. We speculate that the slight drop in the extent of EAM from the oldest to the middle cohort might be driven by the mechanism of SCT, while the transition from the middle to the youngest cohort suggests more the effects of STT. Specifically, one possible factor in this vein is the preference for Shanghai household registration status in union formation in Shanghai. Other things being equal, a partner with a Shanghai household registration status is more attractive. As more people outside Shanghai attended college and lived in Shanghai and college graduates educated elsewhere migrated to Shanghai within higher education expansion, the preference for a Shanghai household registration status might drive down EAM. However, for the youngest cohort, this household registration status preference may become less influential, or overridden by the preference for education, especially in the gloomy economic climate.

In this study, we examine the extent of educational homogamy among the married respondents, so the standardization based on IPF can only ensure that the *marginal counts of married respondents* for both men and women are fixed across cohorts. For our purpose, we control for neither availability of unmarried nor "the force of attraction" between couples with different educational backgrounds (Qian and Preston 1993). Thus, the changing extent of EAM, as well as the potential role played by the mechanisms of availability and preference, is conditional on marriage and only apply to married individuals.

This leads us to a major limitation of this study – there are more unmarried people in the youngest cohort than in the older cohorts. To examine this concern, our supplemental sensitivity analysis (not shown here) excluded people who were married at an older age among the older cohorts in order to achieve a similar age of marriage across the three cohorts. Specifically, we restricted the median duration of marriage for all three cohorts to be no more than two years (the median length of marriage for the youngest cohort) and refit the log-multiplicative layer models. The results again return a U-shaped probability of educational homogamy by cohort. This finding partly alleviates the concern of focusing on the married sample.

The concern of varying ages of marriage by cohort can be also seen from the perspective of age-period-cohort (APC) analysis, which is *de facto* tantamount to the problem of separating age, period, and cohort effects in a cross-sectional study. Cohort variation, when serving as a proxy to period transition in this study, potentially carries the information of life course effect (aging). Without longitudinal or repeated cross sectional data, we cannot investigate cohort variation and *simultaneously* control for age.

Fortunately, the APC identification problem is likely not a severe concern for our study. First, the age range of our sample is between 24 and 32, so the majority of our respondents are in the 20s, the prime ages for marriage in China. Second, the potential age effect, if exists, should roughly shows a *downward* trend of educational homogamy because the older an individual is, the longer the departure from school, and the more likely to meet people with a different level of education (Mare 1991). Yet, our analysis suggests that this age effect, if any, is overwhelmed by the increasing trend in educational homogamy. Third, the mean age at first marriage for both men and women in Shanghai declined monotonically from the 1980 cohort to the 1989 cohort (Cai and Wang 2012). Thus, the marriage postponing effect of aging, at least in Shanghai, has been shrinking.

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Highlights

- The sample of the post-80s generation collected in Shanghai is analyzed.
- A U-shaped pattern of educational homogamy by cohort is detected.
- Structural transition theory is supported.

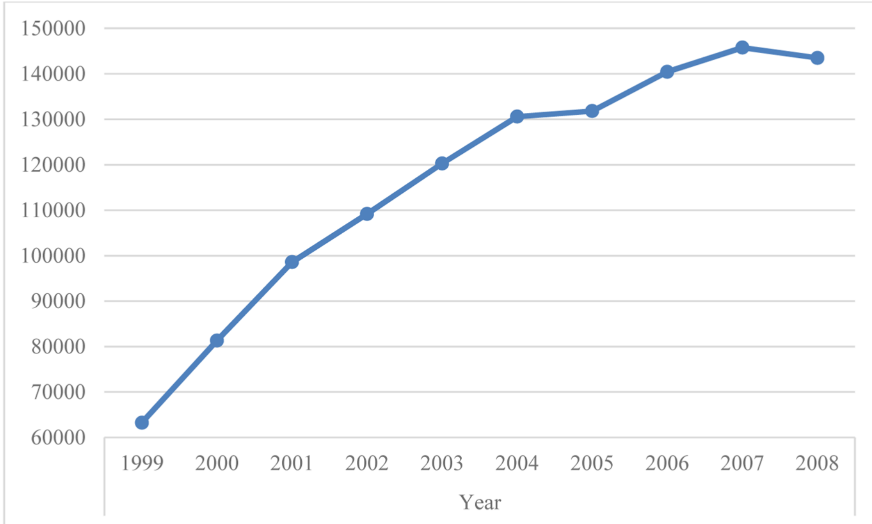


Figure 1.

Changing College Enrollment in Shanghai, China

Data Source: The Statistical Yearbook of Shanghai (http://www.stats-sh.gov.cn/data/release.xhtml)

	Elementary School	Junior High School	Senior High School	Junior College	Regular College
Elementary School	1	1	v1	v1v2	v1v2v3
Junior High School	1	1	1	v2	v2v3
Senior High School	v1	1	1	1	v3
Junior College	v1v2	v2	1	1	1
Regular College	v1v2v3	v2v3	v3	1	1

(a) Parameters

(v1)

0	0	1	1	1
0	0	0	0	0
1	0	0	0	0
1	0	0	0	0
1	0	0	0	0

(v2)

0	0	0	1	1
0	0	0	1	1
0	0	0	0	0
1	1	0	0	0
1	1	0	0	0

(v3)

0	0	0	0	1
0	0	0	0	1
0	0	0	0	1
0	0	0	0	0
1	1	1	0	0

(b) Design Matrices

Figure 2.

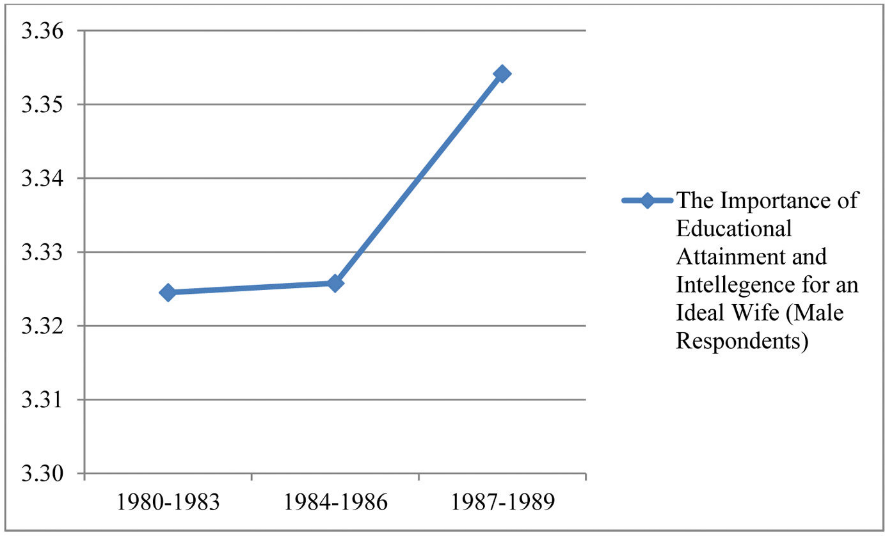
Parameters and Design Matrices for Crossing Effects

1	6	6	6	6
6	2	6	6	6
6	6	3	6	6
6	6	6	4	6
6	6	6	6	5
Main Diagonal (M)				

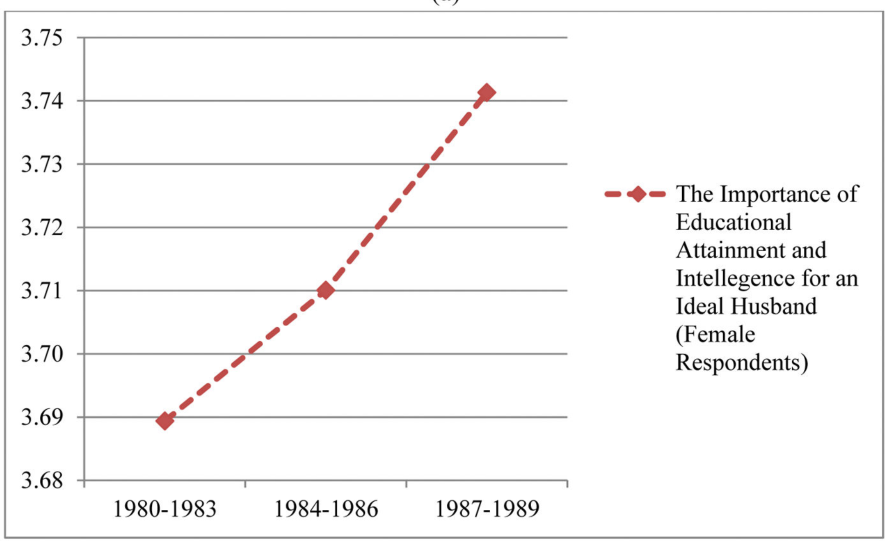
1	6	7	8	9
6	2	6	7	8
7	6	3	6	7
8	7	6	4	6
9	8	7	6	5
Main Diagonal + Distance (D)				

Figure 3.

Design Matrices for the Association between Spouse' Educational Attainment

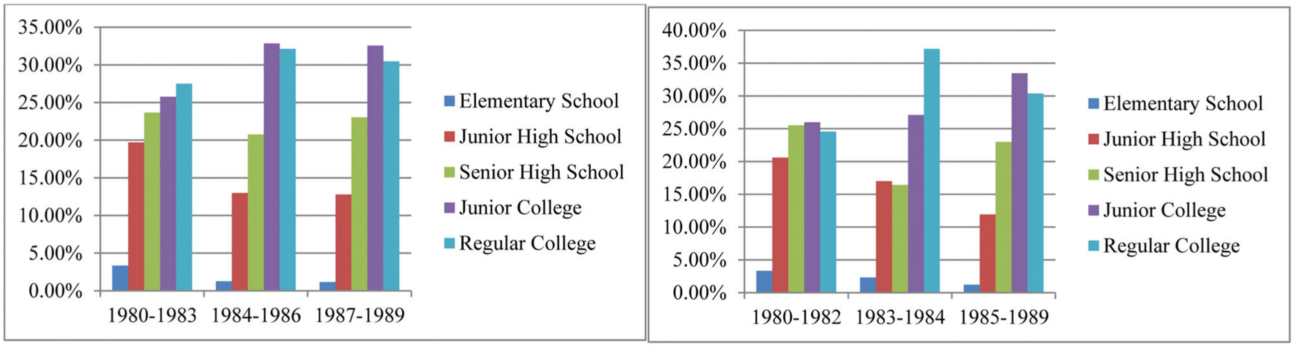


(a)

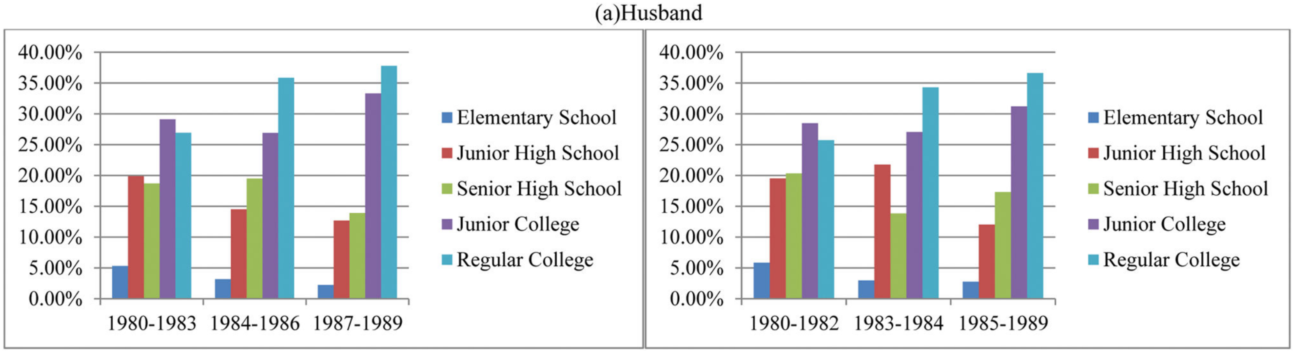


(b)

Figure 4.
Changing Preference for Education
Data Source: the Shanghai Post-’80 Generation Survey



(a)Husband



(b)Wife

Figure 5.

Changing Extent of Availability

Data Source: the Shanghai Post-'80 Generation Survey

Table 1

Theoretical Hypotheses

	Marriage Market Structure	Marital Preference	The Pattern of Educational Assortative Mating
Structural Transition Theory	Increase in the Pool of Potential Partners with Higher Education (Gender Balance of Educational Attainment)	Cultivate the Preference for a Highly-Educated Partner (Preference for a Highly-Educated Woman in Union Formation)	Strengthened
Status Closure Theory	Increasingly Penetrable Educational Boundaries	Decline in the Preference for a Highly-Educated Partner	Weakened

Table 2

Descriptive Results (%)

		wife's education				
	1980–1983	Elementary School	Junior High School	Senior High School	Junior College	Regular College
	Elementary School	1.39	1.39	0.15	0.15	0
	Junior High School	2.94	14.09	4.18	0.93	0
	Senior High School	1.08	6.04	9.6	5.57	1.7
	Junior College	0.15	0.77	4.8	13.47	6.35
	Regular College	0.15	0	1.24	8.82	15.02
						N=646
	1984–1986	Elementary School	Junior High School	Senior High School	Junior College	Regular College
	Elementary School	0.57	0.85	0	0	0
	Junior High School	1.42	12.82	1.99	1.42	0.28
husband's education	Senior High School	0.85	4.84	11.97	3.99	1.71
	Junior College	0.57	0.85	5.41	13.96	9.4
	Regular College	0	0	3.42	7.41	16.24
						N=351
	1987–1989	Elementary School	Junior High School	Senior High School	Junior College	Regular College
	Elementary School	1.14	1.7	0	0	0
	Junior High School	1.14	16.48	4.55	0.57	0.57
	Senior High School	0.57	4.55	12.5	9.66	0
	Junior College	0	1.14	5.68	12.5	6.25
	Regular College	0	0	0	6.82	14.2
						N=176

Data Source: the Shanghai Post-'80 Generation Survey

Table 3

Results of Log-Multiplicative Layer Models

Observed Data	**d.f.**	**L^2**	**BIC**	**AIC**	**Δ**	**ϕ_k across Cohorts**		
						1980–1983	**1984–1986**	**1987–1989**
(1) WC, HC	48	1000.86	661.63	904.86	0.35			
(2) WC, HC, M, constant ϕ_k over C	43	374.05	70.16	288.05	0.16			
(3) WC, HC, M, varying ϕ_k over C	41	372.46	82.70	290.46	0.16	1	1.06	1.15
(4) Model 2 + D	40	47.27	−235.42	−32.72	0.05			
(5) Model 3 + D	**32**	**39.51**	**−186.64**	**−24.49**	**0.04**	**1**	**0.56**	**2.43**
Counterfactual based on IPF	d.f.	L^2	BIC	AIC	Δ	ϕ_k across Cohorts		
						1980–1983	1984–1986	1987–1989
(1) WC, HC	48	1779.68	1416.35	1683.68	0.37			
(2) WC, HC, M, constant ϕ_k over C	43	660.61	335.12	574.61	0.16			
(3) WC, HC, M, varying ϕ_k over C	41	656.33	345.99	574.33	0.16	1	1.05	1.16
(4) Model 2 + D	40	94.39	−193.65	29.13	0.05			
(5) Model 3 + D	**32**	**88.79**	**−153.43**	**24.79**	**0.04**	**1**	**0.81**	**2.28**

Data Source: the Shanghai Post-’80 Generation Survey

Note: W=wife’s education; H=husband’s education; C=cohorts; M=main diagonal; D=distance from the main diagonal; d.f. = degree of freedom; L^2=the log likelihood ratio chi-square statistic; BIC= Bayesian information criterion; AIC= Akaike information criterion; Δ=the dissimilarity index between observed and predicted frequencies. N=1173.

Table 4

Descriptive Results (%) for Robust Analysis

		wife's education					
	1980–1982	Elementary School	Junior High School	Senior High School	Junior College	Regular College	
	Elementary School	1.53	1.15	0.19	0.19	0	
	Junior High School	3.06	13.77	4.4	1.15	0	
	Senior High School	1.34	6.12	10.13	6.12	2.1	
	Junior College	0.19	0.38	5.54	12.81	6.88	
	Regular College	0.19	0	1.34	8.22	13.19	
							N=523
	1983–1984	Elementary School	Junior High School	Senior High School	Junior College	Regular College	
	Elementary School	0.42	1.67	0	0	0	
	Junior High School	2.09	16.74	2.93	0.84	0.42	
husband's education	Senior High School	0	6.28	6.28	3.77	1.26	
	Junior College	0.42	2.09	2.93	12.97	6.28	
	Regular College	0	0	2.51	9.62	20.5	
							N=239
	1985–1989	Elementary School	Junior High School	Senior High School	Junior College	Regular College	
	Elementary School	0.97	1.22	0	0	0	
	Junior High School	1.22	12.9	2.92	0.97	0.24	
	Senior High School	0.97	4.14	14.11	6.33	0.73	
	Junior College	0.24	0.73	5.84	14.6	8.27	
	Regular College	0	0	1.7	7.06	14.84	
							N=411

Data Source: the Shanghai Post-'80 Generation Survey

Table 5

Results of Log-Multiplicative Layer Models: Robust Analysis

Observed Data	**d.f.**	**L^2**	**BIC**	**AIC**	**Δ**	**ϕ_k across Cohorts**		
						1980–1983	**1984–1986**	**1987–1989**
(6) WC, HC	48	986.88	647.65	890.88	0.35			
(7) WC, HC, M, constant ϕ_k over C	43	364.91	61.01	278.91	0.16			
(8) WC, HC, M, varying ϕ_k over C	41	360.99	71.23	278.99	0.15	1	1.05	1.20
(9) Model 2 + D	40	38.17	−244.52	−41.83	0.05			
(10) Model 3 + D	**32**	**31.97**	**−194.18**	**−32.03**	**0.03**	**1**	**0.92**	**1.81**

Counterfactual based on IPF	d.f.	L^2	BIC	AIC	Δ	ϕ_k across Cohorts		
						1980–1983	1984–1986	1987–1989
(6) WC, HC	48	1337.49	984.30	1241.49	0.36			
(7) WC, HC, M, constant ϕ_k over C	43	525.07	208.67	439.07	0.16			
(8) WC, HC, M, varying ϕ_k over C	41	519.54	217.85	437.54	0.16	1	0.99	1.18
(9) Model 2 + D	40	67.03	−227.30	−12.97	0.05			
(10) Model 3 + D	**32**	**56.69**	**−178.77**	**−7.31**	**0.04**	**1**	**0.48**	**1.65**

Data Source: the Shanghai Post-’80 Generation Survey

Note: W=wife’s education; H=husband’s education; C=cohorts; M=main diagonal; D=distance from the main diagonal; d.f. = degree of freedom; L^2=the log likelihood ratio chi-square statistic; BIC= Bayesian information criterion; AIC= Akaike information criterion; Δ=the dissimilarity index between observed and predicted frequencies. N=1173.

Table 6

Results of Weighted Log-Multiplicative Layer Models

Data based on cohort grouping scheme 1*	**d.f.**	**L^2**	**BIC**	**AIC**	**Δ**	**ϕ_k across Cohorts**		
						1980–1983	**1984–1986**	**1987–1989**
(11) WC, HC	48	1002.81	663.58	906.81	0.35			
(12) WC, HC, M, constant ϕ_k over C	43	374.76	70.86	288.76	0.16			
(13) WC, HC, M, varying ϕ_k over C	41	373.09	83.33	291.09	0.16	1	1.06	1.16
(14) Model 2 + D	40	46.33	−236.37	−33.67	0.05			
(15) Model 3 + D	**32**	**38.94**	**−187.21**	**−25.06**	**0.04**	**1**	**0.55**	**2.40**
Data based on cohort grouping scheme 2**	d.f.	L^2	BIC	AIC	Δ	ϕ_k across Cohorts		
						1980–1983	1984–1986	1987–1989
(16) WC, HC	48	989.66	650.43	893.66	0.35			
(17) WC, HC, M, constant ϕ_k over C	43	366.35	62.45	280.35	0.16			
(18) WC, HC, M, varying ϕ_k over C	41	362.48	72.72	280.48	0.15	1	1.05	1.20
(19) Model 2 + D	40	37.92	−244.77	−42.08	0.05			
(20) Model 3 + D	**32**	**31.80**	**−194.36**	**−32.20**	**0.03**	**1**	**0.99**	**1.80**

Data Source: the Shanghai Post-’80 Generation Survey

* cohorts 1980–1983, 1984–1986, and 1987–1989

** cohorts 1980–1982, 1983–1984, and 1985–1989

Table 7

Results of the Crossing-Effect Model

	1980–1983	1984–1986	1987–1989	z value		
	Cohort1	**Cohort2**	**Cohort3**	**Cohort1–Cohort2**	**Cohort1–Cohort3**	**Cohort2–Cohort3**
v1	−0.96 (0.34) **	−0.76 (0.52)	−1.86(1.03)#	0.32	0.83	0.95
v2	−2.50 (0.28) ***	−2.17 (0.32) ***	−2.34 (0.52) ***	0.78	0.27	0.27
v3	−1.79 (0.24) ***	−1.20 (0.26) ***	−3.47 (1.02) ***	1.67#	1.60	2.16 *
AIC	8.44	6.86	4.78			
BIC	46.67	22.55	−5.37			

# p<0.1

* p<0.5

** p<0.01

*** p<0.001

Note: loglinear regression coefficients with standard error in parentheses.