# COMMENT AND REPLY

*Comment on Smits, Ultee, and Lammers,*
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## TEMPORAL AND REGIONAL VARIATION IN THE STRENGTH OF EDUCATIONAL HOMOGAMY

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A recent study by Smits, Ultee, and Lammers (1998, henceforward SU&L) examines cross-national variation in the strength of educational homogamy. The authors not only document the presence of cross-national variation in the strength of educational homogamy, but also show that this variation reflects the influence of societal forces. Indeed, their fundamental premise is that the strength of educational homogamy can be used as an indicator of societal openness (Ultee and Luijkx 1990). Like patterns of intergenerational occupational mobility, patterns of educational assortative mating are assumed to indicate the ease or difficulty with which individuals are able to cross social strata. By employing log-linear models that incorporate country-level characteristics, SU&L demonstrate the relationships between the strength of educational homogamy and measures of industrialization, political democracy, and dominant religion. Their basic conclusion is that the relationship between economic development and educational homogamy can be described by an inverted U-curve: The degree of educational homogamy increases with industrialization at low levels of economic development, but decreases at higher levels of economic development.

SU&L's empirical work is highly commendable. After assembling cross-classifications of spouses' educational attainment for 65 countries, they estimated parsimonious log-linear models to derive one-degree-of-freedom contrasts of the strength of assortative mating across these countries. Finally, they pooled information from all 65 countries in a multivariate analysis incorporating country-level variables measuring industrialization, political democracy, and dominant religion. In a major finding from this multivariate analysis, SU&L reveal very high levels of educational homogamy in the four Confucian countries analyzed (Hong Kong, Japan, Korea, and Taiwan).

In this comment, we extend SU&L's analysis to an examination of longitudinal data. Using data for two marriage cohorts in China, Japan, Taiwan, and the United States, we reexamine two of their main conclusions about regional and temporal variation in educational homogamy.

## NEW MARRIAGE TABLES FOR CHINA, JAPAN, AND TAIWAN

Here we assemble new tables cross-classifying husbands' and wives' educational attainment for China, Japan, and Taiwan. Given SU&L's central concern with trends over time, our tables are disaggregated by marriage cohort, with one cohort marrying in the early 1970s and another cohort marrying in the mid- to late 1980s. We also include comparable data for the United States as a reference. Data for China are included as an interesting case for comparison with the two Confucian societies, Japan and Taiwan. Although not a strictly Confucian society, China is a country with a Confucian tradition that has undergone radical social and economic changes in recent decades.

Although our data cover only a small subset of the 65 countries examined by SU&L, they facilitate important extensions of their analysis. First, we have true trend data, with

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two marriage cohorts per country, while SU&L had only cross-sectional data. Second, our tables consist of recently married couples rather than all married women in a cross-sectional survey as in SU&L and in Ultee and Luijkx (1990). Reasons for preferring newlyweds in a trend analysis of assortative mating are well established (Kalmijn 1994; Mare 1991; Qian 1997). From marriage tables encompassing all married couples, it is difficult to pin down the influence of particular historical periods and thus of particular macro-level influences.[1] Finally, our data are more recent than those used by SU&L.

Our data for China come from the 1985 In-Depth Fertility Survey, a survey of ever-married women under age 50 residing in Hebei, Shaanxi, and Shanghai provinces. From these data, we construct two marriage cohorts, couples marrying between 1970 and 1974 and couples marrying in 1984 and 1985. Data for Japan come from the 10th National Fertility Survey conducted in 1992, a nationally representative survey of roughly 9,000 married women between the ages of 18 and 49.[2] From these data, we construct two marriage cohorts, couples marrying between 1970 and 1974 and couples marrying between 1988 and 1992.[3] Data for Taiwan are taken from the 1975 and 1990 editions of the *Taiwan-Fukien Demographic Factbook* (Ministry of the Interior, Republic of China 1976, 1991). These publications provide cross-classifications of husbands' and wives' educational attainment for all marriages registered in these two years.[4] We extract United States data for 1970 and 1985–1987 newlyweds from Mare (1991, table 2).

## TEMPORAL VERSUS REGIONAL VARIATION

SU&L's primary concern is with trends in educational assortative mating over time. For example, their inverted-U shape hypothesis consists of "a *trend* toward more educational homogamy as industrialization increases" at low levels of economic development and then "a *trend* toward less educational homogamy at higher levels of industrialization" (SU&L, pp. 266–67, emphasis added). Lacking trend data with sufficient variation in economic development, SU&L utilized regional variation in economic development and educational homogamy as a proxy for temporal variation. This approach, while creative in the absence of longitudinal data, has some limitations. Specifically, it hinges on the assumption that future patterns of educational homogamy in now-developing countries are the same as contemporary patterns in more developed countries. Inferring temporal variation from regional variation, or "reading history sideways" (Thornton 1992), is inappropriate in the presence of period effects and/or interactions between country and time. This problem mirrors the need for caution in interpreting period-based measures in demography: Period effects such as ideological diffusion or technological transfer may render period-based demographic measures (e.g., total fertility rate or life expectancy) very different from those based on the experience of any real cohort.

Similarly, conclusions based on the approach taken by SU&L are susceptible to interactions between country and time. In the comparative mobility literature, there is a longstanding debate about whether different societies share or approach some common level of openness (Featherman, Jones, and

[1] For example, consider labor force composition, one of the main indicators of economic development used by SU&L. The share of Japan's labor force not in agriculture increased rapidly from 59 percent in 1956 (SU&L, table 2) to 81 percent in 1971 (World Bank 1980). In the data analyzed by SU&L, members of all marriage cohorts are assumed to have selected their spouses under homogeneous economic conditions.

[2] We thank the National Institute for Population and Social Security Research for providing these data for use in the first author's dissertation research, from which the tables used in this analysis are taken.

[3] Because the marriage tables for China and Japan are based on retrospective information from cross-sectional surveys, these data may suffer from selective marital dissolution. However, this problem should not cause bias because marital dissolution, through both divorce and mortality, has been very low in these countries.

[4] The table for 1975 consists of all marriages, while the table for 1990 consists of all first marriages.

Hauser 1975; Lipset and Zetterberg 1959; Ultee and Luijkx 1990). SU&L's research design of capitalizing on regional variation to test hypotheses about temporal change prevents them from evaluating whether the inverted-U pattern is consistent with the hypothesis that the strength of educational assortative mating *approaches* a common level in highly industrialized countries. This limitation is apparent in SU&L's second major finding—that of large regional variation in levels of educational homogamy, with Confucian countries at higher levels than Protestant countries. If these regional differences are rooted in culture and if such cultural differences are altered by forces of economic development, both of which are suggested by SU&L, we cannot rule out the possibility that educational assortative mating in Confucian countries will approach a level on par with that observed in the United States and other Protestant countries.

Given the potential problems inherent in the inference of temporal variation from regional variation, our extension of SU&L's analysis to longitudinal data is primarily motivated by inconsistencies between their findings and our expectations based on several earlier studies. In particular, SU&L's findings contradict empirical results from trend analyses of educational assortative mating in the United States. According to the inverted U-curve hypothesis, educational homogamy in highly developed societies like the United States should be constant, or perhaps decreasing. However, the post-World War II trend toward greater educational homogamy in the United States is well documented (Kalmijn 1991; Mare 1991). Is the United States an exception to the general trend of increasing societal openness at higher levels of development?

In addition, SU&L's results are at odds with studies that find societal openness as defined by relative intergenerational occupational mobility to be very similar in Confucian (e.g., Japan) and Western industrialized countries (Ultee and Luijkx 1990; Wong 1990, 1992; Yamaguchi 1987). Assuming that occupational mobility and educational heterogamy are both indicators of general societal openness, this inconsistency is puzzling. The marked rigidity in educational assortative mating in Confucian countries shown by SU&L begs for explanation and further analysis.[5]

## ANALYTICAL STRATEGY

As in SU&L, we employ log-linear models as our analytical tool for the four-fold contingency table of husband's education ($H$), wife's education ($W$), country ($C$), and period ($P$). We can conveniently view the four-way table as consisting of eight marriage tables (i.e., $T = 1, \ldots, 8$, with $T = C \times P$). We also follow SU&L in adjusting the original data to ensure comparable sample sizes across the eight tables. Without adjustments, the number of couples per table ranges from 1,126 for the second Chinese table to 149,637 for the first Taiwanese table. As noted by Ultee and Luikjx (1990) and SU&L, estimation results based on unadjusted data such as these will be disproportionately influenced by spouse-pairing patterns in the tables with the largest number of cases. To adjust the sample sizes, we shrank all cell entries by an arbitrary constant required to generate an overall table size of 1,000 to 2,000 marriages. These adjusted cross-tabulations of spouses' education by country and marriage cohort are presented in Table 1.

Using these eight marriage tables, we attempt to replicate two of SU&L's major findings: (1) that educational homogamy is stronger in Confucian societies than in non-Confucian societies, and (2) that educational homogamy decreases over time at higher levels of economic development. Except for China, the countries we examine are highly industrialized (i.e., well to the right of the peaks of the inverted U-curves in Figures 2 and 3 of SU&L, pp. 279 and 281), suggesting that the barriers to educational heterogamy should be lower among more recent marriage cohorts than earlier cohorts in Japan, Taiwan, and the United States. In China, where the level of economic development is much lower, the inverted-U pat-

[5] In an earlier cross-national study of educational assortative mating (Ultee and Luijkx 1990, table 3 or table 8), homogamy in the one Confucian country examined (Japan) did not appear to be any stronger than in several European countries.

**Table 1. Crosstabulations of Husband's and Wife's Education, by Country and Period**

| | Husband's Education | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | China, 1970–1974 (N = 1,884) | | | | | China, 1984–1985 (N = 1,126) | | | | |
| Wife's Education | (1) | (2) | (3) | (4) | Total | (1) | (2) | (3) | (4) | Total |
| (1) ≤ Primary | .484 | .218 | .051 | .004 | .757 | .090 | .123 | .055 | .000 | .267 |
| (2) Junior HS | .037 | .084 | .032 | .013 | .166 | .034 | .276 | .124 | .010 | .444 |
| (3) Senior HS | .004 | .012 | .025 | .019 | .061 | .007 | .095 | .159 | .019 | .280 |
| (4) University | .000 | .001 | .004 | .012 | .016 | .000 | .001 | .002 | .006 | .009 |
| Total | .524 | .316 | .112 | .048 | 1.000 | .131 | .495 | .340 | .035 | 1.000 |

| | Husband's Education | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Japan, 1970–1974 (N = 1,840) | | | | | Japan, 1988–1992 (N = 1,343) | | | | |
| Wife's Education | (1) | (2) | (3) | (4) | Total | (1) | (2) | (3) | (4) | Total |
| (1) Junior HS | .119 | .062 | .005 | .004 | .190 | .020 | .024 | .005 | .002 | .051 |
| (2) Senior HS | .088 | .394 | .026 | .089 | .596 | .033 | .297 | .042 | .102 | .474 |
| (3) Junior College | .011 | .053 | .020 | .073 | .157 | .008 | .109 | .066 | .176 | .360 |
| (4) University | .000 | .004 | .001 | .052 | .057 | .001 | .008 | .007 | .098 | .115 |
| Total | .218 | .513 | .051 | .218 | 1.000 | .063 | .439 | .120 | .379 | 1.000 |

| | Husband's Education | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Taiwan, 1975 (N = 1,497) | | | | | Taiwan, 1990 (N = 1,318) | | | | |
| Wife's Education | (1) | (2) | (3) | (4) | Total | (1) | (2) | (3) | (4) | Total |
| (1) ≤ Primary | .468 | .096 | .084 | .015 | .662 | .094 | .103 | .062 | .017 | .277 |
| (2) Junior HS | .047 | .027 | .041 | .013 | .128 | .064 | .129 | .085 | .022 | .300 |
| (3) Senior HS | .019 | .019 | .071 | .043 | .153 | .045 | .088 | .131 | .061 | .325 |
| (4) University | .002 | .003 | .015 | .038 | .057 | .008 | .011 | .031 | .049 | .099 |
| Total | .536 | .145 | .210 | .109 | 1.000 | .211 | .331 | .310 | .149 | 1.000 |

| | Husband's Education | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | United States, 1970 (N = 1,315) | | | | | United States, 1985–1987 (N = 1,985) | | | | |
| Wife's Education | (1) | (2) | (3) | (4) | Total | (1) | (2) | (3) | (4) | Total |
| (1) <12 years | .110 | .078 | .017 | .002 | .208 | .054 | .046 | .010 | .003 | .112 |
| (2) 12 years | .078 | .245 | .099 | .032 | .453 | .064 | .257 | .074 | .032 | .428 |
| (3) 13–15 years | .012 | .052 | .093 | .052 | .210 | .012 | .073 | .090 | .062 | .237 |
| (4) ≥16 years | .003 | .015 | .030 | .081 | .129 | .002 | .032 | .040 | .150 | .224 |
| Total | .203 | .391 | .238 | .168 | 1.000 | .132 | .408 | .213 | .247 | 1.000 |

tern suggests that educational homogamy should be stronger among the second marriage cohort. These predictions based on SU&L's findings can be evaluated by estimating log-linear models that include table-specific (i.e., country- and cohort-specific) parameterizations of the association between spouses' educational attainment. The general model is expressed by equation 1 (next page), where $F_{ijkl}$ is the predicted number of marriages between women of education $i$ to men of education $j$ ($i, j = 1, \ldots, 4$) in country $k$ ($k = 1, \ldots, 4$) during time period $l$ ($l = 1, 2$). Parameters $\tau_0$, $\tau_i^W$, $\tau_j^H$, $\tau_k^C$, $\tau_l^P$,

$$F_{ijkl}=\tau_0\tau_i^{W}\tau_j^{H}\tau_k^{C}\tau_l^{P}\tau_{ik}^{WC}\tau_{jk}^{HC}\tau_{il}^{WP}\tau_{jl}^{HP}\tau_{ikl}^{WCP}\tau_{jkl}^{HCP}\tau_{ij}^{WH}\tau_{ijk}^{WHC}\tau_{ijl}^{WHP}\tau_{ijkl}^{WHCP}. \quad (1)$$

$$F_{ijkl} = \tau_0\tau_i^{W}\tau_j^{H}\tau_k^{C}\tau_l^{P}\tau_{ik}^{WC}\tau_{jk}^{HC}\tau_{il}^{WP}\tau_{jl}^{HP}\tau_{ikl}^{WCP}\tau_{jkl}^{HCP}\exp(\psi_{ij}\phi_{kl}). \quad (2)$$

$\tau_{ik}^{WC}$, $\tau_{jk}^{HC}$, $\tau_{il}^{WP}$, $\tau_{jl}^{HP}$, $\tau_{ikl}^{WCP}$, and $\tau_{jkl}^{HCP}$ saturate the distributions of husbands' and wives' educational attainment across country and time. A model containing only these terms represents "conditional independence" and should serve as the baseline for evaluating the extent of assortative mating and its variation by location and time (Xie 1998). $\tau_{ij}^{WH}$ represents the "general" two-way interaction between $H$ and $W$ (i.e., the pattern of assortative mating) and may be restricted using any of a variety of design matrices employed in assortative mating research. Our primary interest rests in the final three parameters: $\tau_{ijk}^{WHC}$, $\tau_{ijl}^{WHP}$, and $\tau_{ijkl}^{WHCP}$, which describe how the strength of the general pattern of assortative mating ($\tau_{ij}^{WH}$) varies by country and period.

One difficulty in characterizing variations in two-way association across a third and a fourth dimension is that the general model of equation 1 typically generates more parameters than can be easily interpreted. Another difficulty is that the model leaves no or very few degrees of freedom with which to evaluate substantive hypotheses. Thus, it is necessary to impose some structure on equation 1 in order to derive parsimonious models (Xie 1998). To this end, we propose the use of log-multiplicative layer effect models (Xie 1992). This class of models assumes that the variation in association between husbands' and wives' educational attainment can be captured by a pattern of association common to all tables and a table-specific parameter. It reduces the last four terms in equation 1 to $\exp(\psi_{ij}\phi_{kl})$, as shown in equation 2 (above), where $\psi_{ij}$ describes the common association pattern between husbands' and wives' educational attainment, and $\phi_{kl}$ represent the table-specific deviations in this association. More specifically, $\phi_{kl}$ measure the multiplicative extent to which log-odds ratios describing the common pattern of association differ by country ($k$) and period ($l$):

$$\log(\theta_{ij|kl}) = \log(\theta_{ij})\phi_{kl}, \quad (3)$$

where

$$\log(\theta_{ij}) = (\psi_{ij} + \psi_{(i+1)(j+1)} - \psi_{(i+1)j} - \psi_{i(j+1)})$$

are the log-odds ratios representing the common pattern of association (Xie 1992: 382). An attractive feature of this specification is that it generates eight parameters (subject to normalization) representing differences in the strength of that association across the four countries and two marriage cohorts (i.e., $C \times P = T = 8$). This approach is parsimonious and flexible in that it simultaneously allows one-degree-of-freedom cross-table comparisons and unrestricted specifications of the design matrix for the $WH$ interaction.

## RESULTS

Table 2 presents the results of selected specifications of log-linear and log-multiplicative layer effect models. The different specifications are grouped in three panels. For each model, we present the degrees of freedom, the log-likelihood ratio chi-square statistic ($L^2$), the Bayesian Information Criterion (BIC), and the $\phi$ parameter estimates, where relevant.[6] Model 1 fits the marginal distributions of husbands' and wives' education by marriage cohort and country while assuming no association between spouses' educational attainment. This conditional independence model serves as the baseline (Xie 1998). We use two different specifications for the two-way association between spouses' education, (i.e., $\psi_{ij}$ in equation 2). The models in the second panel (Models A-1 to A-3) fit the main diagonal (labeled M), allowing the strength of homogamy to vary by educational level but placing no restrictions on heterogamous pairings. The models in the third panel (Models B-1 to B-3) fit, in addition to the

[6] BIC is calculated as $L^2 - (\text{d.f.})\ln(N)$, where N is the sample size (12,308 in this case), and thus penalizes unparsimonious models. A negative BIC indicates that the estimated model is preferred to the saturated model, whose $L^2$ and BIC, by definition, equal zero. The more negative the BIC, the better the model (Raftery 1995).

| | | | |
|---|---|---|---|
| 1 | 5 | 5 | 5 |
| 5 | 2 | 5 | 5 |
| 5 | 5 | 3 | 5 |
| 5 | 5 | 5 | 4 |

**Main Diagonal (M)**

| | | | |
|---|---|---|---|
| 1 | 5 | 6 | 7 |
| 5 | 2 | 5 | 6 |
| 6 | 5 | 3 | 5 |
| 7 | 6 | 5 | 4 |

**Main Diagonal + Distance (D)**

**Figure 1. Design Matrices for the Association between Spouses' Educational Attainment**

main diagonal cells, one parameter for each set of off-diagonal cells of the same distance from the main diagonal. We label this specification D. The design matrices of M and D are given in Figure 1.

As shown in Figure 1, specification D adds parameters for the three distinct distances from the main diagonal, consuming two more degrees of freedom. The two additional parameters represent the effect of differences in spouses' educational attainment on the likelihood of marriage.[7] If heterogamous marriages are most common among men and women in adjacent educational categories, the value of these parameters will become progressively more negative as one moves away from the main diagonal. For both specifications of the two-way association between husbands' and wives' education, we estimate three models. Model 1 is the complete homogenous model, constraining the strength of assortative mating to be homogeneous across all countries and marriage cohorts. Model 2 is the time-homogenous model, allowing the strength of association to vary by country but not by marriage cohort. Model 3 is the heterogeneous model, with the strength of association varying both by country and by marriage cohort. The three- and four-way log-multiplicative interactions in Models 2 and 3 enable a parsimonious re-evaluation of SU&L's main findings.

By both $L^2$ and BIC, models estimating parameters for the main diagonal only fit the data poorly. $L^2$ varies from 1,202.71 (d.f. = 68) for the complete homogenous model (Model A-1) to 1,103.35 (d.f. = 61) for the heterogeneous model (Model A-3). BIC, a less stringent test, also yields the same conclusion (BIC > 500 for Models A-1 through A-3). Thus, we conclude that the main diagonal alone is not an adequate representation of educational pairing patterns.

The addition of parameters for the off-diagonal distances vastly improves model fit. For the homogenous specification, for example, $L^2$ is reduced from 1,202.71 in Model A-1 to 235.46 in Model B-1 for only 2 additional degrees of freedom. Reductions in $L^2$ of similarly large magnitudes are also seen for the time-homogenous specification (B-2 versus A-2) and the time-heterogeneous specification (B-3 versus A-3). In fact, the $L^2$ statistic indicates that Model B-3 is marginally acceptable as a null model (85.32, d.f. = 59, $p$ = .014). According to the BIC statistic, all specifications of Model B are preferable to the saturated model, with B-3 being the best model (BIC = –470.34).

The strength of educational assortative mating is measured by the $\phi$ parameters, which are country-specific for Models A-2 and B-2 and country- and period-specific for Models A-3 and B-3. As latent scores, the $\phi$ parameters are subject to normalization. We follow Xie's (1992:382) normalization rule, $\Sigma\phi_{kl}^2 = 1$, for Models A-2 and B-2. To retain rough comparability in the magnitude of the parameters, we normalize $\phi$ in Models A-3 and B-3 so that $\Sigma\phi_{kl}^2 = 2$.

The estimated $\phi$ parameters, reported in the last eight columns of Table 2, reveal that the strength of educational homogamy has either declined or remained stable in the four countries examined. The trends toward increased educational heterogamy in Japan and Taiwan, and an absence of change in the

[7] These parameters correspond to the distance parameters in Model 5. Table 1 of SU&L (p. 273).

**Table 2. Goodness-of-Fit Results for Models of Assortative Mating**

| | | | | Cross-Table Variation in the Strength of Educational Homogamy ($\phi_{kl}$) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | China | | | Japan | | | Taiwan | | | United States | | |
| Model | d.f. | $L^2$ | BIC | 1970–1974 | Both | 1984–1985 | 1970–1974 | Both | 1988–1992 | 1975 | Both | 1990 | 1970 | Both | 1985–1987 |
| Baseline model | 72 | 4,462.88 | 3,784.78 | — | | — | — | | — | — | | — | — | | — |
| Model A | | | | | | | | | | | | | | | |
| (A-1) M [a] | 68 | 1,202.71 | 562.28 | — | | — | — | | — | — | | — | — | | — |
| (A-2) M, $\phi_k$ [b] | 65 | 1,142.50 | 530.33 | — | .53 | — | — | .58 | — | — | .39 | — | — | .49 | — |
| (A-3) M, $\phi_{kl}$ [c] | 61 | 1,103.35 | 528.86 | .51 | | .55 | .61 | | .53 | .48 | | .29 | .48 | | .48 |
| Model B | | | | | | | | | | | | | | | |
| (B-1) D [a] | 66 | 235.46 | –386.12 | — | | — | — | | — | — | | — | — | | — |
| (B-2) D, $\phi_k$ [b] | 63 | 130.14 | –463.20 | — | .57 | — | — | .55 | — | — | .34 | — | — | .51 | — |
| (B-3) D, $\phi_{kl}$ [c] | 59 | 85.32 | –470.34 | .60 | | .53 | .59 | | .49 | .43 | | .26 | .51 | | .50 |

*Notes*: M = main diagonal; D = main diagonal + distance. $L^2$ is the log-likelihood ratio chi-square statistic with the reported degrees of freedom. BIC = $L^2$ – (d.f.)ln(N), where N is the number of observations (12,308). All models were estimated using the LEM software package (Vermunt 1997).

[a] Complete homogenous model.

[b] Time homogenous model.

[c] Heterogeneous model.

United States, are consistent with SU&L's inverted U-curve hypothesis at high levels of economic development. Let us use results of Model B-3 to illustrate. The strength of educational homogamy, as measured by $\phi$, decreased in Japan (from .59 to .49) and Taiwan (from .43 to .26), and remained constant in the United States (from .51 to .50).[8] However, it is surprising that we also observe a decreasing trend for China (from .60 to .53), a developing country where an increasing trend in educational homogamy is predicted by SU&L's inverted U-curve. In this sense, our results only partially support SU&L's inverted U-curve hypothesis.

Our results do not, however, support SU&L's finding that educational homogamy is uniformly stronger in Confucian societies than in the United States. Let us again discuss our results from Model B. According to Model B-2, the strength of educational homogamy in Japan ($\phi$ = .55) is very similar to that in the United States ($\phi$ = .51), while educational homogamy in Taiwan ($\phi$ = .34) is actually weaker than in the United States. Allowing assortative mating to vary by marriage cohort, the $\phi$ parameters of Model B-3 show that, for the same three countries, the strength of educational homogamy in the United States is either greater than or equal to that of all but the first Japanese cohort. Hence, our results are ambiguous enough to prevent us from concurring that educational homogamy is stronger in Confucian societies than in Protestant societies.[9]

## CONCLUSION

We agree with SU&L that the strength of educational assortative mating can be used

[8] For the time period considered here, the stability of the United States parameters is not surprising. Previous studies have shown that while the association between spouses' educational attainment increased through the 1970s (Kalmijn 1991; Mare 1991), it has remained constant or decreased since then (Mare 1991; Qian 1997).

[9] To evaluate the robustness of these findings to alternative model specifications, we also fit the log-linear model estimated by SU&L (their Model 8, table 1, p. 273) and models allowing full-interaction between spouses' education. After normalization, the values of the country and period interaction parameters for these models are nearly identical to the log-multiplicative parameters for Models A and B (results available from authors on request).

as an important indicator of general societal openness. In this comment, we have presented new marriage tables cross-classifying husbands' and wives' education in China, Japan, and Taiwan for two periods. We pooled these tables with two similar tables for the United States and utilized log-multiplicative layer effect models in an attempt to replicate two of SU&L's main findings. As a whole, the results of our models support the major implication of SU&L's inverted U-curve hypothesis: The strength of educational homogamy decreases at higher levels of economic development. However, we find no evidence that greater educational assortative mating is an enduring characteristic of Confucian societies. On the contrary, our results indicate that, in recent years, the strength of educational homogamy is very similar in three of the four countries we studied.

Seen in this light, our results are partially consistent with the Featherman, Jones, and Hauser (1975) classic thesis that *relative* openness in all industrialized societies should be roughly the same.[10] In sum, our results suggest a general trend toward greater societal openness over time that depends not on the level of economic development but rather one that is characterized by unique cultural paths not easily represented by readily observable characteristics such as dominant religion.

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[10] The much lower level of homogamy in Taiwan, however, is not consistent with this thesis of convergence or with Wong and Lu's (1999) conclusion that the association between spouses' education has not changed over time in Taiwan

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*Reply to Raymo and Xie*

# MORE OR LESS EDUCATIONAL HOMOGAMY? A TEST OF DIFFERENT VERSIONS OF MODERNIZATION THEORY USING CROSS-TEMPORAL EVIDENCE FOR 60 COUNTRIES

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WE address two issues central to current stratification research: trends in educational homogamy in modernizing societies, and differences in educational homogamy between countries with different religious backgrounds. Regarding the trends in educational homogamy, there are different versions of modernization theory that lead to different predictions about the direction of the trends. With respect to the effect of a country's religious background on educational homogamy, Raymo and Xie (2000, henceforward R&X) present new empirical evidence that appears to contradict the results of our paper on this subject (Smits, Ultee, and Lammers 1998). In this reply, we discuss these issues in detail and try to place them in a new light by presenting new empirical findings on trends in educational homogamy in 60 countries.

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## BACKGROUND

In our paper, we tested three hypotheses on the effect of *modernization* on educational homogamy: (1) the *status-attainment hypothesis*, which predicts educational homogamy to increase in modernizing societies (because in modern societies the economic importance of education is higher and hence its importance is higher as a criterion in marriage choice); (2) a hypothesis called here the *general openness hypothesis*, which predicts educational homogamy to decrease in modernizing societies (because processes associated with modernization—like urbanization, greater geographical mobility, the rise of the welfare state, and the spread of mass communication—make the boundaries between all social groups more permeable); and (3) an *inverted U-curve hypothesis*, which combines the predictions of the other two hypotheses and posits that with increasing modernization educational homogamy first will increase and then subsequently will decrease.

As a fourth alternative, R&X mention a classic thesis running through the literature on comparative mobility, which states that