EDUCATIONAL ASSORTATIVE MATING ACROSS MARRIAGE MARKETS: NON-HISPANIC WHITES IN THE UNITED STATES*

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Whether local marriage market conditions shape marriage behavior is a central social demographic question. Most work on this subject, however, focuses on one type of market condition—sex ratios—and on a single outcome—marital timing or sorting. We examine the impact of local marriage markets' educational composition on educational assortative mating and on how sorting varies with age. We estimate a discrete-time competing-risks model of educational sorting outcomes, using individual data from the NLSY and community descriptors aggregated from census microdata. Results show that residents of educationally less favorable marriage markets are more likely to marry down on education, and that (for women) their chance of doing so increases with age more than for residents of more favorable markets.

In this paper we investigate how the educational composition of local marriage markets affects both educational assortative mating and the relationship between educational sorting and timing of marriage. Sociologists and demographers have long asked whether population composition shapes the tendency to marry assortatively (e.g., Kennedy 1943) because this question clarifies how structural constraints influence behavior linked to reproduction and the maintenance of inequality, despite individual preferences and social pressures toward homogamy. We examine a feature of local marriage markets that is not considered in most studies of assortative mating: educational concentration, or the proportion of locally available potential mates with at least one's own level of education. We expect that in less educationally concentrated marriage markets, residents are more likely to marry hypogamously along education. We also expect that the less the degree of educational concentration in a marriage market, the more residents' chances of educational hypogamy increase with age—a previously unexamined connection between market conditions and marriage.

Using data from the National Longitudinal Survey of Youth (NLSY) and local area descriptors, we show that a more educationally concentrated distribution of potential mates facilitates men's and women's educational sorting. In contrast, past studies of marriage market effects focusing on local sex ratios found no tie between market conditions and individuals' educational sorting. Also, although past research examined how population composition affects either marital timing or sorting, we find some evidence that local educational concentration *links* marriage timing with educational sorting: Therefore the less educationally concentrated marriage markets are, the sharper the increase, with age, in women's relative chance of marrying down educationally rather than marrying up or homogamously.

THEORETICAL PERSPECTIVES

Assortative mating is pervasive (Buss and Barnes 1986) and important. Educational sorting is especially significant and has become more so, if anything, as it has increased in the past several decades (Kalmijn 1991a, 1991b; Mare 1991; Qian and Preston 1993). Because education is a proxy for ultimate socioeconomic status, the strength of educational sorting indicates the strength of status boundaries generally (Mare 1991). Education is especially meaningful to potential partners because it reflects both socioeconomic status and cultural capital (Kalmijn 1991a). And educational sorting may magnify interhousehold inequality by joining individuals with like resources (Blackwell 1998; Kalmijn 1998). Thus it is useful to understand whether and how structural conditions in marriage markets contribute to educational sorting.

Three perspectives commonly link population composition to marriage formation. The first emphasizes sex ratios as determinants of marital sorting and timing (e.g., Akers 1967; Muhsam 1974; Schoen 1983). It stems from demographers' concern about how marriage "squeezes" affect marriage timing and the proportions ever marrying, traditionally important correlates of fertility. Another, different perspective arose in the sociological literature; this is best described as the "structuralist" approach (Blau 1977; Blau, Blum, and Schwartz 1982; Blau and Schwartz 1984). It is concerned with social heterogeneity, especially how a group's small size relative to the total population might affect intergroup contacts and so might weaken group boundaries over time. This perspective draws attention to concentration rather than to sex ratios. The third perspective, marriage search theory, focuses on how the distribution of potential mates affects the relationship between time spent searching for a partner and the type of match ultimately achieved (England and Farkas 1986; Oppenheimer 1988). In this case, the concern is not only sorting or timing but also the connection between them.

The Sex Ratio Approach

Demographers usually have analyzed the effect of population composition on marriage rates in terms of sex ratios, essen-

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tially asking whether there is an appropriate man for every woman. "Appropriate" was first defined by age (Akers 1967). Over time, however, the definition broadened to include characteristics such as race, education, or men's economic attractiveness, in recognition of observed assortative mating patterns (Fossett and Kiecolt 1991; Goldman, Westoff, and Hammerslough 1984; Lichter et al. 1992; Schoen 1986; Schoen, Wooldredge, and Thomas 1989; Wilson and Neckerman 1986). Yet in all these examples, the measures used were sex ratios, however specified, and thus indexed variants of the same concept: competition, or imbalances in the numbers of women and of men of the specified type.

The questions investigated have also broadened to include how sex ratio imbalances might affect marital sorting (e.g., Lichter, Anderson, and Hayward 1995; Qian and Preston 1993; Schoen 1986). Most such work has been conducted at the aggregate level in an attempt to estimate propensities toward homogamy over time, net of shifting population composition (e.g., Kalmijn 1991a, 1991b, 1993; Qian and Preston 1993; Schoen and Kluegel 1988; Schoen and Wooldredge 1989). Generally this literature finds that although imbalanced sex ratios exert some influence, they do not govern trends or aggregate patterns of variation in marriage (Qian and Preston 1993; Schoen 1986; Schoen and Kluegel 1988). Some observers find evidence that women's marriage rates are higher in communities with advantageous sex ratios (Fossett and Kiecolt 1993; Lichter, LeClere, and McLaughlin 1991; South and Lloyd 1992).

The growing availability of longitudinal data with information on individuals' geographical location has allowed researchers to model marriage formation at the individual level while taking into account local marriage market effects.[1] Two studies using NLSY data (Lichter et al. 1992; Lloyd and South 1996) consider how marriage market features—generally sex ratios of various kinds—affect individual-level annual probabilities of marriage. Lichter et al. (1995) also examine whether local sex ratios affect marital sorting among NLSY women. Although these studies reveal sex ratio effects on marriage probabilities (Lichter et al. 1992), they find no such effects on educational sorting (Lichter et al. 1995). Thus, while *aggregate* results suggest that sex ratios influence sorting, *individual* results suggest that it is at best uncertain whether local conditions—at least sex ratios—do so.

Structural Theory

In contrast to the sex-ratio approach, the structuralist perspective is concerned with social heterogeneity: whether different groups remain distinct over time or assimilate into others. According to structural theory, group size is critical. Small groups, it is argued, necessarily have proportionally more out-group contacts than larger groups. Thus closer intergroup relationships are fostered, including intermarriage, although marital sorting is only one of several outcomes examined by structuralists (see Blau 1977; Blau et al. 1982; Blau and Schwartz 1984).

Though both of these approaches link market conditions with marriage formation, they differ substantially. Structuralists focus on marital sorting to the exclusion of marriage timing or nonmarriage. And the structural approach highlights relative group size rather than imbalances in numbers of women and men. The structuralist argument implies that even with a perfect balance between the sexes, members of a group still may face difficulty in marrying assortatively and hence may outmarry frequently if the group of similar potential mates is relatively small and if the group of dissimilar potential mates is large. There is evidence that this is true for education: In the aggregate, heterogamy is more common for smaller educational groups (Blau et al. 1982).

The structuralist perspective suggests that the chance of marrying down increases with a decline in concentration (that is, the proportion of all potential mates who are not hypogamous).[2] In one sense this is a simple numerical argument. The fewer the potential mates who possess a given feature, the more likely one is to marry someone without that feature. Yet this is not a trivial product of mathematical necessity. People prefer (and are under strong social pressure) to marry certain kinds of mates, and need not simply accept the most common type. They can remain selective on one feature by compromising on others, or can delay marriage so as to match on a rare but desired feature. Thus it is not obvious that if similar or better-educated partners are relatively rare, people must be more likely to marry down on education.

This idea, however, highlights a point overlooked in structural theory: Marriage market concentration can affect marriage formation by altering people's marriage timing as well as their sorting. Depending on how unfavorable their market is, people may be able to delay marrying to find a partner who matches their preferences. Delay may be a more successful sorting strategy in more favorable markets. Thus market concentration affects not only marital sorting, but also how sorting varies with age. This possibility, the source of our second hypothesis, is suggested by search theory.

1. A potential problem with such studies, including this one, is that community effects may not be entirely exogenous. People may both select themselves into certain communities and make marital choices based on some other, unmeasured variable (such as a desire to marry a partner with characteristics that are common in that community). Insofar as this is true, it could lead to overestimates of the effect of local conditions on marital sorting. Many studies, however, find that market conditions have weak or no effects on marital sorting; this suggests it is unlikely that market effects are being overestimated. This may be the case because three factors minimize possible endogeneity. First, many people never change residences during early adulthood before first marrying. Second, of those who do, only a minority move between marriage markets as they are usually defined (MSAs here). Third, even among those who move far, most do so not expressly to find partners but instead for reasons that have at best indirect connections to marital choice (such as jobs or schooling).

2. Structural theorists call the proportion of a population not in a given group *heterogeneity*. Because this differs from the common statistical definition of heterogeneity, we use instead the term *concentration* to refer to its inverse.

Search Theory

The third perspective linking population composition to marriage, search theory, was adapted from economic job search theory by Oppenheimer (1988) and England and Farkas (1986). It assumes that people seek partners from a distribution of potential mates about which they possess imperfect information. Searching for a partner entails costs and expected benefits. Costs include direct costs such as the expense, time, and emotional risk of dating, as well as opportunity costs of forgoing possible matches to continue searching. Benefits take the form of achieving a higher-quality match. Costs and benefits, in turn, depend on factors including individuals' marriage market capital (such as education, income, or charm) and the distribution of potential mates. A person accepts an offer when the costs of rejecting it and continuing to search outweigh the expected benefits of doing so.

Search theory connects marriage timing and sorting to each other and to market composition. The nature of the relationship between timing and sorting depends on the costs and the benefits of search. If search were costless and its benefits constant, longer searches would produce better matches because the longer one draws from a given distribution, the higher the cumulative chance of meeting a set standard. Costs and benefits of search vary, however, so the link between timing and sorting varies as well. For some, there are many well-matched potential mates (and thus high benefits for search). These persons can be selective and still find mates quickly. Others have fewer well-matched potential mates (and lower search benefits). They can find mates just as quickly as those with many potential mates, but only if they are less selective. Some live in markets where many potential partners are well-matched, and therefore can improve their sorting opportunities through extended search. Others live in markets where few potential partners are well-matched; therefore they can expect little benefit from extended search.

Just as conditions of search vary across persons and places, they shift over the life course. Four such shifts may reduce educational sorting opportunities with age, offsetting any sorting benefits of continued search. First, one's marriage market capital changes with age. Income and social skills usually increase, but fecundity, physical attractiveness, or adaptiveness may decrease. The ability to bargain for an educational match can decline if potential mates value the latter features. Second, education may become less important for sorting as people age. Young people sort on education partly because it serves as proxy for potential mates' long-term economic status, but with age they can sort directly on realized performance. Third, potential mates marry off, leaving a thinning market. This increasing sparseness in the pool of potential mates can limit people's ability to sort on any feature, including education. And finally, with age, people move from organizations that concentrate educationally matched singles (schools) to organizations less advantageous for sorting (workplaces).

Therefore extended search would improve educational sorting if returns to search were constant, but they are not. As a result, in markets where conditions are most unfavorable, we expect that low returns to search should cause sorting to worsen with age to a greater degree than in more favorable markets. Conversely, in favorable markets, where returns to search remain relatively high, sorting outcomes should stay level or even improve with age as people search. Researchers have argued that returns to search decline with age (Lichter 1990; Lichter et al. 1995), and aggregate-level studies show that the rate of educational intermarriage increases with age (Lichter 1990; Mare 1991). Such findings are not inconsistent with our expectation, but neither do they provide direct evidence supporting it.

In addition to describing a link between marital timing and sorting that depends on market composition, search theory reinforces structural theory's prediction connecting population composition with sorting. According to search theory, search is less efficient in markets with relatively few well-matched potential mates and with many other potential mates. Such markets confer lower search benefits and exact higher costs than do more efficient markets. Thus, where hypogamous potential mates are common relative to other potential mates, hypogamous marriages should be more common.

We follow Lichter et al. (1995) in analyzing marriage market effects using a discrete-time hazard model and NLSY data. Our questions and empirical approach, however, expand on theirs, leading us to different conclusions. Lichter et al. evaluate market composition in terms of sex ratios; we believe that educational concentration in the market is at least as important. Lichter et al. focus on whether market composition affects marital sorting; we also ask whether market composition (particularly concentration) affects the link between educational sorting and marriage timing. Finally, our data differ from theirs: We are forced to limit our analysis to non-Hispanic whites (for reasons discussed below), but we include both males and females, and have six more years of data—a valuable addition for this late-marrying cohort.

Like Lichter et al., we find no evidence that women's chance of marrying down educationally depends on the local education-specific sex ratio. In our evaluation of our two main hypotheses, however, our results support new conclusions. We find that local educational concentration affects educational sorting, and furthermore, that concentration affects how educational sorting varies with age (at least for women). Thus we conclude that market conditions can strongly influence marital sorting, and that they also may exert a subtler and (until now) overlooked effect on marriage formation: They may alter the connection between sorting and timing.

CONCEPTUALIZATION AND MEASUREMENT

Marriage Market Measures

We define the target group of potential matches as those in the marriage market of the opposite sex, of the same race,

and of similar age. We assume, for women, that men of target ages are two years younger to three years older.[3] Individuals' (and their spouses') education reflects years of school completed, collapsed at the conventional break points to degrees: high school diploma (12 years), one to three years of college (13–15), or college degree or higher (16 or more).[4] A respondent marries hypogamously along education if her partner's highest degree is less than hers. A trichotomous annual response measures sorting, taking the value 0 if no marriage occurs by the next interview, 1 if an educationally homogamous or hypergamous match occurs, and 2 in the case of a hypogamous marriage. During the observation period, 64% of our sample marry: 45% homogamously or hypergamously and 19% hypogamously.

Educational sorting poses three issues. First, because men historically married down along education (Landis and Day 1945; Schoen and Wooldredge 1989), one might assume that they prefer hypogamy. That pattern, however, was partly due to the differential gender distribution of education, and it has become less prevalent as women's education has increased (Kalmijn 1991b). In addition, men, like women, express more willingness to marry a more highly educated partner than a less well-educated individual (South 1991); this suggests that both genders prefer homogamous and hypergamous marriages to hypogamous matches.[5] The second issue is whether those still in school sort on expected rather than current education. Sorting on expectations is probably less important than sorting on current education because future plans are less certain than education already achieved. Also, few of those who marry obtain more education after marriage (only 15% in the NLSY). The third issue is whether persons enrolled in school are in the marriage market. We include them because excluding them would bias results by removing marriages that occur during or just after college—marriages that may be systematically earlier and more homogamous than average.

We measure three dimensions of local mate availability. Our focus is educational concentration. We also control for sex ratio and economic attractiveness because they are central to other research on marriage market effects. All are aggregated from census Public Use Microdata (1980 PUMS data for years before 1986, and 1990 data for later years). For the 80% of the sample in metropolitan areas, we equate the marriage markets with their MSA or PMSA. A non-MSA resident's marriage market consists of all PUMAs (census-defined contiguous areas of about 100,000 residents) that encompass his or her county. Our data contain 247 MSAs or PMSAs and 579 nonmetro counties.

Marriage market educational concentration is the proportion of age-matched potential mates with at least as much education as a respondent. For each sampled woman or man, respectively, of age k and educational level h, we calculate

$$\frac{\sum_{j=k-2}^{k+3}\sum_{g=h}^{4} M_{jg}}{\sum_{j=k-2}^{k+3}\sum_{g=1}^{4} M_{jg}} \quad \text{or} \quad \frac{\sum_{j=k-3}^{k+2}\sum_{g=h}^{4} F_{jg}}{\sum_{j=k-3}^{k+2}\sum_{g=1}^{4} F_{jg}},$$

where M_{jg} and F_{jg} are numbers of unmarried males and females of the specified age and education in a given local area, and education (g) is the highest completed degree (from 1 to 4). This measure, by definition, equals unity for the least educated (high school dropouts). Everyone has at least as much education as they do, so they are not at risk of marrying down. (All others, including the most highly educated, are at risk of both types of matches—hypogamous, and homogamous or hypergamous.) Inclusion of dropouts thus would distort estimates; therefore we exclude them.

We control for the two other features of markets. The age- and education-specific sex ratio is

$$\frac{\sum_{j=k-2}^{k+3}\sum_{g=h}^{4} M_{jg}}{\sum_{j=k-3}^{k+2} F_{jg}} \times 100.$$

We measure well-matched potential partners' economic attractiveness separately from the sex ratio (and do so for men as well as women) with the proportion of such mates employed full-time, year-round:

$$\frac{\sum_{j=k-2}^{k+3}\sum_{g=h}^{4} M'_{jg}}{\sum_{j=k-2}^{k+3}\sum_{g=h}^{4} M_{jg}} \quad \text{or} \quad \frac{\sum_{j=k-3}^{k+2}\sum_{g=h}^{4} F'_{jg}}{\sum_{j=k-3}^{k+2}\sum_{g=h}^{4} F_{jg}},$$

where M' and F' are those employed 35 or more hours a week for 45 or more weeks in the past year.

Concentration is not simply a variant of these other marriage market measures. Empirically, the correlation of concentration with sex ratio is .14; with economic attractiveness the correlation is –.21. Conceptually, concentration indexes the chance that any given potential partner will be an educationally homogamous or hypergamous match versus a hypogamous match; the sex ratio reflects competition or imbalance between women and men of a specified education. In a

3. For men, the women of target ages are three years younger to two years older. Although age-sorting norms may broaden as people age, we find it complex and unnecessary to specify a variable-width target age range when our sample ranges only from age 18 to 29 and thus probably is subject to fairly homogeneous age-sorting norms. We intend the target ages to cover most but not all matches occurring in the data—not all, because a basic assumption of search theory is that even if people prefer to match on age (or any other criterion), some will not do so. Of marriages in the sample, 75% fall within the specified age range.

4. College graduates are combined with postgraduates because respondents reported having 17 or more years of education in only 2.4% of person-years in our data.

5. We do not assume that men's and women's preferences regarding educational sorting are identical, but merely that both prefer homogamy or hypergamy to hypogamy. This is consistent with empirical evidence. Studies that examine preferences directly find that women emphasize potential mates' education and occupation more strongly than do men (Buss and Barnes 1986; Howard, Blumenstein, and Schwartz 1987; South 1991), but this does not mean that men want to marry down. South (1991) discovers only a small difference in men's and women's stated willingness to marry someone with less education, and finds that both men and women are more willing to marry a more highly educated than a less highly educated person.

college-educated woman's marriage market, for example, concentration depends on numbers of men with college degrees versus all men; the sex ratio depends on numbers of men with college degrees versus numbers of women with college degrees.

As defined so far, the market measures share a shortcoming: Their values depend not only on one's community, but also on his or her age, sex, and education. For example, because educational attainment is bounded, concentration in a given market is higher for those with less education. Our goal is to capture effects of market variation, not individual variation. One way to think of this is that we wish to learn the effect of living in a market more or less favorable than the average market faced by others of the same age, sex, and education. Therefore we group-standardize the market variables. We calculate means and standard deviations of the three variables for each age, sex, and education group. Then we express an individual's score on a market variable in standard deviation units from the mean value for those in the same group. Group-standardized market concentration (or sex ratio or attractiveness) measures the degree of educational concentration (or competitiveness or attractiveness) of one's market relative to the average market faced by similar individuals.

To see the implications of this idea, consider a fictitious community, Inton, where 25% of women have college degrees and 50% more have high school diplomas. By the raw concentration measure, a man with a high school diploma would find Inton a more favorable marriage market than would a college-educated man. (By the raw measure, a high school graduate would find any market more favorable than would a college graduate.) But if the *average* market contained 15% college-educated women and 70% more with high school diplomas, then by the group-standardized measure the college graduate would find Inton more favorable than average (because 25% of women have at least a college degree versus 15% in the average market), whereas the high school graduate would find it less favorable (because 75% have at least a high school diploma versus 85% in the average market). The group-standardized measures depend not on one's age, sex, or education, but only on variation among local marriage markets.

We predict, first, that living in a more educationally concentrated market should increase one's chance of marrying up or homogamously on education and should decrease the chance of marrying down so as to improve sorting. Second, concentration should interact with age so that the chance of marrying down rather than up or homogamously increases with age less in educationally concentrated markets than in sparse markets.

Covariates

Life-course models of marriage timing often include aggregate variables—particularly region and community size or urbanism—as controls in otherwise individual-level models. We control for community size and region as well. Size is the logged population of the county in which the respondent lives, expressed in standard deviations from the sample mean (as are other continuous variables). Region is a dummy variable for residence in the South.

Sex and race affect marriage formation so pervasively that analyses typically separate these groups. We follow this practice, reporting separate regressions by sex, but we cannot do likewise by race/ethnicity. Despite the black and Hispanic oversamples in the NLSY, some age/race/sex groups yield few or no hypogamous marriages because blacks' marriage rates are low and because hypogamous matches are a minority of those already infrequent marriages. Thus we are forced to limit our sample (and likewise their target mates) to non-Hispanic whites.

Although the structural determinants of marriage sorting and timing are our main interest, we also control for individual-level effects. Table 1 lists and defines all variables. Education, enrollment status, and their interaction are measured by dummy variables. Nonemployment is the percentage of weeks since the last interview in which the respondent had no job, expressed in standard deviations. We also include family background characteristics that may be related to marriage timing (Goldscheider and DaVanzo 1989; Lichter et al. 1992; Marini 1985; Michael and Tuma 1985): religion (a dummy variable for Catholic), number of siblings, and nonintact family (a dummy variable indicating that the respondent did not live with both of his or her parents at age 14).

METHODS AND DATA

To test whether market conditions affect sorting, we use a discrete-time hazard model with cause-specific risks (Allison 1982, 1984; Hachen 1988; Yamaguchi 1991). We report three coefficients for each variable: its effect on the risk of marrying up or homogamously versus not marrying in the subsequent year, its effect on the risk of marrying down versus not marrying, and its effect on the risk of marrying down versus marrying up or homogamously. The third of these (which can be derived from the other two, and is our focus) gives the effect on sorting. All coefficients are exponentiated to represent more easily interpretable odds. Dummy variables for two-year age groups, with 18–19 as the reference category, empirically determine the shapes of the hazards. Interactions between age and local educational concentration test whether the relationship between sorting and timing depends on local educational distribution.

The NLSY provides the best data for testing our hypotheses. It surveys a large national sample of youths aged 14–21 in 1979, following them annually through the ages in which most marriages occur; retention rates for the sample are high. Because the NLSY identifies respondents' place of residence, it is one of the few nationally representative samples that allows us to attach community descriptors to individual records. We use data from 1979–1992. By 1992, the youngest respondents are in their mid-twenties and the oldest in their early thirties. We limit the analysis to persons aged 18–29 because our data contain relatively few marriages outside this range, and because marriages below age 18 may require parental consent and often result from unplanned pregnancies.

TABLE 1. DEFINITIONS OF VARIABLES, WITH MEANS AND STANDARD DEVIATIONS AT AGE 24

Variable	Definition	Mean and *SD*[a] Females	Mean and *SD*[a] Males
Marriages			
Same/up	Marriage to spouse with same highest degree as respondent, or higher	.11 (.31)	.08 (.28)
Down	Marriage to spouse with less education	.05 (.21)	.03 (.17)
Enrollment × Education	Enrollment status and highest completed degree		
No, 12	Not enrolled, having completed high school	.34 (.47)	.42 (.49)
No, 13–15	Not enrolled, having completed part college (reference)	.19 (.40)	.17 (.38)
Yes, 12–14	Enrolled in years 1–3 of college	.06 (.23)	.06 (.24)
Yes, 15	Enrolled in year 4 of college	.03 (.17)	.04 (.19)
16	Not enrolled, having completed college	.38 (.49)	.31 (.46)
Family Background			
Nonintact	Did not live with both biological parents at age 14	.18 (.38)	.17 (.38)
Siblings	Number of siblings	2.83 (1.81)	2.76 (1.82)
Catholic	Raised as a Catholic	.38 (.48)	.37 (.48)
Nonemployed	% of weeks not employed in past year[b]	15.67 (28.00)	21.44 (32.32)
South	Currently lives in southern state	.24 (.43)	.22 (.42)
Population	County population[b]	789,981 (1,277,795)	795,131 (1,293,031)
Local Market	Characteristics of local matches of appropriate age, opposite sex, and/or same or more education, depending on the index. Men's appropriate-age mates are women 3 years younger to 2 years older, and vice versa.		
Economic attractiveness	Proportion working full-time all year, of those of appropriate age, opposite sex, and target education[b]	.51 (.09)	.45 (.09)
Sex ratio	Males per 100 females, of those of appropriate age and target education[b]	89.69 (16.04)	89.01 (16.45)
Concentration	Proportion with target education, of those of appropriate age and opposite sex[b]	.56 (.27)	.61 (.30)

[a]Means and standard deviations (in parentheses) for persons age 24 who are at risk of marriage.

[b]In regressions, these variables are transformed as discussed in the text. Raw means are reported here.

We organize the merged individual/aggregate data into interview years. The person-year file contains a record for each person from the first interview at which he was 18 or older and a high school graduate, to the year when he first married. For those who turned 18 and graduated before 1979, we create records dating back to age 18, constructing response variables from marital history questions asked in the first interview. Retrospective data are available for some covariates. Elsewhere we replace the missing covariates with mean values for those of the same sex and age during a

TABLE 2. ODDS RATIOS FOR MULTINOMIAL LOGISTIC REGRESSIONS

	Women						Men					
	Model 1			Model 2			Model 1			Model 2		
	Same/Up vs. None	Down vs. None	Down vs. Same/Up	Same/Up vs. None	Down vs. None	Down vs. Same/Up	Same/Up vs. None	Down vs. None	Down vs. Same/Up	Same/Up vs. None	Down vs. None	Down vs. Same/Up
Age												
18–19	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
20–21	1.07	.84	.78	1.07	.83	.78	1.72***	1.39	.81	1.71***	1.39	.81
22–23	1.23†	.88	.72	1.23†	.89	.72	2.23***	1.65*	.74	2.22***	1.65*	.75
24–25	1.13	.76	.67†	1.14	.77	.68	2.25***	1.65*	.73	2.27***	1.69*	.74
26–27	.95	.72	.76	.94	.74	.79	2.06***	1.15	.56†	2.09***	1.20	.57†
28–29	.79	.60†	.75	.80	.62†	.78	1.72***	1.25	.72	1.76**	1.30	.74
Enrollment × Education												
No, 12	1.64***	.37***	.23***	1.64***	.37***	.23***	1.51***	.27***	.18***	1.47***	.27***	.18***
No, 13–15	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
Yes, 12–14	.49***	.39***	.81	.48***	.41***	.85	.48***	.26***	.57*	.47***	.28***	.59†
Yes, 15	.90	.78	.87	.91	.85	.94	.69†	.55**	.82	.67*	.56*	.84
16	1.06	1.00	.95	1.06	1.05	.99	.85	1.10	1.28	.87	1.12	1.29
Family Background												
Nonintact	.92	1.09	1.18	.93	1.09	1.17	.76**	.86	1.13	.77**	.87	1.12
Siblings	1.03	1.04	1.01	1.03	1.04	1.01	1.02	1.08**	1.06	1.01	1.07*	1.06†
Catholic	.93	.87	.94	.92	.91	.99	.94	.83	.89	.95	.87	.91
Nonemployed	.80***	.90†	1.13†	.80***	.90†	1.12	.76***	.85**	1.13	.77***	.86*	1.12
South	1.03	1.44***	1.41**	1.03	1.27*	1.23	1.41***	1.51***	1.08	1.35**	1.40**	1.04
Population				.98	.88*	.90				.84***	.84**	1.00
Local Market												
Economic attractiveness				1.09*	1.05	.96				1.05	.99	.95
Sex ratio				.95	.99	1.04				1.04	1.06	1.02
Concentration				1.09*	.86**	.80***				1.06	.92	.87*
N		10,974			10,974			13,500			13,500	
Log-Likelihood		–4,642			–4,627			–4,427			–4,409	

†$p \le .10$; *$p \le .05$; **$p \le .01$; ***$p \le .001$

survey year. For those who miss a question or an interview during the survey, we similarly back-fill covariates with retrospective data from the next year available, or impute them otherwise.[6]

Our sample includes 1,876 women and 2,000 men. On average, each woman contributes 5.9 person-years until she marries or is lost to observation; each man contributes 6.8 years. (This difference exists because men marry later than women.) Therefore 11,009 person-years of data for women and 13,546 for men are available for analysis. Table 1 contains means and standard deviations of each variable for 24-year-old never-married males and females. Raw means are reported for continuous and marriage market variables. (In regressions these variables are rescaled as described above.)

RESULTS

Marriage Market Composition and Sorting

We now turn to the regressions displayed in Table 2. The first three columns for each sex (Model 1) control for individual characteristics only. This serves as a baseline, to which we add first the marriage market descriptors to represent the effect of market conditions on sorting, and then the age-

6. We imputed marriage market descriptors for 11% of all person-years—mostly constructed retrospective years. In test models we found that an imputation dummy variable had a significant coefficient (probably reflecting a period effect in part), but its inclusion did not appreciably change the coefficients or significance levels of other variables. Thus we report models without the dummy variable.

concentration interactions to represent how age patterns of sorting depend on local educational concentration.

Does market composition influence educational sorting? Comparing the log-likelihood of the model containing market variables to the model without these variables, we find that the market variables improve the fit ($p \leq .001$ for both sexes). Educational concentration in particular influences educational sorting significantly for both men and women. Annually, women in markets with a concentration one standard deviation better than in similar women's average market are 20% less likely to make a hypogamous marriage, relative to a homogamous or hypergamous marriage, than are similar women in average markets ($p \leq .001$). For men, living in a market one standard deviation better than those of similar men is associated with a significant decline in the relative risk of marrying hypogamously rather than otherwise (odds of .87, $p \leq .05$). Hence our data support the argument that local educational composition is an important factor in marital sorting. Where the educational distribution of potential mates is better, people are less likely to marry down along education.

These concentration effects are annual. They cumulate over time to alter marital sorting substantially. Consider a group of average women, holding all but age and local educational concentration at sample means, and using standard life table techniques to estimate cumulative risks. If the average woman is exposed to a market one standard deviation better than average over ages 18–29, she would have a chance of marrying down that was 66% as great as her chance of marrying up or homogamously. In a market one standard deviation worse than average, her chance of marrying down would be virtually identical to her chance of marrying up or homogamously (98% as great). In short, the chance of marrying down rather than up or homogamously would be 48% higher in an unfavorable market than in a favorable market. The cumulative effect for men is smaller but still notable.

The other market variables do not affect sorting. No coefficients for sex ratio are significant, nor does potential mates' economic attractiveness affect sorting. These results echo those of Lichter et al. (1995) on the specific question of whether sex ratios affect marital sorting, but they diverge on the larger question: whether market composition affects educational sorting. We find that those in more educationally concentrated marriage markets sort more successfully along education. Thus, local market concentration affects marital sorting even if local sex ratios do not do so.

Market Composition, Timing, and Sorting

We hypothesize that the age pattern of sorting depends on concentration. Thus, educational sorting will not worsen with age in more concentrated markets, but it will do so in less concentrated markets. We test this hypothesis by adding interactions of educational concentration with age to the preceding regressions (Table 3). Estimates for women support this expectation. When the log-likelihood is compared with that in Table 2, the added age/concentration interaction terms improve the fit significantly ($p \leq .001$). The interactions in the third column show that aging reduces the chance of marrying hypogamously (rather than homogamously or hypergamously) more with age for women in more favorable markets. Sorting depends significantly on market concentration only at later ages, but the smaller effects at the central ages are in the same direction.

This finding is consistent with the expectation that sorting will be most susceptible to variation in market conditions as individuals age and the market thins. The later women in more educationally concentrated markets marry, the less likely they are to marry down rather than to match or to marry up. Conversely, women in *less* educationally concentrated markets who marry later are *more* likely to marry down rather than to match or to marry up. In average markets, women ages 28–29 are 28% less likely than those 18–19 to marry hypogamously versus nonhypogamously, whereas in markets one standard deviation better than average, women ages 28–29 are 72% less likely [$1 - (.39 \times .72)$] than those 18–19 to marry hypogamously versus nonhypogamously.

Figure 1 illustrates the results of these regressions. It graphs women's expected annual probabilities of each type of marriage and the relative probability of the two, in markets one standard deviation more concentrated than average (top panel), and one standard deviation less concentrated than average (bottom panel). All variables except age and market concentration are at their means. Women in educationally sparse markets (bottom) who marry after age 25 are increasingly more likely to marry hypogamously than homogamously or hypergamously. In educationally concentrated markets, however (top), women's age does not increase the probability that those who marry will marry hypogamously rather than homogamously or hypergamously; if anything, that probability decreases with age in concentrated markets. Thus, in keeping with our second main hypothesis, for women the age pattern of educational sorting depends on educational concentration in the market.

The data for men, on the other hand, do not support the hypothesis that the connection between age and sorting depends on market concentration. Adding the age/concentration interactions does not improve the model's fit, and in no case are differences between the interaction coefficients in the sorting equation statistically significant.

Several possible factors may contribute to the sex difference in results. First, it may stem from the fact that men are less normatively constrained than women from choosing a younger mate. Hence, even in educationally sparse markets, men have more options for expanding their choices to younger partners (who are more likely to be single). The ability to exercise this option increases with a man's age because the number of suitably educated younger women is also increasing. Second, men marry later than women on average; thus the men in this sample are at an earlier stage of the marriage formation process. This would reduce the chance of finding effects that begin to impinge only later in the process of searching for a partner. Finally, men's age pattern for educational sorting may be affected less strongly

TABLE 3. ODDS RATIOS FOR MULTINOMIAL LOGISTIC REGRESSIONS WITH AGE-BY-CONCENTRATION INTERACTIONS[a]

	Women			Men		
	Same/Up vs. None	Down vs. None	Down vs. Same/Up	Same/Up vs. None	Down vs. None	Down vs. Same/Up
Age						
18–19	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)	(1.00)
20–21	1.10	.81	.74	1.72***	1.39	.81
22–23	1.27*	.87	.69†	2.25***	1.70*	.76
24–25	1.17	.76	.65†	2.31***	1.71*	.74
26–27	.88	.74	.84	2.12***	1.23	.58†
28–29	.76	.55*	.72	1.75***	1.27	.72
Local Market						
Economic attractiveness	1.05	1.06	1.00	1.02	.99	.96
Sex ratio	.95	.98	1.03	1.06	1.06	1.01
Concentration	.87†	.92	1.06	.93	.83	.90
Age × Concentration Interactions						
20–21	1.20†	.92	.76	1.01	1.01	1.01
22–23	1.21†	.92	.77	1.25†	1.28	1.02
24–25	1.24†	.92	.74	1.19	1.09	.92
26–27	1.92***	1.12	.58*	1.10	1.23	1.12
28–29	1.79**	.70	.39**	1.44*	.93	.65
N		10,974			13,500	
Log-Likelihood		–4,614			–4,402	

[a]These equations, like those reported in Table 2, control for education and enrollment, family background, employment status, region, and local population size. The effects of those control variables, not reported here, are essentially identical to those reported in Table 2.

†$p \leq .10$; *$p \leq .05$; **$p \leq 01$; ***$p \leq .001$

than women's pattern by local educational concentration because men's search process in general places less emphasis than women's on potential partners' education. Thus the sorting difficulties imposed by an educationally sparse market may alter women's behavior more than men's.

Whether the sex difference in results is due to one of these factors or to some other explanation is an issue for further research. For now, because the age pattern of educational sorting depends on concentration for women but not for men, our data confirm our second hypothesis only partially.

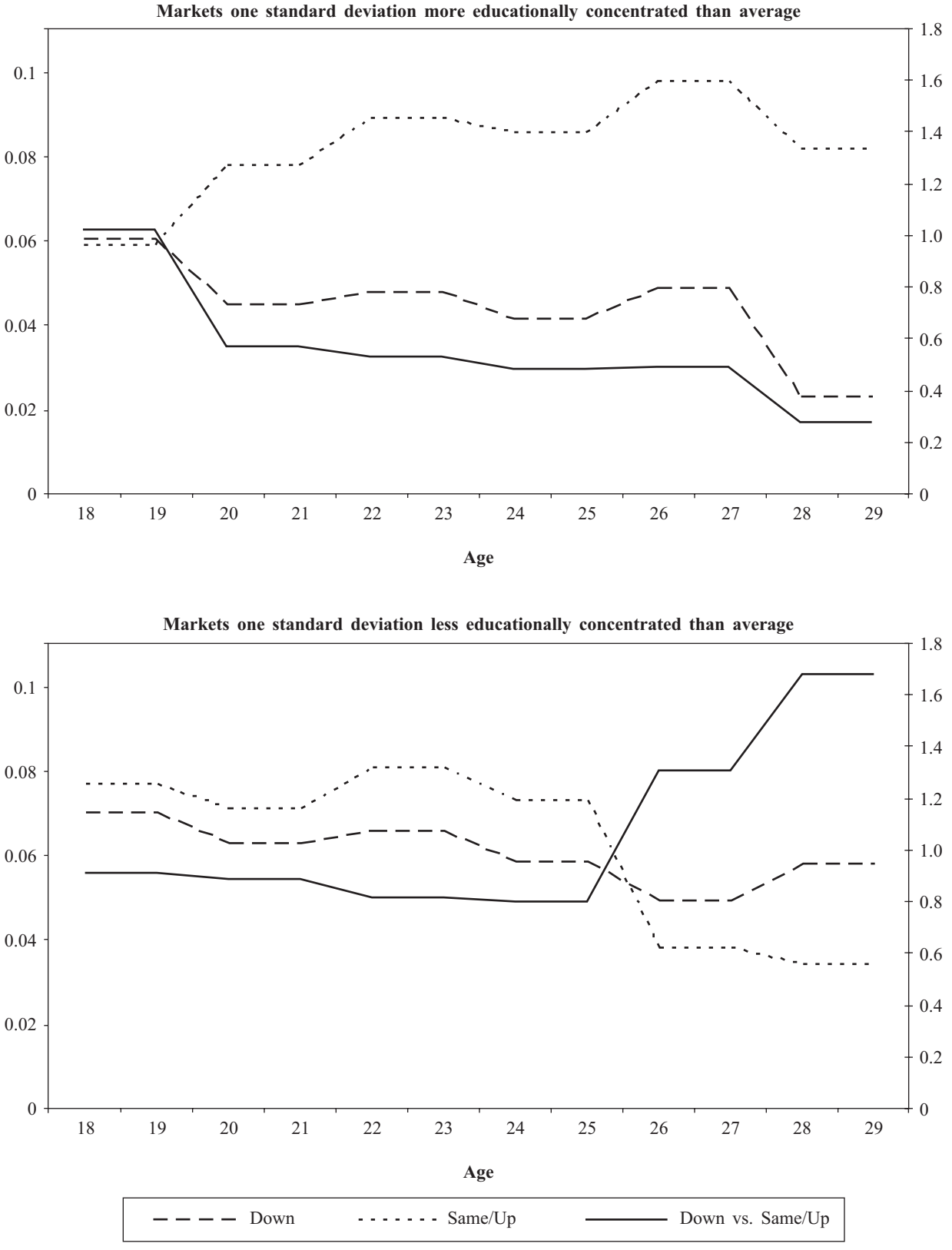
CONCLUSIONS

We find that local educational concentration influences educational sorting. Both women's and men's chances of marrying down increase greatly if they live in educationally sparse rather than concentrated markets. This holds even when their own education and other individual characteristics are controlled. We also find, for women but not for men, that educational concentration in the marriage market affects the connection between marriage timing and educational sorting. Women's chance of marrying down rather than homogamously or up increases more with age if they live in educationally sparse marriage markets. Thus we find partial confirmation for our second hypothesis. Why the pattern differs for men is still unexplained, and suggests a need for further research.

Further research also would benefit from examining the multidimensional nature of marital sorting. Individuals sort on many features simultaneously, such as age, income, ethnicity, religion, sense of humor, and appearance, as well as education. If partners who match their preferences on one feature are rare, people may adapt their preferences for other features rather than compromising on that one. Some empirical researchers consider sorting axes in pairs such as ethnicity and education or religion and education (e.g., Kalmijn 1991b; Qian and Preston 1993; Schoen et al. 1989). Others develop models to adjust measures of homogamy on one feature for sorting on other features (Pullum and Peri 1997). Even so, the full complexity of people's marital choices is still poorly understood.

We began with a broad question: Do local marriage market conditions shape assortative mating? The market conditions usually considered, with mixed results, are sex

FIGURE 1. ADJUSTED RISK OF MARRYING DOWN AND UP/SAME (LEFT AXIS) AND RELATIVE RISK (RIGHT AXIS), WOMEN



ratios: whether imbalances between women and men of specific types affect either marital timing or sorting. Notably, in view of the mixed results obtained in the past, we find that another market condition, local educational concentration, strongly reduces the chance of educational hypogamy. This occurs in spite of people's preferences for homogamy or hypergamy, and even though they can choose to forgo or delay marriage rather than accepting a hypogamous match. We also find some evidence (although it is not uniform) that local concentration can affect marriage formation more subtly, by altering the connection between sorting and age at marriage. Together these results suggest that the constraints of local marriage market conditions can affect marriage formation in more ways, and in more complex ways, than traditionally has been examined by research on marriage market effects.

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