Assortative Mating and Residential Segregation of Ancestry Groups in Stockholm

(Extended Abstract)

Robert D. Mare
California Center for Population Research, UCLA and
Institute for Analytic Sociology, Linköping University

Monica K. Nordvik
Institute for Analytic Sociology, Linköping University

Introduction and Background. This paper reports an analysis of the interdependence of assortative mating patterns, residential choices, and neighborhood segregation by ancestry and immigration groups in Stockholm, Sweden over the past 20 years. Sweden has experienced large immigration flows in recent decades, resulting in urban neighborhood segregation among persons of diverse national and ancestries and among persons whose families have been in the country different periods of time. As elsewhere, racial, ethnic, and ancestral segregation is a significant concern in Sweden because it may create barriers to full social participation and economic opportunities of disadvantaged groups. Ancestry and immigration status are also key bases for the establishment of intimate relationships, including marriages and cohabiting unions. Whether because of homophilous preferences or differential opportunities for meeting persons from different groups, individuals tend to pair with members of their own group, although the degree of endogamy varies by time, place, and group. Residential segregation and assortative mating both have rich research literatures, yet for the most part these two phenomena are studied separately, ignoring their behavioral and demographic connections. A contribution of this paper is to elucidate how assortative mating and residential segregation are linked, both analytically and empirically.

Opportunities to meet partners for dates and more enduring relationships are structured by a variety of institutions, such as schools, workplaces, places of worship, clubs, and parks. But place of residence is a fundamental basis of opportunity structure inasmuch as it may affect who meets whom directly via residential propinquity as well as indirectly via the other institutions already mentioned. To the extent that ancestry and immigrant groups live in ethnically homogeneous neighborhoods, residential segregation may contribute to homogamous marriages and other unions. On the other hand, when a pair of individuals first lives together as a couple, they face a decision about what neighborhood to live in. If, as individuals, they prefer to live in neighborhoods with relatively large numbers of members of their own ethnic group, ethnically homogamous couples are more likely to reinforce patterns of residential segregation by opting to live with their co-ethnics than heterogamous couples who, by definition, must select a neighborhood that underrepresents at least one member of the couple. Thus, whereas ethnic and ancestral residential segregation may increase homogamy of co-residing couples, homogamous unions may increase residential sorting along ethnic and ancestral lines (Bruch and Mare 2009). As illustrated in Figure 1, residential segregation and assortative mating are dynamically linked, each potentially reinforcing the other.

Most empirical analyses of segregation, including the classic studies of racial segregation trends in the United States, are static in that they examine patterns of segregation at one or more points in time without examining the individual-level moves and population flows that alter the spatial distribution of populations. Alternatively, more dynamically oriented segregation studies, typically based on the ideas of Schelling, tend to be weakly tied to empirical data (Bruch and Mare 2006), though for key exceptions see Quillian (1999), Bruch and Mare (2012), and Bruch (2014). Yet both types of segregation studies share a common tendency to focus on overall patterns of segregation, rather than specific demographic processes that may affect segregation for key subgroups. Our approach is first to describe overall patterns of ancestry and immigration group segregation in Sweden, but then to zero in on a specific set of demographic processes that govern the segregation of newly cohabiting couples. In so doing, we do not specify general mechanisms that apply to all individuals, but we gain precision by looking in depth at mechanisms that segregate important subpopulations. We exploit the unique features of Swedish register data, which provide longitudinal data over more than 20 years on all individuals in the Swedish population. This allows us to observe how individuals form cohabiting unions, how union formation is both a cause and consequence of residential mobility and choice, and how the process of couple formation and residential choice combine to influence the spatial distribution of the population and thus residential segregation.

Data. Data for these analyses are drawn from the Swedish population register, an annual longitudinal file of records on all individuals and households who reside in the country, including their places of residence, family and household rosters, place of birth, marital status, place of work and school attendance, and other basic demographic and socioeconomic characteristics. The data provide a comprehensive longitudinal record of residential mobility and co-residence and are thus uniquely suited to a study of assortative mating and residential mobility. For the preliminary analyses reported in this abstract, observations are confined to the period from 1990 to 2003 for Stockholm and residential locations are identified as the 832 SAMS (Small Areas for Marketing Statistics) in Stockholm. SAMS are similar in concept and scale to census tracts in the United States. The analyses to be presented in the final version of the paper will also be based on Stockholm but cover the period from 1990 to 2012 and identify residential locations as 100 square meter "neighborhoods." This will result in a great many more distinct residential units and enable us to approximate more closely the immediate residential neighborhoods that individuals experience. For both the SAMS and 100^2 meter analyses, we know geographic coordinates and can therefore compute distances between the centers of each spatial unit.

Measurement of Immigration and Ancestry Status. We classify individuals into three categories of immigrant status: (1) Swedish born to Swedish born parents; (2) Swedish born to foreign born parents; and (3) foreign born. When parents differ in their place of birth, we classify based on mother's place of birth. We classify individuals into six ancestry categories: (1) Swedish; (2) Western Europe and North America; (3) Eastern Europe and Russia; (4) Africa and Middle East; (5) Asia; and (6) Latin America. Our preliminary analyses reported below combine the small Asia and Latin America categories, but they will be kept distinct in the final version of the paper. Ancestry is determined only by place of birth of individuals and their parents. Thus, individuals born in Sweden to Swedish born parents are classified as Swedish, regardless of place of birth of grandparents or more remote kin. Individuals born to parents of mixed ancestry are classified on the basis of their mothers' places of birth.

Measurement of Segregation. Our preliminary analyses (see below) are based solely on the index of dissimilarity, computed for each pair of ancestry-immigration groups and for each group relative to the rest of the population. In our ongoing work, we are experimenting with a variety of measures to assess the robustness of our results. At a minimum the paper will report a basic measure of population evenness, such as the dissimilarity index, and a measure that takes distance between neighborhoods into account, such as the measure proposed by White (1983).

Measurement of Cohabitation. Because more than 90 percent of new marriages in Stockholm are preceded by a period of unmarried cohabitation and many couples do not formally marry, we focus on co-residence rather than legal marriage. Additionally, because we are interested in the processes that link residential location and cohabitation, we seek to focus on *entry* into cohabitation, rather than the status of cohabitation itself. Unfortunately, cohabitation status is not recorded in the register except at the point when couples have a new birth. It is nonetheless possible to identify a large portion of cohabiting couples indirectly from information on childbearing, marriage, and co-residence. Entry into cohabitation is identified by the following paths: (1) heterosexual pairs of individuals who live in the same dwelling unit for the first time and who subsequently enter formal marriage; (2) heterosexual pairs who live in the same dwelling unit for the first time and who subsequently have a first birth together; (3) heterosexual pairs who live in the same dwelling unit for the first time and subsequently move together to the same new dwelling unit.[1]

Statistical Models. Our analyses include four phases. (1) The effects of residential location on assortative mating are estimated using a variety of poisson and negative binomial regression models of the form:

$$\log\left(\frac{m_{hwst}}{E_{hwst}}\right) = \theta + \theta_h^H + \theta_f^F + \theta_{hw}^{HW} + \beta\log(dist_{st}) \,, \qquad (1)$$

where *h* and *w* index the male and female partners' ancestry-immigration groups respectively; and *t* index the male and female partners' neighborhood of resident prior to cohabitation respectively; $dist_{st}$ denotes the distance between the neighborhoods of the male and female partner prior to their co-residence; and

$$E_{hwst} = F(P_{hs}^M, P_{wt}^F) = \frac{P_{hs}^M \cdot P_{wt}^F}{(P_{hs}^M + P_{wt}^F)}$$

expresses the opportunity for marriage as a "harmonic mean" function of the numbers of single men (P_{hs}^M) and single women (P_{wt}^F) in each ancestry-immigration group in each neighborhood (Schoen 1981; 1988).

(2) The effects of couple and neighborhood characteristics on the residential choices of newly cohabiting couples are estimated using a discrete choice model for residential location:

$$p(y_{ij} = 1 \mid Z_j, X_i) = \frac{\exp(\mu_{ij})}{\sum_{j \in C(i)} \exp(\mu_{ij})}$$

[1] It is not feasible to identify cohabitors simply from heterosexual couples who inhabit the same dwelling unit. In part, this is because the data do not distinguish romantic partners from roommates. More importantly, the dwelling units recorded in the register refer to common street addresses rather than common doorways and shared quarters. Persons who live in a large apartment building are recorded as living in the same dwelling unit. Common dwelling unit is only a marker for cohabitation for small, single-household buildings. Thus, it is necessary to use the longitudinal information on transition to co-residence, marriage, childbearing, and mobility to identify cohabitors.

(2)

where

$$\mu_{ij} = \gamma_i Z_j + \theta_{ij} Z_j X_i$$

where the probability that a newly co-residing couple chooses the j^{th} neighborhood is a function of characteristics of the neighborhood (Z_j) and of the couple (X_i), including the ancestry-immigration composition of that neighborhood, the distance of that neighborhood from the neighborhood where each partner lives before cohabitation, whether a neighborhood is where one or both members of the couple already live, the ancestry-immigration groups of the male and female partners, and various nonlinearities and interactions among these effects. We follow Bruch and Mare (2012) in modifying these types of models to take account also of the effects of neighborhood size, selection probabilities when choice sets are subsampled to speed computation, the special weight given to one's own neighborhood, and other complications. These details will be discussed in the final version of the paper.

(3) The combined effects of assortative mating and residential choice on the segregation patterns for newly cohabiting couples are computed using the estimated versions of models (1) and (2) under alternative counterfactual conditions about the presence or absence of key effects. These include propinquity, exposure, and homogamous preference effects on assortative mating and sex-specific distance and homophilous preference effects on residential choice. Under alternative scenarios, we compute the expected distributions of new couples in each neighborhood and the resulting patterns of ancestry-immigration group segregation, as illustrated in Figure 1 below. (4) The contribution of the segregation of new couples to changes in the overall segregation of ancestry-immigration groups is estimated in parallel fashion to step (3), using estimated spatial distributions of new couples under alternative assumptions and computing resulting measures of overall segregation.

Preliminary Results. Table 1 shows a matrix of dissimilarity indexes for ancestry-immigration and ancestry groups for Stockholm in 1990-2003. This measure shows substantial segregation, especially for the African and Middle Eastern groups relative to others. In contrast, immigrant groups from Western Europe and North America are well integrated with native-born Swedes. These patterns, both in this form and also using measures that take into account weighted distances between neighborhoods, are a baseline to compare with segregation patterns implied by alternative assumptions about assortative mating and residential and choice. Table 2 shows the distributions by ancestry-immigration group for newly cohabiting couples, for single persons, and for the entire Stockholm population. Swedes are a large majority in these populations, but Western European and African/Middle Eastern populations are significant minorities.

Table 3 two of the many Poisson regression models for assortative mating that we consider in our analyses. One of these models includes a single parameter for marrying within one's own ancestry group and for marrying within one's own immigrant status group. The other model includes homogamy parameters that vary across groups. Table 3 also shows the homogamy parameters for variants of these two types of models that do not control for exposure or distance between neighborhoods and that do control for these aspects of the mating opportunity structure. The estimated models show much higher levels of homogamy for ancestry than immigration status and also that the spatial distribution of potential partners accounts for about one fourth of ancestry homogamy and virtually all of immigrant status homogamy. Homogamy is particularly strong among the African/Middle Eastern group; moderate for Eastern Europeans, Asians, and Latin Americans; and low for Swedes and Western Europeans. Overall, the effects of residential sorting on cohabitation patterns are small.

The estimated coefficients for a simple model of residential choice, shown in Table 4, imply a strong tendency for a newly cohabiting couple to live in the neighborhood where one or both partners lived prior to cohabitation. This effect and the effect of distance from previous places of residence are almost the same for the male and female partners. In contrast, newly cohabiting couples are drawn to neighborhoods in which their ancestry-immigration groups are relatively highly represented, but couples weight the representation of the male partners' ancestry group much more heavily than the female partner's group.

Our analyses of the implications of these relationships for residential segregation are still underway. Figure 2 illustrates the type of analyses that we are going. Each triangle denotes a matrix of pairwise segregation indices between ancestry-immigration status groups. Separate sets of matrices will be computed for dissimilarity indices and indices that take into account weighted distances among neighborhoods. The rows and columns of the figure denote alternative counterfactual conditions about assortative mating and residential choice that we will assume in computing expected segregation patterns.

Remaining Work. In our remaining work, we will compute the expected segregation patterns under alternative combinations of effects shown in Figure 2 for several segregation indices. Additionally, we will replace all preliminary analyses with estimates for the 1990-2012 period using a grid of 100 x 100 meter areas, rather than the SAMS used for the estimates reported in this abstract. We will attempt to draw conclusions about the interdependence of assortative mating and residential segregation and the significance of the behavior of new cohabitors for overall ancestry-immigration segregation.

References

Bruch, Elizabeth E. 2014. "How Population Structure Shapes Neighborhood Segregation." *American Journal of Sociology* 119: 1221-78.

Bruch, Elizabeth E., and Robert D. Mare. 2006. "Neighborhood Choice and Neighborhood Change." *American Journal of Sociology* 112: 667-709.

Bruch, Elizabeth E., and Robert D. Mare. 2009. "Segregation Processes." Pp. 269-293 in P. Bearman and P. Hedström (eds.). *Oxford Handbook of Analytical Sociology*. Oxford University Press.

Bruch, Elizabeth E., and Robert D. Mare. 2012. "Methodological Issues in the Analysis of Residential Preferences and Residential Mobility." *Sociological Methodology* 42: 103-54.

Quillian, Lincoln. 1999. "Migration Patterns and the Growth of High Poverty Neighborhoods." *American Journal of Sociology* 105: 1-37.

Schoen, Robert. 1981. "The Harmonic Mean as the Basis of A Realistic Two-Sex Marriage Model." *Demography* 18: 201-216.

Schoen, Robert. 1988. *Modeling Multigroup Populations*. New York: Plenum.

White, Michael. 1983. "The Measurement of Spatial Segregation." *American Journal of Sociology* 88: 1008-1018.

Table 1. Residential Segregation (D) among Ancestry and Immigrant Groups in Stokholm (1990-2003)

Ancestry-Immigrant Status	All Others	Swede	Europe/NA(2)	Europe/NA(1)	E Europe/Russia(2)	Europe/Russia(1)	Africa/Mid East (2)	Africa/Mid East (1)	America/Asia (2)
Swede	0.26								
Europe/NA(2)	0.08	0.11							
Europe/NA(1)	0.12	0.18	0.10						
Eastern Europe/Russia(2)	0.14	0.15	0.15	0.18					
Eastern Europe/Russia(1)	0.23	0.29	0.23	0.19	0.24				
Africa/Mid East (2)	0.52	0.58	0.53	0.48	0.55	0.43			
Africa/Mid East (1)	0.53	0.57	0.51	0.45	0.53	0.36	0.24		
S America/Asia (2)	0.23	0.28	0.26	0.24	0.26	0.23	0.44	0.42	
S America/Asia (1)	0.33	0.39	0.33	0.28	0.35	0.18	0.35	0.27	0.25

Ancestry	All Others	Swede	Europe/NA	Europe/Russia	Africa/Mid East
Swede	0.26				
Europe/North America	0.10	0.15			
Eastern Europe/Russia	0.19	0.25	0.17		
Africa/Middle East	0.53	0.57	0.47	0.39	
South America/asia	0.32	0.38	0.28	0.20	0.28

Table 2. New Unions, Single Adults (18-45), and All Adults by Ancestry-Immigrant Group, Stockholm, 1990-2002

	New Unions		Singles		All Adults
	Male	Female	Male	Female	
Swedes	74.0	73.6	71.7	72.6	68.8
Europe/NA(2)	7.1	7.2	8.8	8.6	6.0
Europe/NA(1)	8.2	8.0	6.3	6.4	10.6
E. Europe/Russia(2)	1.0	1.0	1.5	1.5	1.0
E. Europe/Russia(1)	2.1	2.6	1.9	2.3	3.8
Africa/Mid-East(2)	0.2	0.4	0.8	0.8	0.4
Africa/Mid-East(1)	4.6	3.5	5.4	3.8	5.7
Lat America/Asia(2)	0.1	0.1	0.5	0.4	0.2
Lat America/Asia(1)	2.6	3.7	3.3	3.7	3.5
Total	100.0	100.0	100.0	100.0	100.0
N	76,397	76,397	3,655,207	3,321,908	16,235,814

Table 3. Homogamy Parameters for Selected New Union AM Models					
	Unadjusted	Exposure	Exposure	Adj/Unadj	Adj/Unadj
	(Unadjusted)		& Distance	Exp	Exp & Dist
ANCESTRY & IMMIGRANT GRP					
Ancestry	0.72	0.55	0.51	0.76	0.71
Immigrant Group	0.23	0.02	-0.03	0.08	-0.13
A-GRP AND I-GRP-SPECIFIC					
Swede	0.09	-0.71	-0.84	-7.54	-8.96
Europe/NA	0.46	0.69	0.72	1.51	1.57
E. Europe/Russia	2.44	1.98	1.91	0.81	0.78
Africa/Mid-East	4.25	4.25	4.10	1.00	0.96
S. America/Asia	2.04	1.85	1.81	0.91	0.89
Generation 2	-0.03	-0.05	-0.05	1.75	1.69
Generation 1	1.33	1.38	1.34	1.04	1.01

Table 4. Coefficients for Neighborhood Choice by Couples in New Unions		
Variable	β	z(β)
log SAMS size	0.736	133
man's SAMS (t-1)	3.338	191
woman's SAMS (t-1)	3.412	196
log metres from man's t-1 SAMS	-0.629	-140
log metres from woman's t-1 SAMS	-0.680	-150
prop of SAMS in man's ancestry	1.201	19
prop of SAMs in woman's ancestry	0.727	11
-log selection probability	1.000	
log likelihood	-231065	
n=539781 (couple-options)		

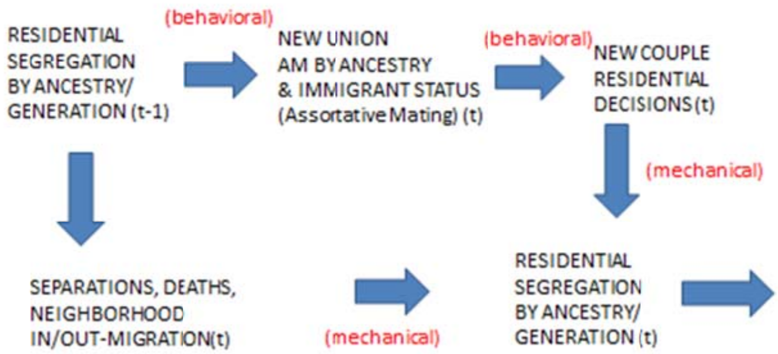

Figure 1. Model of Links between Residential Segregation and Assortative Mating

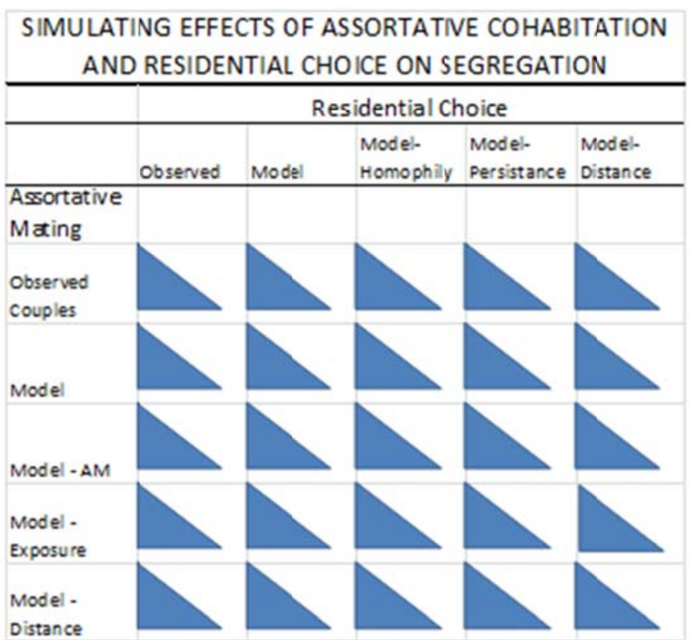

Figure 2. Segregation Patterns Under Alternative Hypothetical Assortative Mating and Residential Choice Assumptions.