Migration is Many Different Things: Using Network Analysis to Distinguish Different

Interpretations of US Interstate Migration Patterns

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It is tempting to view the concept of "migration" as straightforward, unidimensional, and easy to interpret. But the movement of people across political boundaries, such as between states or countries, is anything but straightforward, and is certainly not unidimensional. We apply a migration measurement perspective, and a set of network analytic procedures, to study interstate migration patterns from the past several decades. Our measurement models make clear that migration means different things, depending on whether interest is in in-migration, out-migration, or net-migration, and on how the migration statistics are standardized/normed. Our models provide interesting and interpretable empirical results, but also highlight and clarify the many different interpretations of what migration means.

We develop the use of seriation, a scaling procedure originally used in the archaeological literature, and then further developed in the psychometric literature, to estimate network models of migration. In the first set of analyses, we used seriation to directly model U.S. Census data reflecting state-to-state migration over three decades, fitting these models to raw, unadjusted state-to-state migration counts. Our focus is on transition from 1975-1980, 1985-1990, and 1995-2000. Following, we use seriation to analyze different definitions of what constitutes a migration stream, using two perspectives based on different norming procedures. With these second and third definitions, we norm each migration stream for total state population size and for state migrant population size. These standardization procedures are similar to the probability-of-migration measurements discussed at least as far back as Haenszel (1967), but they also allow

us to move past a simple net migration approach and to separately consider out-migration and in-migration patterns.

In the final analytic procedure, we combine seriation with other network models presented in the psychometric literature to examine migration dispersion and reciprocity in the context of a state nearest neighbor analysis. This set of models can be used to test the effects of predictor variables on dominant migration patterns, and to visually represent the migration streams themselves. Overall, our analyses all demonstrate very different understandings of how we can conceptualize migration, depending on the definition we use. And together they provide a relatively complete picture of U.S. migration patterns during these periods, including accounting for the complexities built into its underlying multidimensional nature.

The presentation of our analytic results are contained in tables, but more vividly in a number of graphical representations using the U.S. state maps and SAS-GRAPH to show the visual results of these analyses. As a result, the various definitions of migration can be compared visually over time; the separate state patterns can be compared across states; and even state-by-time interactions can be identified visually. Two examples of map representations are contained in this submission; others are completed, and will be available for presentation at PAA.

Among the most interesting -- and substantively important -- features of the migration results presented in this paper are to show that substantially different pictures of migration emerge, depending on how migration is defined (i.e., out- versus in- versus net-migration, crossed with the norming procedure that is used). No one procedure is any more "correct" than any other, but the presentation makes clear the complexity and richness of studying migration patterns among geographic units. A number of the analytic results -- in particular, the nearest

neighbor analyses -- are ones that even those untrained in methodology can easily appreciate, and these have obvious policy implications.

Finally, we note that although the 2005-2010 migration data were not available at the time of this research, they will be released in the near future. We expect ultimately to fit models to these more modern patterns, and compare them to the earlier patterns identified in this paper.

Seriation results, using net migration (1995-2000) and raw count data (dark states receive more migrants than they send out)
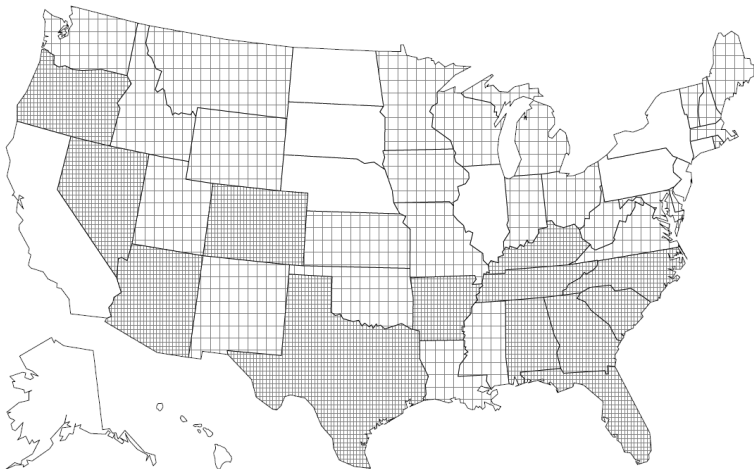
Seriation results, out-migration (1995 – 2000), adjusted for the estimated state total population in 1995 (dark states send out a higher proportion of their population to other states than the proportion that other states send to them)