sociological science

Supplement to:

Villarreal, Andrés. 2020. "The U.S. Occupational Structure: A Social Network Approach." Sociological Science 7: 187-221.

Appendix

Out-Degree in Occupational Labor Markets

A network node's degree is the number of ties it has with other nodes. In a directed network we can further distinguish between a node's out-degree and in-degree defined as the number of ties out of and into a node, respectively. By taking the average of the degree of all nodes in a network we can obtain an alternative measure of social cohesion. In an occupational network in which ties are directed rather than symmetric, we are most interested in the average out-degree, that is the average number of occupations that can be directly reached from each occupation. A higher out-degree indicates greater occupational options for the average worker. Mathematically, the average degree may be expressed as:

$$\bar{d} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} x_{ij}}{n}$$

A network's average degree is directly related to its density and may in fact be expressed as a function of the latter. For a non-reflexive network:

$$\bar{d} = (n-1)density$$

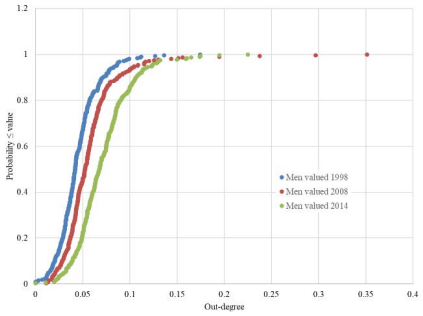
Although the average out-degree provides similar information as network density, one advantage of examining nodal out-degree is that it is measured for each individual node rather than the entire network. This allows us to further explore the distribution of the out-degree in a network, beyond calculating its central tendency. By examining the distribution of nodal out-degree we can assess whether occupational transitions are concentrated among a few occupations, or are evenly spread out among many occupations.

Finally, just as with network density, the out-degree of a node can also be computed for valued networks. For the occupational network in which the tie between two occupations is

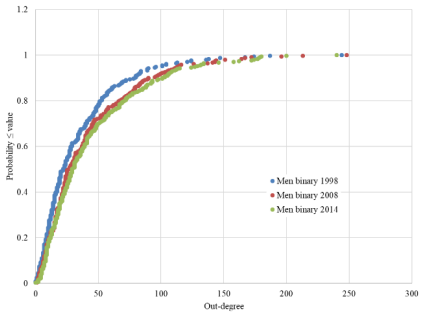
defined as the probability that a worker in occupation *i* will move to occupation *j*, the nodal out-degree is the overall probability that a worker will move out of each occupation during the specified time interval. The average out-degree will therefore be the probability of moving out of the current occupation for the average worker, which is a customary measure of occupational mobility.

The graphs in Figure A show the cumulative out-degree distributions for the full valued and binary networks for all men, and for men of different race and ethnicity, and level of education. The top two graphs (Figures A1 and A2) show a modestly higher out-degree overall for occupational nodes over time consistent with the estimates of network density. The cumulative distribution graphs for later years dominate those for earlier years for all parts of the distribution. However, the corresponding graphs for men of different race and ethnicity and level of education reveal an interesting pattern. When the valued networks are used (Figure A3), we observe a higher out-degree for many black and Hispanic workers compared to white workers, consistent with the findings for network density. The higher out-degree for white workers at lower levels of the cumulative distribution is largely due to the presence of isolates in the occupational networks for black and Hispanic men, that is, nodes from which no occupational transitions exist or in which there are no workers of that ethnoracial category. However, when the ties among occupations are dichotomized (Figure A4), the cumulative out-degree distribution shows that white workers have much higher connectivity. The cumulative graph using binary ties for white workers dominates the corresponding graphs for black and Hispanic workers for all parts of the cumulative distribution. These findings once again suggest that black and Hispanic men have a high probability of moving among a limited set of occupations, but generally lack the broad range of occupational options available to white workers. The cumulative distribution

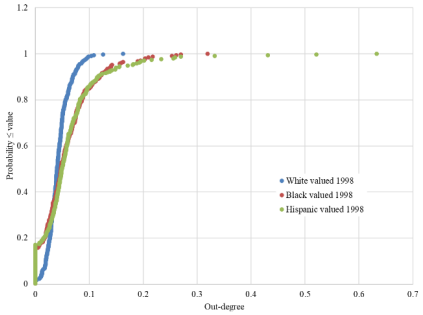
graphs for men with and without a college degree show a similar reversal when the valued and binary occupational networks are used (Figures A5 and A6), except that in this case, it is the disadvantaged group with a lower level of education that exhibits greater occupational connectivity. Men without a college degree are moving among a wider set of occupations.



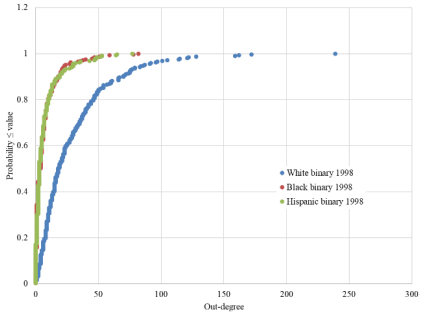
1) Valued networks by year



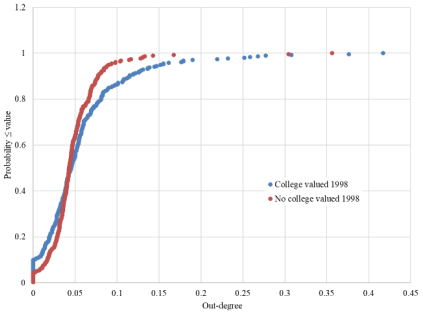
2) Binary networks by year



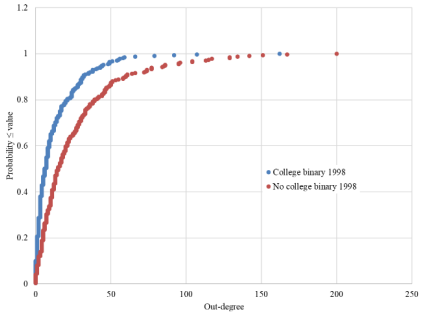
3) Valued networks by race and ethnicity, 1998



4) Binary networks by race and ethnicity, 1998



5) Valued networks by level of education, 1998



6) Binary networks by level of education, 1998

Figure A: Cumulative out-degree distribution for full valued and binary networks for all men, and men of different race and ethnicity, and level of education, 1998-2014