Spatial Integration and Neighborhood Diversity in Mid-Sized US MSAs, 1990-2000

Earlier research on racial/ethnic residential sorting have generally conceived of urban spaces as highly segregated, and much of these discussions have revolved around the existing conceptual frameworks -- Assimilation, Stratification, and Resurgent Ethnicity. Recently, though, these frameworks have been increasingly questioned as contemporary urban residential dynamics exhibit different patterns from increasing multi-ethnicity. Brown and Chung (2008) suggests that increasingly the market forces are having larger roles in influencing household decisions of residential choice. This project examines these dynamics of changing racial/ethnic residential intermixing (1990-2000) among continental US mid-sized MSAs that had greater than 1 million population in 2000. It does so by computing the Theil Entropy Index, a measure if intermixing (or segregation) among multiple groups, and at different scales of geography. The population segments considered are African American (AA), American Indian (AI), Asian (including Pacific Islanders) (A), Caucasian (C), All Other Groups (AO), and Hispanic (H). Aside from measuring intermixing per se, unlike the more usual two-group measures such as the Dissimilarity Index, Theil Entropy Index can be decomposed into their component parts – at geographic scales and into group components. For example, to what degree does a particular census tract(s) contribute more or less to the overall MSA index; likewise to what extent does white versus non-white intermixing contribute to the overall index at various geographic scales. In this project, the levels of residential intermixing among all six racial/ethnic groups (as defined by Census 2000), as well as among Caucasians versus Non-Caucasians and African Americans versus Non-African Americans are computed and analyzed for all 49 MSAs larger than 1 million population in 2000.

The statistic used for measuring intermixing (Theil Entropy Index) has two elements – a Diversity Score, D, and an Entropy Index, E. The Diversity Score D, literally represents the "diversity" of a spatial unit. Thus, if D is the Diversity Score for an MSA; D_i the Diversity Score for a Census Tract or Block Group i within that MSA; and Pr(g) the proportion of a particular racial/ethnic group g, where there are n racial/ethnic groups. Then, D and D_i are computed as:

$$D = \sum_{g=1-n} Pr(g) * Ln\,(1/Pr(g)) \qquad (1)$$

$$D_i = \sum_{g=1-n} Pr(g)_i * Ln\,(1/Pr(g)_i) \qquad (2)$$

Thus, as can be observed from the formula for computing the Diversity Score for the MSA, and for census tract/block group i within the MSA, its value will differ according to the proportion of each racial/ethnic group (R/E) in the unit, as well as on the number of groups g that reside at each scale. The Entropy Index ranges between 0 and 1, 1 indicating no intermixing, and 0 indicating perfect intermixing. Computationally, let E indicate the Entropy Index for an MSA; T_i the total population of census tract i, with n tracts overall; D and D_i the Diversity Scores for the MSA and census tract i; and let T indicate the MSA's total population. Then, E is computed as:

$$E = \sum_{i=1-n} (T_i * (D - D_i) / (D*T)) \qquad (3)$$

In effect, then, the Entropy Index for the entire MSA represents the deviation of each census tract i's Diversity Score (or mix of racial/ethnic groups) from that of the MSA overall, weighted by the population of i relative to the MSA population, and summed over all census tracts i. A similar formula would be used for computing, say, the Entropy Index for a census tract based on its component block groups. Thus, an Entropy Index closer to 1 indicates high clustering, whereas E closer to 0 indicates high intermixing. This project examines patterns of intermixing by understanding a feeling for the numbers themselves, for example in our present study of the forty-nine largest MSAs and six racial/ethnic groups. In this project, I analyze how evenly groups are distributed across MSA neighborhoods (census tracts in this context) relative to their proportions in the MSA overall; likewise if we consider a census tract and its component block groups. Data sources used for this project include the US Census (1990 and 2000), and the NCDB.

Some of the major findings on 'change analyses of Theil Entropy Index' indicate a distinct pattern of diversity and intermixing among the US MSAs. The American Manufacturing (AMB)/Rust Belt is systematically lower in intermixing and Sun Belt MSAs are systematically greater. Further analyses with MSA characteristics indicate that the pattern of intermixing is closely related to past changes in overall population, minority group segments, and residence between 1995-2000, i.e., that change begets change. Also, a higher share of Asians was associated with more transformation compared to a higher share of Hispanics or African Americans. MSAs with higher shares of recently built housing, a larger share of recently arrived foreign-born, and the like more generally symbolizes a level of dynamism, linking it to higher levels of racial/ethnic intermixing. Further, the level of intermixing in 1990 (E-90) strongly impacts the trajectory of change and intermixing in 2000 (E-2000). As with the 2000 analyses, MSAs were classified, but this time on the basis of E-90 (a key element of change) and ΔE. A major dimension running through both 1990-2000 change and 2000 itself appears to be the role of Sunk Costs, which are considerably higher in AMB/Rust Belt MSAs than Sun Belt ones, but which were reduced considerably, absorbed, or written off in the course of the revival of AMB/Rust Belt economies. Findings also suggest the concept of community inertia (intermixing early leads to intermixing in the future) versus community norms (communities adopt broader regional and national norms regarding racial/ethnic intermixing).

Some Interesting Results from the MSA Analysis: Some interesting patterns concerning what these 49 MSAs exhibit in terms of residential intermixing, and change are illustrated below in Tables 1-A, 1-B, 2-A, and 2-B.

Reference: Brown, L.A. and S-Y Chung. 2008. "Market-Led Pluralism: Re-Thinking Our Understanding of Racial/Ethnic Spatial Patterning in US Cities" *Annals of the Association of American Geographers* 98: 180-212.

Table 1-A: Descriptive Statistics, Entropy Index 1990 (I) and Absolute Change in Intermixing 1990-2000 (ΔI)(a)

		Entropy Index in 1990 (E-90)	Absolute Change in Entropy Index (ΔI)
Median		0.33	4.20
Minimum		0.10	-2.02
Maximum		0.56	9.84
Percentile	35%	0.29	2.70
Equivalents	50%	0.33	4.20
	65%	0.38	6.00

Table 1-B: MSA Classification on the Basis of Intermixing 1990 (I-90) and Absolute Change in Intermixing 1990-2000 (ΔI)[(a)]

Category	Characteristics	#	MSAs
Hi-ΔI / Low-I-90	AMB/Rust Belt	10	Atlanta, Chicago, Cincinnati, Cleveland, Detroit, Indianapolis, Kansas City, Louisville, Philadelphia, St. Louis
Hi-ΔI / Med-I-90	Sun Belt	7	Columbus, Greensboro, Hartford, Jacksonville, Nashville, Tampa, West Palm Beach
Hi-ΔI / Hi-I-90		0	None
Med-ΔI / Low-I-90	AMB/Rust Belt	6	Buffalo, Memphis, Miami, Milwaukee, New York, Pittsburgh
Med-ΔI / Med-I-90	AMB/Rust Belt	5	Boston, Charlotte, Grand Rapids, Rochester, Washington-Baltimore
Med-ΔI / Hi-I-90	Sun Belt	4	Norfolk, Raleigh-Durham, San Antonio, Seattle-Tacoma
Low-ΔI / Low-I-90	Sun Belt	1	New Orleans
Low-ΔI / Med-I-90	Sun Belt	3	Dallas, Houston, Los Angeles
Low-ΔI / Hi-I-90	Sun Belt	13	Austin, Denver, Las Vegas, Minneapolis-St Paul, Oklahoma, Orlando, Phoenix, Portland, Providence, Sacramento[(b)], Salt Lake City[(b)], San Diego[(b)], San Francisco

Notes: (a) ΔI = E1990 - E2000 * 100; (b) Indicates MSA became less intermixed between 1990 and 2000

Table 2-A: Regression on Intermixing 2000

	A: Components With AMB Dummy				B: Components Alone			
Component	**b**	**Beta**	**t-value**	**p-value**	**b**	**Beta**	**t-value**	**p-value**
I	-0.026	-0.275	-2.754	0.009	-0.055	-0.583	-7.095	0.000
II	-0.006	-0.067	-0.918	0.364	-0.016	-0.169	-2.060	0.046
III	0.007	0.078	1.011	0.318	-0.007	-0.071	-0.860	0.394
IV	-0.013	-0.142	-2.037	0.048	-0.017	-0.182	-2.211	0.033
V	0.052	0.555	7.782	0.000	0.045	0.479	5.832	0.000
VI	0.007	0.076	0.897	0.375	0.027	0.283	3.437	0.001
Dummy	0.098	0.516	4.289	0.000	x	x	x	x
Constant	0.247		22.491	0.000	0.285		37.287	0.000
r-squared		0.804				0.716		

Dependent Variable: Entropy Index (2000)

Table 2-B: Regression on Change in Intermixing 1990-2000: 49 MSAs

	A. Components With Entropy Index (E) 1990				B. Components Alone			
Component	**b**	**Beta**	**t-value**	**p-value**	**b**	**Beta**	**t-value**	**p-value**
I	0.759	0.266	2.256	0.029	-0.539	-0.189	-1.831	0.074
II	-0.552	-0.194	-2.253	0.030	-1.001	-0.351	-3.396	0.002
III	-0.646	-0.227	-2.694	0.010	-1.008	-0.353	-3.421	0.001
IV	-0.026	-0.009	-0.086	0.932	0.987	0.346	3.351	0.002
V	-0.166	-0.058	-0.615	0.542	-0.906	-0.318	-3.076	0.004
VI	0.274	0.096	1.147	0.258	0.623	0.218	2.116	0.040
E-1990	20.095	0.799	5.287	0.000	x	x	x	x
Constant	-2.298		-1.814	0.077	4.292		14.717	0.000
r-squared		0.734				0.552		

Dependent Variable: ΔI = E1990 - E2000 * 100

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