Was the Late 19th Century a Golden Age of Racial Integration?

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Abstract

Cutler, Glaeser, and Vigdor (JPE 1999) find evidence that the late 19th century was a period of relatively low residential segregation between blacks and whites. Segregation increased substantially from 1890 to 1940 and, despite falling since 1970, remained considerably higher in 1990 than in 1890. Their segregation measure is a weighted average of within-city segregation indices. It does not reflect segregation between cities, which fell sharply over the period as blacks moved from "ghetto cities" in the south to "ghettos within cities" in the north. We study a variety of segregation indices that reflect both within- and between-city segregation. With these improved measures, we find that segregation increased only slightly from 1890 to 1940. In addition, U.S. cities were less segregated in 1990 than in 1890.

Keywords: segregation, integration, race, ghettos.

1 Introduction

Was the late 19th century a golden age of racial integration? This is the picture that emerges from the comprehensive empirical study of Cutler, Glaeser, and Vigdor

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(henceforth, CGV) [2]. They find that segregation was moderate in 1890. As blacks moved to northern industrial cities over the first half of the 20th century, exclusive practices by whites forced blacks into ghettos, leading to a steep rise in segregation from 1890 to 1940. Since 1970, legal reform and changes in racial attitudes have led to a partial reversal of this trend. However, segregation remained substantially higher in 1990 than in 1890.

CGV consider several measures of segregation. Each is a weighted average of within-city segregation indices for some set of cities. One limitation of these measures is that they are insensitive to changes in segregation *between* cities. We reanalyze CGV's data using a variety of segregation measures that are sensitive to both within- and between-city segregation. We find a much smaller increase in segregation over the 1890-1940 period. On the other hand, we confirm CGV's finding that segregation fell from 1970 to 1990. Overall, we find that segregation in 1990 was slightly lower than segregation in 1890.

The practice of slavery left former slave states in the south with disproportionately large black populations in the 1890 census. Over the next 50 years, segregation between north and south declined as many southern blacks migrated to the north. Most southern cities saw their black percentages fall (Figure 1), while most northern cities experienced the opposite (Figure 2).[1]

In this situation, changes in within-city segregation tell only half the story. This is illustrated in Table 1. Here we imagine a country that is composed of two cities, A and B. Each city has two neighborhoods, I and II. In city A, each neighborhood initially has 90 blacks and 10 whites, while in city B the numbers are reversed. In the subsequent period, neighborhood II in city A has changed places with neighborhood II in city B. Now each city has one neighborhood with 90 blacks and 10 whites and one neighborhood with 10 blacks and 90 whites.

In both periods, the typical black lives in a neighborhood that is 90% black while the typical white lives in a neighborhood that is 90% white. In this sense, there has

[1]Note that the scale in the second figure is half that of the first.

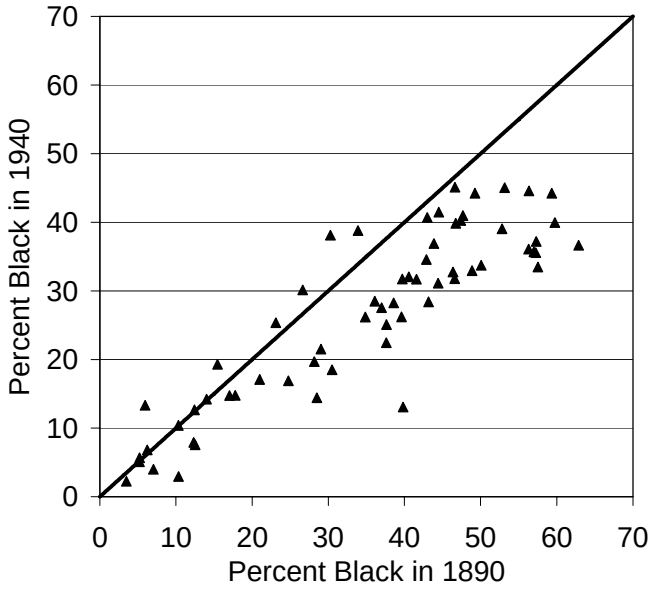

Figure 1: Percent Black in Southern Cities, 1890 and 1940. The south is the 19 states in which slavery was legal before the Civil War: Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and Missouri.

been no increase in segregation. The only difference is that in period 0, blacks live in a "ghetto city" while in period 1, they live in "ghettos within cities." One might argue that segregation has actually declined, since blacks tend to live closer to whites in period 1, and are thus more likely to encounter them in their daily life.[2] We take the more conservative position that segregation has not changed.

To go further than this casual observation, we must choose a segregation index. We will use the index of dissimilarity since it is one of the first segregation indices and has the most intuitive definition.[3] The index of dissimilarity equals the proportion of either group (black or white) that would have to change neighborhoods in order for each

[2]Some segregation measures explicitly take geographic proximity into account; see Massey and Denton [5] for a survey.

[3]This index was introduced to the literature by Jahn et al [4].

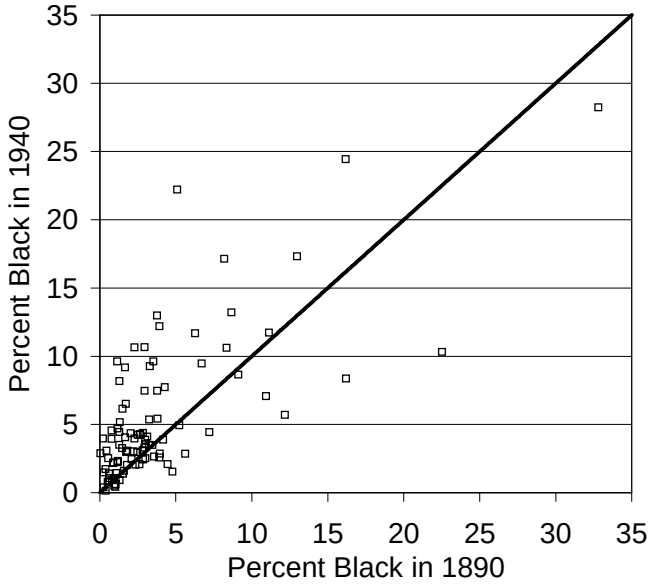

Figure 2: Percent Black in Northern Cities, 1890-1940. Northern cities are those not located in southern states (see Figure 1).

neighborhood in the city to be representative — i.e., to have the same racial distribution as the city as a whole. In period 0, each neighborhood is already representative of the city in which it lies, so the city-level indices of dissimilarity are both zero (line A). Thus, the average of these two city-level indices of dissimilarity — corresponding to CGV's measure — is also zero (line B). In period 1, each city is highly segregated: 80% of blacks or whites would have to change neighborhoods to make each city perfectly integrated (line A). The national average of these indices is also 80% (line B). Within-city segregation has risen substantially.

We can also measure between-city segregation using the index of dissimilarity. Line C gives the proportion of blacks or whites who would have to change cities in order for each city to be representative of the country as a whole. In period 0, 80% of either group would have to change cities; in period 1, the citywide racial distributions (50-50) are already representative of the country, so 0% would have to. Between-city segregation has declined substantially.

One measure of segregation has risen while the other has declined. How can these

	Period 0				Period 1			
	City A		City B		City A		City B	
	I	II	I	II	I	II	I	II
Blacks	90	90	10	10	90	10	10	90
Whites	10	10	90	90	10	90	90	10
Index of Dissimilarity								
A. Within Cities	0		0		0.8		0.8	
B. Within-City Average	0				0.8			
C. Between Cities	0.8				0			
D. Total	0.8				0.8			

Table 1: An example.

two measures be incorporated into a single segregation index? One could take some weighted average. However, it is not clear how to choose the weights, or whether such an average could be given an axiomatic foundation.[4] Instead, we define total segregation as the index of dissimilarity for the pooled set of neighborhoods. In each period, we treat the country as one large city with four neighborhoods: neighborhoods I and II of A, and neighborhoods I and II of B. In each period, 80% of either blacks or whites would have to change neighborhoods (possibly changing cities as well) in order for every neighborhood to be representative of the country as a whole (line D). Total segregation is thus 80% in each period.

This measure shows no change from period 0 to period 1. This conforms with intuition. The races are indeed equally separated in the two periods: 90% of blacks live in neighborhoods that are 90% black; 90% of whites live in neighborhoods that are 90% white.

We now turn to actual data. Table 2 divides the cities of the U.S. into two regions as in Figures 1 and 2. Black wards are those wards with a majority of black residents in the current year; white wards are those with a majority of whites. In each year, we

[4]For an axiomatic approach to segregation indices, see Frankel and Volij [3].

	1890				1940			
	South		North		South		North	
	Black Wards	White Wards	Black Wards	White Wards	Black Wards	White Wards	Black Wards	White Wards
Blacks	18	49	0	34	15	21	22	41
Whites	1	14	0	85	1	12	1	87
Index of Dissimilarity:								
A. Within Regions	0.22		0		0.36		0.34	
B. Within-Region Avg.	0.11				0.35			
C. Between Regions	0.52				0.24			
D. Total	0.52				0.45			

Table 2: Distributions of blacks and whites living in cities in 1890 and 1990. The rows in each year sometimes do not sum to 100 because of rounding error.

normalize the total numbers of blacks and whites in the U.S. to 100 to make the data easy to compare with Table 1. (This does not affect the index of dissimilarity, which is based on percentages of either group.) Percentage point changes are shown in Table 3.[5]

	% Point Change 1890-1940			
	South		North	
	Black Wards	White Wards	Black Wards	White Wards
A. Blacks	-2	-28	+22	+8
B. Whites	0	-2	+1	+2

Table 3: Changes from 1890 to 1940 in Table 2.

The segregation indices in Table 2 are computed as in Table 1. Each of the four

[5]The unrounded data are differenced and then rounded, so the numbers in Table 3 do not always equal the changes of the numbers in Table 2.

ward-region pairs (black-south, white-south, black-north, white-north) is treated as a single area for this purpose. For example, 22% of blacks living in the south would have to move from southern black wards to southern white wards in order for southern black wards, as a group, to have the same racial distribution as the south as a whole.[6]

In 1890, 18% of blacks lived in majority-black wards in the south. 49% of blacks lived in majority-white wards in the south. The remainder lived in majority-white wards in the north. By 1940, this pattern had changed substantially. Blacks left majority-white wards in the south en masse and formed new, majority-black wards in the north. This led to increases in the within-city indices of dissimilarity in both regions; the average within-city index of dissimilarity rose from 11% to 35% (Table 2, line B).

However, this tells only part of the story. Many blacks also left majority-black wards in the south or moved into majority-white wards in the north (Table 3). Moreover, blacks were vastly overrepresented in both black and white wards in the south in 1890. Many southern cities in 1890 were "ghetto cities": cities in which a majority of residents were black (Figure 1). In 1890, fully 52% of blacks would have to move from the south to the north in order to equalize the proportion of blacks in the two regions; by 1940, this had fallen to 24% (Table 2, line C). This change more than offset the increase in within-city segregation, with the result a net decline in total segregation from 52% to 45% (line D).

One limitation of this analysis is that the results could be sensitive to how the data are aggregated, or to special properties of the index of dissimilarity. We now turn to a detailed analysis of the disaggregated data. We also consider a number of segregation indices other than the index of dissimilarity. These indices tell a consistent story: total segregation increased from 1890 to 1940, but substantially less than the increase in within-city segregation. Total segregation fell from 1970 to 1990, and was a bit lower in 1990 than in 1890. Within-city segregation also fell from 1970 to 1990, but remained much higher in 1990 than in 1890.

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[6] This number, 0.22, equals the proportion of southern blacks who live in black wards, $\frac{18}{18+49}$, minus the proportion of southern whites who live in black wards, $\frac{1}{1+14}$.

2 Data and Methods

Data are from CGV [2]. In each year from 1890 to 1990, cities with fewer than 1000 blacks are omitted. From 1890 to 1940, the Census reported data at the political ward level; from 1940 to 1990, data at the census tract level are available. Wards are larger than census tracts and tend to yield lower segregation indices. Following CGV, we exploit the availability of both types of data in 1940 by adjusting the ward data for 1890 to 1940 upwards by the average difference between tract- and ward-based segregation indices in 1940.

The number of cities available varies from year to year. Following CGV, we adjust for this in three ways. The first is not to adjust for it at all: in each year, the full set of available cities is used. We compute both unweighted averages of within-city segregation indices and averages weighted by the number of blacks in each city. The second approach ("Matched Sample") is to compute the change in the segregation index from year t to $t+10$ using only the set of cities that are available in both years. (Again, we compute both weighted and unweighted averages of these cities.) The series is then normalized so that in 1990 it equals the unweighted all-city segregation index in that year.

To ensure robustness of our results, we also consider eight different measures of segregation. The first five indices we use are those surveyed by Massey and Denton [5], of which the first two were also used by CGV.[7]

The Index of Dissimilarity This index measures the proportion of either racial group that would need to be reallocated across neighborhoods in order to obtain perfect integration. Formally,

$$\text{index of dissimilarity} = \frac{1}{2}\sum_{i=1}^{N}\left|\frac{\text{black}_i}{\text{black}_{total}} - \frac{\text{nonblack}_i}{\text{nonblack}_{total}}\right| \tag{1}$$

[7] Massey and Denton [5] also survey several other indices that require additional information about neighborhoods' locations to compute. Like CGV, we do do not use these indices since this geographical information is not available for all years.

where we divide by 2 to avoid double counting. This index was introduced to the literature by Jahn et al [4].

The Index of Isolation This index attempts to measure the extent to which blacks are isolated from whites. In its naive form, it equals the average percent black of the neighborhoods in a city, weighted by the number of blacks in each neighborhood. This weighted average is then scaled to range from zero to one. More precisely:

$$\text{index of isolation} = \frac{\left(\sum_{i=1}^{N} \frac{\text{black}_i}{\text{black}_{\text{total}}} \cdot \frac{\text{black}_i}{\text{persons}_i}\right) - \frac{\text{black}_{\text{total}}}{\text{persons}_{\text{total}}}}{\min\left(\frac{\text{black}_{\text{total}}}{\min_i \text{persons}_i}, 1\right) - \frac{\text{black}_{\text{total}}}{\text{persons}_{\text{total}}}}. \tag{2}$$

(See CGV for a more complete explanation.)

The Gini Index This index is adapted from the income inequality index of the same name. It is related to the Lorenz curve, which plots the cumulative proportion of whites against the cumulative proportion of blacks, having sorted neighborhoods in increasing order of the percentage of blacks. The Gini Index equals the area between this curve and the 45 degree line.

Entropy The entropy of a city is defined as one minus the weighted average entropy of the city's neighborhoods, normalized by the aggregate entropy:

$$\text{Entropy} = 1 - \sum_{i \in N(X)} \frac{\text{persons}_i}{\text{persons}_{\text{total}}} \left(\frac{\text{Entropy}_i}{\text{Entropy}_{\text{aggregate}}}\right) \tag{3}$$

where

$$\text{Entropy}_i = -\left(\frac{\text{blacks}_i}{\text{persons}_i}\right) \ln\left(\frac{\text{blacks}_i}{\text{persons}_i}\right) - \left(\frac{\text{nonblacks}_i}{\text{persons}_i}\right) \ln\left(\frac{\text{nonblacks}_i}{\text{persons}_i}\right)$$

$$\text{Entropy}_{\text{aggregate}} = -\left(\frac{\text{blacks}_{\text{total}}}{\text{persons}_{\text{total}}}\right) \ln\left(\frac{\text{blacks}_{\text{total}}}{\text{persons}_{\text{total}}}\right) - \left(\frac{\text{nonblacks}_{\text{total}}}{\text{persons}_{\text{total}}}\right) \ln\left(\frac{\text{nonblacks}_{\text{total}}}{\text{persons}_{\text{total}}}\right)$$

This index, adapted from the information theory literature, was proposed by Theil and Finizza [6].

Atkinson The Atkinson Index is defined as:

$$\text{Atkinson} = 1 - \sum_{i=1}^{N} \sqrt{\left(\frac{\text{blacks}_i}{\text{persons}_i}\right)\left(\frac{\text{nonblacks}_i}{\text{persons}_i}\right)} \tag{4}$$

The Atkinson index was originally defined as a measure of income inequality (Atkinson [1]).[8]

Of these five indices, only the Atkinson index satisfies all the axioms of Frankel and Volij [3]. We use an additional index that also satisfies their axioms. It is defined as:

$$I_\alpha = \frac{1}{2}\sum_{i=1}^{N} s_i d_i^\alpha$$

$$\text{where } s_i = \frac{\text{blacks}_i}{\text{blacks}_{\text{total}}} + \frac{\text{nonblacks}_i}{\text{nonblacks}_{\text{total}}}$$

$$\text{and } d_i = \left| \frac{\frac{\text{blacks}_i}{\text{blacks}_{\text{total}}} - \frac{\text{nonblacks}_i}{\text{nonblacks}_{\text{total}}}}{\frac{\text{blacks}_i}{\text{blacks}_{\text{total}}} + \frac{\text{nonblacks}_i}{\text{nonblacks}_{\text{total}}}} \right|$$

for $\alpha > 1$. We consider three variants of this index, corresponding to parameters $\alpha = 2, 4, 8$. This index can be understood as follows. Among indices that satisfy the axioms of Frankel and Volij, a neighborhood i's contribution to a city's level of segregation depends on the tradeoff between two aspects of the neighborhood. The first is its size relative to other neighborhoods: larger neighborhoods contribute more. This is represented by the sum of the proportions of the city's blacks and whites in the neighborhood, s_i. The second factor is the degree to which the neighborhood is unrepresentative of the city as a whole: less representative neighborhoods contribute more. This unrepresentativeness is captured by the degree of dissimilarity, d_i. The elasticity of the neighborhood's contribution with respect to size is 1 while its elasticity with respect to its dissimilarity is α. An increase in this elasticity makes the segregation index more sensitive to a given percentage increase in a neighborhood's dissimilarity, without changing its sensitivity to the neighborhood's size. Thus, α captures the tradeoff between a neighborhood's dissimilarity and its size. The Index of Dissimilarity equals I_α with parameter $\alpha = 1$: it gives equal weight to percentage changes in a neighborhood's size and in its dissimilarity. The other indices we consider give varying degrees of greater weight to a neighborhood's dissimilarity.[9]

[8] More precisely, equation (4) is a monotonic transformation of the original Atkinson index with parameter $\beta = 1/2$. (See Frankel and Volij [3].)

[9] It is not possible to give equal or less weight to dissimilarity than to size without violating Frankel

The Isolation and Entropy indices have the undesirable property that they are not scale invariant (Frankel and Volij [3]): if population of either group is increased by the same factor in each neighborhood (due, e.g., to natural population growth), these indices can change. Thus, in computing these two indices, we first scale the population of either group in each neighborhood so that the aggregate population of that group in the set of cities that are used to compute the segregation index in a given year is constant over time. For instance, we multiply the black population of all neighborhoods in all cities in 1930 by a factor, which is constant across neighborhoods and cities in 1930, so that the total black population in 1930 equals the actual total black population in 1890; and we do the same for whites.

3 Results

Figures 3 through 10 show results using the matched sample method. Figures 11 through 18 show results in which all cities are included in each year. The results are essentially the same in all the charts. The within-city indices that were studied by CGV (long dashes) show large increases from 1890 to 1970 followed by partial reversals. The between-city index (short dashes) show a large decrease from 1890 to 1970 and then roughly no change from 1970 to 1990. Our improved indices (solid line), which measure total segregation, show a slight increase from 1890 to 1970 followed by a decline that left total segregation slightly lower in 1990 than in 1890.

References

[1] Atkinson, A.B. 1970. "On the Measurement of Inequality." *Journal of Economic Theory* 2: 244-63.

and Volij's axiom of monotonicity: the migration of an agent from a neighborhood in which she is overrepresented to a neighborhood in which she is even more overrepresented should lead to strictly higher measured segregation. This axiom is also known as the Transfer Principle (Massey and Denton [5]). Such a migration does not affect the index of dissimilarity, so it violates this axiom.

[2] Cutler, David, and Edward Glaeser and Jacob Vigdor. 1999. "The Rise and Decline of the American Ghetto" *Journal of Political Economy* 107: 455– 506.

[3] Frankel, David M., and Oscar Volij. 2004. "Measuring Segregation." Mimeo, Iowa State University.

[4] Jahn, Julius, and Schmidt, Calvin F., and Schrag, Clarence. 1947. "The Measurement of Ecological Segregation." *American Sociological Review* 12:293–303.

[5] Massey, Douglas S. and Nancy A. Denton. 1988. "The Dimensions of Racial Segregation."" *Social Forces* 67:281–315.

[6] Theil, Henri., and A. J. Finizza 1971. "A Note on the Measurement of Racial Integration in Schools." *Journal of Mathematical Sociology* 1:187–1193.

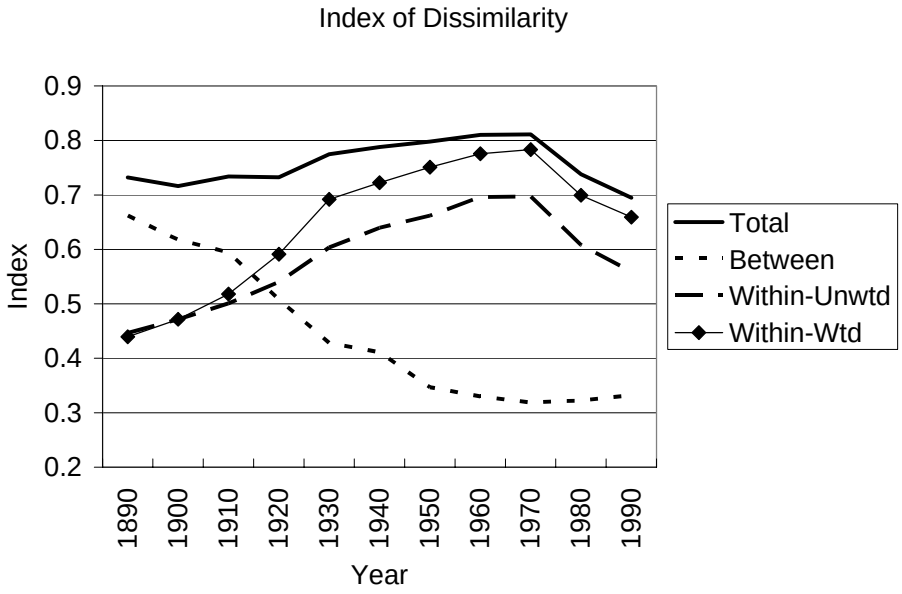

Figure 3: Indices of dissimilarity, 1890-1990, matched sample method.

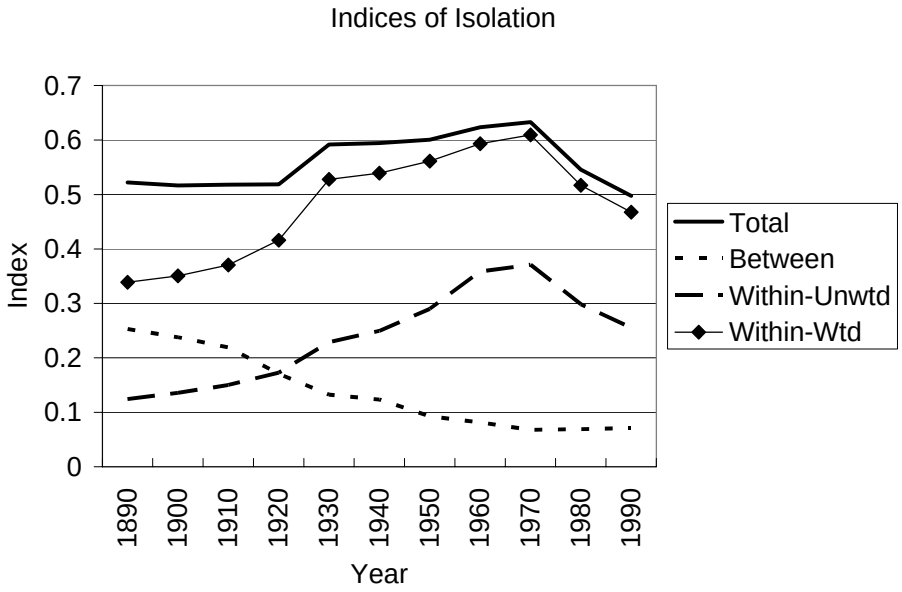

Figure 4: Indices of isolation, 1890-1990, matched sample method. Populations of blacks (whites) in each neighborhood are scaled to maintain constant national percentages of blacks (whites) over time.

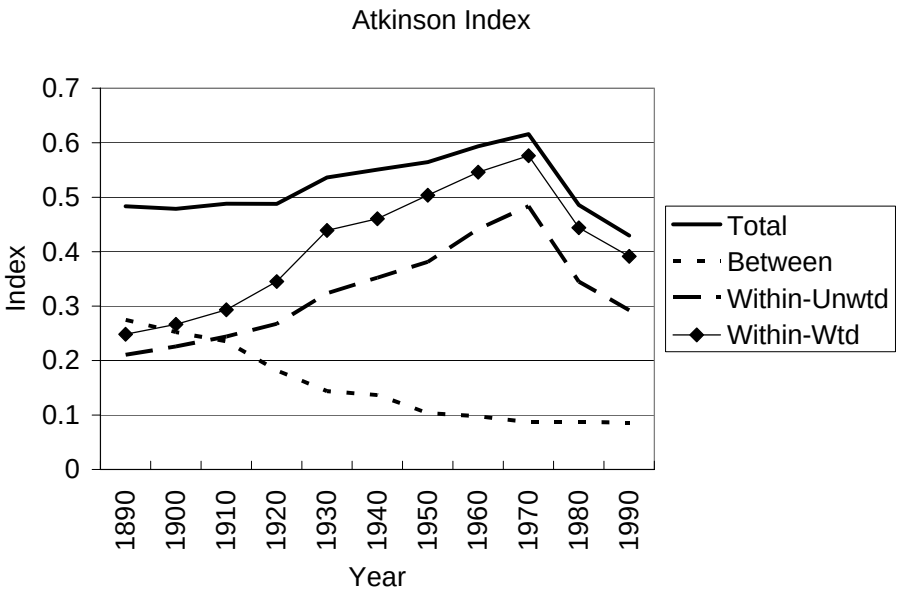

Figure 5: Atkinson index, 1890-1990, matched sample method.

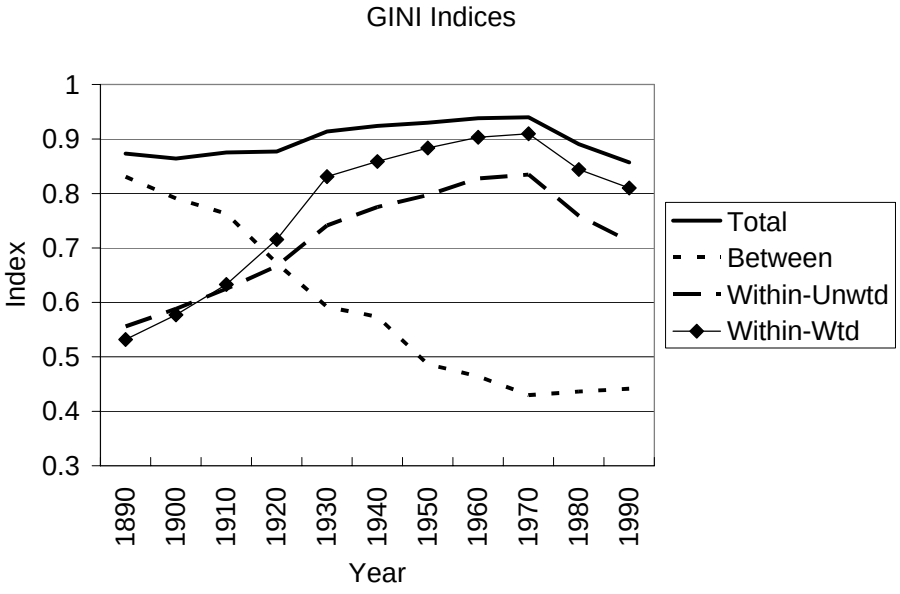

Figure 6: Gini indices, 1890-1990, matched sample method.

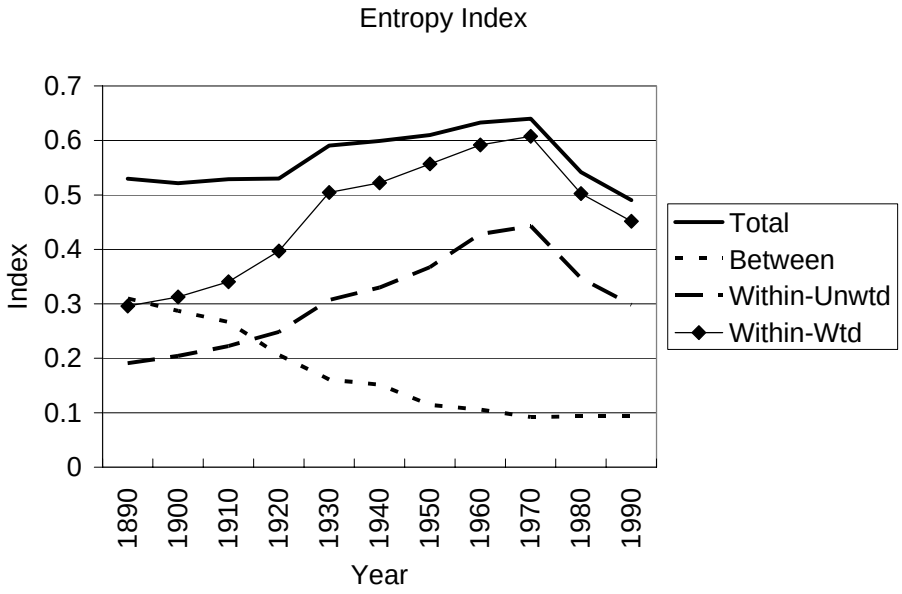

Figure 7: Entropy Index, 1890-1990, matched sample method. Populations of blacks (whites) in each neighborhood are scaled to maintain constant national percentages of blacks (whites) over time.

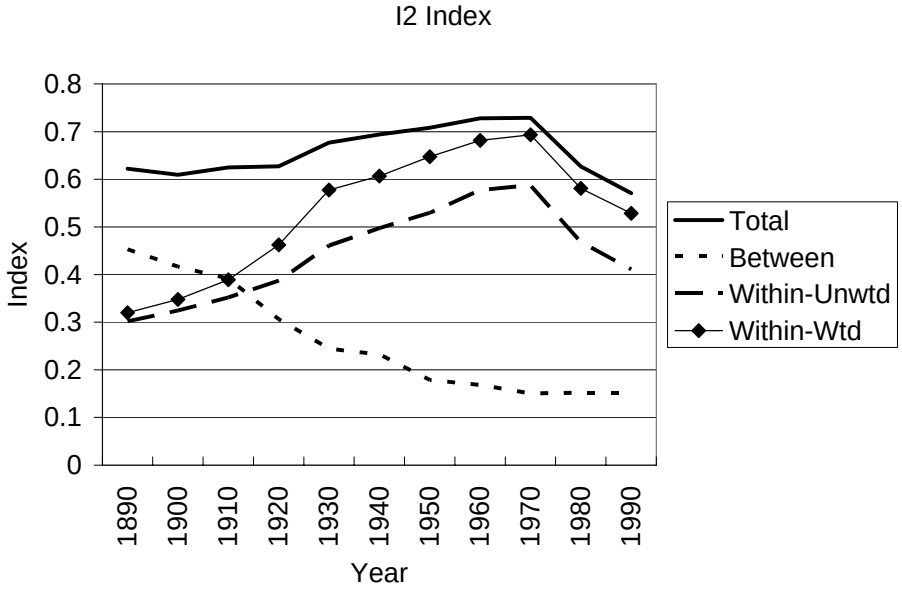

Figure 8: I_2 index, 1890-1990, matched sample method.

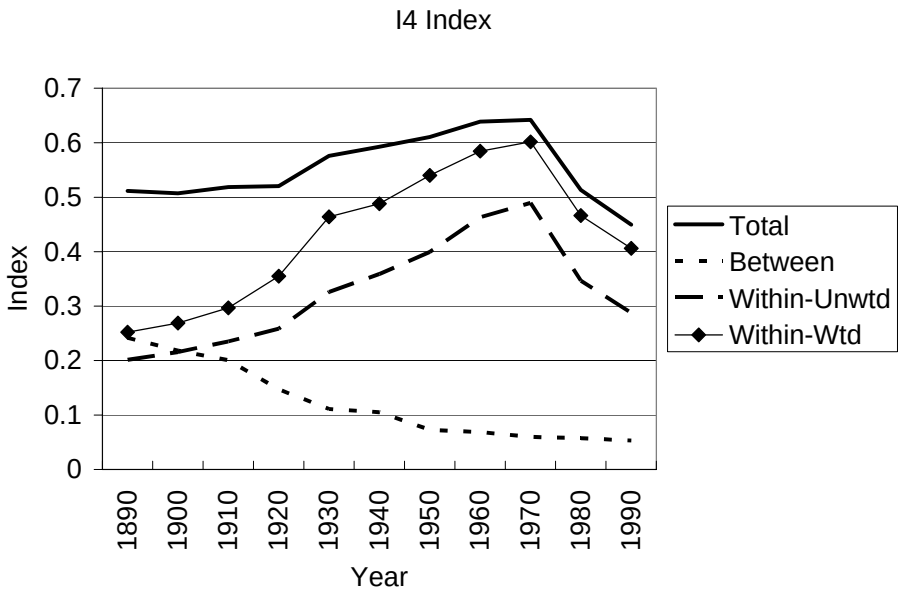

Figure 9: I_4 index, 1890-1990, matched sample method.

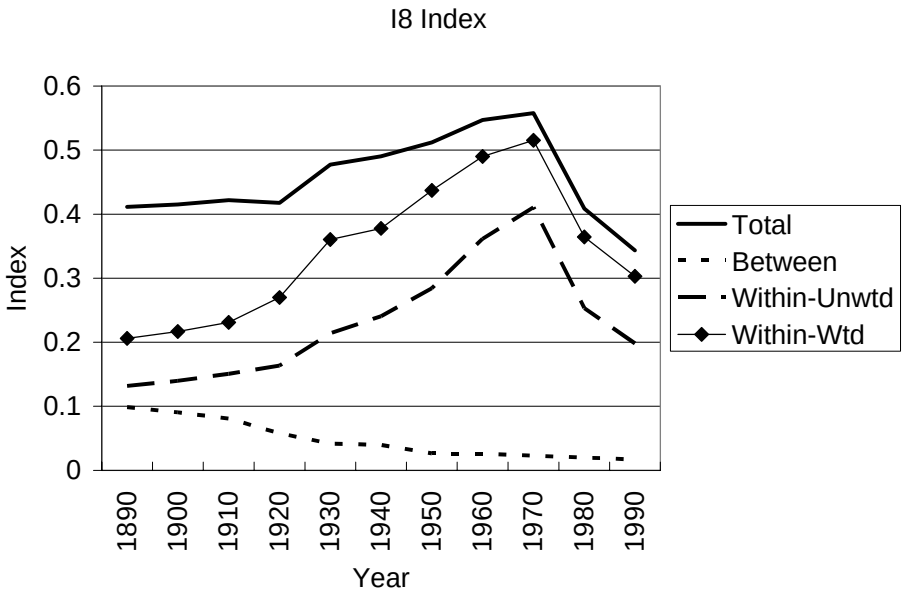

Figure 10: I_8 index, 1890-1990, matched sample method.

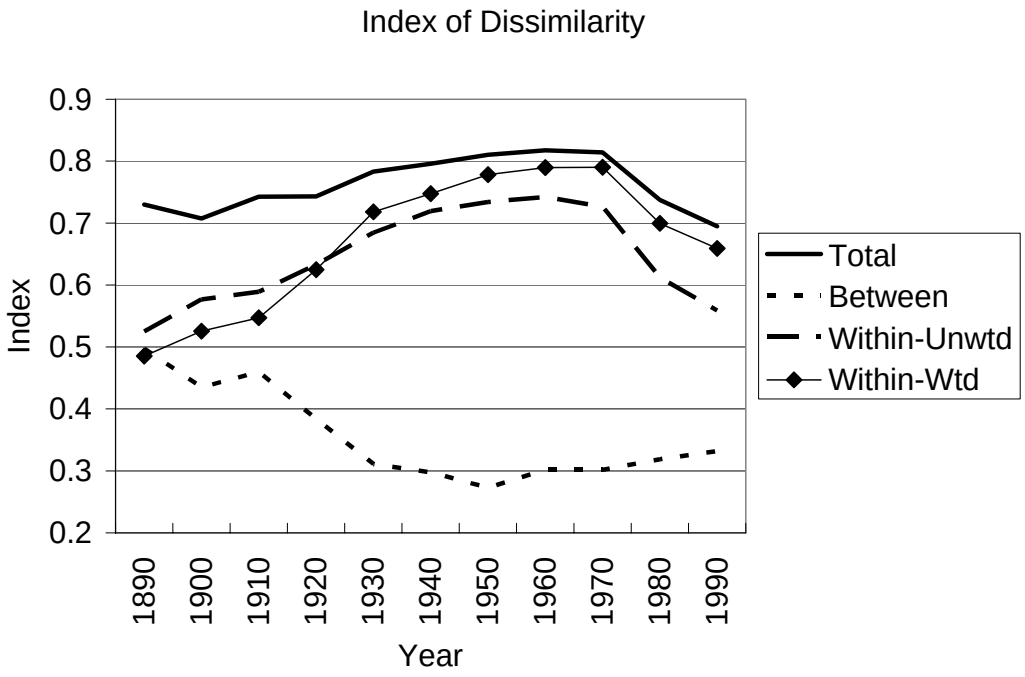

Figure 11: Indices of dissimilarity, 1890-1990, all cities method.

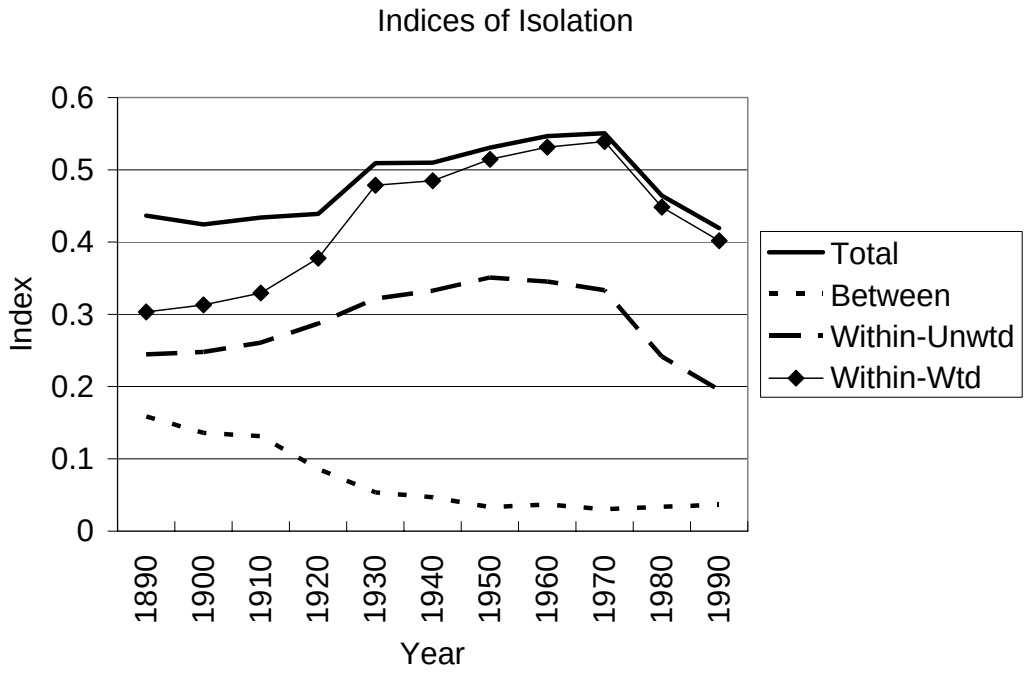

Figure 12: Index of Isolation, 1890-1990, all cities method. Populations of blacks (whites) in each neighborhood are scaled to maintain constant national percentages of blacks (whites) over time.

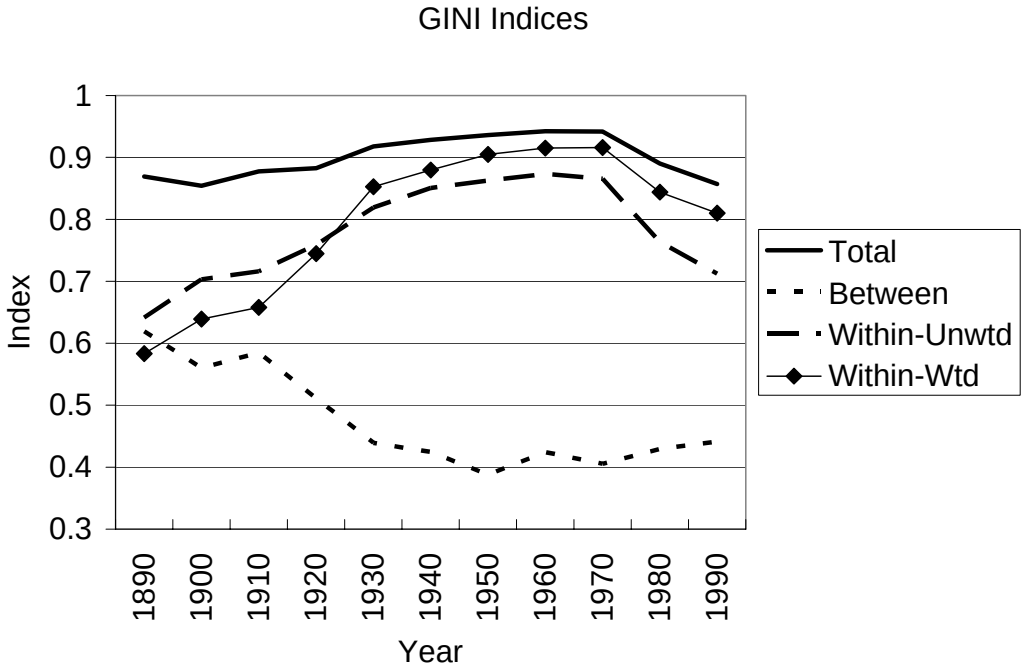

Figure 13: Gini Index, 1890-1990, all cities method.

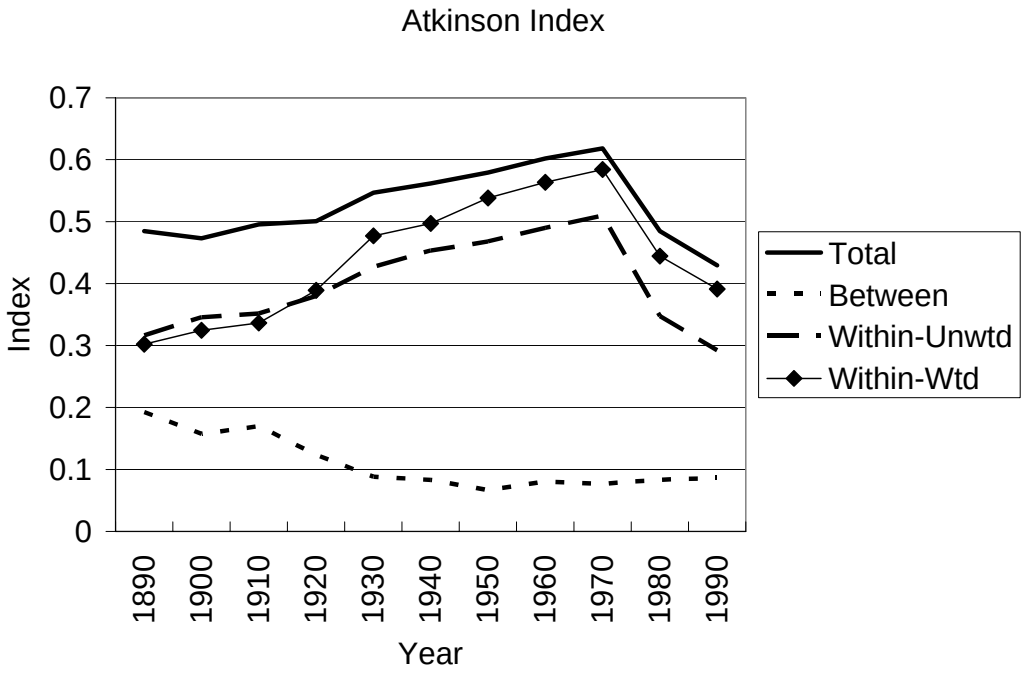

Figure 14: Atkinson index, 1890-1990, all cities method.

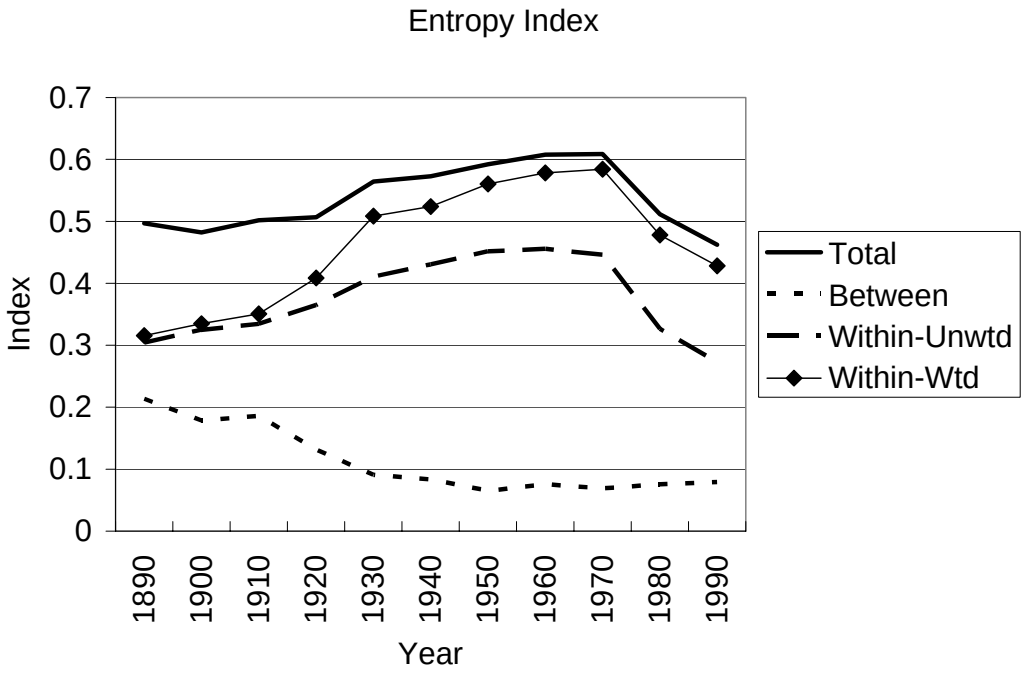

Figure 15: Entropy index, 1890-1990, all cities method. Populations of blacks (whites) in each neighborhood are scaled to maintain constant national percentages of blacks (whites) over time.

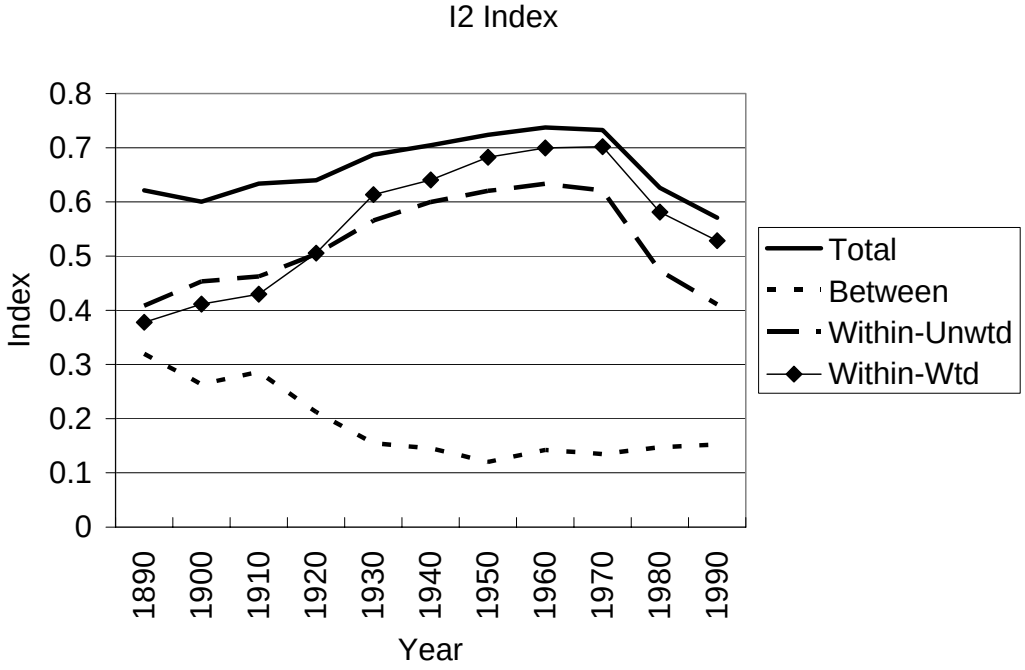

Figure 16: I_2 index, 1890-1990, all cities method.

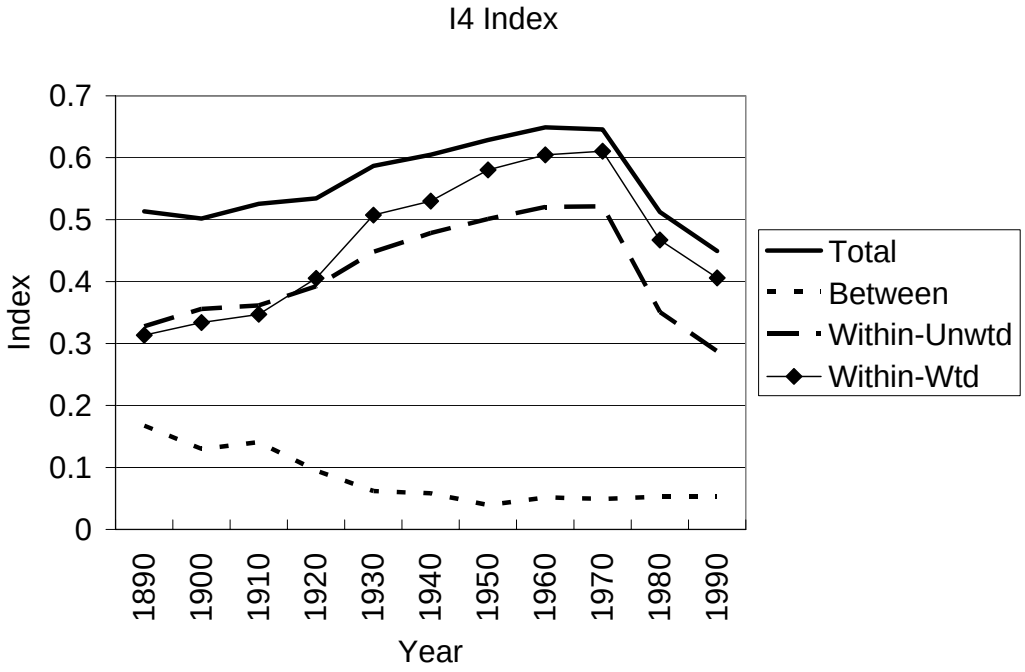

Figure 17: I_4 index, 1890-1990, all cities method.

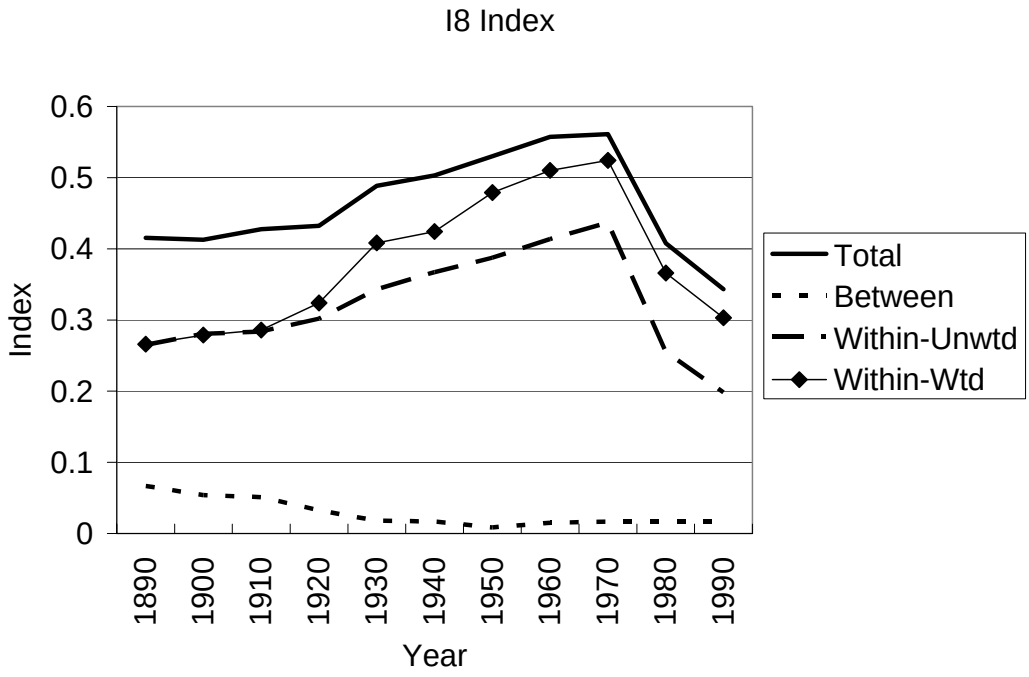

Figure 18: I_8 index, 1890-1990, all cities method.