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Introduction and Purpose

This study is concerned with an analysis of income differentials of white and nonwhite males, and the relationship of such differentials to thier education and age. When education and age are equal for whites and nonwhites, income differentials that exist are an indication of racial discrimination against nonwhites.

The empirical investigation is based on data from the 1940, 1950, and 1960 Censuses. The first section comprises the estimation of white and nonwhite incomes based on a multiplicative regression model. This model looks at income as a joint effect of education and age. In the second section a discrimination measure that goes from zero to one (from no discrimination to complete discrimination) is used to analyze the estimated income data in order to observe changes in discrimination over time. In addition, cohorts are utilized to observe the effect of discrimination with regard to age groups moving through time.

Three questions are to be answered. The first being, "how have the levels of discrimination against nonwhite males changed <u>within</u> each year being considered as their education and age increase on the same basis as white males?" The second question being, "how have the levels of discrimination against nonwhite males changed <u>between</u> the years being considered as their education and age increase on the same basis as white males?" The third question being, "how have the levels of discrimination changed with regard to the education of specific groups of men as these groups (or cohorts) move through time?"

The Model

As a basis for determining whether different racial groups having the same levels of education and age have different incomes or earnings a regression model was utilized. This model assumes that the effects of education and age on income are a joint effect or an "interaction."(1) Such a model is analogous to a production function. The model is multiplicative and can be written as follows:

(1)
$$I_{ij} = a E_j^b A_j^c e_{ij}$$

where i denotes an education classification; j denotes some age group; I denotes the education of individuals; A denotes the age of individuals; e denotes the stochastic or random term that includes other factors.

The Data

The multiplicative model was fitted to the following cross sectional data:(2) white and Negro median earnings of males 25 to 64 years old, by years of school completed for 1939; white and nonwhite income of males 25 to 64 years old, by years of school completed for 1949; and white and nonwhite median earnings of males 25 to 64 years old, by years of school completed for 1959. Functions were estimated for white and nonwhite males for the United States for the years 1939, 1949, and 1959. (3) Since the source data is presented by intervals for the cross classifications of years of school completed and age in years, it was necessary to adjust these intervals to arrive at a single value for years of school completed and age in years.(4)

The Estimation Results

For white and nonwhite males in 1939, 1949, and 1959 equation (1) was estimated in the following form:

(2) $\log I_{ij} = \log a + b \log E_j + c \log A_i$

+ log ei j.

The estimating equations for each group in each year are presented in Table 1. The use of the multiplicative model given by (1) to estimate white and nonwhite incomes as function of years of schooling and age worked very well. In all cases over eighty percent of the variation in incomes was explained.

From the estimating equations in Table 1, Appendix Tables I, II, and III were obtained. These tables give the estimated incomes for white and nonwhite males by years of school completed and age for 1939, 1949, and 1959. The income values in these tables will be analyzed in a following section with the objective of measuring changes in discrimination against nonwhites with regard to their education and age.

^{*}This research was supported by a grant from the Business Research Institute, St. John's University, College of Business Administration.

Year	and Race	Constant	Regression Coe	fficients Age	
1939	White	1.7220	.7139	.4355	.918
			(.0389)	(.0822)	•••
1.04.0	Nonwhite	1.9505	•4840 (•0266)	•2721 (•0556)	•917
1747	White	2.5342	.4641 (.0349)	.3112 (.0721)	•859
	Nonwhite	2.7165	•4375 (•0299)	.0948 (.0617)	.871
1959	White	2.9952	•4540 (•0465)	.1784 (.0919)	.825
	Nonwhite	2.9277	•4724 (•0327)	.1002 (.0646)	•910

ESTIMATING EQUATIONS FOR INCOME OF WHITE AND NONWHITE MALES FOR 1939, 1949, AND 1959

Note: Standard errors are in parentheses.

Measuring Discrimination

One method of measuring discrimination that is suggested by Gary S. Becker is through the use of the "market discrimination coefficient" or MDC.(5) This measure of discrimination is defined as

(3) MDC =
$$\frac{Y(W)}{Y(N)} - \frac{Y_0(W)}{Y_0(N)}$$

where Y(N) and Y(W) represent the actual incomes of N and W, $Y_O(N)$ and $Y_O(W)$ represent the income of N and W without discrimination. If it is assumed that W and N are perfect substitutes with perfect competition in the market place, then $Y_O(W) = Y_O(N)$ and (3) reduces to

$$MDC = \frac{Y(W)}{Y(N)} - 1 = \frac{Y(W) - Y(N)}{Y(N)}$$

In this form the MDC represents the percentage difference between the incomes of W and N with respect to the income of N. If it is assumed that Y(N) will be less than, or equal to Y(W), then MDC values will range upward from zero. The further away from zero the MDC gets the greater the discrimination against N. Because the scale of the MDC is from zero upward, a problem of interpretation can then arise. Values greater than one (1.50, 5.00, 9.00, etc.) lack clear meaning as to the level of discrimination against N. Such values would only suggest that there may exist high levels of discrimination against N.

To provide a clearer indication of the discrimination faced by N a modified measure of the MDC was developed. This modified measure has a scale going from zero to one. That is from no discrimination to complete discrimination. Such a scale is obtained by comparing income differences between W and N against W, rather than against N as **is the** case with the MDC. So that if it is assumed that W and N are perfect substitutes in the market place, then

$$DM = \frac{Y(W) - Y(N)}{Y(W)} = 1 - \frac{Y(N)}{Y(W)}$$

where DM is the modification of the MDC, and is called the "Discrimination Measure." This Discrimination Measure will be used to analyze the estimated income data presented in Appendix Tables I-III. The income of white males is represented by Y(W), and the income of nonwhite males is represented by Y(N).

Analysis of Income Differences

Discrimination measures were calculated for the white and nonwhite estimated incomes given in Appendix Tables I-III. These calculated DM values will help to provide answers to the three questions stated earlier. Table 2 shows the DM values calulated for 1939, 1949, and 1959, by years of school completed and age.

In 1939 as education and age increased the DM values increased. Within each age group as education increased from elementary to college the DM's increased. The DM's for the lowest education class (2.5 years of school completed) suggest that incomes for normhites, DISCRIMINATION MEASURES FOR 1939, 1949, AND 1959 BASED ON ESTIMATED MEDIAN INCOME

Years of School	Age in Years						
Completed	27	32	40	50	60		
939							
Elementary							
2.5	.200	.222	.251	•276	•297		
5,5	.333	.350	. 373	. 397	.415		
7.5	378	395	.416	438	454		
High School	•) [•	•) /)	• • • • •				
0.5	.412	.428	448	.468	.483		
7• 2	. 441	4.57	477	.496	510		
	• • • • •	•+)(• • • • •	•470	•)±0		
טודפפי וער	416	482	LOS	. 513	. 527		
19	1.85	1,00	• - - 7 J 5 1 7	• J + J 5 3 h	• J27 548		
	• 405	• 499	• 517	• 554	• 540		
Elementary	000	208	222	226	102		
2.5	• 27 3	• 290	• 552	• 550	.402		
6	•209	• 315	• 347	• 370	•402		
8	•294	• 320	• 352	و ەو .	•400		
Aigh School				a 0(
10	•229	• 324	• 350	• 386	•410		
12	• 302	• 327	• 359	• 389	•413		
College							
14	• 305	• 330	• 362	• 392	•415		
17	• 308	• 333	• 365	• 395	.418		
959			Age i	n Y ears			
		30	40	50	60		
lementary							
3,5		. 329	. 344	.355	. 364		
8		.318	. 333	346	354		
igh School		•)10	•)))	•) ! •	•)) .		
10		. 316	. 33]	. 342	. 352		
12		.313	. 320	340	.350		
110go		• • • • •	• 167	•)+0	• • • • • •		
1/1 1/1		211	307	338	3/18		
17		• 711	• 141	• • • • • • • • • • • • • • • • • • • •	•)+0 21 c		
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27 to 60 years old were about 20 to 30 percent less than that of white males having the same education and age. The highest education class(17 years of school completed) had DM values suggesting that nonwhite males 27 to 60 years old with a college education had incomes from 49 to 55 percent less than white males with the same education and age. In 1939, the less educated younger nonwhite males faced less discrimination, as shown by lower DM values, than the older better educated nonwhite males.

For 1949 the same overall pattern in DM values as exhibited in 1939 is apparent in Table 2. That is, DM values increasing as education and age increase. For nonwhite males in the lowest education class (2.5 years of school completed) who are 27 to 60 years old, the DM values indicate their incomes were 27 to 40 percent less than the incomes of white males having the same education and age. At the college level, nonwhite males with 17 years of schooling who are 27 to 60 years old had incomes 31 to 41 percent less than that of white males having the same education and age. As was the case in 1939, in 1949 the older bettter educated nonwhite male faced more discrimination than the younger less educated nonwhite male.

In 1959 the patterns of the increasing DM values as education and age increase previously found in 1949 and 1939 are not found in the values presented in Table 2. For 1959 it can be seen that as education increases for each age the DM values decline for the first time. But, as age increases within each education classification the DM values increase as was the case in 1939 and 1949. In 1959 nonwhite males in the lowest education class(3.5 years of school completed) who are 30 to 60 years old, had DM values indicating that their incomes were 33 to 36 percent less than the incomes of white males having the same education and age. Nonwhite males with a college education who are 30 to 60 years old had incomes as indicated by the DM values that were 31 to 35 percent less than that of white males having the same education and age. Older better educated nonwhite males did not face more discrimination than younger

less educated nonwhite males as was the case in 1939 and 1949.

With regard to the question of changes in discrimination between years, the DM values in Table 2 when followed from year to year show a decline over time in each education and age classification. To obtain an overall view of the changes in the levels of discrimination against nonwhites having the same education and age as whites that have occurred over time, summary statistics for the values in Table 2 were calculated. Table 3 presents for 1939, 1949, amd 1959, means, standard deviation, and coefficients of variation for the DM values in Table 2.

TABLE 3

SUMMARY STATISTICS FOR DM VALUES; 1939, 1949, AND 1959

Year	Mean	Standard Deviation	Coefficient of Variation
1939	.425	.090	.212
1949	.352	.043	.122
1959	•336	.015	.045

All of the statistics in Table 3 indicate a decline in the DM values over time. In 1939 the DM values had a mean and standard deviation of .425 and .090 respectively. By 1959 the mean DM had dropped to .336 with a standard deviation of .015. The coefficients of variation show the variation about the mean DM for each year on a relative basis. This measure of relative dispersion shows a decline from 21 percent in 1939 to 4.5 percent in 1959. These declining summary statistics suggest that over time discrimination against nonwhite males having the same education and age as white males has been declining. Furthermore, these measures also suggest that the discrimination against nonwhite males is not only declining, but is also becoming more uni-form over the education and age classifications shown in Table 2.

With regard to the question of changes in discrimination against the same group of men over time, a cohort analysis was used to examine changes in discrimination against nonwhite males over time when they have the same education and age as white males. This type of analysis compares the same group of men at different points in time rather than comparing a different group of men having the same age at different points in time. Men born in the period 1905-1914 comprise a cohort that in 1939 will consist of men 30-34 years old; in 1949 35-44 years old; and in 1959 45-54 years old. Cohorts for 1905-1914 and 1895-1905 are used in conjunction with the discrimination measures shown in Table 2.

Table 4 shows the discrimination measures for these two cohorts. For the men comprising the 1905-1914 cohort the DM values decline as this group moves through the time period 1939-1959. In 1939, at age 32 the DM values increased as education increased. At age 40 in 1949 the DM values begin to show uniformity over the years of schooling. By age 50 in 1959 it appears that as education increases the DM values decline. The DM values for the cohort of 1895-1904 show the same pattern as the 1905-1914 cohort. That is, increasing DM values as education increases in early years, and then declining DM values as education increases in later years.

The DM Values in Table 4 were plotted for each cohort and appear as Figure 1. From this figure the increase in DM values as education increases for younger men (32 and 40) can be seen. As these men get older (40 and 50) the DM values begin to level off as education increases. Finally, the DM values for men 50 and 60 years old in 1959 show declines as education increases. Both the values in Table 4 and the plots in Figure 1 suggest that over the period 1939 to 1959, there was a decline in the discrimination against nonwhite males as their education and age increased on the same basis as white males.

Summary and Conclusions

This study set out to analyze white and nonwhite income differentials as a means of measuring changes in discrimination against nonwhite males having the same education and age as white males. Use was made of a discrimination measure going from zero (indicating nc discrimination) to one (indicating com-plete discrimination). This measure describes relative differences in incomes given white and nonwhite males have the same education (years of schooling) and the same age. Although the study was limited to discrimination against nonwhite males with regard to their education and age, the results obtained do suggest that for the United States as a whole there have been declines in the discrimination against nonwhite males having the same educa-tion and age as white males between the years 1939 and 1959.(6)

DISCRIMINATION MEASURES FOR COHORTS OF 1905-1914, AND 1895-1904, BY SELECTED AGES AND YEARS OF SCHOOL COMPLETED

	Cohort	of 1905-1	.914	Cohort of 1895-1904			
Years of	32 years	40 years	50 years	40 years	50 years	60 years	
School	old in	old in	old in	old in	old in	old in	
Completed	1939	1949	1959	1939	1949	1959	
8	• 395	.352	. 346	.416	• 383	• 354	
10	.428	• 356	• 342	.448	• 386	.352	
12	•457	•359	• 340	•477	• 389	.350	
14	.482	.362	• 338	•495	• 392	• 348	
17	•499	• 365	• 336	• 517	• 395	• 345	

Note: DM values are from Table 2.





APPENDIX TABLES I-III. ESTIMATED INCOME OF WHITE AND NONWHITE MALES, SELECTED AGES, BY YEARS OF SCHOOL COMPLETED FOR 1939, 1949, AND 1959

Years of					Age	in Year	S				
School	27	32*	40	50	60	27	32*	40	50	60	-
Completed	White Income Nonwhite Income							_			
1939											
Elementary										·	
2.5	426	459	506	557	603	341	357	379	403	424	
5.5	748	805	887	978	1059	499	523	556	590	620	
7.5	933	1005	1107	1220	1321	580	608	646	686	721	
High School							100	•			
9•5	1105	1190	1311	1445	1564	650	681	724	769	808	
12	1305	1405	1549	1707	1848	729	763	810	861	905	
College	- • • • •		-				• • •	• • •			
14	1457	1569	1729	1906	2063	785	822	873	928	975	
17	1674	1802	1986	2189	2370	862	<u> 903 </u>	<u> 959 </u>	1019	1071	
<u>1949</u>											
Elementary											
2.5	1460	1539	1650	1768	1915	1062	1080	1103	1126	1146	
6	2191	2310	2477	2655	2810	1558	1583	1617	1652	1681	
8	2504	2640	2830	3034	3211	1767	1796	1834	1873	1906	
High School											
10	2778	2929	3139	3365	3561	1948	1980	2022	2066	2102	
12	3023	3187	3416	3662	3877	2110	2144	2190	2237	2276	
College			- (1.0 4 0						
14	3247	3424	3670	3933	4163	2257	2294	2343	2393	2435	
17	3553	3746	4016	4304	4556	2457	2497	2551	2605	2651	
1959											
Elementary		000			-/-/		~ ~ ~ ~	0.07.1	00(1)	000/	
3.5		3204	3373	3510	3626		2151	2214	2264	2306	
8		4004	4909	5119	5278		3179	3272	3340	3407	
High School		~ ~ ~ ~	-	. ا م م م	~01.0		~~~~	0/0/	0010	000/	
10		5101	5433	5054	5840		3532	3030	3718	3780	
12		5007	5902	0142	0345		3820	3903	4052	4127	
COTTege		(010	6000	6000	6000		1. 7 1. 7	holo	hore	l. h.o.c	
14		6013	0550	0507	0805		4141	4262	4358	4439	
		6567	6913	7194	7432		4539	4071	4777	4865	مير و معرف المراجع المراجع الراجع

*In 1959 age in years begins at 30 years.

Footnotes

(1) Hill, T. P. "An Analysis of the Distribution of Wages and Salaries In Great Britain," <u>Econometrica</u>, Vol. 27, No. 3, July, 1959.

(2) The 1939 data was derived from the
U. S. Bureau of the Census, <u>Sixteenth</u> <u>Census of the United States: 1940</u>, "Education: Educational Attainment by Economic Characterisitc and Marital Status," Tables 29 and 31; the 1949 data was derived from the U. S. Bureau of the Census, <u>United States Census of Population: 1950</u>, Series P-E, No. 5B, "Education," Tables 12 and 13; the 1959 data was derived from U. S. Bureau of the Census, <u>United States</u> <u>Census of Population: 1960</u>, Series PC(2)-7B, "Occupation by Earnings and Education," Table 1.
(3) The 1939 data used is divided into

() The 1999 data used is divided into "white" and "Negro" categories. The "Negro" category is not used in 1949 and 1959. Rather a "nonwhite" category is used in those years. The difference between "nonwhite" and "Negro" populations is slight, since 92 percent of the nonwhite population is Negro, and statistics of the Negro (nonwhite) population generally reflect conditions of the nonwhite (Negro) population.

(4) The years of schooling intervals were adjusted by using the midpoint of the interval for closed end intervals. For open end intervals, 4 years of schooling or more, 17 years was the value used. The age intervals were adjusted by using the midpoint of the interval, or in some cases the midpoint was rounded to the nearest whole year. (5) Becker, Gary S., The Economics of Discrimination, (The University of Chicago Press, Chicago, 1959), p. 14. (6) Additional analyses were carried out using other models that were linear and multiplicative in form along with data that covered the period up to 1967; these analyses also suggested declines in discrimination against nonwhite males having the same education and age as white males. See my unpublished doctoral dissertation, "A Quantitative Analysis of White-Nonwhite Income Differentials as Related to education and Age," New York University, Graduate School of Business Administration, 1971.