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LABOUR FORCE PARTICIPATION, RACE AND HUMAN CAPITAL: INFLUENCE ON EARNINGS DISTRIBUTIONS ACROSS STATES

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In this paper we analyze the level of income inequality across states in 1970 and 1980 for several demographic groups. Furthermore, we examine the impact of labor force participation (LFP), education and other variables on inequality. We find that for the whole population, states with high LFP by females are states with low income inequality. The same holds true for states with high LFP for men. When we disaggregate by race, the results are quite consistent for whites, but not for blacks. States with relatively high education levels are associated with high inequality levels for the white cohort and the whole population, but there appears to be no similar association between education and inequality across states for blacks.

I. INTRODUCTION

Income inequality is most frequently analyzed across time for a given country. However, it is also of interest to examine inequality across states, and by each state over time. It is well known that differences in individual characteristics are important in examining the level of inequality in the personal size distribution of income. By examining differences across states, the policymaker may gain additional insight into how these regional differences in attributes may be affecting the income distribution. We examine levels of family income inequality across states and their relationship with levels of human capital, race and labor force participation across these states. In the United States as a whole, the LFP rate for women has increased from about 35 percent in 1960 to 52 percent by 1980. This increase in LFP by women has been accompanied by a slow, but steady, decline of LFP by men over the same time period. Although this demonstrates a significant change in labor market behavior and composition, the trend effect on the size distribution of income is open to debate.

In this paper we analyze whether the effect of labor force participation across states at a point in time will affect inequality in the same way as change in labor force participation affects inequality across time, cf. Danziger *et al.* (1981), Bergmann *et al.* (1980) and Betson and van der Gaag (1984). Several studies suggest that for the U.S., for the 1952-81 period, increased labor force participation by women has in fact acted to decrease inequality in the marginal distribution of earnings, cf. Betson and van der Gaag (1984) and Shackett and Slottje (1987).

Note: We thank Dan A. Black, Lori Taylor, two unknown referees and the editor for comments. The usual caveat holds.

If states with high male participation rates also have high female participation rates, then we still do not know if the female participants are disproportionately drawn from wives of high income males or from low income males. While some studies indicate that women married to high income males are more likely to have achieved higher education and are therefore more likely to work in the labor market, standard income-substitution analysis indicates that wives of high income husbands should work less, other things being equal, due to strong income effects. Theory is not capable of predicting a definitive net effect.

Using the household-production approach, whether nonmarket time is inferior depends on the correlation between the income elasticities of home-produced commodities and their time intensities, as well as the income of the other earner (Becker, 1965). Thus, as some women work more, their spouses may work less. Smith (1979) examined the distribution of income for husband-wife families and reported that increases in working white wives equalize earnings distributions, but that increases in working black wives increases inequality of family income distributions. Smith's hypothesis is that white family members compensate for changes in each other's labor supply decisions, but labor supply decisions of black family members are positively correlated. He looked at husband-wife families and used the variances of logarithmic earnings as the measure of dispersion. Since previous empirical work has found different results for white and blacks, we provide separate analysis for both of these racial groups.

It is obvious, at any rate, that any attempt to explain variations in inequality must adjust for labor force participation variables for men and women, assuming that multicollinearity does not become an insurmountable problem. In the same context, it may be important to hold constant the income level of families and control for the urban/rural population mix within states. There are reasons to expect that highly urbanized states will have a more predominantly industrialized work setting, which translates into higher wage rates and consequently higher income levels.

We also examine whether states with high levels of median education have associated high levels of inequality in their respective size distributions of income. Although increased education is often supported as a policy to decrease inequality, the human capital model derived by Becker predicts an increase in inequality. This result is, in fact, supported by time series analysis for the U.S. and cross-section analysis of education in California (Shackett and Slottje, 1987, and Hansen and Weisbrod, 1969). Again, the issue of human capital investment measured by education in years must be viewed in a cross-section context. We know that educational levels have increased over time, and that this influence appears to work, as Becker suggested, to increase income inequality. If it is true at a point in time that the supply of funds for education is positively related to the demand for education by individuals, and that demand and possibly supply are positively related to ability of individuals, then we would expect it to follow that higher education levels lead to increased inequality. However, it may be that states with higher average education levels have sought to supply funds to disadvantaged or low income students, which might act to increase the income earning potential at the lower end of the distribution and decrease inequality. We examine these issues below.

The data (which are defined and discussed below) indicate considerable variation in one measure of inequality utilized in this study, the Gini coefficients (see Table 1). Washington, D.C. and Mississippi have the highest overall inequality level for family income in 1980, along with the highest proportion of blacks in the regional population. For whites, Washington, D.C. still leads the field in inequality, but for blacks, D.C. ranks 10th in family income inequality as measured by the Gini coefficient. From the time frame of 1970 to 1980, the average Gini coefficient across all states has declined for both blacks and whites. While in 1980 the average Gini coefficient for blacks was considerably higher than for whites, the difference is substantially reduced by 1980.

TABLE 1

SELECTED GINI COEFFICIENTS FOR STATES BY RACE

Gini 1980 (Rank)		Gini 1970 (Rank)	
0.381(1)	Washington, D.C.	0.425(1)	Mississippi
0.371(2)	Mississippi	0.418(2)	Louisiana
0.368(3)	Arizona	0.418(3-4)	Arizona, Oklahoma
0.365(4)	Florida		
0.328(49)	Nevada	0.367(47)	New York
0.326(50)	Indiana	0.366(48-50)	Michigan
0.323(51)	Utah	0.364(51)	New Hampshire, New Jersey, Indiana
White Gini 1980 (Rank)		**White Gini 1970 (Rank)**	
0.397(1)	Washington, D.C.	0.425(1)	Washington, D.C.
0.378(2)	Pennsylvania	0.412(2)	Oklahoma
0.360(3-4)	Florida, Arizona	0.408(3)	Florida
0.325(49)	South Carolina	0.363(48)	Indiana
0.322(50)	Utah	0.362(49-50)	Maryland, New Hampshire
0.321(51)	Wyoming	0.358(51)	Alaska
Black Gini 1980 (Rank)		**Black Gini 1970 (Rank)**	
0.393(1)	North Dakota	0.559(1)	Arizona
0.389(2)	Mississippi	0.502(2)	Louisiana
0.384(3)	West Virginia	0.492(3)	South Dakota
0.361(10)	Washington, D.C.	0.478(4)	Mississippi
0.328(49)	Ohio	0.368(47-48)	Washington, D.C., Michigan
0.325(50)	Wyoming	0.366(49-50)	Connecticut, New Hampshire
0.320(51)	Indiana	0.356(51)	Hawaii
Means			
Gini	1970 = 0.388 (st. dev. 0.016)		
	1980 = 0.345 (st. dev. 0.012)		
White Gini	1970 = 0.386 (st. dev. 0.014)		
	1980 = 0.341 (st. dev. 0.013)		
Black Gini	1970 = 0.416 (st. dev. 0.041)		
	1980 = 0.352 (st. dev. 0.017)		

Since in this paper we address the issue of variation in inequality across states at a point in time, the unit of measure is total family income (as defined by the Census Bureau) obtained from Census data for 1970 and 1980. We examine inequality for the overall population and for whites and blacks separately.

II. Model

The focus of this study will be to examine the relationship between human capital and labor force participation variables and the degree of income inequality observed across states. We will concentrate on developing models for 1970 and 1980, to see if our results are consistent across time. The models will be estimated for blacks and whites separately to determine if there are appreciable differences in the factors that influence inequality across races. If so, this gives valuable information to the policymaker on how regional differences impact inequality across races. This is in contrast to the usual time series attempts to find differences.

Although many arguments have been developed concerning the composition and underlying causes of the rapidly changing labor force participation rates of women, and the lower changes of participation rates by men, it is difficult to translate these arguments into cross-section results at a given point in time. The sources of cross-section deviations in labor force participation by states are more difficult to analyze, as they may be influenced by cultural traditions, industrial structure, and general income levels, cf. Slottje (1989).

The empirical analysis is divided into two stages. First we examine the simple Spearman Rank Correlations by race to see how labor force participation rates by women are correlated with income inequality based on ranks in a nonparametric fashion. Then we extend the analysis to examine the effect of labor force participation rates by women and the influence of educational levels holding constant for male participation rates and other relevant factors.

The first step in building the statistical model involves estimating income inequality across states by race. In this study, we use Gini coefficients constructed by the Bureau of the Census, cf. Slottje (1990a, 1990b). Given the Gini measures of income inequality, the analysis is made in two stages. First we present the nonparametric Spearman rank correlation tests for all the variables. The Spearman rank correlation test is based upon the test statistic

$$r_s = 1 - \frac{6\sum_i d_i^2}{(n-1)n(n+1)}. \tag{1}$$

The procedure is as follows. First, rank the observations for each variable. Then, obtain the differences in ranks for the paired observations; this is d. Estimate r by (5) where n is the number of d's (Steel and Torrie, 1980, p. 550). To test the significance of the correlation coefficient, note that

$$r_s \frac{n-2}{1-r_s^2} \sim t_{n-2}. \tag{2}$$

By performing Spearman's test, it will be possible to see how the LFP rate in each state correlates with inequality in each state. These results are discussed in Section III below.

The second stage of our empirical work is to presume that inequality (as measured by the Gini coefficients) depends on the LFP rate of women (LFP_W) and men (LFP_M), the urban LFP rate (LFP_u), the overall wage rate in each state (W), the average number of hours worked per state (H), family income in 1970 and 1980 (Y_{70}, Y_{80}), equation (COL), and the percent urban ($PURB$) and percent white (PW) for each state. These variables are included since they caputre human capital effects and labor market impacts, as we noted above.

$$G(Y) = F(LFP_F, LFP_M, LFP_u, W, H, Y, COL, PURB, PW). \tag{3}$$

Several other variables were examined as well. The model was also specified with various alternative measures of education, earnings, and labor force participation by subgroups, but did not improve appreciably. Regional dummy variables were considered, but failed to improve the fit in general, and did not alter the results obtained for the basic model above.

The actual estimating equation takes the logistic form

$$\text{Gini} = \frac{1}{1+e^{-x\beta+\varepsilon}}. \tag{4}$$

The Gini is a 0-1 function, which violates the assumptions of the General Linear Hypothesis; i.e., it has a truncated normal disturbance. This truncation violates the standard assumptions about the error term which allows one to use OLS (Formby *et al.*, 1984). To avoid this, we estimate the form given in (8) and discussed by Amemiya (1973). This logistic model reduces to

$$\begin{aligned} \ln\frac{(1-\text{Gini})}{\text{Gini}} &= \alpha_0 - \alpha_1 LFP_F - \alpha_2 LFP_M \\ &\quad -\alpha_3 LPF_u - \alpha_4 W - \alpha_5 H - \alpha_6 Y - \alpha_7 COL \\ &\quad -\alpha_8 PURB - \alpha_9 PW - \varepsilon \\ &\quad \varepsilon - \sim \text{iid } N(0, \sigma_\varepsilon^2). \end{aligned} \tag{5}$$

The estimates of this model are reported and discussed in Section III below.

III. Empirical Results

The empirical data used are from the 1970 and 1980 *Census of the Population.* In defining each term, definitions and explanations of subject characteristics from each volume of the *Census of the Population* are followed. The date of enumeration for each Census (1970 and 1980) was April 1st of each year. Therefore, although the income statistics cover in turn the calendar years of 1969 and 1979, the characteristics of persons and the composition of families refer to the time of enumeration.

In analyzing income inequality across states, family income from all sources should be used because one concern with the distribution of current family income is that it implies a concern for the distribution of potential consumption. A household may contain unrelated persons; whereas an economic family consists of related persons who share income. If income were pooled within a household

for the purpose of consumption, then the household would be the appropriate unit for analysis. However, income typically is not shared among related cohabiting individuals, a group that has been becoming numerically more important. Thus, the family unit (either the economic family or the unrelated individual) is a more appropriate focus for the study.[1] From the 1970 and 1980 *Censuses of the Population*, Gini coefficients are obtained by race for the family unit, and are used in this analysis.

In Table 2 we show the Spearman Rank Correlation Coefficients of LFP rates and Gini coefficients for each state by race in 1970 and 1980. All of the Spearman rank correlation coefficients are negative. A negative coefficient indicates that states with high LFP rates by women had lower levels of inequality in their respective distributions of income.

TABLE 2

SPEARMAN RANK CORRELATION COEFFICIENTS OF GINI COEFFICIENTS AND FEMALE LABOR FORCE PARTICIPATION RATES

	Female LFP		Non-White Female LFP		White Female LFP	
Year and Race	1970	1980	1970	1980	1970	1980
Gini: Total						
1970	−0.42183		−0.30671		−0.42252	
	(0.0020)		(0.0286)		(0.0020)	
1980		−0.26352		−0.14986		−0.26600
		(0.0617)		(0.2939)		(0.0592)
Non-White						
1970	−0.47327		−0.36087		−0.40760	
	(0.0005)		(0.0093)		(0.0030)	
1980		−0.22018		−0.06094		−0.22248
		(0.1205)		(0.6710)		(0.1166)
White						
1970	−0.38223		−0.29356		−0.43398	
	(0.0056)		(0.0365)		(0.0015)	
1980		−0.37488		−0.20507		−0.38334
		(0.0067)		(0.1489)		(0.0055)

Source: U.S. Census data.

Notes:

1. Numbers in parentheses represent prob$>|R|$ under Ho: $\rho = 0$.
2. 1980 Data represents percent of females (16 years and over) participating in the labor force. Non-White represents only black females.
3. 1970 Data represent percent of females (14 years and over) participating in the labor force.

Reading the diagonal of the table, the result appears to be stronger for 1970 than for 1980. In fact, for 1980 for blacks, the black female labor force participation rate is not significantly correlated with the black Gini coefficient. Although the results are suggestive in that states with high LFP rates for women have lower rankings with respect to levels of income inequality, it is appropriate to defer conclusions until the matter is investigated holding other influences constant.

In Table 3 we present the analysis derived from estimation of equation (9) for 1980, while in Table 4 we display results for 1970. In examining the results,

[1]Cowell (1980) discusses the issues involved in comparing data collected in different units.

TABLE 3

COEFFICIENT ESTIMATES OF STATE INCOME INEQUALITY MEASURES (GINI COEFFICIENTS) WITH RESPECT TO VARIOUS STATE LABOR MARKET VARIABLES, BY RACE, 1980

	All	White	Black	Black**
Constant	0.5183 (3.03)	0.0392 (0.161)	0.3226 (0.78)	0.5643 (1.80)
LFP_F	0.0059 (2.50)	0.0011 (0.36)	−0.0031 (−1.04)	0.0171 (4.26)
LFP_M	0.0147 (4.96)	0.0091 (2.56)	0.0006 (0.27)	0.0239 (4.64)
LFP_u	−0.0136 (−4.02)	−0.0009 (−0.21)	0.0026 (0.63)	−0.0307 (−5.25)
COL	−0.0040 (−2.59)	−0.0042 (−2.92)	0.0009 (0.48)	−0.0057 (−2.05)
Y_{80}	0.0115 (2.88)	0.0085 (1.67)	0.0125 (3.47)	−0.0001 (−0.03)
W	0.0096 (2.25)	0.0036 (0.64)	−0.0049 (−0.52)	0.0177 (2.22)
H	−0.0149 (−4.02)	−0.0041 (−0.83)	−0.0040 (−0.48)	−0.0181 (−2.70)
PW	0.1370 (3.39)	0.1026 (1.87)	0.178 (2.58)	0.0356 (0.49)
PURB	−0.0008 (−2.14)	−0.0005 (−1.20)	0.0012 (1.64)	−0.0002 (−0.32)
R^{2*}	0.7731	0.6510	0.4413	0.5960
MSE	0.00083	0.0014	0.0037	0.0026

Source: U.S. Census data.

Notes:

1. The numbers in parentheses are *t*-statistics.

2. For models (2) and (3) the independent variables are based on white and black data respectively for the LFP, education and income variables.

* Adjusted Coefficient of Determination.

** Model uses overall independent variable measures rather than black independent variable measures.

TABLE 4

COEFFICIENT ESTIMATES OF STATE INCOME INEQUALITY MEASURES (GINI COEFFICIENTS) WITH RESPECT TO VARIOUS STATE LABOUR MARKET VARIABLES, BY RACE, 1970

	All	White	Black	Black**
Constant	−0.0721 (−0.331)	0.1093 (0.532)	0.017 (0.02)	−0.2773 (−0.32)
LFP_F	0.0026 (1.05)	0.0049 (2.16)	0.0044 (0.85)	0.0087 (0.87)
LFP_M	0.0103 (3.00)	0.0098 (3.92)	0.0013 (0.46)	−0.0104 (−0.77)
LFP_u	−0.0058 (−1.52)	−0.0080 (−1.96)	0.0057 (0.59)	0.0115 (0.77)
COL	−0.0060 (−2.22)	−0.0038 (−1.72)	−0.0118 (−1.85)	−0.026 (−2.13)
Y_{70}	0.0479 (6.23)	0.0337 (5.45)	0.0779 (4.06)	0.0867 (4.66)
W	0.0256 (2.07)	0.0350 (3.08)	−0.0671 (−1.32)	0.0019 (0.04)
H	−0.0062 (−1.25)	−0.0086 (−1.87)	−0.0166 (−0.82)	−0.0100 (−0.52)
PW	0.0511 (1.01)	0.0614 (1.28)	0.2366 (1.39)	0.1489 (0.75)
PURB	−0.0014 (−3.03)	−0.0015 (−3.73)	−0.0006 (−0.29)	0.0013 (0.69)
R^{2*}	0.7957	0.7864	0.4641	0.5236
MSE	0.00107	0.0009	0.0189	0.0168

Source: U.S. Census data.

Notes:

1. The numbers in parentheses are *t*-statistics.

2. For models (2) and (3) the independent variables are based on white and black data respectively for the LFP, education and income variables.

* Adjusted Coefficient of Determination.

** Model uses overall independent variable measures rather than black independent variable measures.

the implications of equation (9) are that a positive coefficient implies a negative effect on inequality so that a positive sign increases equality. The overall estimation is comparable for 1970 and 1980, with much better estimates for the overall population and white cohort equations than for the black cohort models. In fact, the black cohort models have a better fit when the independent variables are the overall measures rather than the measures for the black cohort itself (column 4). This result will be discussed below.

The results for the overall population (All) equation for 1980 are quite strong. We find that high female LFP rates (LFP_F) have a negative influence on income inequality for the entire population. High male LFP rates (LFP_M) also show a negative relationship with income inequality for the whole population. For the white cohort, only the result for male participation remains precise, while for the black cohort, no black labor force participation rates appear to significantly affect inequality in the black cohort distribution of income. However, when overall LFP rates are related to black income inequality (model 4), they repeat the pattern of significant effects noted in the overall model (1). As there has been considerable evidence suggesting that women may be close substitutes for black men in the labor force, this result may reflect that as women enter the labor force, black men are replaced at the margin. Thus, the distribution for the black cohort appears more equal, when in fact it may represent a truncation phenomenon, the lowest paid (lowest skilled) blacks leave the labor force so inequality appears to go down.

A high urban LFP rate (LFP_u) is associated with higher inequality for the overall population model and the black cohort model with overall population variables in 1980. In fact, a high percent urban of the population ($PURB$) within a state is consistent with higher inequality overall for both 1970 and 1980, and for whites alone in 1970.

The education variable (COL, percentage of population with at least 4 years of college) shows a significant association with higher inequality for 1970 and 1980 for all versions of the models except for black education and black income inequality in 1980. Even for blacks in 1980, the overall effect of higher general levels of education of the population of a state results in higher measured income inequality.

High state wage levels (W) tend to be associated with lower income inequality, while longer average hours worked in a state (H) are associated with higher income inequality. These results appear to be stronger for blacks in 1980 and for whites in 1970.

The role of family income (Y_{70}, Y_{80}) appears to be that high averages for family income are associated with lower inequality. However, for the overall population and white cohorts, family income lagged one decade is a stronger predictor than current family income levels at predicting current income inequality.[2] For the black cohorts, family income levels per state act as a major source to predict income inequality, although current family income works as

[2]Using family income or lagged family income levels yields very similar results. While these two variables are highly correlated, lagged family income is less likely to be correlated with other current variables, and can permit better precision in estimation.

well as lagged family income in this case. For 1970, family income played an extremely important role in black income inequality, but by 1980, other factors were beginning to play significant roles as well.

For the 1980 models, a high percentage of the state population being white (*PW*) was associated with lower inequality, even for the white and black equations separately. The results have the same sign, but are much weaker with regard to both magnitude and precision for 1970. A high percentage of the population being urban is associated with higher inequality for the overall population model, although the effect appears to be strongest for the white subgroup in 1980.

IV. Conclusions

The results of our study can be summarized as follows. First of all, we attempted to verify whether the results of time series analysis on income inequality in the U.S. would hold up in cross-section analysis of regional variation in income inequality. Our results are, for the most part, supportive of the indications observed across time. High LFP rates by women are associated with decreased inequality across time for the U.S. as a whole (Shackett and Slottje, 1987), but we got mixed results across states at a point in time. In addition, the role of increased education is consistent across time and across states at a point in time, being associated with increased (higher) income inequality in both circumstances. Finally, increasing real wages across time and high regional wage contours are associated with decreased (lower) income inequality.

The attempt to develop the analysis for racial subgroups met with mixed results. It was possible to develop reasonably good results for white income inequality as a function of white LFP, education and income variables. However, the remaining variables, such as wages and hours worked, were unavailable by race and had to be entered as overall measures of wages and hours. It proved to be very difficult to model black income inequality as a function of black variables, and in fact black family income levels and possibly the percentage of white persons in the state population proved to be the most reliable indicators. Adjusting for the percent of population that is black had no statistical significant impact on the model.

Better results for black income inequality were obtained by using overall measures of independent variables, especially for 1980. For 1970, family income level seemed to offer the best prediction of black income inequality, but by 1980 other factors appeared to be affecting the model. In particular, high LFP by men and women and low urban LFP ratios for the general regional population were associated with lower income inequality for blacks. In general, the black equation using overall variables roughly matched the overall population equation, although with a poorer fit.

The evidence for the role of education in our society is more bleak. While conventional wisdom is that increasing educational opportunities will offer routes to better jobs for our disadvantaged citizens, and therefore act as a force to equalize incomes, it does not appear that education is currently playing this role. As Becker indicated, if the demand for education and the supply of educational funds and/or opportunities are positively related in the aggregate, then greater

amounts of education will offer the most benefits to those who were most capable to begin with, other factors held constant.

If increasing college education opportunities results in helping those who have a relative advantage already, through reaching middle and upper income class students with supportive family backgrounds and solid primary and secondary educational experience, this is hardly a surprising result. Students from the lower end of the income distribution usually grow up in poor neighborhoods, attend schools which have a low spending per student ratio, and face urgent family demands for their discretionary time. Such students are more likely to seek jobs than to attend college, assuming that they finish high school, and they also face a high probability of failure if they do attempt to gain funding and attend college.

A strong policy implication is that, if education is to be used to promote income equality, it is not enough to merely increase the average educational levels achieved across the population. We must specifically attempt to offer educational advantages to students from the lowest income strata, and we must also try to give these students a solid primary and secondary education so that they are able to take advantage of higher educational opportunities. Making educational opportunities more available at the ground level is essential if we wish to use higher education as a route to income equalization.

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