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How Demanding Should Equality of Opportunity Be, and How Much Have We Achieved?

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Abstract

[Excerpt] This chapter proposes tests of various notions of equality of opportunity and applies them to intergenerational income data for the United States and Britain. Agreement is widespread that equality of opportunity holds in a society if the chances that individuals have to succeed depend only on their own efforts and not on extraneous circumstances that may inhibit or expand those chances. What is contentious, however, is what constitutes "effort" and "circumstances." Most people, we think, would say that the social connections of an individual's parents would be included among circumstances: equality of opportunity is incomplete if some individuals get ahead because they have well-connected parents. This and other channels through which circumstances affect income opportunities in an intergenerational context are discussed in Section 2.

Section 3 then formulates four, increasingly stringent criteria for equality of opportunity. In Section 4, we turn to an empirical implementation of these criteria to test for equality of opportunity in the United States and Britain. The results, presented in Section 5, provide only the weakest of support for equality of opportunity in the United States and no support at all in Britain.

Concluding remarks are presented in Section 6.

Keywords

income, equality, United States, Britain, opportunity

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Comments

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CHAPTER THREE

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Valentino Dardanoni, Gary S. Fields, John E. Roemer, Maria Laura Sánchez Puerta

1. INTRODUCTION

This chapter proposes tests of various notions of equality of opportunity and applies them to intergenerational income data for the United States and Britain. Agreement is widespread that equality of opportunity holds in a society if the chances that individuals have to succeed depend only on their own efforts and not on extraneous circumstances that may inhibit or expand those chances. What is contentious, however, is what constitutes "effort" and "circumstances." Most people, we think, would say that the social connections of an individual's parents would be included among circumstances: equality of opportunity is incomplete if some individuals get ahead because they have well-connected parents. This and other channels through which circumstances affect income opportunities in an intergenerational context are discussed in Section 2.

Section 3 then formulates four, increasingly stringent criteria for equality of opportunity. In Section 4, we turn to an empirical implementation of these criteria to test for equality of opportunity in the United States and Britain. The results, presented in Section 5, provide only the weakest of support for equality of opportunity in the United States and no support at all in Britain.

Concluding remarks are presented in Section 6.

2. CIRCUMSTANCES, EFFORT, RESPONSIBILITY, AND CHANNELS FOR TRANSMISSION OF OPPORTUNITY

Recently, one of the authors has attempted to formalize a general conception of equality of opportunity, conceived of as "leveling the playing field"

(Roemer 1998, 2002). Five words comprise the language of that approach. The *objective* is the aspect of well-being for which the policymaker or society wants to equalize opportunities. In this chapter, the objective is the wage-earning capacity of individuals. *Circumstances* are the aspects of the environments of individuals that affect their achievement of the objective, *and* for which the society in question, or the policymaker, does *not* wish to hold individuals responsible. A *type* is the set of individuals in the society who share the same circumstances. *Effort* comprises the totality of actions of the individual that affect his or her achievement of the objective, and for which society *does* hold the individual responsible. Finally, the *instrument* is the policy that can be manipulated in order to change the value of the objective.

We are now ready to define the core concept of this chapter, namely, equality of opportunity (EOp). We shall say that equality of opportunity has been achieved when all those who expend the same degree of effort, regardless of their type, have the same chances of achieving the objective. In terms of the preceding language, EOp holds that differences in the values of the objective are ethically acceptable if they are due to differential effort but not if they are due to differential circumstances.

An *equal opportunity policy* is a value of the instrument that makes it the case that the achievement of the objective of individuals shall be a function only of their efforts, not of their circumstances. In other words, the instrument is used to compensate fully those with disadvantageous circumstances, so that, in the end, they have the same chances of acquiring high values of the objective as do those with advantageous circumstances.

In this chapter, we discuss four channels through which circumstances affect income opportunities in an intergenerational context:

C1. Parents affect the chances of their children through provision of *social connections*.

C2. Parents affect the chances of their children through formation of *beliefs and skills* in children through family culture and investment.

C3. Parents affect the chances of their children through genetic transmission of *native ability*.

C4. Parents affect the chances of their children through the instillation of *preferences and aspirations* in children.

Various notions of equality of opportunity are based on the ethical observer's choice of which of these channels to regard as circumstances and which are subsumed under effort.

3. FOUR LEVELS OF EQUALITY OF OPPORTUNITY

We have listed the four channels for transmission of opportunity—social connections, beliefs and skills, native ability, and preferences and aspirations—in what we believe most of us would choose as the right order for nested inclusion in the set of circumstances. We think that nearly all observers would regard differential family connections as a circumstance outside of the control of the individual. A somewhat smaller number of observers would be likely also to count a person as unfairly disadvantaged because of having been raised in a family that inculcated the children with pessimistic beliefs about what they could become, or that did not invest in their skills. Probably a smaller number still would also say that the children are not responsible for low innate ability. Finally, we think that few observers would treat the preferences and aspirations of children as falling outside their control.

We do not wish to be dogmatic about the ordering of these four channels and can see how some observers might wish to reverse the order of the last two. The reason that "family influence on preferences" is listed as the last channel is that we think that most people would say that an adult should be responsible for his preferences—in particular, with regard to pursuit of economic opportunities—even if those preferences are in large part the consequence of his upbringing. As one influential philosopher has written, a person should be held responsible for his preferences if and when he is glad he has them (Dworkin 1981). This definition excludes addictions and compulsions, which are preferences one would prefer not to have, but not income-occupational choice preferences, even if they were instilled in childhood. We shall denote by P^S those preferences that the individual has that are attributable to the self (hence the superscript "S"). In our analysis, the individual is always held responsible for these preferences. This is to be contrasted with the preferences that the individual has because of family influences, for which he or she may or may not be held responsible.

For the sake of argument, let us make two assumptions: first, that the four kinds of circumstances listed exhaust the set of parental influences on child incomes, and second, that the set of parental influences is "nested" in the preceding order, with regard to arguable inclusion in the set of circumstances for EOp policy. If so, then we have four associated conceptions of equality of opportunity, associated with four possible sets of circumstances:

EOp1: Circumstances = {C1}. Effort = {C2, C3, C4, P^S}.

EOp2: Circumstances = {C1, C2}. Effort = {C3, C4, P^S}.
EOp3: Circumstances = {C1, C2, C3}. Effort = {C4, P^S}.
EOp4: Circumstances = {C1, C2, C3, C4}. Effort = {P^S}.

Thus, when X is the number of channels designated as circumstances, EOpX denotes equality of opportunity when there are X channels.

4. TESTING THREE LEVELS OF EQUALITY OF OPPORTUNITY

A. Three Tests

As we do not have data that permit us to test for the effect of parental social connections, we will henceforth ignore EOp1. The tests for equality of opportunity at the other levels (EOpX, X = 2, 3, 4) proceed as follows.

Let Y denote the outcome variable and let m(.) denote a function or statistic by which the outcome variable is judged—for example, the cumulative distribution function or the mean of Y. Let $j = 1, \ldots, J$ be the values of the C2 channels, $k = 1, \ldots, K$ the values of the C3 channels, and $l = 1, \ldots, L$ the values of the C4 channels.

The most demanding criterion for equality of opportunity is EOp4. This test maintains that the distribution of the outcomes should be the same for all (*social connections*), *beliefs and skills*, *native ability*, and *preferences and aspirations* groups. That is:

$$\text{Test of EOp4: Are the numbers } m_{jkl} \text{ all the same, for all values of } (j, k, l)? \quad (1)$$

If individuals are held to be responsible for the family-induced preferences and aspirations (C4) but not for the other intergenerational transmission channels (C1-C3), we move to the EOp3 criterion. The test for EOp3 maintains that the distribution of outcomes should be the same for all (*social connections*), *beliefs and skills*, and *native ability* groups within a preferences and aspirations category. In other words:

$$\text{Test of EOp3: For each choice of } l, \text{ are the numbers } \{m_{jkl} \mid l \text{ fixed}, j = 1, \ldots J, k = 1, \ldots, K\} \text{ the same?} \quad (2)$$

Suppose that individuals are also held responsible for native ability. We then have the EOp2 criterion, the test for which is that the distribution

of outcomes should be the same for all (*social connections* and) *beliefs and skills* groups. The corresponding test is then:

$$\text{Test of EOp2: For each choice of } l \text{ and } k, \text{ are the numbers } \{m_{jkl} \mid l, k \text{ fixed}, j = 1, \ldots, J\} \text{ the same?} \quad (3)$$

As noted earlier, EOp4 is a more demanding criterion than most observers, we think, hold.

One final remark: we take it as axiomatic that no ethical observer would hold individuals responsible for the consequence of their parents' social connections or lack thereof. To hold individuals responsible for *everything* about their environments would comprise the extremely laissez-faire view that any person, regardless of his situation, can "pull himself up by his bootstraps," and so equality of opportunity would require only antidiscrimination legislation.

B. The U.S. and British Data Sets

These tests for equality of opportunity are performed on data for the United States and Britain. In the case of the United States, we use the Wisconsin Longitudinal Study (WLS). This is a long-term study of a random sample of 10,317 men and women who graduated from Wisconsin high schools in 1957. Survey data were collected from the original respondents or their parents in 1957, 1964, 1975, and 1992. These data provide a full record of social background, youthful aspirations, schooling, military service, family formation, labor market experiences, and social participation of the original respondents. The survey data from earlier years have been supplemented by mental ability tests, measures of school performance, and characteristics of communities of residence, schools and colleges, and employers and industries. The WLS sample is broadly representative of white, non-Hispanic American men and women who have completed at least a high school education. Among Americans aged 50 to 54 in 1990 and 1991, approximately 66 percent are non-Hispanic white persons who completed at least 12 years of schooling.

In the case of Britain, we use the National Child Development Survey (NCDS) and the British Cohort Survey (BCS). These data sets are two UK cohort studies targeting the population born in the UK respectively between 3–9 March 1958 and between 5–11 April 1970. Individuals were surveyed at different stages of their life, and information on their parental background was collected. The latest NCDSs were conducted in 1981, 1991, and 1999

when the cohort members were aged 23, 33, and 41, while the latest BCS was conducted in 1999.

In implementing these tests on U.S. and British data, the outcome variable is the individual's monthly income in the United States, and hourly wage in the UK. In the United States, we have two income variables y. The principal income variable for our analysis, y_1, is the labor market earnings of the individual high school graduate in 1992, which is the most recent round of the survey. The data set also includes, for the household that the individual lives in, the income from the labor market and other sources. This total income, expressed on a per capita basis, is our second income variable y_2. In the case of Britain, the data set only provides information on individual labor market hourly wage, which is the sole outcome variable for our analysis.

The explanatory variables for the two countries are similar. *Beliefs and skills* are proxied by parents' education. *Preferences and aspirations* are proxied by individual's education. *Native ability* is proxied by individual's IQ.

Before continuing, we comment on the commonly used test for equality of opportunity, which is to ask if the distribution of outcomes among children is independent of parents' outcome values, using as test whether the rows of the intergenerational transition matrix are equal. This test implies taking EOp4 as the appropriate definition of equality of opportunity. However, as we have suggested, most ethical observers would probably not endorse EOp4 as the appropriate notion of equal opportunity, and hence the usual test is far too demanding, as it is not associated with an ethical view that many people hold.

We turn now to two approaches for relating the outcome variables to the explanatory variables.

C. Implementing the Tests by Quantile Regression

In our first empirical approach, we use quantile regression to check the four hypotheses considered in this chapter. Quantile regression differs from ordinary regression in the following way. In ordinary regression, the regression equation gives the mean of the outcome variable conditional on the explanatory variables:

$$Y_{mean} \mid A, E, PE = a + b\,A + cE + dPE.$$

Quantile regression, in contrast, provides an equation for the qth quantile of the conditional distribution. Thus, the equation for the conditional median is

$$Y_{med} \mid A, E, PE = a_{med} + b_{med} A + c_{med}E + d_{med}PE.$$

In this study, we estimate the conditional distribution of the outcome variable Y at four different quantiles, q = 0.20, 0.40, 0.60, and 0.80, and see how the conditional distribution of Y depends on the conditioning variables in correspondence of the chosen quantiles. Let

$$Y_q \mid A, E, PE = a_q + b_q A + c_qE + d_qPE. \quad q = 0.20, 0.40, 0.60, 0.80$$

denote the conditional quantiles of the outcome variable, conditional on individual's education, individual's ability, and parents' education. Positive values of b_q, c_q, and d_q mean that higher values of ability, education, or parents' education *raise* income at the qth quantile of the conditional income distribution. It is possible, and indeed our results below show, that b_q, c_q, and d_q are not all positive at all quantiles of the distribution.

Turning now to tests for equality of opportunity, the three tests can be implemented with the following quantile regression equations:

$$\text{Test of EOp4: For all q's, } b_q = c_q = d_q = 0. \quad (1^a)$$

$$\text{Test of EOp3: For all q's, } c_q = d_q = 0. \quad (2^a)$$

$$\text{Test of EOp2: For all q's, } d_q = 0. \quad (3^a)$$

The advantage of quantile regression over ordinary regression is that the former provides a test for whether the *distributions* of the outcome variable are independent of various circumstances, instead of whether the means of those distributions are independent of circumstances.

Implementing the Tests Nonparametrically

In our second empirical approach, we dichotomize the parental education, ability, and individual education variables in order to have a small number of different populations that can be directly compared in a nonparametric fashion.

We implement the three dichotomous variables in the following ways. The first thing that the approach turns on is the implementation of *beliefs and skills*. We create two categories of parents, "advantaged" and "disadvantaged." In both countries, parents' education is expressed as the average of the education level of the two parents. In the United States, the advantaged parents are those who averaged at least a high school diploma. In Britain, the dividing line between advantaged and disadvantaged parents is the median of

average education, 9.5 years. The second concept that we use is individual's *native ability*. We distinguish two "ability" groups, gauged by the score on an IQ test, and call them "highly able" and "less able" according to whether they fall above or below the median. Third, the approach identifies two different groups for *preferences and aspirations*, according to the education of the individual. In the United States, the "high preference" individuals are those with one or more year of college. In Britain, those with A-level education or higher are regarded as "high preference" and those with O-level education or less are regarded as "low preference."

Accordingly, the three equality of opportunity tests, in decreasing order of stringency, are:

$$\text{Test of EOp4: For eight parents' education/IQ/individual's education groups, } m_{111} = m_{112} = \ldots = m_{222}. \quad (1^b)$$

$$\text{Test of EOp3: For each individual's education group, the mean incomes are the same for each parents' education/IQ group: } m_{11l} = m_{12l} = m_{21l} = m_{22l}\ l = 1, 2. \quad (2^b)$$

$$\text{Test of EOp2: For each individual's education/IQ group, the mean incomes are the same for each parents' education group: } m_{1kl} = m_{1kl}\mid k = 1, 2, l = 1, 2. \quad (3^b)$$

To test for the three levels of equality of opportunity EOp2, EOp3, and EOp4, we perform a main test and a number of robustness tests. The main test uses individual labor earnings y_1 as the outcome variable of interest and compares the means μ of the eight distribution functions.

The robustness tests use different income variables or different statistics. The first and second robustness tests compare median individual earnings and CDFs of individual earnings instead of means. Finally, the third and fourth tests compare mean incomes per capita, y_2, for the United States and mean log-earnings instead of earnings in dollars for both countries.

5. RESULTS

A. First Set of Results: Quantile Regression

Tables 3.1 and 3.2 present the results of the estimation of the conditional quantile regressions for the two countries. Table 3.1 reveals that all coefficients are significantly positive for all quantiles. Thus, all three equality of opportunity hypotheses are strongly rejected for the UK. On the other

TABLE 3.1

Quantile Regression Results for the UK
Dependent Variable: Logarithm of Wage

	20TH QUANTILE		40TH QUANTILE		60TH QUANTILE		80TH QUANTILE	
	Coefficient	*Std Error*	*Coefficient*	*Std Error*	*Coefficient*	*Std Error*	*Coefficient*	*Std Error*
Constant	1.33	.032***	1.59	.049***	1.77	.043***	1.97	.048***
Ability	.080	.006***	.090	.006***	.091	.007***	.092	.010***
Education	.170	.006***	.164	.006***	.144	.005***	.122	.007***
Parents' ed.	.011	.003***	.007	.005	.011	.004***	.017	.005***

*, **, *** mean 10, 5 and 1 percent level of significance.

TABLE 3.2
Quantile Regression Results for the United States
Dependent Variable: Earnings

	20TH QUANTILE		40TH QUANTILE		60TH QUANTILE		80TH QUANTILE	
	Coefficient	*Std Error*	*Coefficient*	*Std Error*	*Coefficient*	*Std Error*	*Coefficient*	*Std Error*
Constant	−32.413	3,483.6***	−35,511	2,487.9***	−32,059	2,949.3***	−46,891	5,269.8***
Ability	21.7	9.5**	44.9	13.7***	61.9	16.2***	98.1	19.7***
Education	3,112.3	266.7***	4,304.5	236.8***	4,427.7	232.7***	5,966.6	406.7***
Parents' ed.	−434.8	96.9***	−498.6	153.3***	−35.8	176.9	744.4	279.0***

*, **, *** mean 10, 5 and 1 percent level of significance.

hand, the results for the United States presented in Table 3.2 are somewhat mixed. Individual's own education and own ability always exhibit statistically significant positive effects. Thus, EOp4 and EOp3 are strongly rejected. However, parents' education exhibits mixed effects. The coefficients are *significantly negative* at the 20th and 40th percentile of the conditional earnings distribution, *statistically insignificant* at the 60th percentile of the conditional earnings distribution, and *significantly positive* at the 80th percentile of the conditional earnings distribution. Thus, the hypothesis that parents' education, after conditioning on own education and ability, has no effect on children's outcome is strongly rejected. However, the rejection is in an unexpected direction, with profound differences between the lower and higher sections of the conditional distribution.

In summary, the results using the quantile regression method are that (1) we reject equality of opportunity as defined by EOp4 and EOp3 for both countries, (2) we reject equality of opportunity as defined by EOp2 for Britain, and (3) our results do not permit us to conclude whether EOp2 holds for the U.S. population described by our data.

B. Second Set of Results: Nonparametric Approach

In this subsection we present the results for the tests of equality of opportunity with the nonparametric approach. We begin with the results for the main tests, from the most stringent to the least, followed by the results of the robustness tests performed. The United States results using this method are presented in Tables 3.3 and 3.4, the British results in Tables 3.5 and 3.6.

The result for the main tests for EOp3 and EOp4 is that we reject the null hypothesis at the 1 percent level of significance. This result is the same for both the United States and Britain.

The results for the main test for EOp2 differ for the United States and Britain. In the case of the U.S. data set, we reject the null hypothesis at the 5 percent level of significance but not at the 1 percent level. That is, using mean individual earnings in dollars, we can be 95 percent confident (but not 99 percent confident) that equality of opportunity is rejected. However, for the case of Britain, the result for the main test for EOp2 is that we reject the null hypothesis at the 1 percent level of significance.

In summary, the results for the main tests are that (1) we reject equality of opportunity as defined by EOp4 and EOp3 for both countries, (2) we reject equality of opportunity as defined by EOp2 for Britain, and (3) we find

TABLE 3.3

United States: Data for Tests of Equality of Opportunity

	MAIN TEST: COMPARISON OF MEAN EARNINGS IN DOLLARS							
	Group 1 mean = 48,405	*Group 2 mean = 36,578*	*Group 3 mean = 26,415*	*Group 4 mean = 21,915*	*Group 5 mean = 43,288*	*Group 6 mean = 33,930*	*Group 7 mean = 24,389*	*Group 8 mean = 19,871*
Group 1 (mean = 48,405)								
Group 2 (mean = 36,578)	$\mu_1 > \mu_2^{***}$							
Group 3 (mean = 26,415)	$\mu_1 > \mu_3^{***}$	$\mu_2 > \mu_3^{***}$						
Group 4 (mean = 21,915)	$\mu_1 > \mu_4^{***}$	$\mu_2 > \mu_4^{***}$	$\mu_3 > \mu_4^{***}$					
Group 5 (mean = 43,288)	$\mu_1 > \mu_5^{**}$	$\mu_5 > \mu_2^{***}$	$\mu_5 > \mu_3^{***}$	$\mu_5 > \mu_4^{***}$				
Group 6 (mean = 33,930)	$\mu_1 > \mu_6^{***}$	$\mu_2 > \mu_6$	$\mu_6 > \mu_3^{***}$	$\mu_6 > \mu_4^{***}$	$\mu_5 > \mu_6^{***}$			
Group 7 (mean = 24,389)	$\mu_1 > \mu_7^{***}$	$\mu_2 > \mu_7^{***}$	$\mu_3 > \mu_7$	$\mu_7 > \mu_4^{**}$	$\mu_5 > \mu_7^{***}$	$\mu_6 > \mu_7^{***}$		
Group 8 (mean = 19,871)	$\mu_1 > \mu_8^{***}$	$\mu_2 > \mu_8^{***}$	$\mu_3 > \mu_8^{***}$	$\mu_4 > \mu_8^{**}$	$\mu_5 > \mu_8^{***}$	$\mu_6 > \mu_8^{***}$	$\mu_7 > \mu_8^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: means are equal.

ROBUSTNESS TEST 1: COMPARISON OF MEDIAN EARNINGS IN DOLLARS

	Group 1 median = 36,000	*Group 2 median = 30,000*	*Group 3 median = 21,000*	*Group 4 median = 19,000*	*Group 5 median = 38,000*	*Group 6 median = 32,000*	*Group 7 median = 20,000*	*Group 8 median = 17,000*
Group 1 (median = 36,000)								
Group 2 (median = 30,000)	$med_1 > med^{***}$							
Group 3 (median = 21,000)	$med_1 > med^{***}$	$med_2 > med_3^{***}$						
Group 4 (median = 19,000)	$med_1 > med^{***}$	$med_2 > med_4^{***}$	$med_3 > med_4^{*}$					
Group 5 (median = 38,000)	$med_5 > med_1$	$med_5 > med_2^{***}$	$med_4 > med_3^{***}$	$med_5 > me^{***}$				
Group 6 (median = 32,000)	$med_1 > med^{***}$	$med_6 > med_2$	$med_6 > med_3^{***}$	$med_6 > me^{***}$	$med_5 > med^{***}$			
Group 7 (median = 20,000)	$med_1 > med^{***}$	$med_2 > med_7^{***}$	$med_3 > med_7$	$med_7 > med_4$	$med_5 > med^{***}$	$med_6 > me^{***}$		
Group 8 (median = 17,000)	$med_1 > med^{***}$	$med_2 > med_8^{***}$	$med_3 > med_8^{**}$	$med_4 > med_8$	$med_5 > med^{***}$	$med_6 > me^{***}$	$med_7 > med^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: medians are equal.

(*continued*)

TABLE 3.3
(continued)

	ROBUSTNESS TEST 2: STOCHASTIC DOMINANCE IN DOLLARS							
	Group 1	*Group 2*	*Group 3*	*Group 4*	*Group 5*	*Group 6*	*Group 7*	*Group 8*
Group 1								
Group 2	1 ≻ FOD 2***							
Group 3	1 ≻ FOD 3***	2 ≻ SOD 3***						
Group 4	1 ≻ FOD 4***	2 ≻ FOD 4***	3 ≻ SOD 4***					
Group 5	1 ~ 5	5 ≻ SOD 2***	5 ≻ FOD 3***	5 ≻ FOD 4***				
Group 6	1 ~ 6***	2 ~ 6	6 ≻ SOD 3***	6 ≻ SOD 4***	5 ≻ FOD 6***			
Group 7	1 ≻ FOD 7***	2 ≻ SOD 7***	3 ~ 7	7 ≻ SOD 4***	5 ≻ FOD 7***	6 ≻ SOD 8***		
Group 8	1 ≻ FOD 8***	2 ≻ FOD 8***	3 ≻ FOD 8***	4 ~ 8*	5 ≻ SOD 8***	6 ≻ SOD 8***	7 ≻ FOD 8***	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: CDFs are equal.

	ROBUSTNESS TEST 3: COMPARISON OF MEAN INCOME PER CAPITA IN DOLLARS (STRICTLY POSITIVE VALUES)							
	Group 1 mean = 42,114	*Group 2 mean = 33,021*	*Group 3 mean = 28,736*	*Group 4 mean = 23,743*	*Group 5 mean = 36,913*	*Group 6 mean = 30,929*	*Group 7 mean = 24,952*	*Group 8 mean = 21,529*
Group 1 (mean = 42,114)								
Group 2 (mean = 33,021)	$\mu_1 > \mu_2^{***}$							
Group 3 (mean = 28,736)	$\mu_1 > \mu_3^{***}$	$\mu_2 > \mu_3^{**}$						
Group 4 (mean = 23,743)	$\mu_1 > \mu_4^{***}$	$\mu_2 > \mu_4^{***}$	$\mu_3 > \mu_4^{***}$					
Group 5 (mean = 36,913)	$\mu_1 > \mu_5^{***}$	$\mu_5 > \mu_2^{**}$	$\mu_5 > \mu_3^{***}$	$\mu_5 > \mu_4^{***}$				
Group 6 (mean = 30,929)	$\mu_1 > \mu_6^{***}$	$\mu_2 > \mu_6$	$\mu_6 > \mu_3$	$\mu_6 > \mu_4^{***}$	$\mu_5 > \mu_6^{***}$			
Group 7 (mean = 24,952)	$\mu_1 > \mu_7^{***}$	$\mu_2 > \mu_7^{**}$	$\mu_3 > \mu_7^{***}$	$\mu_7 > \mu_4$	$\mu_5 > \mu_7^{***}$	$\mu_6 > \mu_7^{***}$		
Group 8 (mean = 21,529)	$\mu_1 > \mu_8^{***}$	$\mu_2 > \mu_8$	$\mu_3 > \mu_8^{***}$	$\mu_4 > \mu_8^{***}$	$\mu_5 > \mu_8^{***}$	$\mu_6 > \mu_8^{***}$	$\mu_7 > \mu_8^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_0: means are equal.

(*continued*)

TABLE 3.3
(continued)

	ROBUSTNESS TEST 4: COMPARISON OF MEAN LOG-EARNINGS IN DOLLARS							
	Group 1 mean = 9,330	*Group 2 mean = 8,864*	*Group 3 mean = 8,339*	*Group 4 mean = 7,931*	*Group 5 mean = 9,440*	*Group 6 mean = 9,147*	*Group 7 mean = 8,342*	*Group 8 mean = 7,866*
Group 1 (mean = 9,330)								
Group 2 (mean = 8,864)	$\mu_1 > \mu_2^{**}$							
Group 3 (mean = 8,339)	$\mu_1 > \mu_3^{***}$	$\mu_2 > \mu_3^{**}$						
Group 4 (mean = 7,931)	$\mu_1 > \mu_4^{***}$	$\mu_2 > \mu_4^{***}$	$\mu_3 > \mu_4^{*}$					
Group 5 (mean = 9,440)	$\mu_5 > \mu_1$	$\mu_5 > \mu_2^{***}$	$\mu_5 > \mu_3^{***}$	$\mu_5 > \mu_4^{***}$				
Group 6 (mean = 9,147)	$\mu_1 > \mu_6$	$\mu_6 > \mu_2$	$\mu_6 > \mu_3^{***}$	$\mu_6 > \mu_4^{***}$	$\mu_5 > \mu_6$			
Group 7 (mean = 8,342)	$\mu_1 > \mu_7^{***}$	$\mu_2 > \mu_7^{***}$	$\mu_7 > \mu_3$	$\mu_7 > \mu_4^{**}$	$\mu_5 > \mu_7^{***}$	$\mu_6 > \mu_7^{***}$		
Group 8 (mean = 7,866)	$\mu_1 > \mu_8^{***}$	$\mu_2 > \mu_8$	$\mu_3 > \mu_8^{***}$	$\mu_4 > \mu_8$	$\mu_5 > \mu_8^{***}$	$\mu_6 > \mu_8^{***}$	$\mu_7 > \mu_8^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: means are equal.

Group 1 = advantaged high ability high preference
Group 2 = advantaged low ability high preference
Group 3 = advantaged high ability low preference
Group 4 = advantaged low ability low preference
Group 5 = disadvantaged high ability high preference
Group 6 = disadvantaged low ability high preference
Group 7 = disadvantaged high ability low preference
Group 8 = disadvantaged low ability low preference

TABLE 3.4

United States: Summary of Tests of Equal Opportunity

		RESULTS OF MAIN TEST	RESULTS OF ROBUSTNESS TESTS			
			Test 1	*Test 2*	*Test 3*	*Test 4*
Test of EOp4	Are all 8 group means equal?	No	No	No	No	No
Test of EOp3	Within a preference group, are all four ability-type groups equal? (Group 1 = Group 2 = Group 5 = Group 6 & Group 3 = Group 4 = Group 7 = Group 8)	No	No	No	No	No
Test of EOp2	Within an ability-preference pair, are the four type comparisons equal? (Group 1 = Group 5 & Group 2 = Group 6 & Group 3 = Group 7 & Group 4 = Group 8)	Yes at the 1% level, no at the 5% level.	Yes at the 1 and 5% level, no at the 10% level.	Yes	No	Yes

NOTE: "Yes" = "Cannot reject that they are equal."
"No" = "Reject that they are equal."

About the Tests:

Main test: Mean earnings are equal.
Robustness test 1: Median earnings are equal.
Robustness test 2: CDFs are equal.
Robustness test 3: Mean incomes per capita are equal.
Robustness test 4: Mean log-earnings are equal.

Group 1 = advantaged high ability high preference
Group 2 = advantaged low ability high preference
Group 3 = advantaged high ability low preference
Group 4 = advantaged low ability low preference
Group 5 = disadvantaged high ability high preference
Group 6 = disadvantaged low ability high preference
Group 7 = disadvantaged high ability low preference
Group 8 = disadvantaged low ability low preference

TABLE 3.5

Britain: Data for Tests of Equality of Opportunity

	COMPARISON OF MEANS IN DOLLARS (EARNINGS)							
	Group 1 mean = 10.86	*Group 2 mean = 9.15*	*Group 3 mean = 7.97*	*Group 4 mean = 6.70*	*Group 5 mean = 9.92*	*Group 6 mean = 8.19*	*Group 7 mean = 7.46*	*Group 8 mean = 6.50*
Group 1 (mean = 10.86)								
Group 2 (mean = 9.15)	$\mu_1 > \mu_2^{***}$							
Group 3 (mean = 7.97)	$\mu_1 > \mu_3^{***}$	$\mu_2 > \mu_3^{***}$						
Group 4 (mean = 6.70)	$\mu_1 > \mu_4^{***}$	$\mu_2 > \mu_4^{***}$	$\mu_3 > \mu_4^{***}$					
Group 5 (mean = 9.92)	$\mu_1 > \mu_5^{***}$	$\mu_5 > \mu_2^{***}$	$\mu_5 > \mu_3^{***}$	$\mu_5 > \mu_4^{***}$				
Group 6 (mean = 8.19)	$\mu_1 > \mu_6^{***}$	$\mu_2 > \mu_6^{***}$	$\mu_6 > \mu_3$	$\mu_6 > \mu_4^{***}$	$\mu_5 > \mu_6^{***}$			
Group 7 (mean = 7.46)	$\mu_1 > \mu_7^{***}$	$\mu_2 > \mu_7^{***}$	$\mu_3 > \mu_7^{**}$	$\mu_7 > \mu_4^{***}$	$\mu_5 > \mu_7^{***}$	$\mu_6 > \mu_7^{***}$		
Group 8 (mean = 6.50)	$\mu_1 > \mu_8^{***}$	$\mu_2 > \mu_8^{***}$	$\mu_3 > \mu_8^{***}$	$\mu_4 > \mu_8$	$\mu_5 > \mu_8^{***}$	$\mu_6 > \mu_8^{***}$	$\mu_7 > \mu_8^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: means are equal.

	COMPARISON OF MEDIANS IN DOLLARS							
	Group 1 median = 10.34	*Group 2 median = 8.82*	*Group 3 median = 7.16*	*Group 4 median = 5.97*	*Group 5 median = 9.44*	*Group 6 median = 7.85*	*Group 7 median = 6.69*	*Group 8 median = 5.96*
Group 1 (median = 10.34)								
Group 2 (median = 8.82)	$med_1 > med^{***}$							
Group 3 (median = 7.16)	$med_1 > med^{***}$	$med_2 > med_3^{***}$						
Group 4 (median = 5.97)	$med_1 > med^{***}$	$med_2 > med_4^{***}$	$med_3 > med_4^{***}$					
Group 5 (median = 9.44)	$med_1 > med^{***}$	$med_5 > med_2^{*}$	$med_4 > med_3^{***}$	$med_5 > me^{***}$				
Group 6 (median = 7.85)	$med_1 > med^{***}$	$med_2 > med^{***}$	$med_6 > med_3^{**}$	$med_6 > me^{***}$	$med_5 > med^{***}$			
Group 7 (median = 6.69)	$med_1 > med^{***}$	$med_2 > med^{***}$	$med_3 > med_7^{**}$	$med_7 > me^{***}$	$med_5 > med^{***}$	$med_6 > med^{***}$		
Group 8 (median = 5.96)	$med_1 > med^{***}$	$med_2 > med^{***}$	$med_3 > med_8^{***}$	$med_4 > med_8$	$med_5 > med^{***}$	$med_6 > med^{***}$	$med_7 > med^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: medians are equal.

(*continued*)

TABLE 3.5
(*continued*)

	STOCHASTIC DOMINANCE IN DOLLARS							
	Group 1	*Group 2*	*Group 3*	*Group 4*	*Group 5*	*Group 6*	*Group 7*	*Group 8*
Group 1								
Group 2	1 ≻ SOD 2***							
Group 3	1 ≻ FOD 3***	2 ≻ SOD 3***						
Group 4	1 ≻ FOD 4***	2 ≻ SOD 4***	3 ~ 4***					
Group 5	1 ~ 5***	5 ≻ SOD 2***	5 ≻ SOD 3***	5 ≻ SOD 4***				
Group 6	1 ≻ FOD 6***	2 ≻ SOD 6***	6 ≻ SOD 3***	6 ≻ SOD 4***	5 ≻ SOD 6***			
Group 7	1 ≻ FOD 7***	2 ≻ SOD 7***	3 ~ 7**	7 ≻ SOD 4***	5 ≻ FOD 7***	6 ≻ SOD 8***		
Group 8	1 ≻ FOD 8***	2 ≻ FOD 8***	3 ≻ FOD 8***	4 ≻ SOD 8	5 ≻ FOD 8***	7 ≻ FOD 8***	7 ≻ SOD 8***	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: CDFs are equal.

	COMPARISON OF MEANS IN DOLLARS (LOG-EARNINGS)							
	Group 1 mean = 2.34	*Group 2 mean = 2.18*	*Group 3 mean = 1.97*	*Group 4 mean = 1.79*	*Group 5 mean = 2.25*	*Group 6 mean = 2.06*	*Group 7 mean = 1.90*	*Group 8 mean = 1.79*
Group 1 (mean = 2.34)								
Group 2 (mean = 2.18)	$\mu_1 > \mu_2^{***}$							
Group 3 (mean = 1.97)	$\mu_1 > \mu_3^{***}$	$\mu_2 > \mu_3^{***}$						
Group 4 (mean = 1.79)	$\mu_1 > \mu_4^{***}$	$\mu_2 > \mu_4^{***}$	$\mu_3 > \mu_4^{***}$					
Group 5 (mean = 2.25)	$\mu_1 > \mu_5^{***}$	$\mu_5 > \mu_2^{***}$	$\mu_5 > \mu_3^{***}$	$\mu_5 > \mu_4^{***}$				
Group 6 (mean = 2.06)	$\mu_1 > \mu_6^{***}$	$\mu_6 > \mu_2^{***}$	$\mu_6 > \mu_3^{**}$	$\mu_6 > \mu_4^{***}$	$\mu_5 > \mu_6^{***}$			
Group 7 (mean = 1.90)	$\mu_1 > \mu_7^{***}$	$\mu_2 > \mu_7^{***}$	$\mu_3 > \mu_7^{**}$	$\mu_7 > \mu_4^{***}$	$\mu_5 > \mu_7^{***}$	$\mu_6 > \mu_7^{***}$		
Group 8 (mean = 1.79)	$\mu_1 > \mu_8^{***}$	$\mu_2 > \mu_8^{***}$	$\mu_3 > \mu_8^{***}$	$\mu_4 > \mu_8$	$\mu_5 > \mu_8^{***}$	$\mu_6 > \mu_8^{***}$	$\mu_7 > \mu_8^{***}$	

*, **, *** for 10, 5, 1 percent significance level respectively. H_o: means are equal.

Group 1 = advantaged high ability high preference
Group 2 = advantaged low ability high preference
Group 3 = advantaged high ability low preference
Group 4 = advantaged low ability low preference
Group 5 = disadvantaged high ability high preference
Group 6 = disadvantaged low ability high preference
Group 7 = disadvantaged high ability low preference
Group 8 = disadvantaged low ability low preference

TABLE 3.6

Britain: Summary of Tests of Equal Opportunity

		RESULTS OF MAIN TEST	RESULTS OF ROBUSTNESS TESTS		
			Test 1	*Test 2*	*Test 3*
Test of EOp4	Are all 8 group means equal?	No	No	No	No
Test of EOp3	Within a preference group, are all four ability-type groups equal?	No	No	No	No
Test of EOp2	Within an ability-preference pair, are the four type comparisons equal?	No	No	No	No

NOTE: "Yes" = "Cannot reject that they are equal."
"No" = "Reject that they are equal."

About the Tests:
Main test: Mean earnings are equal
Robustness test 1: Median earnings are equal
Robustness test 2: CDFs are equal
Robustness test 3: Mean log-earnings are equal.

Group 1 = advantaged high ability high preference
Group 2 = advantaged low ability high preference
Group 3 = advantaged high ability low preference
Group 4 = advantaged low ability low preference
Group 5 = disadvantaged high ability high preference
Group 6 = disadvantaged low ability high preference
Group 7 = disadvantaged high ability low preference
Group 8 = disadvantaged low ability low preference

weak evidence of equality of opportunity using criterion EOp2 for the case of the United States.

Turning now to the robustness tests, we conduct four different ones for each of the three criteria for equality of opportunity. In the case of Britain, all the available robustness tests (using median earnings, CDFs of individual earnings, and mean log-earnings) support the rejection of EOp4, EOp3, and EOp2 at all levels of significance. In the case of the United States, all the robustness tests (using median earnings, CDFs of individual earnings, mean incomes per capita, and mean log-earnings) support the rejection of EOp4 and EOp3 at all levels of significance. However, in the case of EOp2, the robustness tests for the United States produce additional weak evidence in favor of equality of opportunity. Of the four robustness tests, one (the income per capita test) rejects EOp2 at all significance levels, one (CDFs) rejects EOp2 at the 10 percent significance level, and the other two (median earnings and mean log-earnings) do not reject EOp2 at any significance level. Taken together, the main test and the four robustness tests do not decisively reject EOp2 for the United States, but they do not provide strong evidence in favor of it either.

6. CONCLUSION

In market economies like those of the United States and the UK, we should not expect equality of opportunity for prefiscal incomes to hold when native ability and years of education are taken to be "circumstances." That is to say, one would expect prefiscal income, to be sensitive to native ability and years of education, and hence it is no surprise that our results imply that EOp3 and EOp4 do not hold in either country.

One might, however, conjecture that the institution of public education would be sufficient to compensate children for parental disadvantage (as here proxied by the parents" educational level)—that is that equality of opportunity in the sense of EOp2 would hold. Our tests show that this is not the case in the UK; the results are more ambiguous with respect to the United States. One might cautiously suggest, based on this result, that the United States is a more meritocratic society than the UK, in the sense that the disadvantages associated with parental deficits are less important for the success of the child. Our data, however, are not sufficiently fine to allow us to distinguish between the effects of family *connections* and family *culture* on the future

earnings of the child. It is likely that both are important. It is nevertheless conceivable that, in the UK, parents pass their jobs down to their children, in the United States they do not, and this explains the different results for EOp2. It is more likely, however, that family culture is important in both countries; as well, perhaps the fact that private education for the wealthy is more institutionalized in the UK than in the United States explains the "better" results for the United States in regard to EOp2.

Finally, we repeat our caveat with regard to the ethical view associated with asking whether the rows of the intergenerational transition matrix are the same. As such equality could only be expected to hold if EOp4 held, *given* the fact that the joint distribution of native ability and preferences/aspirations differs according to parental type, demanding that kind of equality corresponds to a particularly radical conception of what equalizing opportunities requires.

We hope that our discussion will stimulate others to assemble data sets with more precise measures of the salient characteristics of individuals and their families, so that tests for equality of opportunity may be performed that correspond to commonly held ethical views.

References

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