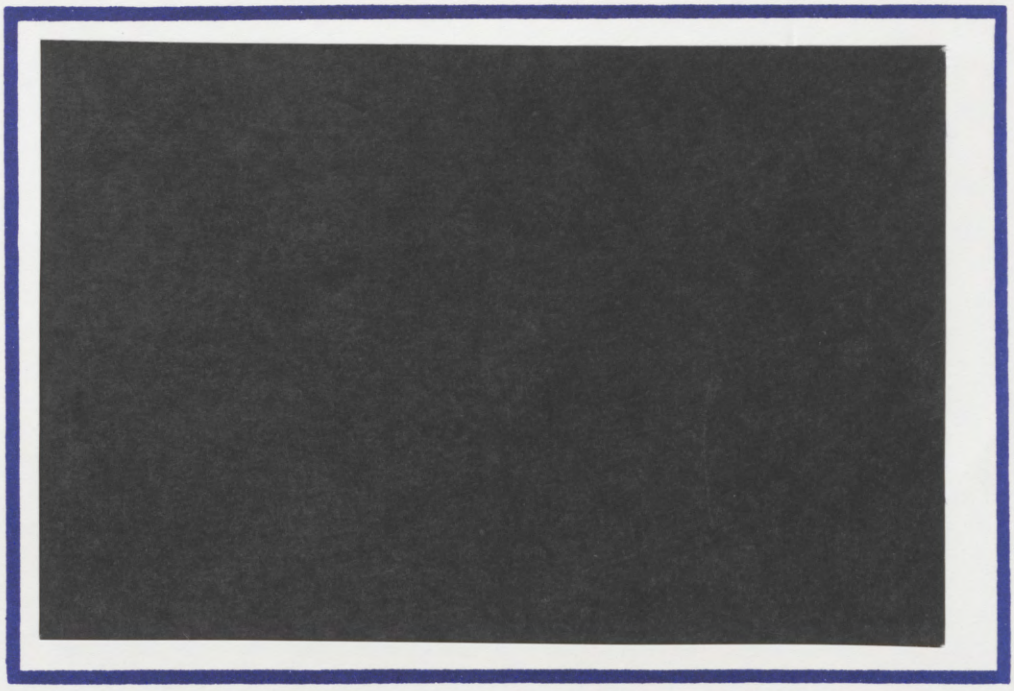
THE FOERDER INSTITUTE FOR ECONOMIC RESEARCH

TEL-AVIV UNIVERSITY

RAMAT AVIV ISRAEL



מכון למחקר כלכלי ע"ש ד"ר ישעיהו פורדר ז"ל

ע"י אוניברסיטת תל-אביב

ENDOWMENT EFFECT AND MARKET EFFECT: REVISITED

by

Gideon Fishelson*

Working Paper No.20–92

September, 1992

* Department of Economics, Tel–Aviv University

This research was partially supported by funds granted to the Foerder Institute for Economic Research by the KEREN RAUCH FUND.

THE FOERDER INSTITUTE FOR ECONOMIC RESEARCH
Faculty of Social Sciences
Tel–Aviv University, Ramat Aviv, Israel.

ABSTRACT

The question regarding the determinants of the earning differential between two population groups at a given time period, and of its evolvement over time has been given continuous attention over the past three decades. The difference of the market prices of various endowments has also been called "discrimination" and measures were suggested for its quantification. In this study we present alternative formulations for the evaluation of the endowments vs. the market factors. We recommend the one which is the most consistent and symmetric over groups and show its performance for U.S. data.

ENDOWMENTS EFFECT AND MARKET EFFECTS

The recent article by Donahue and Heckman (1991) brings up again the question of the appropriate measuring of the factors, the sum of which makes up the difference between the means of the earnings of two groups of people (e.g. white–black, from an Eastern origin – from a western origin, native – new immigrants, etc.). Oxaca's (1973a) and (1973b) traditional procedure was to break up the difference into an endowment effect – the difference in "objective" characteristics and a market effect – measuring the differences in prices assigned to endowments of each group by the market.[1] This approach required the definition of one of the groups as the base group. Correspondingly the magnitude of each factor changes according to this decision. Donahue and Heckman (1991) followed this practice, although they are aware (see their footnote 18) that the formulation of the factors that make up the total difference is arbitrary. Within the context of their study there was no room for further elaboration on this issue, but as we show below it might be crucial to their conclusions. This is the reason why Fishelson et al (1980) present their results using two different formulations.

The purpose of this paper is to suggest a "neutral" way of explaining earning differences, i.e., avoiding the need to define a base group. The demonstration is also expanded to over time comparisons. The importance of the formulation is demonstrated using U.S. data.

The Model

Let the logarithm of the wages, E, of whites, W, in year t be generated by the function:

$$(1) \qquad \ln E_t^W = X_t^W \beta_t^W + U_t^W$$

where X denotes endowments, β market prices and U an unexplained residual. The wages of blacks, B, are formed in a similar way:

$$(2) \qquad \ln E_t^B = X_t^B \beta_t^B + U_t^B .$$

Then the log of the wages ratio in year t is

$$(3) \qquad \ln(E_t^W/E_t^B) = X_t^W \beta_t^W - X_t^B \beta_t^B + (U_t^W - U_t^B) .$$

Equations (1) and (2) can be estimated. The mean values of the fitted E's are equal to the observed means. Hence:

$$(4) \qquad \ln(\bar{E}_t^W/\bar{E}_t^B) = \bar{X}_t^W \hat{\beta}_t^W - \bar{X}_t^B \hat{\beta}_t^B .$$

For the sake of simplicity we drop the "bar" from the X's, the "hat" from the B's and the subscript t from both of them. The traditional approach was to reformulate equation (4) as follows:

$$(5) \qquad \ln(\bar{E}^W/\bar{E}^B) = X^B(\beta^W - \beta^B) + \beta^W(X^W - X^B).$$

The first term on the right was defined as being the market effect (discrimination), and the second term, the endowment effect. However, equation (5) can also be written as

$$(5') \qquad \ln(\bar{E}^W/\bar{E}^B) = X^W(\beta^W - \beta^B) + \beta^B(X^W - X^B).$$

Obviously the calculated magnitudes of the market and endowment effects differ depending on the base group which in equation (5) is "blacks" in terms of endowments and "whites" in terms of market prices while in equation (5′) this order is reversed.[2] In order to formulate a neutral breakdown let us define the term $\bar{X}$ which is the mean of the characteristics of the two populations, i.e. it represents the whole population:

$$\bar{X} = \alpha X^W + (1-\alpha)X^B$$

where α is the share of whites in the total population. Correspondingly:

$$(6) \qquad \ln(\bar{E}^W/\bar{E}^B) = \beta^W(X^W - \bar{X}) + \beta^B(\bar{X} - X^B) + \bar{X}(\beta^W - \beta^B).$$

The first term on the right is the total evaluation of the advantages of whites. The second term is the market total evaluation of the disadvantages of blacks, and the third is the market differentiation between whites and blacks, evaluated at the population endowments.[3]

Everything mentioned above with regard to comparison of the earnings of the two groups at a given period of time holds without any further modification with respect to the comparison of the same group at two different time periods (blacks between 1960 and 1980).

For over time comparisons either one assigns equal weights each of the compared time periods, when calculating the means of the various endowments, or one resorts to the traditional formulation.[4] If W becomes 2 and β becomes 1 then:

$$(7) \qquad \ln(\bar{E}^2/\bar{E}^1) = X^1(\beta^2 - \beta^1) + \beta^2(X^2 - X^1).$$

The first term on the right is the time effect on market prices evaluated at past characteristics. The second term is the time effect on the endowments evaluated at present prices. Equation (7) is written in the same way as equation (5) while equation (7′) can be written in the same way as equation (5′). However, for over time comparison, just from logical reasoning, it is more sensible to follow the formulation of equation (5).[5]

When comparing two populations over time one has thus to blend equation (7) with equation (5). The notations X_1 and X_2 denote the weighted averages of the endowments of the total population in periods 1 and 2. Correspondingly the over time relative change in relative earnings becomes:

$$(8) \qquad \left\{\left[(X_2^W - X_2) - (X_1^W - X_1)\right]\beta_2^W + \left[(X_2 - X_2^B) - (X_1 - X_1^B)\right]\beta_2^B\right\}$$

$$+ \qquad \left\{(\beta_2^W - \beta_1^W)X_1^W - (\beta_2^B - \beta_1^B)X_1^B\right\} + \left\{(X_2 - X_1)(\beta_2^W - \beta_2^B)\right\}.$$

The superiority of equation (8) over Fishelson et al (1980) and Donahue and Heckman (1991) is its symmetry with regard to the compared groups. It is not symmetric in terms of the time dimension, however. In the first and third terms of the equation the market prices are those of the second period, while in the second term the endowments are

of the first period. Equation (8) is made up of three parts, each bracketed by curly brackets. The first is the time effect on the relative endowments of each grup evaluated by the second period prices of the corresponding group. The second is the time effect on the market prices of each group evaluated by the base period endowments of the corresponding group. The third term is an interaction term between the change of the total population endowments and the difference in market prices between the two groups in the second period.

Applications of the new formulations

In what follows we apply U.S. data to equations (5), (5′), (6) and (8) for whites and blacks and for the education variable. Table 1 contains the basic data which are: the average number of years of schooling of whites and blacks and total, in years t and t+1: S^w_t, S^B_t, S^T_t, S^w_{t+1}, S^B_{t+1}, S^T_{t+1} and the regression coefficients for the two groups for schooling for years t and t+1. Table 2 contains the various evaluations of the education endowment and market effects. Table 2 has three parts. In the first, wage differentials between whites and blacks are decomposed for the education variable. In the second, the over time difference in wages between 1960 and 1980 is decomposed separately for whites and blacks using only the education variable. In the third part the relative change between 1960 and 1980 for the relative wages of whites and blacks is decomposed for the education variable. Since only the effects of education are evaluated, the numerical results mainly demonstrate the different implications generated by each formulation. It becomes clear that by using total population means rather than values for one of the groups the effects become milder (their sum is the same as in the other formulations). The interesting result is the decline in the relative wage differential between whites and blacks between 1960 and

1980 which is mainly due to the market evaluation of schooling. This is evident in all the formulations. The calculations for the 1930–39 cohort are of an identical nature and are thus not presented here.

Other interesting results, however, are for whites and blacks of the two cohorts in 1960 and 1980. From the data one sees immediately that the 1930–39 cohort has more schooling and a larger coefficient on schooling than the 1920–29 cohort in 1960 and 1980 respectively. Hence, the quantity, as well as quality of schooling definitely increased. The data also suggests that by 1960 the 1930–39 cohort had not yet completed his education. We thus compare the two white cohorts in 1980, the two black cohorts in 1980 and the white–black 1930–39 cohorts in 1980. These results are presented in Table 3. For comparison equation (6) of the text is used.

We are able to draw two conclusions: 1) for both races there were positive market and endowment effects from 1960 to 1980. They were larger for blacks and thus the white–black differential attributed to education has narrowed over time. 2) In 1980 there was still a considerable, 20%, race differential attributed to education.

Conclusions

An alternative formulation for decomposing relative earning differentials between groups at a given time period and between two different time periods has been presented. The advantage of this newly suggested formulation compared to those used previously is its symmetry with respect to the groups that are being compared. Also each of the resulting terms is self–explanatory. Since the required information for the computation is directly available from the estimation of the earning functions, it is just as easy to follow our path as the other ones and is therefore preferable. Different researchers want to emphasize

different factors and to illuminate the problem from different angles. Our study should be valued by its adding another point of view to intergroups' comparisons of relative earnings.

TABLE 1: EDUCATION AND ITS REGRESSION COEFFICIENTS FOR SOUTHERN BORN MALES OF TWO AGE COHORTS, 1960, 1980.

Born 1920–1929

	Whites		Blacks	
	1960	1980	1960	1980
Education(years)	10.40	11.23	8.36	9.43
Beta Education	0.068	0.051	0.046	0.034
Population(thous.)	24,813	78,748	7,025	16,460

Born 1930–1939

	1960	1980	1960	1980
Education(years)	11.03	12.12	9.45	10.95
Beta Education	0.087	0.064	0.063	0.054
Population(thous.)	23,705	92,427	6,210	20,823

Source: Card and Krueger (1991), Appendix Table 1.

TABLE 2: DECOMPOSITION OF WAGE DIFFERENTIALS–THE 1920–1929 COHORT

A. White–Black Wage Differentials in 1960 and 1980

	1960		1980	
	Market Effect	Endowment Effect	Market Effect	Endowment Effect
Equation (5)	0.184	0.139	0.160	0.092
Equation (5′)	0.229	0.094	0.191	0.061
Equation (6)	0.219	0.104	0.186	0.066
	$\overline{EDu} = 9.95$		$\overline{EDU} = 10.92$	

B. Blacks and Whites within Groups Wage Differentials between 1960 and 1980

	Blacks		Whites	
Equation (5)	–0.100	0.036	–0.177	0.042
Equation (5′)	–0.113	0.047	–0.191	0.056
Equation (6) (equal weights)	–0.107	0.042	–0.184	0.049
	$\overline{EDU} = 8.90$		$\overline{EDU} = 10.82$	

Table 2 (Cont'd)

C. White–Black Wage Differential between 1960 and 1980

	Market Effects	Endowment Effects	Interaction Effects
Card & Krueger (Eq.(3), p.10)	–0.078	0.0009	
Donahue & Heckman[a] (Eq.(4))	–0.047	–0.015	–0.008
Equation (8)	–0.077	–0.011	0.018

[a] In order to follow our terminology we rename the effects in their equation (4):

$$-[(X^B_{t+1} - X^w_{t+1}) - (X^B_t - X^w_t)]\beta^w_t = \text{endowment effect}$$

$$-[(\beta^B_{t+1} - \beta^w_{t+1}) - (\beta^B_t - \beta^w_t)]\, X^B_{t+1} = \text{market effect}$$

$$-\{[(X^B_{t+1} - X^B_t)(\beta^B_t - \beta^w_t)] + [(X^B_{t+1} - X^w_{t+1})(\beta^B_{t+1} - \beta^w_t)]\} = \text{interaction effects.}$$

TABLE 3: COMPARISONS FOR 1980 – THE EDUCATION EFFECTS

a) Whites 1930–1939 vs. Whites 1920–1929 (equal weight)

Market Effect	0.142
Endowment Effect	0.051
Total	0.193

b) Blacks 1930–1939 vs. Blacks 1920–1929 (equal weights)

Market Effect	0.204
Endowment Effect	0.068
Total	0.272

c) White and Black, 1930–1939 Cohort, in 1980 (weights proportional to population, Table 1)

Market Effect	0.119
Endowment Effect	0.072
Total	0.191

FOOTNOTES

1 For early studies of decompositions see also Blinder (1973), Oaxaca (1973a), (1973b) and Smith and Welch (1977). Two recent studies are Oaxaca and Ransom (1988) and Cotton (1988).

2 One can be consistent also by defining the same base group in endowments and market prices. In this case equation (5) would be written as:

$$(5'') \ln(\bar{E}^W/\bar{E}^B) = X^B(\beta^W - \beta^B) + \beta^B(X^W - X^B) + (X^W - X^B)(\beta^W - \beta^B)$$

i.e., an interaction term is added. Correspondingly equation (5′) will be written as

$$(5''') \ln(\bar{E}^W/\bar{E}^B) = X^W(\beta^W - \beta^B) + \beta^W(X^W - X^B) + (X^B - X^W)(\beta^W - \beta^B).$$

Regarding consistency, equation (5′′) seems to be the more appealing. The choice, of course, depends upon the researcher's intentions.

3 In the wake of equation (6) one could suggest the following breakdown:

$$(6') \ln(\bar{E}^W/\bar{E}^B) = X^W(\beta^W - \beta) + X^B(\beta - \beta^B) + \beta(X^W - X^B)$$

where β is the non–discriminatory market prices. However, this formulation is doubted since β cannot be estimated directly. Oaxaca and Ransom (1991) suggest

the decomposition (6′) where β is defined as the nondiscriminatory wage structure and is calculated to be a weighted average:

$$\beta = \Omega\beta^{W} + (I - \Omega)\beta^{B}.$$

The issue is what is the proper Ω such that β would be the non–discriminatory structure.

4 The over time equivalent of equation (6) is:

$$\left\{\beta_2(X_2 - \overline{X}) + \beta_1(\overline{X} - X_1)\right\} + \left\{\overline{X}(\beta_2 - \beta_1)\right\}$$

where $\overline{X}$ is calculated as being the simple average of X_1, and X_2. If one thus calculates, and applies equal weights when calculating $\overline{X}$, $\overline{X} = \frac{1}{2}(X_1 + X_2)$, then he will obtain for the over time evaluation that the endowments and market effects are the averages of those found when applying the over time version to equations (5) and (5′), i.e. equations (7) and (7′).

REFERENCES

Blinder, A.S. (1973) "Wage Discrimination: Reduced Form and Structural Estimates," Journal of Human Resources, Vol.4, 435–455.

Card, D. and A.B.Krueger (1991) "School Quality and Black–White Relative Earnings: A Direct Assessment," NBER Working Paper No.3713.

Cotton, J., "On the Decomposition of Wage Differentials," Rev.Econ.Stat., Vol.70, 236–243.

Donahue, H.J. and J.Heckman (1991) "Continuous versus Episodic Change: The Impact of Civil Rights Policy on the Economic Status of Blacks," Journal of Economic Literature, Vol.29, 1603–1643.

Fishelson, G., Y.Weiss and N.Marks (1980), Ethnic Origin and Income Differentials among Israeli Males 1969–1976," in Arian A. (ed.) Israel a Developing Society, Van Goram, Assen, the Netherlands.

Oaxaca, R.L. (1973a) "Sex Discrimination in Wages," in Ashenfelder 0. and A.Rees (eds.) Discrimination in Labor Markets, Princeton University Press, Princeton, New Jersey.

———————— (1973b) "Male–Female Wage Differentials in Urban Labor Markets," Inter.Econ.Rev., Vol.9, 693–709.

————————and M.Ransom (1988) "Searching for the Effect of Unionism on the Wages of Union and Non–Union Workers," Journal of Labor Res. Vol.9, 139–148.

———————————— (1991) "On Discrimination and the Decomposition of Wage Differentials,"A Study Presented at the International Workshop on the Economics of Labor Market Discrimination and Segregation, Bar Ilan University, Ramat Gan, Israel.

Smith, J.P. and F.R.Welch (1977), "Black–White Male Wage Ratios 1960–1970," American Economic Review, Vol.67, 323–338.

THE FOERDER INSTITUTE FOR ECONOMIC RESEARCH
List of Recent Working Papers*

27.91	Allan Drazen Vittorio Grilli	The Benefits of Crises for Economic Reforms
28.91	Avner Bar–Ilan Anat Levy	Endogenous and Exogenous Restrictions on Search for Employment
29.91	Zvi Hercowitz L(Rubin)Meridor	The Macroeconomic Effects of Mass Immigration to Israel
30.91	Salvatore Modica	Neo–Bayesian Decision Making with Subjective Models
31.91	Gideon Fishelson	More on the Salant Principle
32.91	Chaim Fershtman Yoram Weiss	Social Status, Culture and Economic Performance
33.91	Chaim Fershtman Yoram Weiss	On the Stability of Occupational Rankings
34.91	Alex Cukierman Nissan Liviatan	The Dynamics of Optimal Gradual Stabilizations
35.91	Ariel Rubinstein	On Price Recognition and Computational Complexity in a Monopolistic Model
36.91	Neil Gandal David J.Salant	Movie Wars
37.91	Chaim Fershtman Neil Gandal	Disadvantageous Semicollusion
38.91	Zvi Eckstein Itzhak Zilcha	The Effects of Compulsory Schooling on Growth, Income Distribution and Welfare
1.92	Chaim Fershtman	Privatization of a Firm in Oligpolistic Market (Hebrew)
2.92	Chaim Fershtman Arye Bebchuk	The Effects of Insider Trading on Insiders' Effort in Good and Bad Times

*The list of the Sackler Institute recent working papers follows this list. Copies of the working papers or a complete working paper list of the two Institutes can be obtained from: Mrs.Stella Padeh, The Foerder Institute for Economic Research, Tel–Aviv University, Tel–Aviv, 69978 Israel. Fax: 972–3–640–9908

3.92	Jeffrey Church Neil Gandal	Integration, Complementary Products and Variety
4.92	Arthur Fishman	The Durability of Information, Market Efficiency and the Size of Firms: Search with Repeated Transactions
5.92	Michele Piccione Ariel Rubinstein	Finite Automata Play a Repeated Extensive Game
6.92	Gil Bufman Leonardo Leiderman	Currency Substitution under NonExpected Utility Some Empirical Evidence
7.92	Arthur Fishman Neil Gandal	Experimentation in a Duopoly
8.92	Oz Shy	A Welfare Evaluation of Anti–Dumping Rules
9.92	Gideon Fishelson	Mortgage Market in Israel: 1950–1990 (Hebrew)
10.92	Arthur Fishman	The Informative Role of Prices in Markets with Endogenously Informed Buyers
11.92	Efraim Sadka	International Capital Flows: Efficiency of Savings and Investments
12.92	Elhanan Helpman	Innovation, Imitation, and Intellectual Property Rights
13.92	Zvi Eckstein and Kenneth I.Wolpin	Duration to First Job and the Return to Schooling: Estimates from a Search–Matching Model.
14.92	Adam B.Jaffe Manuel Trajtenberg Rebecca Henderson	Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations
15..92	Manuel Trajtenberg Rebecca Henderson Adam B. Jaffe	Ivory Tower Versus Corporate Lab: An Empirical Study of Basic Research and Appropriability
16.92	Timothy F.Bresnahan Manuel Trajtenberg	General Purpose Technologies: "Engines of Growth?"
17.92	Elhanan Helpman Leonardo Leiderman	Israel's Exchange Rate Band
18.92	Neil Gandal	Hedonic Price Indexes for Spreadsheets and an Empirical Test of the Network Externalities Hypothesis
19.92	Eitan Berglas David Pines	Transaction Costs in a Tiebout Setup
20.92	Gideon Fishelson	Endowment Effect and Market Effect: Revisited

THE SACKLER INSTITUTE OF ECONOMIC STUDIES
List of Recent Working Papers

9.91	Eitan Berglas David Pines	Transaction Cost in a Tiebout Setup
10.91	Arthur Fishman Neil Gandal Oz Shy	Planned Obsolescence as an Engine of Technological Progress
11.91	Oz Shy	International Standardization and Protection
12.91	Chaim Fershtman Arthur Fishman	Random Liquidity, Price Dispersion and Inflation
1.92	Edi Karni David Schmeidler	On the Uniqueness of Subjective Probabilities
2.92	Neil Gandal Nathan Sussman	Tickling the Tolerance: Incentives for Producing Low Quality Coins in French Medieval Mints
3.92	Yoram Weiss	Inflation and Price Adjustment: A Survey of Findings from Micro–Data
4.92	Ariel Rubinstein Asher Wolinsky	A Remark on Infinitely Repeated Extensive Games
5.92	Assaf Razin Shula Pessach	Targeting the Exchange Rate Under Inflation
6.92	Gil Bufman Leo Leiderman	Simulating an Optimizing Model of Currency Substitution
7.92	Ariel Rubinstein	On the Interpretation of Two Theoretical Models of Bargaining
8.92	Gideon Fishelson	Backstop Technology for an Exhaustible Resource: A New Look at an Old Problem
9.92	Gideon Fishelson	Imperfect Competition in a Market of an Exhaustible Resource
10.92	Oz Shy	A Welfare Evaluation of Comparison Advertising
11.92	Assaf Razin Efraim Sadka	International Migration and International Trade