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A common empirical problem one faces in the estimation of education's contribution to the growth rate is the lack of time series data on relative wages by level of schooling. This case is particularly true in studies of less developed countries where until recently census and sampling data on wages were almost non-existent.

Under lack of time series data on relative earnings one is forced to use one year data as weights of the changes over time in the educational distribution of the labor force. The question that arises is what kind of bias is involved in this procedure and what could be its order of magnitude.

1. - The Measurement of Education's Contribution to Growth

For the purpose of measuring education's contribution to growth, it is convenient to write the aggregate production function of the economy in the following general form[1/]:

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*I wish to thank Christopher Dougherty for helpful comments.

1/See M. Selowsky, "Education and Economic Growth: Some International Comparisons", Economic Development Report No. 83, Center for International Affairs, Harvard University.

(1) $$Y = F[K, L_o, L_1, L_2 \ldots\ldots\ldots\ldots L_n]$$

where Y is aggregate output, K capital services and L_i represent man-hour inputs of members of the labor force with i years of schooling. Differentiating with respect to time and assuming that the observed wage W_i is equal to the marginal product of any type of labor L_i we get: (where the dots show time derivatives)

(2) $$\dot{Y} = f_K \dot{K} + \sum_{i=o} W_i \dot{L}_i$$

given that $L = \sum_{i=o} L_i$ and $\dot{L} = \sum_{i=o} \dot{L}_i$ we can rewrite (2) as:

(3) $$\dot{Y} = f_K \dot{K} + W_o \dot{L} + \sum_{i=o} (w_i - w_o)\dot{L}_i$$

where $f_K\dot{K}$ is the contribution of physical capital, $w_o\dot{L}$ the contribution of "bodies" or the "uneducated" component of <u>all</u> members of the labor force and $\sum_{i=o} (w_i - w_o)\dot{L}_i$ is the contribution of education.

Education's contribution can be disaggregated into two components. Define $b_i = \frac{L_i}{L}$. Then $\sum_i \dot{b}_i = 0$, and we get:

(4) $$\sum_i (w_i - w_o) \dot{L}_i = \dot{L} \sum_i (w_i - w_o) b_i + L \sum_i w_i \dot{b}_i$$

$L \sum_i w_i \dot{b}_i$ is the contribution to growth of changes in the relative distribution of workers by years of schooling or the contribution of an increase in labor quality due to education.
$\dot{L} \sum_i (w_i - w_o) b_i$ is the contribution to output of the increase in the labor force that is needed to maintain the distribution by years of schooling constant: We will call this term the contribution of the "maintenance" component.

The contribution of education to the growth rate of output is equal to:

$$(5) \qquad = \frac{\dot{L}}{Y} \sum_i (w_i - w_o) b_i + \frac{L}{Y} \sum_i w_i \dot{b}_i$$

where $\sum_i (w_i - w_o) b_i = \bar{r}$ or the average educational rental in the labor force. Defining α_E as the share of those rentals in total output, α_L as the share of total labor input in total output and $\bar{W}$ as the average wage in the labor force, we can rewrite (5) as:

$$(6) \qquad = \alpha_E(t) \frac{\dot{L}}{L} + \alpha_L(t) \sum_i \frac{W_i(t)}{\bar{W}(t)} \dot{b}_i$$

$$(7) \qquad = \alpha_E(t) \frac{\dot{L}}{L} + \alpha_L(t) \frac{\dot{Q}}{Q}$$

where $\frac{\dot{Q}}{Q} = \sum_i \frac{W_i(t)}{\bar{W}(t)} \dot{b}_i$ is the growth rate of the quality of the labor input due to education.

Notice that in (6) we have expressed α_E, α_L and $\frac{w_i}{\bar{w}}$ (or the weights of the relevant input growth rates) as a general function of time, the reason being that the initial production function was a general one and did not imply any particular behavior of these variables through time.

In other words equation (6) measures the contribution of education independently of the particular form equation (1) can have, and it is simply a result of an excercise in "growth accounting" 1/. The only knowledge we need is time-series data on the relevant variables.

2. - Lack of Time-Series Data and the Need of Some Assumptions on the Production Function

Equation (6) implies that in order to measure education's contribution to growth we need time-series data on the shares of labor and educational inputs, relative wages by schooling and the educational distribution of the labor force.

The U.S. is the only country that to my knowledge has some sort of time-series data on wages by schooling and therefore is the only case study under which the above measurement could be carried appropriately 2/.

However for most of other countries, especially less developed ones and where the role of education could be particularly

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1/See Zvi Griliches, "Notes on the Role of Education in Production Functions and Growth Accounting". Paper to be presented at the Conference on "Education and Income", Madison, Wisconsin, Nov. 1968.

2/Z. Griliches, idem, page 10

interesting, only one year (and relatively recent) data on earnings by schooling is available. This also implies only one year data on α_E because the estimation of it also involves information on relative wages. $\left[\alpha_E(t) = \alpha_L(t) \frac{\ddot{r}(t)}{\ddot{w}(t)}\right]$:

One way of solving this problem is simply to use this one year data for all the other years: this has been the method used in all the country studies in which this information on relative wages was missing[1/]. Obviously this method would give a correct measurement only if relative wages were constant over time and therefore independent of changes in the input mix. Our purpose is to analyze how sensitive are the results to this assumption on constant relative wages: for this purpose we want to explore how the relative wages of the missing years would have looked given the input endowment of that time and some assumptions on the production function of the economy.

In other words our purpose is to generate relative wages by schooling as a function of the input mix of other dates taking as a starting value the single year data available. This implies the need of assuming certain properties of the production function and the problem is to find a function easy to work with empirically and also consistent with the available empirical evidence.

1/E. Denison, Why Growth Rates Differ, (Brookings Institution, 1967). M. Selowsky, op. cit.

The rough evidence we have by looking at the available data is the following:

1) Time-series data on most countries show a rather constant share of the total labor input even in view of strong changes in the capital labor ratio.

2) Time series and inter-country data show a low sensitiveness of relative wages by schooling to changes in the educational distribution of the labor force and to changes in the overall capital-labor ratio[1/]. This phenomena could be the result of a number of factors:

   2a) A relatively high elasticity of substitution among the labor input classified by schooling.

   2b) A labor-saving technical progress "less biased" against more educated labor.

   2c) A higher complementarity between physical capital and more educated labor.

   2d) A higher intensity in the use of educated labor in the commodities of higher income elasticity.

For the purpose of our exercise we want to reproduce this low sensitiveness of relative wages through a production function that is able to use the limited information in existence.

1/Samuel Bowles: Planning Education for Economic Growth.(In press)
Zvi Griliches, op. cit., page 43

Data on the relationships 2b, 2c and 2d is almost non-existent[1/] the few attempts made to explain this low sensitiveness have used 2a) as the empirical relationship picking therefore part of the effect of 2b to 2d. We will use therefore relation 2a due the simplicity it allows and to the fact that for our purposes it implicitly includes part of the other relationships we are explicitly leaving out.

Given the two pieces of information (1 and 2a), what we need is a production function that both allows for unitary elasticity of substitution between capital and the aggregate labor input and leaves unconstrained the value of the elasticity of substitution among labor inputs classified by schooling. If we restrict this last elasticity to a constant value the above function can be written as a combination of a Cobb-Douglas and a C.E.S. production function:

(1) $$Y = K^{\alpha} L^{1-\alpha}$$

where Y and K is aggregate output and the services of the capital stock and where L is the labor input index being itself a CES function of different types of labor classified by years of schooling.

1/The only attempt to measure the effect of changes in the composition of output is in Bowles (op. cit.); on the other hand, Griliches made some estimates on the degree of complementarity between capital and different kinds of labor(Griliches, op.cit.), pages 46-51.

$$(2) \qquad L = \left[\sum_i a_i \, C_i^{\rho} \right]^{\frac{1}{\rho}}$$

where:

C_i = labor category with i years of schooling

a_i = distribution parameter of the ith kind of labor

and:

$$\rho = \frac{\sigma_L - 1}{\sigma_L}$$

where σ_L is the (constant) elasticity of substitution among the labor input.

The marginal product of any labor category i, which we assume equal to the observed wage rate W_i, is:

$$(3) \qquad \frac{\partial Y}{\partial C_i} = (1 - \alpha) \, a_i \, \frac{Y}{C_i} \left(\frac{C_i}{L} \right)^{\rho} = W_i$$

The average wage in the labor force, $\bar{W}$, is equal to:

$$(4) \qquad \bar{W} = \frac{W_L \cdot L}{\sum_i C_i} = \frac{(1-\alpha) Y}{\sum_i C_i}$$

where W_L is the marginal product of the labor index L and $\sum_i C_i$ is the total labor force. The expression we are interested in or the relative wage of any category i is:

$$(5) \qquad \frac{W_i}{\bar{W}} = a_i \frac{\sum_i C_i}{C_i} \left(\frac{C_i}{L}\right)^{\rho}$$

In other words knowing the parameters a_i and ρ we can determine for any year the relative wages of any category i as a function of the educational distribution of the labor force of that year. ρ is obtained by assuming the value of the elasticity of substitution among the labor input. The values of a_i are obtained through the one year data on earnings and on the educational distribution of the labor force. For this purpose we can substitute (2) into (3) so we have for any W_j:

$$(6) \qquad W_j = \frac{(1-\alpha) a_j \; Y \; C_j^{\rho-1}}{\sum_i a_i \; C_i^{\rho}}$$

$$(7) \qquad a_j = \frac{W_j \sum_i a_i \; C_i^{\rho}}{(1-\alpha) \; Y \; C_j^{\rho-1}}$$

the ratio of a_j to any a_i is:

$$(8) \qquad \frac{a_j}{a_i} = \frac{W_j \; C_j^{1-\rho}}{W_i \; C_i^{1-\rho}}$$

summing across i and using the restriction $\sum_i a_i = 1$ we get:

$$(9) \qquad a_j = \frac{W_j C_j^{1-\rho}}{\sum_i W_i C_i^{1-\rho}}$$

and for all other categories of the labor input. It is important to notice that the estimated parameters a_i are a function of the assumed values of $\rho = \frac{\sigma_L - 1}{\sigma_L}$ namely of the elasticity of substitution among the different categories of labor.

3. - An Application to the Case of Chile and Mexico:

The case of Chile and Mexico are typical of the problem described in the introduction: data on the educational distribution of the labor force is available for the period 1940-64, but data on earnings by schooling is available only for 1964[1/].

Our purpose is to determine relative wages for the other years in the past under different assumption on σ_L and then compare education's contribution generated with those wages with the one obtained using the 1964 relative wages.

Tables 1 and 2 present the educational distribution of the labor force for 1940-1964 using 8 categories of labor. Tables 3 to 6 and 7 to 10 present the estimated relative wages for both countries under alternative values of the elasticity of substitution.

Given the above values and the rather constant value of total labor share (α_L = .5 for Chile and α_L = .41 for Mexico), it was possible to estimate α_E or the share of educational inputs

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1/M. Selowsky, op. cit.

[$\alpha_E = \alpha_L \left(1 - \frac{W_o}{\bar{W}}\right)$]1/. These values are presented for both countries on tables 11 and 13.

In those tables it is possible to appreciate the influence of different assumptions on σ_L on the value of α_E: The first is the influence on the level of α_E and the second the effect on its behavior through time, namely:

a) The lower the elasticity of substitution, the higher the value of α_E at any moment of time. The reason is that with a lower σ_L relative wages are more sensitive to changes in the educational distribution of the labor force: given that individuals without education become relatively more abundant in the past, their relative wage $\frac{W_o}{\bar{W}}$ declines this decline being stronger the smaller the assumed value of σ_L. In other words, the share of the educational inputs embodied in the labor force is higher the smaller the value of σ_L the reason being that those inputs perceive a relatively higher price when they become relatively more scarce.

1/For the case of Mexico we used the wage of C_1 as the value for W_o. In the case of Chile we had for 1964 independent estimates of W_o. Therefore $(W_o/\bar{W})$ at any period t was estimated through the equation:

$$\left(\frac{W_o}{\bar{W}}\right)_t = \left(\frac{W_o}{W_1}\right)_{1964} \left(\frac{W_1}{\bar{W}}\right)_t$$

where $(W_1/\bar{W})_t$ is the relative wage of category 1 in t

b) The behavior of α_E through time, given that we assume α_L to be constant, is only a function of $\frac{W_o}{\bar{W}}$, in other words of the proportion of the average wage represented by the payments to "bodies." The lower the value of σ_L, the stronger will be the decline in this ratio when, going back in time, people without education become relatively more abundant.[1/]

Tables 12 and 14 present the growth of the quality of the labor force due to changes in the educational distribution of it ($\sum_i \frac{W_i}{\bar{W}} \dot{b}_i$) using the relative wages generated under different assumptions on σ_L. This information is also presented in graphs 1 and 2.

The use of $\sigma_L = 2$ instead of $\sigma_L = \infty$ (or the constant relative wage assumption) increases the average growth of quality in 2.3 and 2.1 times for Chile and Mexico, respectively (period 1940-64). The reason is that with lower values of σ_L the relative wages of more educated individuals tend to increase when we go back in time (they become relatively more scarce), those wages themselves being the weights for the changes in the proportion that those groups represent in the labor force. In other words, the positive $\dot{b}$'s or the ones of the individuals with higher education are now weighted by the relatively higher wages of those groups in the past.

This is also the reason of why the difference between using different values of σ_L is stronger the farther the period analyzed:

1/ For high values of σ_L it is possible to have the opposite case. The reason is that $W_o/\bar{W} = W_o/\Sigma a_i w_i$ could increase under roughly constant relative wages (W_o/W_i) and declines in $\bar{W}$ due to a deterioration of the average schooling of the labor force.

In the case of Chile the growth of the quality index increases from -.18% to .58% for 1940-45 and from 1.35% to 1.65% for 1960-64 when using $\sigma_L = 2$ instead of $\sigma_L = \infty$; in the case of Mexico this increase is from -.26% to .10% for 1940-45 and from 1.15% to 1.37% for 1960-64.

Finally, tables 15 and 16 present the contribution of education to the growth rate under different alternatives on the value of σ_L. In the case of Chile this contribution (expressed as a percentage of the growth rate) increases for the overall period 1940-64 in 62% (from 17.6% to 28.6%) when using $\sigma_L = 2$ instead of $\sigma_L = \infty$. For Mexico and for the same period this increase is approximately equal to 53%. Again we can see that the difference in the contribution that comes from different assumptions on σ_L is higher the farther the period we look at.

These results would imply that the procedure of using one (recent) year data on relative wages (the $\sigma = \infty$ assumption) could understate substantially the contribution of education to growth depending on how much lower is the real value of σ_L. In other words, the contribution of education obtained with (recent) constant relative wages would represent a lower limit of this magnitude.

At this step it would be useful to explore the upward limit of this contribution in view of the few empirical evidences on σ_L we have available. Samuel Bowles, working with inter-country

data and with 3 classifications of the labor input, found values of σ_L between 6 and 12[1/]. On the other hand Christopher Dougherty, using U.S. time-series data and 8 classifications of labor, found a value equal to 3.63 (the value of $\frac{1}{\sigma}$ was .276 and its standard error .045)[2/].

If we use 4 for the lower limit of σ_L, it would mean that the upward limit of education's contribution as a percent of the growth rate for 1940-64 is 24.6% for Chile and 11.0% for Mexico.

1/Bowles, op. cit.

2/C. Dougherty, "A Cost Benefit Analysis of the Colombian Educational System", Appendix 4. Paper presented at the Development Advisory Service Conference, Sorrento, Italy, September, 1968.

Table 1

CHILE: Educational Distribution of the Labor Force (in%)

Category	Years of Schooling	1940	1945	1950	1955	1960	1964
C_1	0-2	53.48	48.87	43.28	37.01	28.08	20.64
C_2	3-5	11.74	17.31	22.05	25.65	29.65	32.12
C_3	6-7	12.19	12.85	14.43	17.16	20.95	24.51
C_4	8-10	14.34	13.21	12.61	12.05	12.25	12.68
C_5	11	3.10	2.71	2.40	2.27	2.19	2.27
C_6	12	2.42	2.47	2.89	3.47	4.30	4.93
C_7	13-16	1.72	1.58	1.34	1.29	1.26	1.36
C_8	17 or more	1.01	1.00	1.00	1.10	1.31	1.49

Table 2

MEXICO: Educational Distribution of the Labor Force (in%)

Category	Years of schooling	1940	1945	1950	1955	1960	1964
C_1	0-1	60.80	59.09	55.57	49.61	43.49	38.05
C_2	2-3	9.59	12.50	16.43	21.10	25.32	27.95
C_3	4-5	11.29	11.12	11.01	11.11	11.11	11.02
C_4	6	11.59	10.85	10.49	11.01	12.04	13.20
C_5	7-9	2.92	3.03	3.21	3.79	4.39	5.60
C_6	10-11	1.49	1.29	1.23	1.18	1.28	1.53
C_7	12-14	1.16	1.06	1.04	1.13	1.24	1.40
C_8	15 or more	1.16	1.06	1.02	1.06	1.13	1.25

Table 3 MEXICAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 2.0

LABOUR CATEGORY	1940	1945	1950	1955	1960	1964
1	.492	.498	.509	.527	.550	.574
2	1.425	1.247	1.077	.929	.829	.770
3	1.094	1.102	1.096	1.067	1.043	1.022
4	1.554	1.604	1.616	1.542	1.442	1.343
5	2.717	2.665	2.564	2.308	2.096	1.810
6	2.628	2.822	2.862	2.857	2.681	2.392
7	4.248	4.440	4.440	4.165	3.886	3.567
8	7.968	8.329	8.408	8.065	7.636	7.080

Table 4 MEXICAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 4.0

LABOUR CATEGORY	1940	1945	1950	1955	1960	1964
1	.562	.569	.573	.574	.575	.574
2	1.108	1.042	.966	.883	.818	.770
3	1.119	1.129	1.123	1.090	1.057	1.022
4	1.528	1.562	1.562	1.502	1.425	1.343
5	2.347	2.337	2.285	2.133	1.995	1.810
6	2.653	2.764	2.775	2.729	2.594	2.392
7	4.119	4.235	4.221	4.023	3.813	3.567
8	7.948	8.171	8.184	7.888	7.530	7.080

Table 5 MEXICAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 6.0

LABOUR CATEGORY	1940	1945	1950	1955	1960	1964
1	.586	.593	.595	.590	.584	.574
2	1.016	.979	.930	.867	.814	.770
3	1.124	1.135	1.130	1.097	1.062	1.022
4	1.515	1.544	1.542	1.488	1.419	1.343
5	2.227	2.231	2.195	2.076	1.962	1.810
6	2.653	2.738	2.742	2.685	2.564	2.392
7	4.064	4.158	4.143	3.974	3.788	3.567
8	7.916	8.099	8.096	7.824	7.494	7.080

Table 6 MEXICAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 10

LABOUR CATEGORY	1940	1945	1950	1955	1960	1964
1	.605	.613	.613	.603	.591	.574
2	.946	.931	.901	.855	.811	.770
3	1.126	1.139	1.134	1.102	1.065	1.022
4	1.503	1.528	1.525	1.476	1.414	1.344
5	2.134	2.148	2.124	2.032	1.935	1.810
6	2.649	2.715	2.714	2.650	2.541	2.392
7	4.016	4.093	4.080	3.934	3.768	3.567
8	7.881	8.033	8.022	7.771	7.465	7.080

Table 7 CHILEAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 2.0

LABOUR ATEGORY	1940	1945	1950	1955	1960	1964
1	.316	.325	.341	.360	.398	.451
2	1.136	.920	.806	.728	.652	.609
3	1.214	1.163	1.084	.969	.845	.759
4	1.192	1.178	1.191	1.188	1.135	1.084
5	1.378	1.450	1.522	1.526	1.497	1.428
6	3.182	3.097	2.830	2.517	2.179	1.976
7	.653	6.827	7.326	7.278	7.656	6.632
8	.468	15.289	15.109	14.042	12.398	11.288

Table 8 CHILEAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 4.0

LABOUR ATEGORY	1940	1945	1950	1955	1960	1964
1	.410	.414	.423	.427	.435	.451
2	.904	.809	.756	.706	.648	.609
3	1.043	1.016	.979	.909	.823	.759
4	1.235	1.222	1.227	1.203	1.141	1.084
5	1.524	1.556	1.591	1.565	1.503	1.428
6	2.724	2.675	2.552	2.365	2.134	1.976
7	7.218	7.277	7.524	7.366	7.655	6.632
8	14.359	14.208	14.097	13.351	12.166	11.288

Table 9 CHILEAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 6.0

LABOUR CATEGORY	1940	1945	1950	1955	1960	1964
1	.444	.447	.453	.451	.449	.451
2	.832	.772	.738	.698	.646	.609
3	.985	.967	.944	.889	.816	.759
4	1.242	1.232	1.235	1.207	1.142	1.084
5	1.567	1.586	1.611	1.576	1.505	1.428
6	2.572	2.537	2.459	2.313	2.118	1.976
7	7.373	7.402	7.571	7.388	7.039	6.632
8	13.924	13.806	13.738	13.111	12.086	11.288

Table 10 CHILEAN WAGE RATES 1940-64 ELASTICITY OF SUBSTITUTION = 10

LABOUR CATEGORY	1940	1945	1950	1955	1960	1964
1	.473	.474	.479	.472	.459	.451
2	.777	.742	.723	.691	.645	.609
3	.940	.928	.915	.873	.810	.759
4	1.245	1.238	1.241	1.209	1.143	1.084
5	1.598	1.608	1.625	1.585	1.506	1.428
6	2.450	2.428	2.385	2.271	2.106	1.976
7	7.483	7.492	7.601	7.400	7.026	6.632
8	13.556	13.472	13.444	12.916	12.022	11.288

Table 11

CHILE: Share of educational capital on GNP (α_E)*
(α_L = .5)

Elasticity of substitution (σ)	1940-45	1945-50	1950-55	1955-60	1960-64
σ = 2	.36	.35	.35	.34	.32
σ = 4	.32	.31	.31	.31	.30
σ = 6	.30	.30	.30	.30	.30
σ = 10	.29	.29	.29	.29.	.30
σ = ∞	.27	.27	.27	.28	.28

*Beginning of the period relative wages ($\frac{W_o}{\bar{W}}$) were used to obtain α_E

Table 12

CHILE: Annual growth rate of the labor quality index due to education (in percentage)

Elasticity of substitution (σ)	1940-45	1945-50	1950-55	1955-60	1960-64	1940-64
σ = 2	.58	.58	1.12	1.58	1.65	1.04
σ = 4	.16	.24	.88	1.44	1.55	.79
σ = 6	.04	.14	.78	1.34	1.50	.70
σ =10	.04	0	.72	1.34	1.50	.60
σ =∞	-.18	-.22	.52	1.04	1.35	.45

Table 13 Mexico: Share of educational capital on GNP (α_E)*
(α_L = .41)

Elasticity of substitution (σ)	1940-45	1945-50	1950-55	1955-60	1960-64
σ = 2	.21	.21	.20	.19	.18
σ = 4	.18	.18	.18	.18	.18
σ = 6	.17	.17	.16	.16	.17
σ =10	.16	.16	.16	.16	.17
σ = ∞	.15	.15	.15	.16	.16

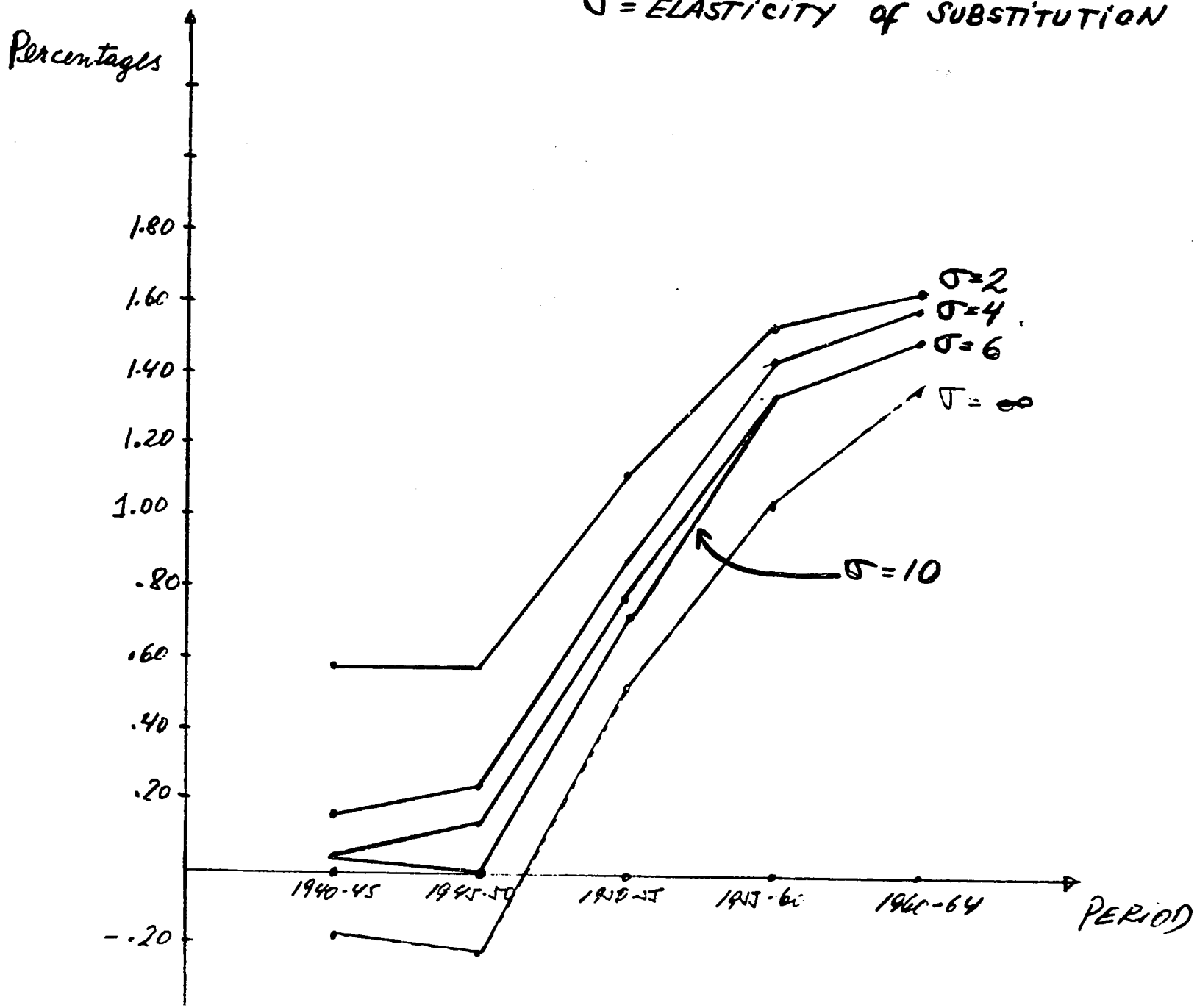
*Beginning of the period relative wages ($\frac{W_o}{\hat{W}}$) were used to obtain α_E

Table 14 Mexico: Annual growth rate of the labor quality index due to education (in percentage)

Elasticity of Substitution (σ)	1940-45	1945-50	1950-55	1955-60	1960-64	1940-64
σ = 2	.10	.48	1.00	1.00	1.37	.79
σ = 4	-.10	.24	.80	.86	1.30	.56
σ = 6	-.16	.18	.70	.82	1.25	.51
σ =10	-.22	.12	.52	.78	1.23	.44
σ = ∞	-.26	.04	.50	.66	1.15	.37

GRAPH 1: CHILE: ANNUAL GROWTH RATE OF LABOR QUALITY DUE TO EDUCATION: $\frac{\dot{Q}}{Q}$ (in percentages)

σ = ELASTICITY OF SUBSTITUTION



GRAPH 2 : MEXICO : ANNUAL GROWTH OF LABOR QUALITY DUE TO EDUCATION : $\frac{\dot{Q}}{Q}$ (in percentages)

σ = ELASTICITY OF SUBSTITUTION

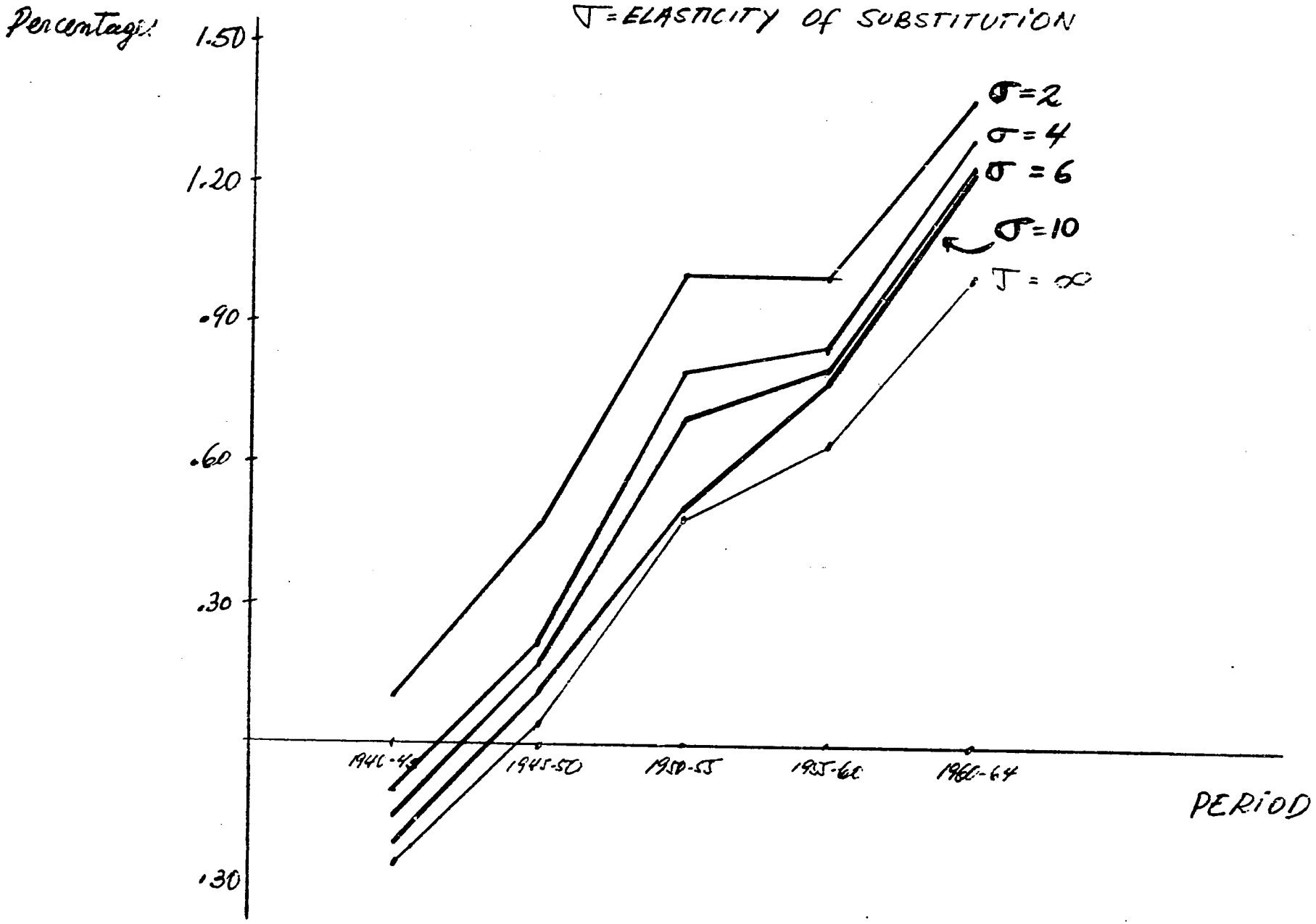


TABLE 15 CHILE: Contribution of Education to the Growth Rate (in %)
(values in parentheses show the percentage contribution to the growth rate)

Elasticity of substitution	Source	PERIOD 1940-45	1945-50	1950-55	1955-60	1960-64	Average 1940-64
$\sigma = 2$	$\alpha_L \frac{\dot{Q}}{Q}$	.29	.29	.56	.79	.82	.52 (13.9)
	$\alpha_E \frac{\dot{L}}{L}$	.65	.63	.56	.49	.53	.55 (14.7)
	Total	.94	.92	1.12	1.28	1.35	1.07 (28.6)
$\sigma = 4$	$\alpha_L \frac{\dot{Q}}{Q}$	.08	.12	.44	.72	.77	.40 (10.7)
	$\alpha_E \frac{\dot{L}}{L}$	.58	.56	.50	.45	.50	.52 (13.9)
	Total	.66	.68	.94	1.17	1.27	.92 (24.6)
$\sigma = 6$	$\alpha_L \frac{\dot{Q}}{Q}$	.02	.07	.39	.67	.75	.35 (9.4)
	$\alpha_E \frac{\dot{L}}{L}$	.54	.54	.48	.44	.50	.46 (12.3)
	Total	.56	.61	.87	1.11	1.25	.81 (21.7)
$\sigma = 10$	$\alpha_L \frac{\dot{Q}}{Q}$	.02	0	.36	.67	.75	.30 (8.0)
	$\alpha_E \frac{\dot{L}}{L}$	.52	.52	.46	.42	.50	.48 (12.8)
	Total	.54	.52	.82	1.09	1.25	.78 (20.8)
$\sigma = \infty$	$\alpha_L \frac{\dot{Q}}{Q}$	-.09	-.11	.26	.52	.67	.23 (6.1)
	$\alpha_E \frac{\dot{L}}{L}$	.48	.48	.43	.41	.45	.43 (11.5)
	Total	.39	.37	.69	.93	1.12	.66 (17.6)

TABLE 16 MEXICO: Contribution of Education to the Growth Rate (in %)
(values in parentheses show the percentage contribution to the growth rate)

Elesticity of substitution	Source	1940-45	1945-50	1950-55	1955-60	1960-64	Average 1940-
$\sigma = 2$	$\alpha_L \frac{\dot{Q}}{Q}$	.04	.20	.41	.41	.56	.32 (5.2)
	$\alpha_E \frac{\dot{L}}{L}$	.43	.55	.48	.54	.59	.49 (8.0)
	Total	.47	.75	.89	.95	1.15	.81 (13.2)
$\sigma = 4$	$\alpha_L \frac{\dot{Q}}{Q}$	-.04	.10	.33	.35	.53	.23 (3.7)
	$\alpha_E \frac{\dot{L}}{L}$	.37	.47	.43	.51	.59	.45 (7.3)
	Total	.33	.57	.76	.86	1.12	.68 (11.0)
$\sigma = 6$	$\alpha_L \frac{\dot{Q}}{Q}$	-.07	.07	.29	.34	.51	.21 (3.4)
	$\alpha_E \frac{\dot{L}}{L}$	.33	.42	.38	.48	.56	.41 (6.7)
	Total	.26	.49	.67	.82	1.07	.62 (10.1)
$\sigma = 10$	$\alpha_L \frac{\dot{Q}}{Q}$	-.09	.05	.21	.32	.50	.18 (2.9)
	$\alpha_E \frac{\dot{L}}{L}$	.33	.42	.38	.46	.56	.41 (6.7)
	Total	.24	.47	.59	.78	1.06	.59 (9.6)
$\sigma = \infty$	$\alpha_L \frac{\dot{Q}}{Q}$	-.11	.02	.21	.27	.47	.15 (2.4)
	$\alpha_E \frac{\dot{L}}{L}$	.31	.39	.36	.46	.53	.39 (6.2)
	Total	.20	.41	.57	.73	1.00	.54 (8.6)