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LABOR QUALITY AND GROWTH ACCOUNTING: THE PHILIPPINES

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In recent years studies in human capital have been readily absorbed into the larger body of economic knowledge. However, there is a scarcity of studies on the value of education between sectors. This paper is an attempt to apply the growth accounting framework so as to determine the significance of education in manufacturing and agriculture sectors of the Philippine economy.

A weighted education per man index (where the weights are earnings by years of schooling) was employed in measuring human capital input and incorporating it into the production function.

Empirical results indicate that education's contribution to Philippine growth rate between 1960 and 1982 is only 17.34 per cent; capital is the dominant factor which accounts for 48.26 per cent of the growth rate during the period. It seems that the role of education in improving the quality of the Philippine labor force does not appear to be significantly substantial; on the contrary, the crucial role of physical capital (rather than human capital) in Philippine economic growth is supported by the evidence.

1. Introduction

In recent years, studies in human capital have been readily absorbed into the larger body of economic knowledge. However, no widespread attempt has been made to consider the value of education between sectors. This study attempts to apply the growth accounting framework in determining the significance of education across sectors in the Philippines. A sectoral analysis is made to see how each sector conforms to the expected relationship between the rate of return to investment in education and human capital accumulation. The construction of the labor quality index is the focus of the analysis.

We have taken what we consider to be a small but important remedial step which may lead to a deeper understanding of sectoral

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growth as well as of the development process itself. Sectoral comparisons are always hazardous, because conditions vary greatly among as well as within sectors for the period under consideration, and often, available data do not accurately reflect these differences. Such limitations inherent in comparisons of economic variable do not however prevent us from pursuing our research concern in the belief that a study of this kind represents a positive and needed step toward empirical verification of existing economic models of growth accounting. Furthermore, the research begun here can be readily extended once the relevant data,[1] such as the highly scarce age-earnings-education profile, are available in the near future.

2. Empirical Analysis

This section discusses the construction of a quality of labor index based on the changing distributions of the Philippine labor force by years of school completed. Clearly, the main issue investigated in this paper is the relative contribution of formal education to a labor quality index. It can deal only with the level and changes in the amount of formal education received by members of the labor force not because non-formal education such as on-the-job training, etc., is less important, but because data which could quantitatively measure its contribution are limited.

Empirically, an estimation of the contribution of increased education to Philippine growth rate of output requires the construction of an index of labor input quality which in turn requires data on percentage distribution by years of school completed and wage differentials by each educational level. The underlying assumption of this analysis is that aggregate output can be explained by labor, physical capital, land, and human capital inputs.[2] The task of measuring human capital input and incorporating it into the production function is the aim of this discussion. Thus, the labor quality index is a weighted education-per-man index where the weights are earnings by years of schooling. This is what Selowsky (1967) calls the "index" method; we, however, refer to this as the factor shares approach in this study.

The data employed here to construct the labor quality index refer only to the male labor force 10 years old and over. These figures are taken from the labor force surveys of the *Bureau of the*

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[1] There is still a scarcity of published data on age-earning-income profile of Philippine labor as of early 1984.

[2] See the Appendix for the specific methodology used.

Census and Statistics Survey of Households Bulletin or BCSSH (May 1961 and October 1965 Labor Force Series).

The basic data on the distribution of the male labor force by years of school completed for 1956, 1961, 1965, and 1970 are summarized in Table 1 which shows the sharp drop in the percentage of the labor force with no schooling from 28.6 per cent in 1956 to 12.36 per cent in 1970. The percentage completing high school is also shown to have approximately doubled from 1956 to 1970, not to mention the increasing percentages observed for those with college education. Column (1) of Table 1 presents the 1966 earnings estimated by Williamson (1969) by years of school completed as derived from the survey data for a small town (Imus, Cavite) south of Manila. The Williamson estimates are referred to as Earnings 1 in Table 1. Similarly, column (2) of Table 1 presents the 1971 ILO (1974) income estimates by years of school completed as derived from the *BCSSH 1971 Family Income and Expenditure Survey.* The ILO estimates are referred to as Earnings 2 in Table 1. For the schooling levels which the ILO figures do not provide, the corresponding estimates under Earnings 1 are used to generate the Earnings 2 estimates. Using the basic ingredients in Table 1, the index of labor quality and its annual percentage change are shown in the lower part of Table 1. The interesting aspect of the results shown in Table 1 is that regardless of which earnings data are used, the pattern of the movement of the index of labor quality is the same: It increases at a diminishing rate over the period examined. Note that the percentage of those with no schooling dropped sharply between 1956 and 1961 but did not move in the same fast pace in the later years. This specific empirical result reinforces the inference that mass education in the Philippines, liberally introduced and subsidized since the American occupation in the beginning of this century, may have in fact reached its maximum attainable point. The marginal product of an educated worker is expected to drop relative to its previous level if the rate of increase of factors that are complementary to an educated worker is outpaced by the rate of increase of the number of educated workers. To the extent that this speculation is true, the proposal of the government to restructure the present Philippine educational system to achieve its output and employment goals demands the utmost consideration. The increasing allocation of scarce government resources to satisfy the social demand for education should be reexamined from the supply side to determine which investment option generates the highest alternative rate of return.

We now move on to estimate the contribution of education to Philippine growth during the period considered as dictated by the

Table 1 — Labor Quality Index

School Year Completed	Williamson 1966 Earnings 1 (1)	ILO 1971 Earnings 2 (2)	Educational Distribution of the Labor Force Males 10 Years Old and Over (in per cent) 1956 (3)	1961 (4)	1965 (5)	1970 (6)
No schooling	792	792	28.60	13.80	10.80	12.36
Elementary 1-4	1162	1162	35.70	35.90	35.70	29.88
Elementary 5-7	1191	1364	20.20	27.20	27.60	28.80
High School 1-3	2644	2128	7.40	11.20	11.90	10.56
High School 4	2644	2128	4.10	5.80	6.80	8.18
College 1-3	3596	2745	2.50	3.50	4.10	4.65
College 4 and over	3596	3596	1.50	2.60	3.20	5.56
Index of Quality						
Earnings 1:			1330	1519	1586	1651
Earnings 2:			1133	1228	1259	1295
Annual percentage change of quality		1956-61	1961-65	1965-70	1961-70	1956-70
Earnings 1:		2.66	1.08	0.80	0.93	1.54
Earnings 2:		2.41	0.91	0.81	0.85	1.41

Sources: Col. (1): Jeffrey Williamson, "Dimensions of Postwar Philippine Economic Progress," *Quarterly Journal of Economics*, LXXXIII (February 1969), Table III, p. 102.

Col. (2): International Labour Organization, *Sharing in Development: A Programme of Employment, Equity, and Growth for the Philippines*, Geneva: International Labour Office, 1974.

Cols. (4) & (5): Bureau of the Census and Statistics, *BCS Survey of Households Bulletin*, May 1961 and October 1965, Manila, Philippines.

Col. (6): [illegible]

available data shown in Table 2. For this purpose, the growth rate of output for the 1960-82 period is needed. Likewise, the growth accounting approach requires the corresponding estimates of the elasticities of output with respect to labor and capital, respectively. Following conventional procedure, labor shares are used as alternative estimates for the elasticity of output with respect to labor. Moreover, as has been suggested, the contribution of education to growth due to changes in the relative distribution of labor by years of school completed is distinguished from the contribution to output of the increase in the labor force which is required to maintain a constant distribution by years of school completed (Selowsky calls this the "maintenance" factor). The contribution of the "maintenance" component is the percentage of the earnings of those with no schooling to the weighted average earnings; the weights of the latter are the schooling distribution (Selowsky, 1967). Table 2 presents the output and input figures from 1960 to 1982 in constant 1972 prices. The growth rates noted at the bottom of Table 2 indicate the average annual rate of growth of GDP, capital, and labor between 1960 and 1982. Capital actually grows at a higher rate than that of GDP because of abnormally high rates of capital growth for the periods 1962-1963 and 1972-1973. However, after smoothing out this erratic capital series, capital grows at an annual average rate of 4.069 between 1960 and 1982. The growth rate of labor is based on the growth of the employed labor as compiled in the *Philippine Statistical Yearbook* (NEDA).

In Table 3, the sources of growth of the Philippine economy for the 1960-1982 period are examined. It shows, in actual percentage points, the breakdown of the output growth rate among the factors which incorporate quality adjustments in the labor input. The proportion of the payments due to human capital embodied in the labor with respect to the total contribution of the labor input is estimated to be approximately 50 per cent.

In Table 4, the percentage contribution of each factor to the growth rate of output is derived from the figures generated in Table 3. Table 4 indicates that education has probably contributed approximately 17 per cent of the growth rate between 1960 and 1982, the main contribution of which is explained by the "maintenance" factor. The role of education in improving the quality of the Philippine labor force does not appear to be significantly substantial in the development process for the period 1960-1982. In fact, its contribution for the period is only 6 per cent. Furthermore, approximately 71 per cent of the growth rate is explained by the growth of capital and labor of constant quality; the contribution of capital is more

Table 2 — Growth of Output, Capital Stock and Labor Force, Philippines, 1960-1982

Year	GDP (In million Pesos at 1972 Prices) (1)	Capital (2)	Labor (In Thousands) (3)	Labor Share (Per cent) (4)
1960	30874	5297	8539	38.5
1961	32602	5814	9095	
1962	34163	5678	9603	
1963	36541	7853	9764	
1964	37810	8243	10572	
1965	39792	8712	10101	37.4
1966	41560	9287	10936	
1967	44093	9542	10867	
1968	46544	9350	10471	
1969	48779	9810	11235	
1970	51014	10670	11358	30.0
1971	53526	11176	12543	
1972	56075	11817	12582	
1973	60931	15742	13865	
1974	64139	15096	13824	
1975	68361	15879	14517	
1976	72962	16371	14238	
1977	77990	18561	14323	
1978	82797	19353	16668	
1979	88346	22601	16267	
1980	92706	22146	16749	
1981	96184	22211	17559	
1982	99031	21070	17653	
Average Annual Rate of Growth	5.45%	4.07%	3.48%	

Sources: Columns (1), (2) and (3): *Philippine Statistical Yearbook.* Manila: National Economic and Development Authority (1975-1983).

Column (4): Leonardo Sta. Romana III, *A Study of Property and Entrepreneurial Income in the Philippines, 1956-1972.* M.A. Thesis, University of the Philippines, 1975.

than twice that of labor which evidently confirms that the role of the improved labor quality due to education is less important during the period studied. On the contrary, the crucial role of physical capital accumulation in explaining Philippine economic growth in this period is supported by the evidence.

The contribution of each educational level can be analyzed by comparing the per capita growth of the educational capital embodied

Table 3 — Sources of Growth: Contribution to Yearly Growth Rate (Percentages)

	Average Labor Share	35.33
(1)	Growth Rate of GDP	5.45
(2)	Capital	2.63
(3)	Labor: Brute Force	0.615
	Maintenance	0.615
(4)	Improved Education	0.33
(5)	Residual	1.26

Sources:
- Row (1): From Table 2
- Row (2): From Table 2; capital growth multiplied by share of capital in national income
- Row (3): From Table 2; labor growth multiplied by share of labor in national income
- Row (4): Labor share multiplied by the growth rate of index of quality of labor
- Row (5): Row (1) — ((Row (2) + Row (3) + Row (4)).

Table 4 — Sources of Growth: Contribution of Each Factor to the Growth Rate (Percentages)

	Average Labor Share	35.33
(1)	Growth Rate of GDP	100.00
(2)	Capital	48.26
(3)	Labor: Brute Force	11.28
	Maintenance	11.28
(4)	Improved Education	6.06
(5)	Residual	23.12

Source: Table 3
Note: Figures represent the contribution of each factor as a percentage of the growth rate (5.45%).

in the labor force at each educational level with the internal rate of return corresponding to each educational level. Table 5 provides the evidence. It apparently does not fully explain the low contribution of increased education to growth because those educational levels — particularly high school and college education — that have shown higher internal rates of return have likewise experienced higher growth rates of educational capital per head. The ILO rate of return estimates, however, indicate that the investment in five to six years of elementary education shows a high rate of return. Though our estimates for educational capital per head need to be disaggregated further, the figure pertaining to the elementary level suggests that this particular investment option is not growing as fast as it should. Later on we will try to reconcile these results using sectoral data. It must be pointed out that the two sets of rate of return estimates shown in Table 6 have differed on the relative profitability of investment in secondary education, probably because the estimates of Williamson and DeVoretz have been claimed to be the result of an underestimate of public expenditure on secondary education. (See Williamson and DeVoretz, 1969; ILO, 1974). In any case, assuming that the Williamson-DeVoretz estimate of the high school rate of return has been overestimated, resource allocative considerations suggest that the appropriate investment strategy from the viewpoint of efficiency is towards physical capital formation. This is supported by the high opportunity cost of physical capital investment as represented by the net returns (net profit after tax as a percentage of net worth) to equity capital in manufacturing in practically all the years within the period examined in this study. Even if the private and social rates of returns are lower in the education sector relative to the opportunity cost in the outside sectors, such as manufacturing, Philippine schooling is still profitable to people who cannot afford high return but expensive investment options. In fact, schooling investment provides a relatively attractive yield relative to various assets within reach of average Filipino households.[3]

3. Sectoral Comparison

In Table 7, the educational distribution of the labor force between agriculture and manufacturing by years of school completed for 1961, 1965, and 1970 (manufacturing data are available only for 1961 and 1965) is shown. The 1970 data for agriculture are derived from the *1970 Census of Population and Housing* (NCSO),

[3] See Miao (1971). She argues that for the social classes which cannot afford to attend the expensive religious and public institutions, private investment in proprietary institutions yields higher returns to financial options within reach of these households.

Table 5 — Annual Rate of Growth of Educational Capital
(Percentages)

Schooling Level	Total (1956-65)	Agriculture (1961-65)	Manufacturing (1961-65)
	A. Growth of Educational Capital		
Elementary	3.34	1.21	−1.43
High School	10.52	−1.50	9.59
College	13.73	−9.24	22.03
Labor Growth Rate	1.39	0.48	−0.23
	B. Growth of Educational Capital Per Head		
Elementary	1.95	0.73	−1.66
High School	9.13	−1.98	9.36
College	12.34	−9.72	21.80

Sources: Annual rate of educational capital per head is the difference between the growth rates of educational capital and labor force, the latter of which are computed from May 1956, May 1961 and October 1965 BCSSH labor survey data.

Table 6 — Rates of Return to Educational and Physical Capital

	Rate of Return (percentages)
Williamson Estimates (1966)[1]	
Elementary over no schooling	8.0
High School over elementary	21.0
College over high school	11.0
ILO Estimates (1971)[2]	
Elementary 1-4 years over no schooling	5.0
Elementary 5-6 years over 1-4 elementary	6.5
High School 1-3 years over 5-6 elementary	4.0
High School 4 years over 5-6 elementary	6.0
College 1-3 years over 4 high school	5.0
College 4 years over 4 high school	7.5
College 5 or more years over 4 high school	7.8

Year	Net Returns to Equity Capital in Manufacturing (percentages)[3]		Return on Average Net Worth in the Banking Industry[4]	
1961	15.8		1973	14.0
1962	14.1		1974	14.0
1963	13.6		1975	15.0
1964	14.2		1976	13.7
1965	11.4		1977	13.8
1966	13.5	10.0	1978	14.6
1967	14.9	10.0	1979	14.3
1968	17.6	11.0	1980	13.5
1969	16.1	10.0	1981	11.7
1970	15.6	12.0	1982	17.0
1971	10.5	12.0		
1972		12.0		

Sources:

[1] Williamson and DeVoretz, *op. cit.*, Table 5.3.1, p. 162.

[2] ILO, *Sharing in Development, op. cit.*, Table 156, p. 635.

[3] *Ibid*, Table 138, p. 571.

[4] Cesar Saldaña, "The Philippine Commercial Banking System: Structure, Performance and the Impact of the Capital Buildup Program of 1972," Discussion Paper No. 84-1, College of Business Administration, University of the Philippines, February 1984.

1975); the rest of the years are taken from the BCSSH labor surveys in those years. With this brief explanation, let us turn to discuss the information provided by the latter table. The sectoral percentage distribution between 1961 and 1965, for instance, indicates that within the no-schooling category, those in agriculture declined by 1.9 percentage point which is approximately 10 per cent of its 1961 distribution while its counterpart in manufacturing dropped by 1.5 percentage points which is in turn approximately 20.5 per cent of its 1961 distribution. Clearly, the concentration of educated labor force is in the manufacturing sector. The rural-urban migration of educated labor might have contributed to the deteriorating skills of the agricultural labor force. This is partly supported by the slight decline of the size of the completed school year in agriculture between 1961 and 1965.

The lower part of Table 7 shows that the average annual percentage rate of growth of the index of labor quality is definitely much faster in manufacturing than in agriculture between 1961 and 1965, regardless of which earnings data are employed. As shown in Table 5, the sectoral growth of educational capital per head in agriculture indicates the negative growth of the educational levels (high school and college education) that have experienced higher rates of return. On the other hand, elementary education which has a lower rate of return experiences a faster growth of educational capital per head. This explains the low contribution of increased education to growth in agriculture. In contrast, the profitable high school and college investments have shown the highest growth of educational capital per head in manufacturing, an appropriate investment strategy that accounts for the faster growth of the labor quality index in manufacturing. However, education is a factor that is hardly considered as technologically neutral in the sense that more education tends to complement work requiring adaptation to change.

Table 7 — Sectoral Educational Distribution of the Labor Force (Males 10 years old and over in per cent)

	Agriculture			Manufacturing	
	1961	1965	1970	1961	1965
No schooling	18.9	17.0	17.82	7.3	5.8
Elementary 1-4	41.4	40.8	38.89	23.7	20.8
Elementary 5-7	29.1	31.6	30.47	27.2	28.6
High School 1-3	6.8	6.8	7.86	16.2	15.1

Table 7 (continued)

	Agriculture			Manufacturing	
	1961	1965	1970	1961	1965
High School 4	2.7	2.9	3.31	14.5	16.5
College 1-3	0.9	0.7	1.18	6.1	7.0
College 4 or more	0.3	0.4	0.5	4.9	6.1

	Annual Percentage Change of Labor Quality, 1961-65	
	Using Earnings 1	Using Earnings 2
Agriculture	0.18%	0.28%
Manufacturing	0.93%	0.87%

Source: Bureau of the Census and Statistics, *Survey of Households Bulletin Labor Force*, May 1961 and October 1965: *1970 Census of Population and Housing, National Summary*, Vol. II, National Census and Statistics Office, Manila, Philippines.

As new technological developments arise, persistent flexibility is needed in the modern sectors such as manufacturing. Thus, education is relevant to sectors having a higher rate of modernization and demanding adaptation to changing environment. Returns on investment in human capital are high because of the increasing economic value of human time (Schultz, 1972). The other implication is that in the absence of modernization in agriculture, farm workers have no incentive to invest in schooling unless they wish to migrate to urban centers.[4] It seems that in Philippine agriculture, the optimum level of schooling has not exceeded the elementary level and that the improvement of the economic value of education in this sector has a long way to go.

[4] For further elaboration the role of education in the agriculture and manufacturing sectors, see Patalinghug (1982).

APPENDIX

The Analytical Framework of Growth Accounting of Labor Quality

The particular specification of the contribution of education to sectoral growth adopted in the preceding analysis follows the Selowsky (1969) approach.[1] We begin by describing the aggregate production process:

$$(1) \quad Y = f(K, L_o, L_1, \ldots L_n)$$

where Y is aggregate output; K is the flow of services of the physical capital stock; and $L_0, L_1, \ldots, L_n$ are labor inputs with $0, 1, \ldots, n$ years of schooling, respectively.

Differentiating (1) with respect to time, we get:

$$(2) \quad \frac{dY}{dt} = \frac{dK}{dt} f_k + \frac{dL_o}{dt} fL_o + \frac{dL_1}{dt} fL_1 + \ldots + \frac{dL_n}{dt} fL_n$$

where fK is the marginal product of capital; and $fL_o, fL_1, \ldots fL_n$ are the marginal products of the members of the labor force with $0, 1, \ldots, n$ years of schooling, respectively. If we assume that wages reflect marginal productivities, we can rewrite (2) as:

$$(3) \quad \frac{dY}{dt} = \frac{dK}{dt} fK + \sum_i wi \frac{dLi}{dt}$$

where wi is the real wage of individual with i years of schooling. Define $L = \sum_i Li$, so that $\frac{dL}{dt} = \Sigma i \frac{dLi}{dt}$. Equation (3) then can be written as:

$$(4) \quad \frac{dY}{dt} = fK \frac{dK}{dt} + wo \frac{dL}{dt} + \sum_i (wi - wo) \frac{dLi}{dt}$$

where $fk \frac{dK}{dt}$ is the contribution of physical capital to growth; $wo \frac{dL}{dt}$ is the contribution of the uneducated (brute force) com-

[1] For further reference to the literature on the link between human capital and growth in national income, see e.g., Denison (1962), Griliches (1964), Schultz (1961), and Selowsky (1969).

ponent of the members of the labor force, and $\sum_i (wi\text{-}wo) \frac{dLi}{dt}$ is the contribution of education.

If we define $ai = Li/L$, then $\sum_i \frac{dai}{dt} = o$, and the contribution of education can be broken down into two components:

$$(5) \quad \sum_i (wi\text{-}wo) \frac{dLi}{dt} = \frac{dL}{dt} \sum_i (wi\text{-}wo)\, a_i + L \sum_i wi \frac{dai}{dt}$$

The first term on the right-hand side of equation (5) is the contribution to growth of changes in the relative distribution of workers by years of education; the second term is the contribution to output coming from the educational resources used in maintaining constant the relative distribution of the labor force by years of education. Selowsky (1969) calls the latter term as the "contribution of the maintenance component."

Equation (4) can also be written as:

$$(6) \quad \frac{dY}{dt} = fk \frac{dK}{dt} + [wo + \sum_i (wi\text{-}wo)\, ai] \frac{dL}{dt} + L \sum_i wi \frac{dai}{dt}$$

The average wage $\bar{w}$ is equal to $\sum_i wiai$. In order to have at the left-hand side the more familiar concept of the average annual rate of growth of output (g_Y), equation (6) can therefore be rewritten as:

$$(7) \quad \frac{1}{Y}\frac{dY}{dt} = \frac{1}{Y}\frac{dK}{dt} fk + \frac{1}{Y}\frac{dL}{dt} flo + \sum_i (fLi\text{-}fLo)\, ai \frac{dL}{dt} \frac{1}{Y} + \frac{1}{Y} L \Sigma_i fL_i \frac{dai}{dt}$$

or

$$(8) \quad g_Y = \alpha_k g_k + (\alpha_B + \alpha_E)\, g_L + \alpha_L g_q + R$$

where:

g_Y : the rate of growth of output

α_k : $\frac{fkK}{Y}$ the share of capital in total output

g_k : the rate of growth of capital

α_B : $wo\ L/Y$ the share of uneducated labor in total output

g_L : the rate of growth of the labor input

α_E : $(\bar{w}\text{-}wo)\ L/Y$ the share of educational inputs in total output

$\alpha_L = \alpha_B + \alpha_E$ = the share of labor in total output

$g_q = \sum_i (wi/\bar{w}) \frac{dai}{dt}$ the relative change in the index of the quality of the labor force

R = a residual or the contribution of other factors to the growth rate.

The total contribution of education to the growth rate is equal to $\alpha_E g_L + \alpha_L g_q$ (from Equation (8)) which is the sum of the contribution of the maintenance factor and the contribution of increases in the quality of the labor force due to education, respectively.

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