

PNH811877  
I S N 71465

THE EFFECT OF UNEMPLOYMENT  
AND GROWTH ON THE RATE OF RETURN  
TO EDUCATION:  
THE CASE OF COLOMBIA  
by  
Marcelo Selowsky  
Harvard University

Economic Development Report No. 116.

November 1968.

A.I.D. Contract # 1543

DEVELOPMENT ADVISORY SERVICE,  
and  
PROJECT FOR QUANTITATIVE RESEARCH  
IN ECONOMIC DEVELOPMENT,  
Center for International Affairs,  
Harvard University,  
Cambridge, Massachusetts.

## TABLE OF CONTENTS

	Page
I. Introduction	1
II. The Costs of Education in Colombia	6
A. The Cost of Primary Education in the Urban Area	8
B. The Cost of Secondary Education (bacillerato)	15
C. The Cost of University Education	17
III. The Benefits of Education	19
IV. The Estimation of the Internal Rate of Return to Education	25
A. Introduction	25
B. Different Concepts of the Internal Rate of Return	28
Version I	28
Version II	29
Version II	30
Version IV	32
Version V	38
V. Appendix A: The Urban Unemployment in Colombia: 1964	43
VI. Appendix B: The Production Function and the Demands for Labor	46
VII. The Internal Rate of Return through Time and the Problem of the Optimization of the Educational Expenditure	50
VIII. The Results	54
IX. Interpretation of the Results and Policy Recommendations	62
X. Policy Recommendations	
Statistical Appendix	71

## I. Introduction

The purpose of this study is to determine the economic rate of return of investing in different levels of the Colombian educational system.

The study departs from the traditional methodology of the internal rate of return by introducing macroeconomic relationships able to take explicitly into account the problem of unemployment and the effect of growth of both the economy and the educational sector. However our approach maintains the two key assumptions used in this kind of analysis:

First, observed wages reflect the marginal productivity of the labor input, namely, the wage rate represents a point on the demand curve for labor.

The assumption that wages reflect the marginal product of labor is often criticized, the reason being that many times the wage rate is determined exogenously through minimum wage legislation or through the effect of labor unions. However this is an

---

I am greatly in debt to Christopher Dougherty for his valuable suggestions and comments; to Dr. Gustavo Lopez for his collaboration on the empirical part; and to the Electronic Center of the Universidad Nacional of Colombia for the use of its computer.

Portions of this research were supported by the Development Advisory Service and the Project for Quantitative Research in Economic Development, Harvard University, through funds provided by the Agency for International Development under Contract CSD-1543. The views expressed in this paper do not, however, necessarily reflect the views of AID.

erroneous argument as long as firms have freedom in the hiring of the labor input since under this situation any wage fixed exogenously will represent a point on the demand for labor.

The main criticism to this assumption is the existence of market conditions which produce a divergence between the demand and the marginal product of labor (i.e., monopsonic markets); in this case the wage rate would be lower than the marginal product of labor.

Second, wage differentials according to level of schooling are only the effect of formal education and do not represent a payment to a higher innate talent and/or "home environment" that could be correlated with people of higher educational levels.

The traditional analysis of the internal rate of return implies a rather simple methodology and the relevant question is how sensitive could be the results to the introduction of more complex economic relations. The specific criticisms one could make to the traditional method are:

(1) The fact that the returns to education are evaluated at the marginal productivity of the employed labor force which could be different to the shadow wage or scarcity price of it. In other words, if labor markets are out of equilibrium, the marginal

product of labor does not necessarily reflect at the same time the relative abundance of each type of the labor input. This criticism is especially valid under cases of strong unemployment of the labor input.

(2) The actual internal rate of return is a function of the future relative wages of different categories of the labor force and, therefore, is not independent of today's investment decisions in education. Different policies of expansion of the educational system imply different relative supplies of each category in the future and, therefore, different relative wages. This implies the possibility of obtaining different (actual) rates of return as a function of different alternatives of today's expansion of the educational system.

(3) The analysis of the internal rate of return is not explicit in the determination of magnitudes of investment unless one carries out the analysis in a context of optimization. For this purpose we need, in addition to (2), to project the rates of return through time as a function of different alternatives of expansion of the educational system.

Our study attempts to take into account those criticisms in the following way:

1. Given the high urban unemployment of Colombia, we have analyzed explicitly how unemployment can affect the profitability of investing in different educational levels. For this purpose, we have introduced the problem of unemployment in two alternative ways:

1.a) The age-earning profiles according to levels of schooling were adjusted by probable distributions of unemployment by age and education. This implicitly assumes that, at the market wage, the probability of unemployment of a new member of the labor force is equal to the average unemployment of members of the labor force with the same characteristics.

1.b) The internal rate of return has been evaluated at the shadow wage or scarcity price of each type of the labor input. For this purpose we have used a production function which allows for different substitution among the labor input and between labor and capital.

2. Using the same type of production function, in addition to projections of growth of the Colombian economy, we have determined the behavior of relative wages in the future: this has been done under different alternatives of growth of each category of the labor force which implies different expansions and investment policies in the educational sector.

With the future relative wages accordingly determined we have estimated the internal rate of return of investing today in different schooling levels. This means that the rates obtained are a function of the different expansion alternatives of the educational system itself.

3. Given the future relative wages determined according to the method just mentioned, we have determined the behavior of the rate of return through time. The purpose is to have an idea of the magnitude of the decreasing returns to invest in education and its sensitivity to alternative projections of the educational system. This exercise is useful for analyzing the problem of optimization of the educational expenditure and different ways of approaching this problem from an operational point of view are suggested.

For the purpose of estimating the rate of return to education in Colombia we have analyzed only the urban sector. The reason is on one hand empirical and on the other conceptual: the lack of data --and the difficult interpretation of it in the case of being available--on wages by schooling in the agriculture sector is the main empirical reason for not having considered this sector. On the other hand, given the low quality of the educational inputs

used in this sector (teachers, educational equipment, etc.), we believe that the cost data of the agricultural sector is not relevant for a future policy of investment in education.

## II. The Costs of Education in Colombia

The total cost of educating an individual has two components: income foregone or the earnings that the student foregoes while attending school and the direct cost which includes payments to teachers, schooling materials and depreciation and interests of the educational equipment. The first component will be discussed in the next section because it simply comes from the same age earning profiles used for the analysis of the benefits. In this section we will discuss the estimation of the second component, or direct costs.

The analysis of the direct costs depends mainly on the purpose we are interested in. If our purpose is to analyze the profitability of investing today in different educational levels-- or the actual rate of return--we can use actual data on costs. If we are interested in the profitability of investing in future dates this data has to be corrected by the probable changes in the relative prices of the educational inputs and by the change in the proportion in which these inputs are utilized. For the moment

we shall study the first case or the actual costs of schooling in Colombia.

The value of these direct costs can be obtained in two different ways depending on whether we analyze the public or private schools. Public education in Colombia is almost completely free so its cost can be estimated through the federal and the departmental current expenditures. Given that almost all the public schools own their buildings, an additional component has to be added for depreciation and opportunity cost of the educational equipment.

If the private schooling industry is in equilibrium--in the sense that its return to capital is equal to the opportunity cost of it--the tuition charged should be equal, for a given quality of schooling, to the costs of the public schools.

Given the importance of private education in Colombia and the impossibility of obtaining data on its costs, part of our analysis will be to analyze the difference between the costs of the public schools and the revenue of the private schools. If the last one is bigger, a problem to study is to what extent this difference can be explained by differences in quality and to what extent is only a rent to private entrepreneurs. If the difference is only a rent, the cost data we shall use will be the one

of the public sector because this data, and not the revenue of the private schools, represent the opportunity costs of the resources utilized in the educational sector.

A) The cost of primary education in the urban area

For the purpose of estimating the costs of the public sector we have divided them into two components: payments to teachers and depreciation and interests of the educational equipment.

The first component was estimated through the distribution of teachers by departments and by categories: Knowing the same distribution for salaries it is possible to estimate the total expenditure in teachers. This was done for the years 1964 to 1966 and the results are presented in tables I-A, II-A and III-A of the Statistical Appendix.

Given the lack of information on the value of the educational equipment it was impossible to make a direct estimate of the depreciation and opportunity costs of it. As an alternative we used the following method: given that some of the public schools do not own their buildings and therefore pay rent (whose value is an index of the depreciation and opportunity costs of the invested capital) we have attempted to estimate this value per a unit of measurement that later on can be utilized for the entire public school system.

For this purpose we used a sample for 1967 of 185 public primary schools of Bogota which pay rent and we expressed this rent per classroom. In pesos of 1966 the annual rent per classroom was equal to \$2546.<sup>1/</sup> For the other departments we assumed the following percentages of this value:

Antioquia, Atlantico, Caldas, Santander, Valle del Cauca	75%	\$1909.
Rest of the departments	50%	\$1273.

Given the distribution of the (urban) public schools equipment by number of classrooms and by departments we estimated in Table IV-A the implicit annual rent of this equipment.

Table V-A summarizes the information on costs and expresses it in terms of student-year. It is important to notice that the total annual cost has been divided by what we call "average attendance" or the average between initial enrollment and students' attendance at final examinations.

For the private sector, which in the urban area represents 27% of total enrollment in 1964, it was impossible to obtain any data on their operation costs. As an alternative we tried to estimate the average tuition of the private schools through the

---

<sup>1/</sup> From now on \$ will represent Colombian pesos.

1967 schooling census of Bogota.<sup>1/</sup> This census covered 829 private schools and 94,671 students, and the average yearly tuition obtained from it was equal to \$737 in pesos of 1966. With this information we have the following figures for the private and public primary schools in pesos of 1966.

Cost per student year, public sector	\$457
Annual tuition, private sector	\$737

The relevant question is to what extent this difference reflects a better quality of private education and to what extent it represents a rent reflecting the disequilibrium in this economic activity.

Through Table V-A we can conclude that the main costs of primary education are expenditures on teachers and therefore should be the main explanation of possible differences between the costs of the private and public sector.

Given the lack of information on teachers' salaries in the private sector (however, informal talks I had in Bogota made me believe they are not significantly different to the public sector ones) we attempted to look for probable differences in the quality of teachers in both sectors. Table VI-A presents the

---

<sup>1/</sup> Censo de Colegios Privados: Oficina de Estadística del Distrito Especial de Bogota.

educational distribution of (urban) primary teachers and from it we do not observe any significant difference between both sectors. The main difference is the importance of normalist teachers in public schools and of teachers with bachillerato and university education in the private ones, the last one consequence of the high percentage of religious teachers in the private schools.

The other possible source of difference could be the existence of different student-teacher ratios in private and public schools. According to data from DANE we have the following figures on student-teacher ratios<sup>1/</sup>:

<u>Year</u>	<u>Public Schools</u>	<u>Private Schools</u>
1960	43	23
1961	43	22
1962	42	23
1963	42	23
1964	40	22

Part of the difference in the student-teacher ratio can be explained by the fact that while in the public schools only one

---

<sup>1/</sup> DANE: Departamento Administrativo Nacional de Estadística de Colombia.

teacher is in charge of a group of students, in the private schools teachers are hired by specific courses and generally under part-time basis. This has the effect of understating the student-teacher ratio in the private schools due to the fact that the number of teachers is not adjusted by hours worked. However, we believe that this adjustment is not big enough to equalize the student-teacher ratio in both sectors and for our purposes we will assume that the effective figure for the private sector is equal to 30 students per teacher.

Assuming that wages of teachers of similar schooling are equal in both types of schools and their educational distribution is roughly the same, we can estimate the cost per student year in the private sector through the cost figures of the public schools.

Using a ratio equal to 40 students per teacher for the public schools we arrive at the following figure for the private sector in 1966<sup>1/</sup>:

$$\$596 = \left(\frac{4}{3}\right) + \$39$$

These figures help us understand the probable relationship between the private and public primary (urban) education in Colombia. This is shown in Graph 1.

---

<sup>1/</sup> See again Table V-A.

GRAPH 1

URBAN PRIMARY SCHOOLS

PUBLIC SCHOOLS

PRIVATE SCHOOLS

Cost Per Student-Year

Cost Per Student-Year

$(\frac{S}{T} = 40) 457$

$(\frac{S}{T} = 30) 596$

= Average Tuition

0

A<sub>2</sub> A<sub>1</sub>

B<sub>2</sub> (T<sub>0</sub> = 0)

Average Attendance

Average Attendance

$\frac{S}{T}$  = student-teacher ratio

$D_1A_1$  represents the demand for enrollment in the public schools of those families who consider public and private schools as roughly perfect substitutes: Given that the supply of enrollments is  $OA_2$  and that primary education is free we obtain an excess demand equal to  $A_2A_1$ . To my knowledge the number of applicants that are rejected in the urban public primary schools are relatively low which is reflected in the low value of  $A_2A_1$  in relation to the total demand  $OA_1$ .

Given the relatively small value of  $A_2A_1$  we will assume that, independent of the rationing scheme used in the public sector, this excess demand doesn't affect the private schools market. Private schools face a relatively independent demand for enrollments that results even in the case that public schools do not charge any tuition ( $T_0 = 0$ ).

$D_2D_2$  is generated by those families who consider private schools as of better quality in addition to identify them with higher social prestige. This last phenomena is a result of private schools being able to discriminate between the demands of different income groups therefore homogenizing students according to the family income they come from.

The annual tuition charged by private schools (\$737) is higher than their estimated cost, therefore we could conclude that this

tuition is determined only by demand conditions generating a quasi-rent equal to \$141 (in pesos of 1966) per student-year. According to these figures, this economic activity would have a rate of profit, over the opportunity cost of capital, <sup>1/</sup> of roughly 23.6%, which represents a rent for private entrepreneurs and a transfer to the Church in the case of schools administrated by religious institutions. This could be the explanation of the big expansion of this activity in the last years; from 1955 to 1963 the number of students in private schools (urban and rural) increased by 69.3% and almost at the same rate than total primary education (69.5%).

The problem is to decide which of those figures of cost is the relevant one for our calculations of the internal rate of return to primary education. The first value to be rejected is \$737 because part of it is a quasi-rent to private entrepreneurs in the private schools, reflecting the disequilibrium in this activity. We have also rejected the cost of the public schools because we consider as inefficient, from an educational point of view, a student-teacher ratio ( $\frac{S}{T}$ ) equal to 40. For the purpose of our study we have used the cost of the private schools (\$596)

---

<sup>1/</sup> It is useful to remember that the opportunity cost of the educational equipment is included in the annual rent and therefore is also included in the cost of the private schools.

because we believe that their student-teacher ratio is more appropriate from the point of view of educational quality.

In addition to the expenditures in teachers and rent, we have to include the costs of schooling materials which are usually financed by the student itself. Table VII-A summarizes this information for private and public schools: We have used the average of both figures for the purpose of our estimations.

The direct costs to be used, classified according to the year of schooling within primary education, are the following:

<u>Direct Cost Per Student Year: 1966</u>	
1st year	\$696
2nd year	\$721
3rd year	\$780
4th year	\$789
5th year	\$793

B) The cost of secondary education (bachillerato)

Given that practically all secondary education is located in the urban areas we will work, for the purpose of estimating the costs, with the total number of secondary schools.

Table VIII-A summarizes the total operation costs, federal and departmental, of the public secondary schools. For 1966 the cost per student-year was \$1232. For the private schools this same information is summarized for 1963 in Table IX-A: The cost per student-year was equal to \$1167 and equal to \$1716 in pesos of 1966.

To explain this difference in cost it is again useful to analyze the probable sources of it: different quality of teachers and different student-teacher ratios in both types of schools. Table X-A shows that the number of students per teacher is approximately the same in both types of schools and therefore cannot be an explanation of the differences in costs. Table XI-A summarizes, for both types of schools, the distribution of teachers according to their educational level and again we do not observe obvious differences in this measure of quality.

For the purpose of our estimations we shall use the private schools figure (\$1716) having in mind that its use gives us an upper limit of the direct costs of secondary schooling.<sup>1/</sup> As we shall see later, this potential overstatement will not be significant when including the remaining costs of secondary education.

---

<sup>1/</sup> It is useful to recall that the value of \$1232 obtained for the public schools does not include, due to lack of information, the implicit rent of the educational equipment: this means that this figure is probably an understatement of the costs per student-year.

To the above figure we have to add the expenditure per student-year due to schooling materials and whose data is shown in Table XII-A. With this information we obtain the total direct cost per student-year classified by year of schooling within bachillerato:

<u>Direct Costs Per Student Year: 1966</u>	
First Year	\$1948
Second Year	\$1966
Third Year	\$1994
Fourth Year	\$2022
Fifth Year	\$2068
Sixth Year	\$2105

C) The costs of university education

For the purpose of estimating the costs of university education we used the reports on operation costs of the universities of the public sector which, in 1966, represented 59% of the total university enrollment.

Given that university education, as a difference with primary and secondary schooling, consists of different careers with different costs and different wages, it would have been useful to

have done this analysis by types of careers. Unfortunately, as we will see later, our wage data was not classified by university professions; therefore we were forced to study the university sector from an aggregate point of view.

Table XVIII-A summarizes, by universities, the expenditures of the public sector: the cost per enrolled student was for 1966 equal to \$11,858. However, as we saw in the earlier sections, a more relevant figure is expenditure per average attendance which takes into account the desertion at the beginning of the school year. We do not have direct data on average attendance at the university level, but certain orders of magnitude can be obtained through the retention data.<sup>1/</sup>

Table XIV-A shows the rates of retention at the National University: the average rate per grade was 82.8% which is equivalent to a rate of desertion equal to 17.2%. Given that this figure includes the desertion during the academic year plus the desertion at the end of the year (after having completed the respective schooling year) and given that for the purpose of estimating the average attendance we are interested only in the former, we can conclude that the difference between enrollment

---

<sup>1/</sup> Retention rate at certain schooling level is defined as the number of students that continue to the next grade over the enrollment of the previous one.

and average attendance has to be less than 17.2%. For the purpose of our study we will assume a value of 10%.

Using the above figure, the cost per average attendance increases to \$13,175 per student-year. To this cost we have to add the cost of schooling materials which were assumed, due to lack of information, equal to the one of the last year of secondary schooling (\$389). The total cost per student-year at the university level in 1966 comes therefore to \$13,564.

### III. The Benefits of Education

In addition to the effects of education on the productivity of individuals, there are several other benefits that should be taken into account.

There is no doubt that part of the educational process is simply a consumption of individuals, namely, the student obtains an enjoyment in the studying process, enjoyment comparable to the consumption of economic goods. If we accept this fact, we face the dilemma of considering part of the costs of education as payments to this consumption and not as part of the investment cost whose purpose is to increase the productivity of individuals in the future. This consumption component should be equal to the amount that an individual would be willing to pay for education

even knowing that this education will not benefit him in the future from either the economic nor social point of view.

Given that we do not have any method for estimating this component, which should be subtracted from the total expenditures in order to obtain the net cost of education as an investment, we are forced to use the total cost as an approximation of the investment cost. This procedure has the effect of underestimating the internal rate of return to education, a kind of bias we have to have in mind when interpreting the final results.

The effects of education in the future (the effects after the schooling process) or the relevants for estimating the benefits of education as an investment can be classified conceptually in economic and non-economic ones: the economic ones refer mainly to the effect of education on individuals as productive agents of the economy, i.e., the effect on their economic productivity. The non-economic ones refer to the effects that education can have on the distribution of income<sup>1/</sup>, social mobility, political participation, etc.

The purpose of our approach is to estimate the economic returns to education and therefore it will include only the effect

---

<sup>1/</sup> Somebody could argue that there are alternative methods of distributing income: however for the case of Colombia we believe that other mechanisms of distribution are politically and institutionally less feasible.

on the economic productivity of individuals. If we accept that education has also the non-economic effects just mentioned, our results will again underestimate the returns of education in its broader sense.

The economic benefits associated with certain schooling level will be measured through the wage differential between individuals with and without that educational level. Given that we are only interested in the effect of education on the productivity of the labor input, we have to eliminate any component that could represent payments to the capital owned by individuals. For this purpose we have excluded from the analysis all individuals whose income is mainly retribution to capital. Accordingly we have used data on earnings of workers and self-employed workers of Bogota which were provided by the unemployment samples of the Centro de Estudios sobre Desarrollo Economico of the Universidad de los Andes (CEDE). In order to eliminate the effect of unemployment on the earnings data, we decided to express the wage by the minimum period of time possible: the unit chosen was wage per hour. A first rough test of the effect of schooling on wages is presented for 1963-66 in Tables XV-A to XVIII-A where the earnings data appear also classified by economic activity. It is possible to observe that not only at the aggregate level but also at the activity level there is a clear positive relation between schooling and wages, even under a very fine classification





of schooling. This is exceptionally true for the grades which represent a completion of certain schooling level, i.e., 5th Primary, 6th Bachillerato and 5th-6th of University.

A more relevant relationship for the purpose of our analysis of the internal rate of return is the one between schooling and age, which is summarized for the years 1963 to 1966 in Tables XIX-A and XX-A. Looking at the average wages by schooling, it is possible to conclude that the wage differences between males and females diminishes when the level of schooling increases: At the lower levels the male wage is approximately double the one of males-females, 15% higher at the completion of primary and bachillerato and approximately the same at the completion of university. The above information is also presented in Graphs 2 and 3, and one can observe the same phenomenon that is found in similar studies for other countries: For a large part of the lifetime of individuals earnings are closely correlated to age and even more interesting, this correlation is stronger the higher the level of schooling. If we identify age with experience this would mean that experience is a complement of formal education, namely, the higher would be the effect of experience, the higher the level of education.

In order to make comparable costs and benefits, we need to express the hourly wage in terms of income per year. Given that we are interested in the annual income of a fully employed member of the labor force the relevant question is: how many annual hours of work are offered by an individual-of certain age and

schooling—who is not interested in working additional hours at the existing wage rate? In other words, how many annual hours are considered as full employment for an individual of given characteristics?

Table XXI-A shows the number of weekly hours of work of those individuals who were working during the week in which the CEDE sample was taken: obviously as long as there is unemployment by daily hours or by days per week, these figures will not be a good index of full employment by hours per week. However, the high values found lead us to believe that this fractional unemployment is not very important and that the hours per week found are a good index of the full employment hours.

One of the interesting conclusions from Table XXI-A is that the hours worked diminish with increased schooling especially in the case of women: the high number of hours worked when including women in the groups of low schooling can be the effect of including domestic services (maids) which represent approximately 25% of the female employment of Bogota.

For the purpose of our study we shall use the following figures on weekly hours worked by educational level:

Males

Illiterates and individuals with years of primary education	50
Individuals with years of Bachillerato	48
Individuals with years of university education	45

Males and Females

Illiterates and individuals with less than 5 years of primary education	54
Individuals with 5 years of primary	50
Individuals with years of Bachillerato	48
Individuals with years of university education	45

Our next step is to adjust the age earning profiles by the expected participation in the labor force. The need for adjusting for the expected participation in the labor force comes from the fact that the cross section earnings are based on the labor force's profiles while the rate of return we are interested in is an index of the profitability of educating individuals, not all of whom will be permanent members of the labor force in the future.

In other words, we have to take into account the possibility that an individual, in whom the community is investing educational resources, will not become a member of the labor force.

If we are interested in the effect of education on measurable output, we need to adjust the cross section wages by the probability that the typical student will become in the future a participant of the labor force<sup>1/</sup>. For this purpose Table XXII-A summarizes the participation of the population not at school in the total labor force.

#### IV. The Estimation of the Internal Rate of Return to Education

##### A. Introduction

The purpose of estimating an internal rate of return to education is to treat this investment in a comparable form to any investment project. This allows to compare the profitability of investing in different economic sectors, the educational sector being one of them.

The internal rate of return is defined as the discount rate which equalizes the costs and benefits of an investment project. In our specific case we need first to define our project in order to define afterwards the relevant costs and benefits: the definition of the educational project itself will depend on the

---

<sup>1/</sup> If a potential member of the active population decides not to become a part of the labor force after going through school, it will mean that the non-economic product (and/or the product not generated in the labor market) of his education is valued by him in an amount at least equal to the one determined by the market.

different kinds of decisions we are interested in. These decisions could be, for example:

1. How much to invest in primary, secondary, and university education.
2. How much to invest in a specific grade within each educational level.

The first decision is generally interested in the returns of completing a higher educational level, i.e., the rate of return of completing bachillerato after an individual has completed primary schooling. In this case the costs of the project are:

- a) the annual direct costs of bachillerato while the individual is studying at that level.
- b) the income the individual foregoes while he attends bachillerato.

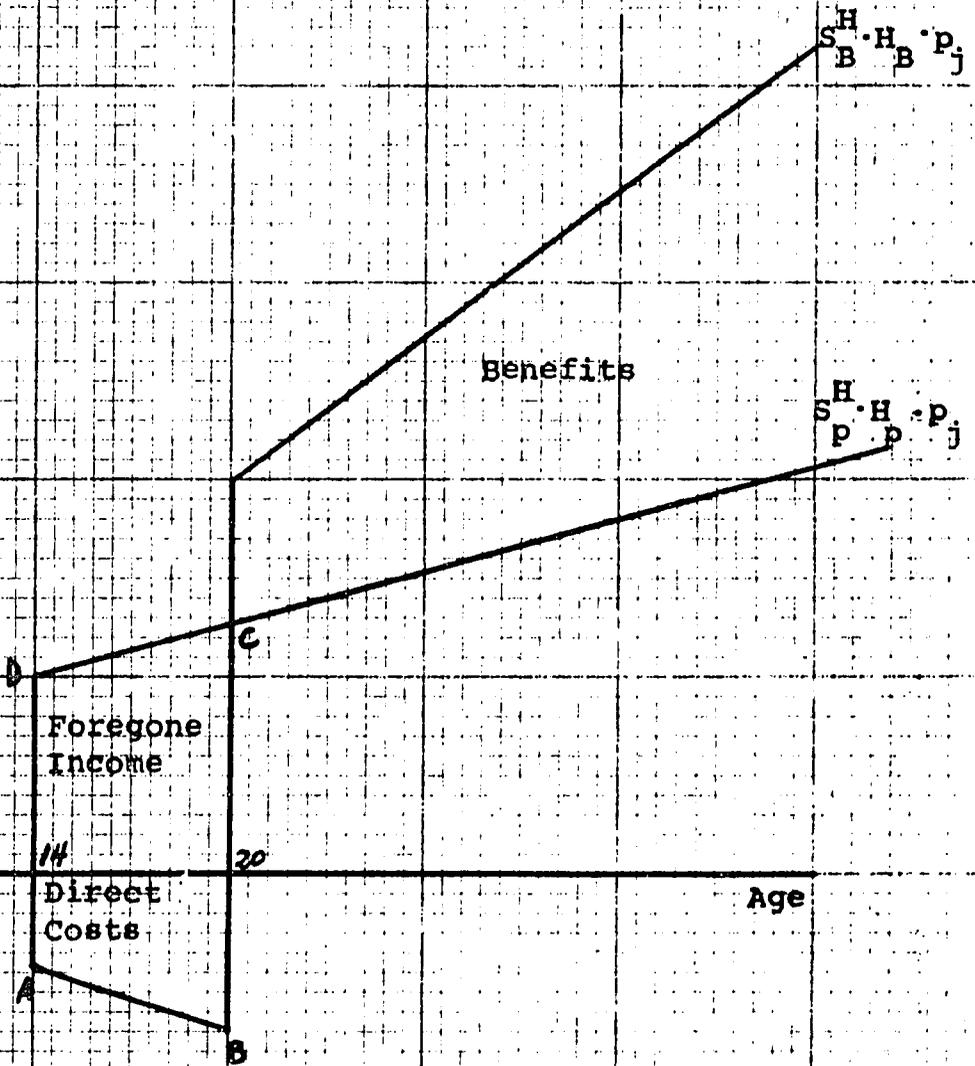
The benefit of this project would be the lifetime increase in earnings of the individual after he completes bachillerato.

Graph 4 presents diagrammatically this specific project: we assume that an individual completes primary education at 13 years of age therefore the next year he has the choice of entering the labor force or continuing to bachillerato entering the labor force at 20 years of age. During the six years of bachillerato

-26a-

GRAPH 4

Yearly  
Earnings



$S_P^H$  and  $S_B^H$  = Hourly wage of individuals with primary and  
 bachillerato education respectively.  
 $H_P$  and  $H_B$  = Annual hours of full employment of individuals  
 with primary and bachillerato education.  
 $P_j$  = Rate of participation in the labor force of  
 individuals of age j.

he and society incur a cost equal to ABCD; after 20 years of age the benefits are the integral of the wage differential he obtains. The internal rate of return of this project is the discount rate which equalizes costs and benefits. In a more general way we can define:

$$s_{ij} = S_{ij}^H H_i P_j$$

Average annual earnings of an individual with schooling level  $i$  and age equal to  $j$ .

and where:  $S_{ij}^H =$

hourly wage of individuals of schooling  $i$  and age  $j$

$$H_i =$$

yearly hours of full employment of individuals of schooling  $i$

$$P_j =$$

participation rate of individuals of age  $j$

$$d_{ij} = s_{ij} - s_{i-1,j}$$

difference in annual earnings between an individual of schooling  $i$  and another one with schooling  $i-1$ , both with the same age  $j$ .

$$C_{i,j-J+1} =$$

direct costs at the  $(j-J+1)$ <sup>th</sup> grade in schooling level  $i$ ;  $J$  is the age at which the individual starts schooling level  $i$

therefore:

$$\sum_{j=J}^{\infty} d_{ij} (1+r)^{J-j} - \sum_{j=J}^{\infty} c_{i,j-J+1} (1+r)^{J-j} = 0$$

where  $r$  is the internal rate of return of an increase in schooling from  $i-1$  to  $i$ . It is important to notice that the costs due to foregone income are included in the first term of the above equation, since during the school period  $d_{ij}$  is negative and equal to  $s_{i-1,j}$ . The values of  $H_i$  and  $p_j$  used were the ones analyzed in the earlier section. Using the midpoints of the age groups, the values of  $S_{ij}$  were derived by linear interpolation of the earnings data.

#### B. Different concepts of the internal rate of return

It is important to emphasize the possibility of deriving different internal rates of return, each one relevant for answering a different question. We shall define five successive rates of return, each one of them estimated under different circumstances:

Version 1: This version is equal to the one defined in the earlier section except by the fact that the age earning profiles are not adjusted by the participation rates in the labor force: in other words  $s_{ij} = S_{ij}^H H_i$ .

Obviously this rate of return is higher than the one that includes the adjustment for participation and its use could be relevant in answering the following questions:

1. What is the economic rate of return of educating an individual who has certainty of becoming a member of the labor force?

2. In the case of estimating the rate of return of educating women this definition would imply that the effect of education on women as housewives has the same value than the wage differential they would have perceived as members of the labor force: in other words, it would be an attempt to quantify the effects of education which are not reflected on measurable output.

Version 2: It is equal to the definition given in the introduction, namely,  $s_{ij} = S_{ij} H_i P_j$ .

In this case  $r$  is the internal rate of return of educating a typical student who has a probability  $p_j$  of becoming a member of the labor force at age  $j$ . Implicitly this definition is interested in the effect of education on measurable output since no value is given to the possible effect that education could have, for example, on housewives.

Even more important, Versions 1 and 2 are "full employment versions" since they multiply the hourly wage by the annual hours of full employment. Both rates of return assume that the typical student, after finishing school, will be fully employed during his lifetime. Given that both versions use market wages, the rates of return obtained would show the profitability of educating individuals under the assumption that at those wages they will be always fully employed.

Version 3: As we just mentioned, Versions 1 and 2 assume that the individual, when entering the labor force and at the existing market wage, will be always fully employed with H hours of work per year.

However, the evidence suggests that at market wages there is a substantial unemployment in the urban areas being itself strongly correlated with education and age. This unemployment biases the earlier estimates of the rate of return, since they do not take into account that a fraction of the labor force works less than the full employment hours.

To take into account this effect, we derived from the 1964 population census the percentage of unemployment of the labor force for the cities of Medellin, Barranquilla, Cartagena, Manizales, Bogota, Bucaramanga, and Cali which represented 42% of the urban labor force<sup>1/</sup>. This data was classified by sex, age, and educational level and is presented and explained in detail in Appendix A.

The unemployment rates obtained were 19.3% for men and 21.4% for women. These figures are substantially higher than the unemployment figures obtained for Bogota through the samples of CEDE and support the hypothesis that the rate of unemployment is higher in other urban areas.

---

<sup>1/</sup>We have defined as the urban labor force the labor force of sectors 20 to 91, namely, excluding agriculture and mining.

The data show a clear relation between unemployment and level of schooling and between unemployment and age, and some of these relationships are presented in Graph 5.

The fact that unemployment is concentrated in the low age groups is of big importance for the internal rate of return analysis because this rate is more sensitive to the earlier flows of the educational project, namely, to the earnings of those groups.

Version 3 takes into account unemployment in the sense that it shows the rate of return of educating an individual who, as a member of the labor force and given the market wage, has a probability of employment equal to  $E_{ij}$  where  $i$  indicates the educational level and  $j$  the age group. The value of  $E_{ij}$  is simply one minus the rate of unemployment of that group  $ij$  and was obtained through the census date mentioned earlier. This procedure implies the following assumptions:

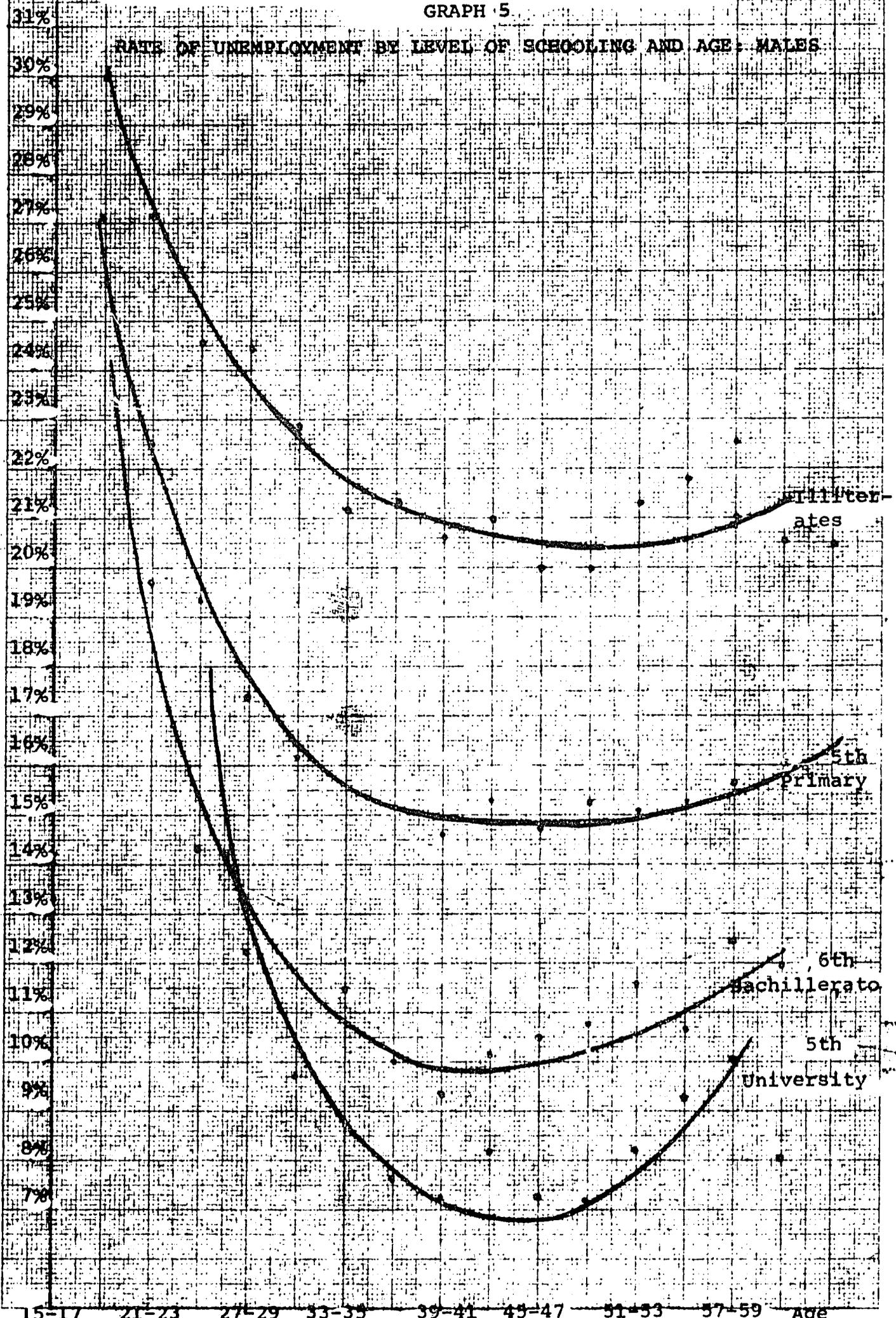
1. The probability of unemployment of a new member of the labor force with characteristics  $ij$  is equal to the average unemployment of that group of the labor force.
2. To use the 1964 data on unemployment in order to project the future probabilities of unemployment of the actual students assumes that the amount and composition of unemployment will not

---

<sup>1</sup>/ CEDE: Empleo y Desempleo en Colombia, 1968.

GRAPH 5

RATE OF UNEMPLOYMENT BY LEVEL OF SCHOOLING AND AGE: MALES



change through time<sup>2/</sup>.

Under this version the value of  $s_{ij}$  relevant for the construction of the age earning profiles is equal to

$$s_{ij} = S_{ij}^H H_i P_j E_{ij}$$

Version 4: The purpose of this section is to evaluate the rate of return to education at the wages that would have been determined under full employment of every category of the labor input (shadow or scarcity wages).

To construct the age earnings profiles we have used the wages that would have existed in the period 1963-66 under full employment of the labor force. Likewise, the cost of education due to teachers expenditure were calculated at shadow wages of teachers.

What is the purpose of Version 4? Does it provide us with answers which we are unable to obtain from Version 3?

Version 3 estimates rates of return using market wages and the probability that at those wages the individual could become unemployed. In other words it uses the marginal productivity of people presently employed independently if this productivity reflects at the same time the relative abundance of each type of the labor input.

---

<sup>2/</sup> We do not believe that this assumption has a significant bias on the rate of return of investing today in education. The reason is that the rate of return is more sensitive to the near future data on earnings and we do not think that in the near future the unemployment figures will change significantly.

Version 4 estimates the rate of return at shadow or full employment wages and its comparison with Version 3 would show to what extent the distortions in the labor markets affect the relative returns of investing in different levels of schooling.

The equilibrium wages we will determine for the purpose of this analysis are function of the existing demands for labor in the Colombian economy and therefore are function of the volume of effective demand, the amount of foreign exchange generated, etc.<sup>1/</sup> If the volume of effective demand is not "appropriate" or there are distortions in the external sector, the present demands for labor are not the relevant ones for the estimation of shadow wages.

In order to incorporate the effect of all those "distortions" on the demands for different types of labor we need a general equilibrium model of rather high complexity. To avoid this problem we have decided to define as shadow wages the equilibrium wages determined under the actual conditions of demand in the economy.

Given that we want to overstate the difference between the market wage and the "pure shadow" wage--in order to see how much difference does it make to the relative returns to invest in education--our procedure helps us in the "right direction". The reason is that under a higher volume of effective demand and

---

<sup>1/</sup> I wish to thank Lester Taylor for comments on this section.

foreign exchange the equilibrium wages should be higher than our estimates.

The fact that we observe, at existing conditions of demand, a substantial unemployment would mean that there is a mechanism in the labor market that is preventing the market wage from going down to its equilibrium level. This could be the effect of minimum wage legislation and the legislation on the terms under which work contracts can be canceled: It seems that the costs of canceling employment are equivalent, for a typical worker, to approximately six months of salary<sup>1/</sup>.

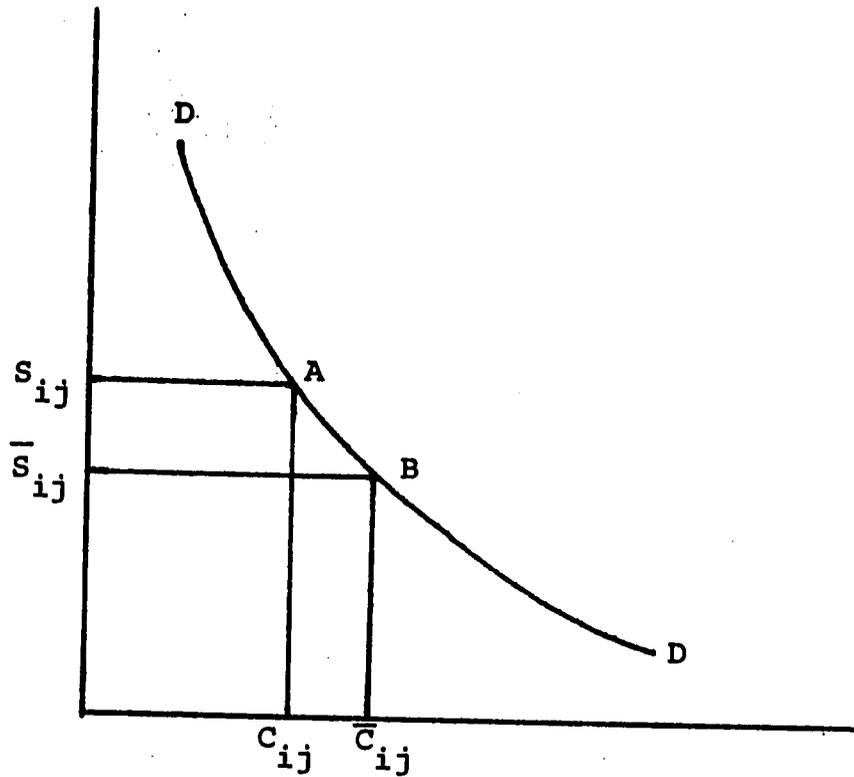
On the other hand, part of the urban unemployment could be explained by the dual character of the manufacturing sector: one craft sector of small firms and with low value added per worker and a modern sector of big firms and high value added per worker. For a given digit industry the latter one seems to have wages 1 1/2 to 2 times the wages of the former<sup>2/</sup>. The explanation could be that the labor unions in the modern sector have prevented an expansion of employment in that sector.

To estimate the shadow wage of any type of the labor input, we need information on its degree of unemployment and the form of its demand curve. This is shown in Graph 6.

---

<sup>1/</sup> Robert Slighton, *ibid.*, p. 60.

<sup>2/</sup> Richard Nelson, "A Study of Industrialization in Colombia: Part 1, Analysis," Memorandum TM-5412-AID, The Rand Corporation, 1967.



GRAPH 6.

$C_{ij}$  are members of the labor force with schooling  $i$  and age  $j$ ,  $S_{ij}$  is their hourly wage, and  $DD$  their marginal productivity or demand function. Given the existing wage and employment, we want to estimate  $\bar{S}_{ij}$  or the hourly wage corresponding to a full employment value equal to  $\bar{C}_{ij}$ . For this purpose we need to know the volume of unemployment  $\bar{C}_{ij} - C_{ij}$ , and the elasticity of demand between  $A$  and  $B$ : This elasticity depends on the particular production function we want to assume and for the purpose of this analysis we have constructed Appendix B.

For the purpose of the above calculations we classified the labor force in 15 categories,  $C_{ij}$ , where  $i$  and  $j$  go from 1 to 4 in the following way.

	<u>Level of Schooling</u>
$i = 1$	Illiterates and individuals with 1 year of primary school
$i = 2$	Individuals with 2 to 5 years of primary school
$i = 3$	Individuals with 1 to 6 years of bachillerato or secondary education
$i = 4$	Individuals with 1 to 6 years of university education

	<u>Age Groups</u>
$j = 1$	15 - 19 years of age
$j = 2$	20 - 24 years of age
$j = 3$	25 - 29 years of age
$j = 4$	30 - 59 years of age

The criteria used for the above classification was the amount of unemployment of each category. The following Table shows the hourly wage for the period 1963-1966 and the rate of unemployment in 1964 for each one of these categories<sup>1/</sup>.

---

<sup>1/</sup>category  $C_{41}$  was not included, since the number of individuals with university education and age 15-19 was negligible.

Table 1

<u>Category</u>	<u>Hourly Wage (in pesos of 1966)</u>	<u>Rate of Unemployment (1964 census, seven cities)</u>
C <sub>11</sub>	0.16	28%
C <sub>12</sub>	0.70	26%
C <sub>13</sub>	0.91	24%
C <sub>14</sub>	2.13	21%
C <sub>21</sub>	1.21	26%
C <sub>22</sub>	2.30	23%
C <sub>23</sub>	2.61	19%
C <sub>24</sub>	4.68	16%
C <sub>31</sub>	4.00	26%
C <sub>32</sub>	5.09	20%
C <sub>33</sub>	6.67	14%
C <sub>34</sub>	13.82	11%
C <sub>42</sub>	12.16	14%
C <sub>43</sub>	18.05	11%
C <sub>44</sub>	36.79	8%

The values of  $C_{ij}$  were obtained by multiplying labor's educational distribution in sectors 20-91 (obtained through an educational matrix provided to us by the Departamento Administrativo de Estadística, DANE)<sup>1/</sup> by the age distribution of the same educational groups

---

<sup>1/</sup> This matrix was generated from the 1964 census and classifies the labor force by schooling, 2 digit occupations and 2 digit economic activity. This study will shortly be published by DANE.

provided by the study of unemployment of the seven cities.

To evaluate expenditure on teachers at shadow wages, we assumed that teachers in primary and secondary schools belonged to category  $C_{34}$ . University teachers were classified in category  $C_{44}$ .

Version 3: All the earlier internal rates of return were of static nature in the sense that they were evaluated at real wages of one point in time, in this case the wages of the period 1963-66.

However, the profitability of educating individuals in the present should be a function of the real wages they will obtain in the future and not of the real wages observed in the past. The purpose of this version is to estimate the rate of return taking into account wages not only as a function of education and age but also as a function of calendar time. For this purpose we can rewrite the expression for the net present value of an educational project as:

$$\sum_{j=J}^{\infty} d_{ij}(t) (1+r)^{J-j} - \sum_{j=J}^{\infty} C_{i,j-J+1}(t) (1+r)^{J-j} = 0$$

and were:

$$d_{ij}(t) = s_{ij}(t) - s_{i-1,j}(t)$$

$t$  being the time period and where  $t=0$  corresponds to the present year. We can define  $t$  as  $t = j-J$  where  $J$  is the age at which individuals enter the schooling system. Consequently the wage at age  $j$  of an individual that enters today the schooling system (with age  $J$ ) will

be equal to  $s_{ij}(t=j-J)$ , wage he reaches with schooling level  $i$ , age  $j$  and in the  $j-J^{\text{th}}$  calendar year from today. This is also true for the direct costs, since the main component of them are teachers salaries which are also a function of time.

The problem is to determine the way in which wages according to schooling will change over time: for this purpose it is necessary to project through time the supply and demand for each category of the labor force. This implies the need of:

1. Estimating how many individuals with a given amount of schooling will enter each year the urban labor force.
2. To make some assumptions on the demands for the labor input and, therefore, on the aggregate production function of sectors 20-91.
3. To project the future growth of sectors 20-91.

For the purpose of this analysis we have classified the labor input by schooling only: The criteria used was to include in each category all schooling levels with relatively similar wages. The categories used were the following:

<u>Category</u>	<u>Level of Schooling</u>
$C_1$	Illiterates and individuals with no schooling
$C_2$	Individuals with 1 to 3 years of primary schooling
$C_3$	Individuals with 4 to 5 years of primary schooling

<u>Category</u>	<u>Level of Schooling</u>
C <sub>4</sub>	Individuals with 1 to 4 years of bachillerato
C <sub>5</sub> <sup>1/</sup>	Individuals with 5-6 years of bachillerato and 1-2 years of university education
C <sub>6</sub>	Individuals with 3 to 6 years of university education

For projecting the future supply of each category we used two alternatives: The first one, of pessimistic nature, assumes that the educational distribution of the labor force remains constant and equal to the one of 1964. The second one assumes that the annual growth rate of each category will be the same as the one of the period 1951-1965: Those growth rates, obtained when comparing the 1951 with the 1964 census, are the following:

Individuals with years of primary schooling	4%
Individuals with years of secondary schooling	4.4%
Individuals with university education	5.8%

Given that we expect through time a decline in the rates of desertion within primary, secondary, and university education and a tendency to complete a given schooling level, we have projected differently those categories which represent the completion of certain educational level. Therefore we have projected the growth rates of the different categories in the following way:

---

<sup>1/</sup> It also includes specialized secondary education.

$C_2$	3.5%
$C_3$	4.0%
$C_4$	4.0%
$C_5$	5.8%
$C_6$	5.8%

The growth rate of the urban labor force was projected in 3.5% and equal to the rate observed between 1951 and 1964 for the sectors 20 to 91. Category 1 was obtained residually as the difference between the total labor force and the sum of categories  $C_2$  to  $C_6$ .

For the purpose of deriving the demands for each category we have utilized the same type of aggregate production function used in the analysis of the determination of shadow wages (See Appendix B). The only difference is a reclassification of the different categories of the labor input. Assuming that wages are equal to the marginal product of labor, we can determine at any time  $t$  the wage of any category  $i$  of the labor input:

$$S_i(t) = (1-\alpha)a_i \left( \frac{Y(t)}{C_i(t)} \right) \left( \frac{C_i(t)}{L(t)} \right)^\theta \quad i = 1, 2, 3, 4, 5, 6$$

where  $(1-\alpha)$ ,  $\theta$ , and  $a_i$  are constants through time and  $t$  represents the year for which we are interested in.

The values of  $a_i$  were estimated using the wage information of CEDE and the 1964 educational distribution of the labor force provided by the educational matrix of DANE.  $(1-\alpha)$  is simply the relative share

of the labor input in sectors 20 to 91, and  $Y(t)$ , the aggregate product of those sectors in year  $t$ , was estimated assuming a growth rate of 5%, equal to the rate observed in the decade 1956-1966.

Table 2 summarizes this information and shows the projections for the years 1970, 1975, 1980, and 1985.

TABLE 2

PROJECTIONS OF THE EDUCATIONAL DISTRIBUTION OF THE LABOR FORCE

	1 9 6 4		Alternative A.				Alternative B.				
	Labor Force 1964, DANE		Hourly-Wage 1963-66 (pesos of 1966) CEDE	1970	1975	1980	1985	1970	1975	1980	1985
C <sub>1</sub> Illiterates	319.141	(13.44)	.88	392.226	466.010	563.616	657.696	308.902	277.997	216.707	112.268
C <sub>2</sub> 1-3 Primary	836.408	(34.44)	1.41	1.027.945	1.221.156	1.450.733	1.723.471	1.027.945	1.221.199	1.450.784	1.723.531
C <sub>3</sub> 4-5 Primary	790.160	(32.56)	3.57	971.106	1.153.674	1.370.564	1.628.230	999.552	1.216.455	1.480.426	1.801.678
C <sub>4</sub> 1-4 Bachiller.	317.954	(13.10)	5.93	390.765	464.228	551.503	655.185	402.212	489.492	595.712	724.982
C <sub>5</sub> 5-6 Ba., 1-2 Un.	194.769	( 4.49)	14.26	239.371	284.372	337.839	401.352	273.261	362.344	480.468	637.101
C <sub>6</sub> 3-6 Univ.	54.832	( 2.27)	23.28	67.388	80.055	95.105	112.985	76.929	102.008	135.263	179.359
<b>Total</b>	<b>2.513.264</b>			<b>3.088.801</b>	<b>3.669.495</b>	<b>4.359.360</b>	<b>5.178.919</b>	<b>3.088.801</b>	<b>3.669.495</b>	<b>4.359.360</b>	<b>5.178.919</b>
Gross domestic product at market prices, sectors 20 to 91.	42.781			57.326	73.147	93.335	119.095	57.326	73.147	93.335	119.095

V. Appendix A: The Urban Unemployment in Colombia: 1964

To study Colombia's urban unemployment, we asked DANE for a report on unemployment in the cities of Bogota, Cali, Manizales, Medellin, Catagena, Barranquilla, and Bucaramanga to be taken from the 1964 Census. Given the census classification, the economically active population was defined in the following way:

1. We excluded from the total population:

- (a) Individuals who were primarily housewives
- (b) Students: those individuals who spend most of their time at school
- (c) Individuals under 12 years of age and over 85 years of age
- (d) Handicapped individuals and the elderly living in old-age homes
- (e) Individuals who are retired.

2. From the remaining population we considered as members of the economically active population the following:

- (a) Individuals who held a remunerated occupation at the date of the Census,
- (b) From those not qualifying under (a), we included those looking for employment in the month which ended at the Census date.

In order to estimate the unemployment of the members of the economically active population, we used a question in the Census form concerning the total number of months worked in the year. Assuming a work potential of twelve months per year, it was possible to obtain

the rate of unemployment by educational level and age. This information is summarized in Table 3.

In spite of the high unemployment figures found, we believe that they still understate the rate of unemployment if we express the supply of labor in terms of hours per year. The reason is that our measure of unemployment does not include the unemployment in terms of hours per month.

TABLE 3

URBAN UNEMPLOYMENT OF THE ECONOMICALLY ACTIVE POPULATION BY SCHOOLING AND AGE (percentages)  
Bucaramanga, Barranquilla, Cali, Bogotá, Cartagena, Manizales y Medellín

Age Group	<u>ILLITERATES</u>		<u>5th. PRIMARY</u>		<u>6th. BACHILLERATO</u>		<u>5th. UNIVERSITY</u>		<u>ALL LEVELS</u>	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
12 -14	37.9	37.1	39.2	39.5						
15 -17	34.0	33.6	33.8	33.7						
18 -20	29.3	27.8	26.4	24.8	27.5	35.3				
21 -23	27.1	24.9	22.4	20.6	34.3	27.4				
24 -26	24.6	23.9	19.3	18.8	22.8	18.8	29.3	29.5		
27 -29	24.5	22.2	17.3	17.8	15.3	13.3	19.9	19.3		
30 -32	22.9	21.7	16.0	17.3	12.5	13.3	12.6	15.1		
33 -35	21.2	20.2	15.5	16.4	10.3	12.2	9.7	13.4		
36 -38	21.4	20.4	15.1	15.3	10.3	12.6	8.9	9.8		
39 -41	20.6	19.7	14.6	15.0	9.4	12.1	7.6	6.7		
42 -44	21.0	19.2	15.2	15.2	10.5	13.0	7.2	9.6		
45 -47	20.0	19.9	14.7	15.1	11.1	11.1	8.2	13.9		
48 -50	20.6	19.2	15.1	15.3	10.9	12.3	7.3	9.2		
51 -53	21.3	17.8	15.1	13.5	11.2	11.8	7.2	16.1		
54 -56	21.9	18.5	15.3	14.6	10.6	12.3	8.2	6.4		
57 -59	22.7	17.7	15.7	15.7	9.6	15.0	9.3	2.5		
60 -62	20.6	18.6	16.1	16.3	10.5	14.0	10.1	20.5		
63 -65	20.4	17.6	16.6	16.0	9.6	10.4	7.9	4.1		
66 -68	20.9	23.2	14.0	15.1	11.2	14.2	11.1	16.6		
69 -71	20.6	17.6	13.8	11.8	12.5	8.0	7.3	0.0		
72 -74	21.3	15.5	15.3	14.3	8.7	12.1	8.5	0.0		
75 -77	21.1	15.7	16.1	18.8	12.2	9.1	10.4	0.0		
78 -80	19.1	16.0	17.0	23.9	10.8	4.6	9.1	0.0		
81 -83	19.8	11.4	9.0	19.8	4.1	27.7	10.3	0.0		
84 -85	22.8	21.5	13.4	20.0	5.5	0.0	10.0	0.0		
<b>TOTAL</b>	<b>23.7</b>	<b>23.9</b>	<b>19.0</b>	<b>20.6</b>	<b>13.5</b>	<b>15.5</b>	<b>10.8</b>	<b>15.9</b>	<b>19.3</b>	<b>21.5</b>

Source: DANE

VI. Appendix B: The Production Function and the Demands for Labor

In order to determine the demands for different categories of the labor input by sectors 20 to 91, we have to make some assumptions on their aggregate production function.

Our purpose is to assume a production function that fulfills two requirements: it has to be easy to work with from an empirical point of view and at the same time have properties consistent with the available empirical evidence. For this last purpose we shall use two empirical evidence:

- 1) Time-series data in a large number of countries show that the relative share of the aggregate labor input has remained roughly constant in spite of strong changes in the capital-labor ratio. This is consistent with a unitary elasticity of substitution between capital and aggregate labor.
- 2) There is some evidence that the elasticity of substitution among the labor input classified by years of schooling is substantially bigger than one. Samuel Bowles, working with cross-country data and with three classifications of labor, found values between 6 and  $10^{1/}$ . Christopher Dougherty found, using time-series data for the U. S. and with 8 classifications, a value equal to  $3.63^{2/}$ . On the other

---

<sup>1/</sup> Samuel Bowles: "Planning Education for Economic Growth", in print.

<sup>2/</sup> Christopher Dougherty: "A Cost Benefit Analysis of the Colombian Educational System". Paper presented at the Development Advisory Service Conference, Sorrento, Italy, September 1968.

hand, the author found, working with cross-section data on U. S. manufacturing and with 7 classifications, values between 60 and infinity with a 95% confidence interval.

These evidences suggest the need of a production function which allows for a different elasticity of substitution between labor and capital and among different categories of the labor input. This function can be expressed as a combination of a Cobb-Douglas function and a constant elasticity of substitution function (C.E.S.).

This production function can be written as:

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

where Y is output and K the capital services of sectors 20 to 91. L is an index C.E.S. of different categories  $C_{ij}$  of the labor input where i represents years of schooling and j the age group.

$$(2) \quad L = \left[ \sum_i \sum_j a_{ij} c_{ij}^\theta \right]^{\frac{1}{\theta}}$$

where:

$a_{ij}$  = distribution parameter of the ij labor category

$\theta = \frac{\sigma_L - 1}{\sigma_L}$ , being  $\sigma_L$  the (constant) elasticity of substitution among labor groups.

Equation (1) can therefore be written:

$$(3) \quad Y = AK^\alpha \left[ \sum_i \sum_j a_{ij} c_{ij}^\theta \right]^{\frac{1-\alpha}{\theta}}$$

The marginal product of any type  $C_{ij}$  of the labor input is:

$$(4) \quad \frac{\partial Y}{\partial C_{ij}} = AK^\alpha (1-\alpha) a_{ij} C_{ij}^{\theta-1} \left[ \sum_i \sum_j a_{ij} C_{ij}^\theta \right]^{\frac{1-\alpha}{\theta} - 1}$$

$$(5) \quad \frac{\partial Y}{\partial C_{ij}} = (1-\alpha) a_{ij} Y C_{ij}^{\theta-1} \left[ \sum_i \sum_j a_{ij} C_{ij}^\theta \right]^{-1}$$

$$(6) \quad \frac{\partial Y}{\partial C_{ij}} = (1-\alpha) a_{ij} \left( \frac{Y}{C_{ij}} \right) \left( \frac{C_{ij}}{L} \right)^\theta$$

We have to estimate the parameters of (6) in order to solve for the full employment marginal product ( $\bar{S}_{ij}$ ) or the one corresponding to  $C_{ij} = \bar{C}_{ij}$  in all markets of the labor input.

For given values of  $\theta$  and  $(1-\alpha)$  [which is assumed to be equal to the relative share of aggregate labor], we have to solve for the  $i \times j$  values of  $a_{ij}$  of the  $i \times j$  demands for labor.

Knowing the actual value of output and the existing wage and employment of any category of labor ( $S_{ij}$  and  $C_{ij}$ ), we can construct a system of  $i \times j$  equations to solve the  $i \times j$  values of  $a_{ij}$ <sup>1/</sup>.

With the values of  $a_{ij}$ ,  $\bar{C}_{ij}$  and  $\theta$ , it is possible to compute the full employment labor index  $\bar{L}$ . Finally we need to determine the full employment aggregate output  $\bar{Y}$ : Given that in this exercise the

---

<sup>1/</sup> See the following page for extended footnote.

capital stock K remains constant, this value is equal to:

$$(7) \quad \bar{Y} = Y \left( \frac{\bar{L}}{L} \right)^{1-\alpha}$$

Having the values of  $a_{ij}$ ,  $\bar{C}_{ij}$ ,  $\bar{Y}$ , and  $\theta$ , we can solve for  $\bar{S}_{ij}$  or the full employment wage of any category  $ij$ .

---

<sup>1/</sup> Given that the  $i \times j$  equations are homogenous, we can obtain infinite solutions for  $a_{ij}$ . To solve this problem, we need an additional restriction so we used  $\sum_i \sum_j a_{ij} = 1$ . Therefore we have:

$$(1) \quad (i \times j - 1) \text{ equations of the type } S_{ij} = (1-\alpha)a_{ij} \left( \frac{Y}{C_{ij}} \right) \left( \frac{C_{ij}}{L} \right)^\theta$$

$$(2) \quad \sum_i \sum_j a_{ij} = 1$$

Therefore any  $a_{ij}$  is equal to:

$$a_{ij} = \frac{S_{ij} C_{ij}^{1-\theta}}{\sum_i \sum_j S_{ij} C_{ij}^{1-\theta}}$$

VII. The Rate of Return Through Time and the Problem of Optimization  
of the Educational Expenditure

At this step it is necessary to make a deeper analysis of the meaning of the internal rate of return to invest in certain schooling level.

The rate of return is an index of the profitability of a given investment project and to undertake it is only justifiable if this rate is higher than the opportunity cost of capital.

The internal rate of return to schooling is usually computed with the costs and benefits of increasing the amount of education of one individual, namely the investment project is specific for a single student. If this project is profitable in the earlier sense, this rate of return does not give us any information on the optimum magnitudes to invest in that particular level of schooling. In other words, it does not provide information on how many individuals we should educate.

This is one of the main criticisms to the use of the rate of return for educational investment purposes and explains the popularity of the manpower approach where the investment magnitudes in each schooling level are automatically determined.

This shortcoming of the internal rate of return approach is a product of the partial equilibrium framework usually used for its calculation and should not be a criticism to the rate of return

analysis per se. When determining the rate of return of educating an individual, we take as given certain magnitudes that become variables for the analysis of investing in a big number of individuals. The possibility of determining an optimum volume of investment, in each educational level and at each moment of time, stems from the fact that the internal rate of return at any moment of time is not independent of the investment decisions itself: The actual rate of return to investment in university education depends on the actual and future investment in that level; the greater the volume of investment, the greater the supply of professionals in the future and, ceteris paribus, the lower their relative wages and therefore the actual rate of return.

Theoretically, the optimal magnitude and composition of the educational expenditure at any moment of time is the one that fulfills the following equality:

$$(1) \quad r_1(t) = r_2(t) = r_3(t) \dots r_n(t) = \bar{r}(t)$$

where  $r_i(t)$  [1,2,3....n] is the internal rate of return to schooling level  $i$  in period  $(t)$  and  $\bar{r}(t)$  is the opportunity cost of capital in that period.

A more simple and operational alternative to determine these optimum magnitudes of investment is to achieve the above equality

in a certain future date, for example 1980<sup>1/</sup>. The problem is therefore to estimate, given the increase in the demand for each category of the labor input, in how much we have to increase the supply of each category in order to generate relative wages such that we achieve equality (1) in 1980.

Two restrictions are needed for this analysis: one is the opportunity cost of capital for 1980, since all the rates of return to schooling should be equal to it by that date and second, we have to determine the precise path of the supply of each category. The reason is that there are infinite combinations of projections for each category, all of them consistent with equality (1) for 1980. Graph 7 presents a hypothetical example of projecting certain category (in example  $(C_3)$ ) given the growth of the other ones, all the projections being consistent with  $r_3 = \bar{r}$  for 1980<sup>2/</sup>.

A simple solution for this problem is to choose a growth path that implies a constant annual growth rate for each category. Determining this (constant) rate, one determines automatically the needs of enrollment at each schooling level and therefore the appropriate

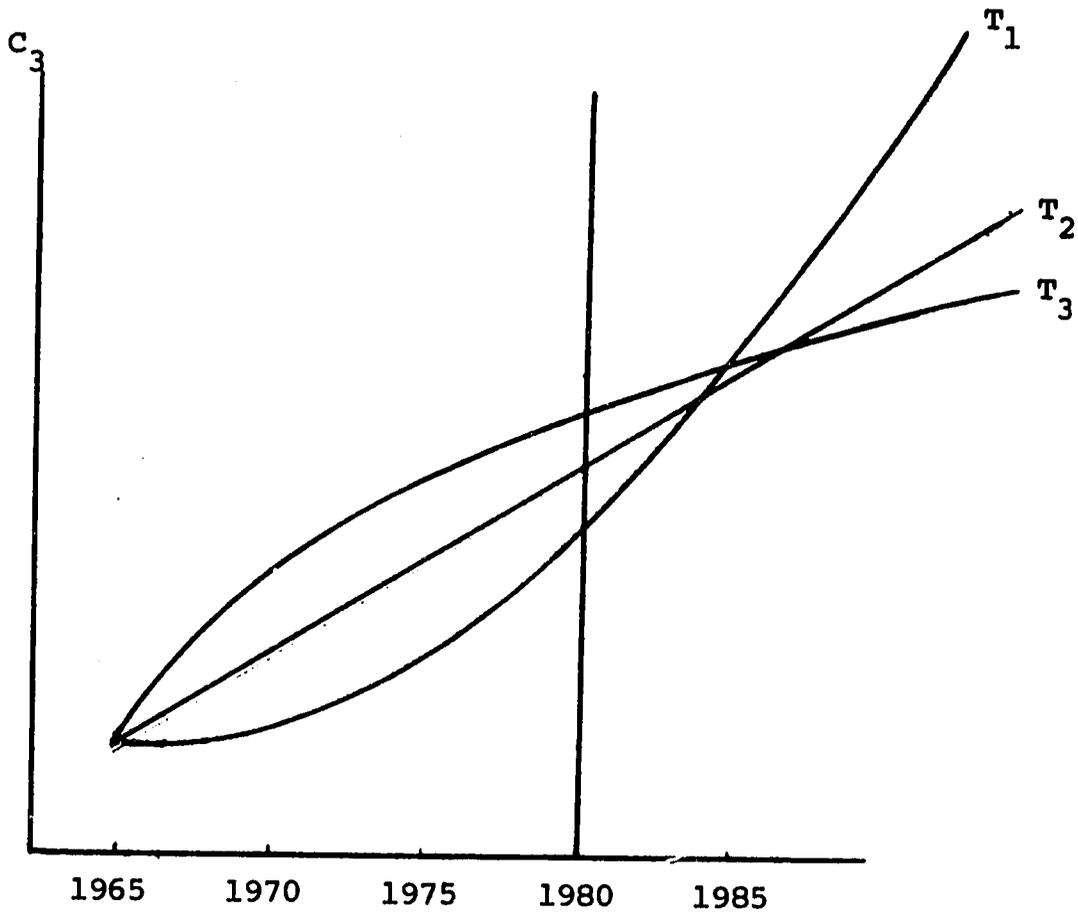
---

<sup>1/</sup> We believe that any attempt to obtain this equality in the short run would encounter strong technical and political problems: substantial changes in the number and composition of teachers and rapid and substantial changes in the national budget.

<sup>2/</sup> The three growth paths of  $C_3$  imply a different wage for this category from 1980 on, all of them consistent with the same  $r_3$  for 1980.  $T_1$  implies a relatively high wage in 1980 and a relatively low one after 1985. The reverse is true for  $T_3$ .

needs of investment.

Given the complex computational problems involved, this analysis of optimization will be presented in a consequent study. As a more simple alternative we have determined the behavior of the rates of return through time generated under the alternative projections analyzed in Version V. These estimates were done for 1970, 1975, and 1980.



GRAPH 7.

### VIII. The Results

1. Tables 4 and 5 present the rates of return to schooling for the period 1963-66 using the wages of Bogota provided to us by CEDE<sup>1/</sup>. The males' rates of return were estimated only under Versions 1 to 3, and the reason will be explained later. For the moment we shall discuss those first three versions.

Rates of return (3), (6), and (9) show the profitability of achieving an additional schooling level while the other ones show the profitability of marginal years of schooling. The highest rate of return is on primary education. This rate is the one most affected by unemployment, especially by including women, yet after the adjustment its magnitude is considerable.

It is interesting to note that the highest differences in the rates, before and after including women, appear in Version 1. However, those differences decline for Version 2, and in Version 3 the inclusion of women has a relatively small effect.

The high rates of return to primary education observed in Version 1 when including women is explained by the extremely low wages of illiterate females. However, this low wage could be the result of not including income in kind of domestic services and which represent a high percentage of the illiterate female labor force in the urban

---

<sup>1/</sup> Later on we shall analyze the possible bias of using Bogota wages instead of a weighted average of urban wages.

TABLE 4

INTERNAL RATE OF RETURN TO EDUCATION: 1963-66

	MEN		
	VERSION 1	VERSION 2	VERSION 3
	Without Adjustment %	Adjustment by Participation %	Adjustment by Participation and Unemployment %
1) 3d. Primary over illiterates	35	33	29
2) 5th. Primary over 3d. Primary	30	28	28
3) 5th. Primary over illiterates	33	31	29
4) 3d. Bachillerato over 5th. Primary	18	19	18
5) 6th. Bachillerato over 3d. Bachillerato	29	31	31
6) 6th. Bachillerato over 5th Primary	23	23	23
7) 3d. University over 6th Bachillerato	7	7	8
8) 5th. University over 3d. University	Negative	Negative	6
9) 5th. University over 6th. Bachillerato	6	6	7

TABLE 5

INTERNAL RATE OF RETURN TO EDUCATION

MEN AND WOMEN

1963 - 1966

	VERSION 1	VERSION 2	VERSION 3	VERSION 4	VERSION 5	
	Without Adjustment	Adjustment by Participation	Adjustment by Participation and Unemploy.	Adjustment by Participation and Difference Between Shadow and Market Wages	Adjustment by Participation, Unemployment, and Growth	
	%	%	%	%	Alter. 1	Alter. 2
					%	%
1) 3d. Primary over Illiterates	38	32	26	31	28	
2) 5th. Primary over 3d. Primary	42	38	30	35	32	
3) 5th. Primary over Illiterates	40	33	28	32	30	28
4) 3d. Bachillerato over 5th. Primary	23	20	18	20	21	
5) 6th. Bachillerato over 3d. Bachil.	24	23	24	23	25	
6) 6th. Bachillerato over 5th. Primary	24	21	21	21	23	20
7) 3d. University over 6th. Bachillerato	6	Negative	Negative	Negative	Negative	
8) 5th. University over 3d. University	13	9	10	9	12	
9) 5th. University over 6th. Bachil.	8	6	6	6	7	6

areas.

The high male-female rates to primary education observed in Version 1 are strongly affected by the adjustment for participation and unemployment. They decline substantially with those adjustments, and in Version 3 they do not appear significantly different to the male rates of return.

Graphs 8 and 9 show the effect of those adjustments on the present value of 3 years of primary schooling. In the case of males the adjustment by unemployment is more important than the one by participation, the reverse being true when including females.

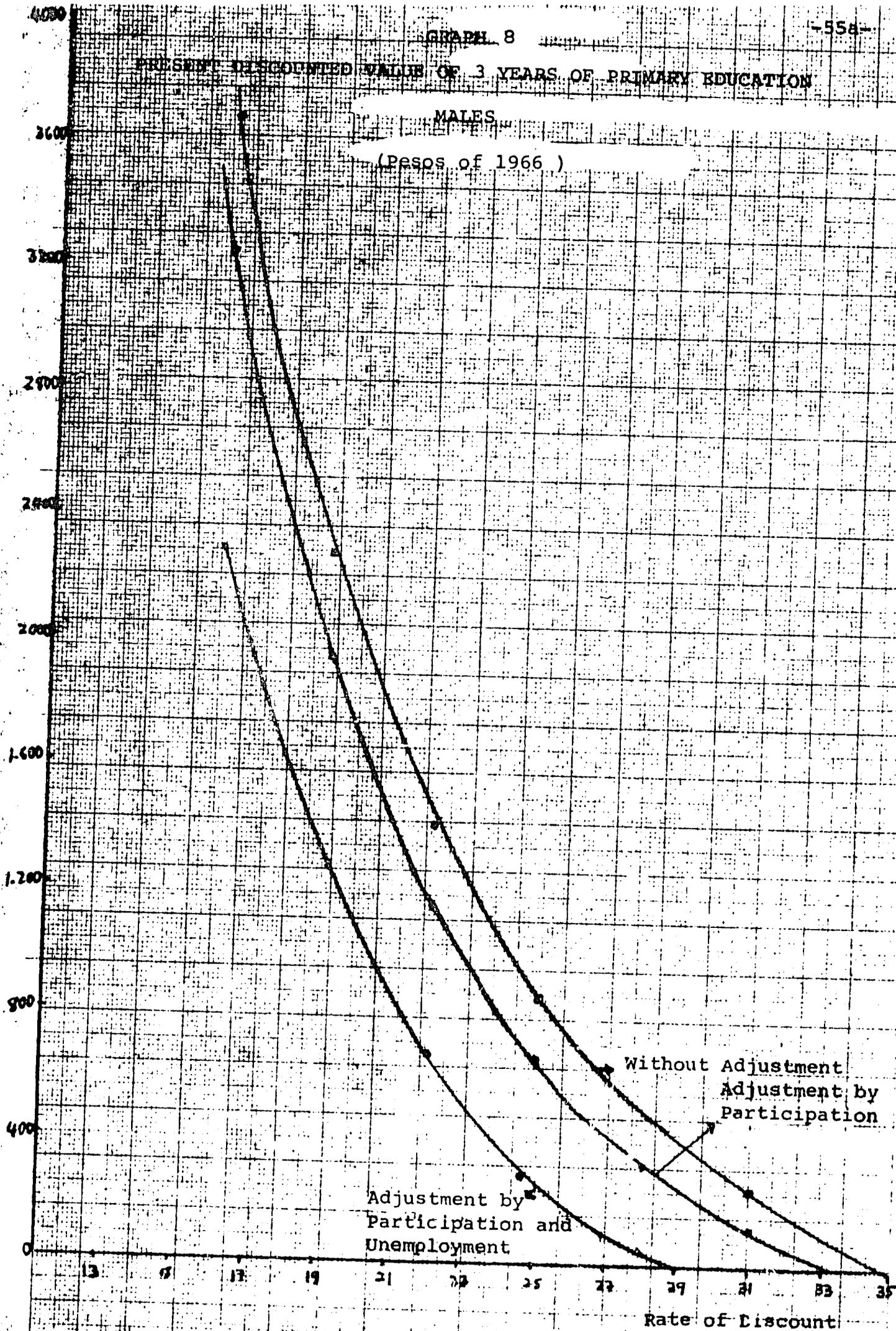
Bachillerato has the second payoff in the Colombian educational system. In this case the rate of return is less sensitive to the adjustments by participation and unemployment: The reason is that the student enters the labor force at an older age which is correlated with a higher participation and a smaller unemployment rate.

It is interesting to note that the highest rates of return observed for primary and bachillerato schooling are the marginal rates to completing the level (30% and 24%, respectively, Version 3, Table 5). These results are consistent with similar estimates for other countries and reflect the relatively high premium given by the market to the completion of an educational level. On the other hand, those high rates of return are an index of the high cost of the school dropout.

PRESENT DISCOUNTED VALUE OF 3 YEARS OF PRIMARY EDUCATION

MALES

(Pesos of 1966)

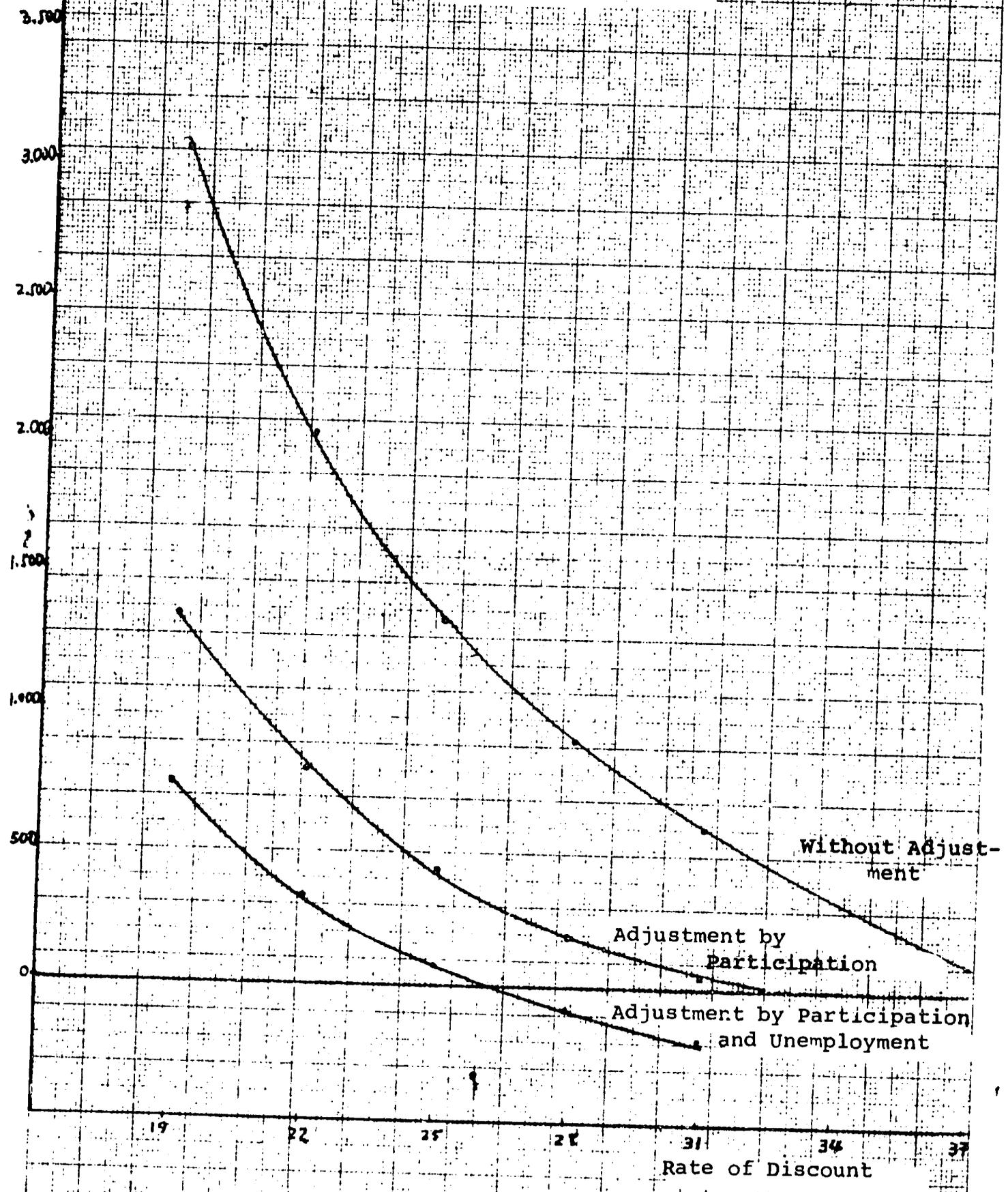


GRAPH 9

PRESENT DISCOUNTED VALUE OF 3 YEARS OF PRIMARY EDUCATION

MALES AND FEMALES

(Pesos of 1966)



The rates of return to university education turned out to be extremely low in relation to the other schooling levels and also in relation to the ones found for other Latin American countries: In Colombia the average wage of professionals is 1.7 times the one of people with bachillerato; those values are 2.95 and 3.25 for Chile and Mexico, respectively. On the other hand, the ratio of direct costs of university to bachillerato is 6.8, 5.7, and 5.3 for Colombia, Mexico, and Chile, respectively<sup>1/</sup>.

2. As we analyzed earlier, the purpose of Version 4 is to estimate the rates of return which would exist under full employment of each category of the labor input.

As we saw in Appendix B, the shadow or full employment wages are a function of the particular production function assumed and therefore on the elasticity of substitution among labor groups. Using a value for this elasticity equal to 3, we determined the shadow wages for the period 1963-66<sup>2/</sup>. These results are presented

---

<sup>1/</sup> M. Carnoy: "The Costs and Returns to Schooling in Mexico," Ph.D. Dissertation, University of Chicago, 1963.

M. Selowsky: "Education and Economic Growth: Some International Comparisons," Ph.D. Dissertation, University of Chicago, 1967.

<sup>2/</sup> Somebody could ask why we have used a relatively low value for this elasticity given the high values discussed in Appendix B.

One reason is that the high values found in the time series analysis could be affected by the accumulation of physical capital if there is a higher complementarity between capital and more educated labor. Our analysis is an exercise in comparative static and where the capital stock remains constant.

On the other hand, we want to derive an upper limit for the difference between market and shadow wages. This difference is higher the less elastic the demands for labor, namely, the lower the elasticity of substitution among labor groups.

in Table 6.

In Table 6 one can observe that the difference between market and shadow wages is higher the lower the level of schooling and the age group: This simply reflects the higher degree of unemployment for those groups of the labor force. On the other hand, it explains why, when comparing Versions 3 and 4, we find that the highest differences between the rates of return correspond to the lower levels of schooling. For those groups we find a higher rate in Version 4 than in 3, the reason being that at shadow wages the foregone income (which represents the earnings of a category of lower schooling and age) declines relatively more than the earnings of those groups.

For males we did not estimate independently their shadow wages: The reason is the need of doubling the number of categories, namely, to classify the labor input by sex as well as by schooling and age.

3. Version 5 evaluates today's rate of return to education at the wages that the actual students will receive in the future.

As we explained earlier, this implies the need of projecting the labor market for each category of the labor input so we can determine its wage through time. For the purpose of this exercise we used again a value of the elasticity of substitution equal to  $3\frac{1}{2}$ .

---

<sup>1</sup>/ The reason for using a low value for this elasticity is to increase the sensibility of future relative wages to alternative projections of the educational distribution of the labor force.

**TABLE 6**

	Unemployment Rate	Market Wage (per hour) \$ of 1966	Shadow Wage (per hour) \$ of 1966	Ratio of Shadow to Market Wage
C <sub>11</sub>	28%	.16	.13	.81
C <sub>12</sub>	26%	.70	.59	.85
C <sub>13</sub>	24%	.91	.79	.86
C <sub>14</sub>	21%	2.13	1.87	.87
C <sub>21</sub>	26%	1.21	1.04	.86
C <sub>22</sub>	23%	2.30	2.00	.87
C <sub>23</sub>	19%	2.61	2.31	.88
C <sub>24</sub>	16%	4.68	4.02	.86
C <sub>31</sub>	26%	4.00	3.44	.86
C <sub>32</sub>	20%	5.09	4.49	.88
C <sub>33</sub>	14%	6.67	6.03	.90
C <sub>34</sub>	11%	13.82	12.65	.91
C <sub>42</sub>	14%	12.16	11.00	.90
C <sub>43</sub>	11%	18.05	16.52	.92
C <sub>44</sub>	8%	36.79	34.05	.92

Sources: Unemployment data: DANE

Wage DATE: CEDE

Table 7 shows the future wages for each category under projection 1, namely, maintaining constant the 1964 educational distribution of the labor force. The production function used implies that relative wages are only a function of the relative supply of each category so the above projection results in an equal growth rate for all wages equal to 1.4% per year and independent of the elasticity of substitution.

Table 8 shows the future wages under projection 2, using alternative values for the elasticity of substitution equal to 3 and 6.

Under this projection the real wages of the more educated groups of the labor force are almost constant through time: This can be explained by the high growth in the supply of those categories in relation to the growth of their demand.

The wages of  $C_1$  (or illiterates) experience a substantial increase given that its relative supply declines through time. It is interesting to note that this increase is higher the lower the elasticity of substitution.

Summarizing, given an annual growth rate of output in sectors 20-91 equal to 5% and given projection 2 (which implies to increase the supply of educated individuals at the same rate than in the period 1951-64), the real wages of people with schooling will not have significant changes through time. For the categories of highest education ( $C_5$  and  $C_6$ ) this change is almost nil. Comparing

**TABLE 7**

**PROJECTION OF REAL HOURLY WAGES IN SECTORS 20-91**

( in pesos of 1966)

Alternative 1

Year Catego- ry of Labor Force	1964	1970	1975	1980	1985
C1	0.880	0.959	1.030	1.106	1.188
C2	1.410	1.537	1.651	1.773	1.904
C3	3.570	3.892	4.180	4.490	4.823
C4	5.930	6.465	6.944	7.458	8.011
C5	14.260	15.547	16.699	17.936	19.264
C6	23.280	25.382	27.262	29.282	31.451

Growth Rate of the Hourly Wage

C1	1.4	1.4	1.4	1.4
C2	1.4	1.4	1.4	1.4
C3	1.4	1.4	1.4	1.4
C4	1.4	1.4	1.4	1.4
C5	1.4	1.4	1.4	1.4
C6	1.4	1.4	1.4	1.4

TABLE

PROJECTION OF REAL HOURLY WAGES IN SECTORS 20-91

( in pesos of 1966)

Alternative 2

Elasticity of Substitution Equal to 3

Cat. Labor Force	Year	1964	1970	1975	1980	1985
C1		0.880	0.997	1.135	1.355	1.853
C2		1.410	1.476	1.531	1.588	1.647
C3		3.570	3.701	3.809	3.919	4.032
C4		5.930	6.148	6.328	6.510	6.698
C5		14.260	14.283	14.287	14.285	14.283
C6		23.280	23.318	23.325	23.321	23.317

Elasticity of Substitution Equal to 6

Cat. Labor Force	Year	1964	1970	1975	1980	1985
C1		0.880	0.948	1.021	1.124	1.323
C2		1.410	1.460	1.501	1.540	1.579
C3		3.570	3.680	3.767	3.851	3.933
C4		5.930	6.113	6.257	6.397	6.533
C5		14.260	14.449	14.581	14.695	14.793
C6		23.280	23.589	23.804	23.990	24.151

Growth Rate of the Hourly Wage

C1	2.1	2.6	3.7	6.4
C2	0.8	0.7	0.7	0.7
C3	0.6	0.6	0.6	0.5
C4	0.6	0.6	0.6	0.6
C5	0.1	0.1	0	0
C6	0.1	0.1	0	-0

Growth Rate of the Hourly Wage

C1	1.2	1.5	2.0	3.2
C2	0.6	0.6	0.5	0.5
C3	0.5	0.5	0.4	0.4
C4	0.5	0.5	0.4	0.4
C5	0.2	0.2	0.2	0.1
C6	0.2	0.2	0.2	0.1

the rates of return obtained with projection 1 in Version 5 with the ones of Version 3, we observe that the former are higher by approximately two percentage points. In other words, an annual increase in all wages by 1.4% will increase the rates of return--estimated through cross section wages--by two percentage points<sup>1/</sup>.

On the other hand, when comparing the rates of return of projection 2 in Version 5 with the ones of Version 3, we observe almost no differences. This means that under projection 2 the growth of real

<sup>1/</sup>The effect on the internal rate of return of an equal growth rate for all real wages can be easily analyzed under the following simplifying assumptions:

- a) Only one initial investment cost
- b) The effect of age on wages is disregarded
- c) Infinite life of the individual.

Calling C the initial investment cost, D, today's wage differential by schooling, and  $\lambda$ , the annual growth rate of wages, the internal rate of return  $r_1$  is the one that solves the following equation:

$$C = \frac{D(1+\lambda)}{1+r_1} + \frac{D(1+\lambda)^2}{(1+r_1)^2} + \frac{D(1+\lambda)^3}{(1+r_1)^3} \dots\dots\dots$$

$$C = D \left[ \frac{1+\lambda}{1+r_1} + \left(\frac{1+\lambda}{1+r_1}\right)^2 + \left(\frac{1+\lambda}{1+r_1}\right)^3 \dots\dots\dots \right]$$

The value of the series in parenthesis is  $\frac{1+\lambda}{r_1-\lambda}$  thus  $C = D \left(\frac{1+\lambda}{r_1-\lambda}\right)$

and the internal rate of return is  $r_1 = \frac{D}{C} (1+\lambda) + \lambda$ .

Defining the internal rate of return obtained without growth in wages as  $r_0 = \frac{D}{C}$  and substituting we can express  $r_1$  as:

$$r_1 = r_0 (1 + \lambda) + \lambda.$$

wages does not affect the rates of return to schooling. The reason is that the earnings of people with less schooling grow relatively faster, neutralizing therefore the tendency toward a higher rate produced by an over-all increase in real wages.

From the results of Version 5 we can conclude that today's rates of return to invest in education are very little sensitive to different alternative expansions of the educational system.

Graph 10 shows the behavior of the rates of return through time as a function of the two alternative schooling projections of the labor force discussed earlier. Again we assumed a 5% annual growth in the output of sectors 20-91 and an elasticity of substitution among the labor input equal to 3.

With projection 1 we observe constant rates of return through time, the reason being that each year all cost and benefits of the educational projects increase by 1.4%. This is explained by the fact that almost all the cost components of an educational project are payments to the labor input such as foregone income and teachers' salaries.

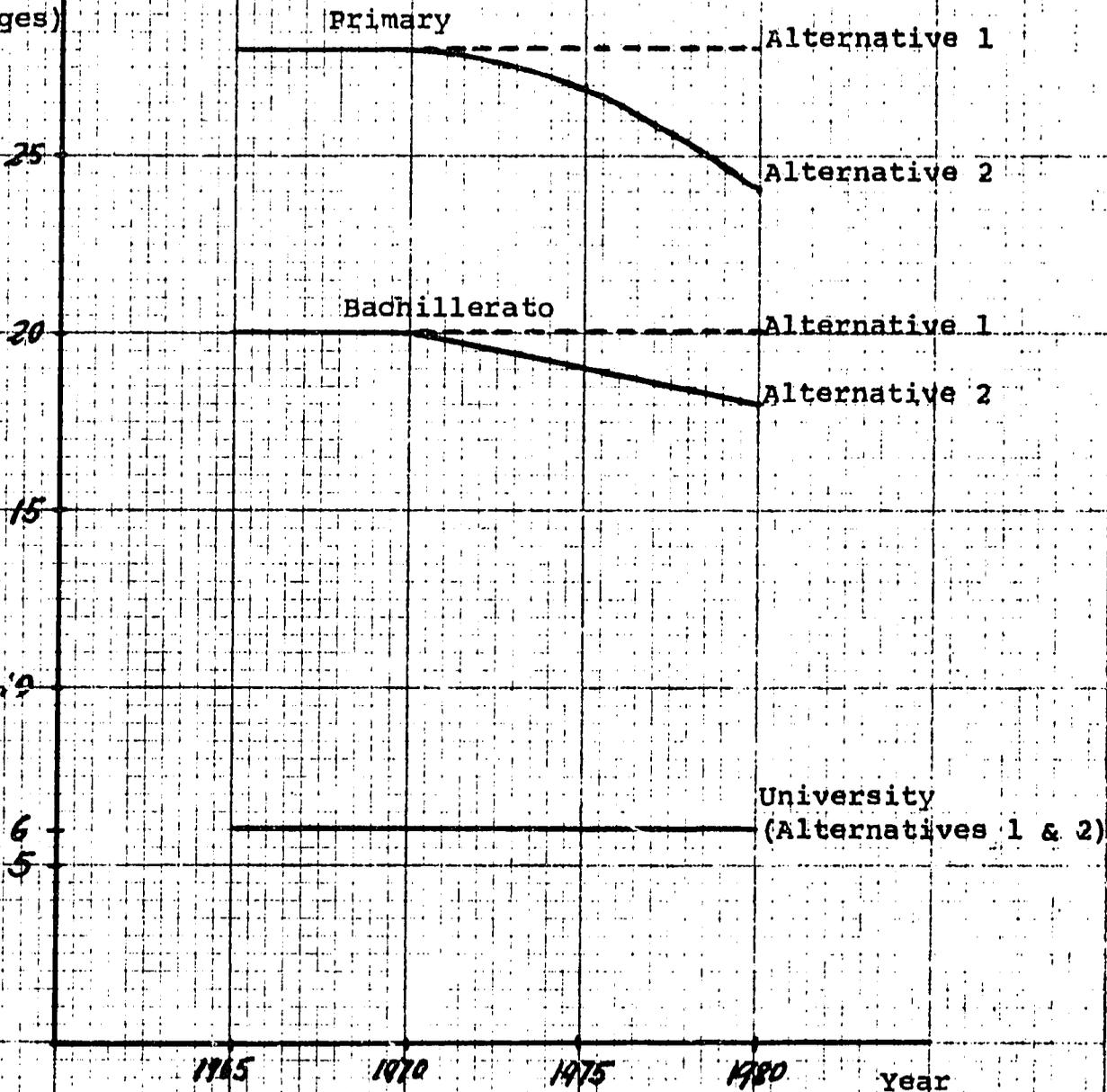
With projection or alternative 2 we observe:

- a) A decline in the rate of return to primary schooling from 28% in 1965 to 24% in 1980. The reason for this decline is the increase in the relative wages of illiterates with respect to people with primary education.

GRAPH 10  
THE INTERNAL RATE OF RETURN THROUGH TIME  
( ALTERNATIVES 1 AND 2 )

Internal  
Rate of  
Return 30  
(percentages)

$\sigma = 3$



It is interesting to note how small is the change in the rate of return given the substantial difference in the growth rate of wages of illiterates and individuals with primary education. The explanation is that at those high values of the internal rate of return the "future does not matter," namely, the future changes in relative wages have a small effect on the results.

- b) A decline in the rate of return to bachillerato from 20% in 1965 to 18% in 1980. This decline is smaller than in the above case, the reason being that the ratio of earnings of bachillerato to primary declines less than the ratio of earnings of primary to illiterates.
- c) The rate of return to university education remains constant through time and equal to the values obtained with projection 1. The explanation is that under alternative 2 the real wages of individuals with bachillerato and university education remain roughly constant through time.

## IX. Interpretation of the Results and Policy Recommendations

1. To interpret the former results and to generalize them for all the urban sector of Colombia, it is necessary to stress the fact that the estimated rates of return were evaluated at the wages of Bogota. The question to be asked is how different could be the wages in other urban areas than Bogota.

For this purpose we have put together some limited information regarding wages in other cities in Colombia. This data is summarized in Table 9.

Table 9 shows that the wage differential between illiterates and individuals with primary schooling is not significantly different in Bogota than in other cities. At higher educational levels the earnings in Bogota are substantially higher, particularly at the level of bachillerato.

It is not our purpose to discuss the sources of this difference, but to analyze how the estimated rates of return would change if we would evaluate them at a weighted average of urban wages. Even more relevant, we have to analyze to what extent the policy implications we can derive from the Bogota data could change by including other urban areas.

From Table 5 we can conclude that the rates of return to primary schooling are of considerable magnitude in relation to the probable cost of capital of the Colombian economy and in relation to the returns

**TABLE 9**

**HOURLY WAGES IN OTHER CITIES OF COLOMBIA**

(MEN AND WOMEN)

Cities Schooling	Medellín October/67	Bucaramanga October/67	Manizales October/67	Popayán October/67	Barranquilla October/67	Ibagué May/67	Average Other Cities	Average - Bogotá (Table XX-A)
Zero years	1.5 (42)	1.2 (45)	1.1 (32)	0.8 (39)	2.0 (31)	1.1 (27)	1.41 (195)	0.88 (864)
1. Primary	2.7 (19)	1.2 (14)	1.7 (28)	0.6 (11)	1.9 (15)	1.5 (28)	1.67 (115)	1.36 (391)
2-3 Primary	1.9 (127)	2.0 (117)	1.5 (106)	1.2 (103)	2.8 (95)	2.0 (115)	1.89 (663)	1.75 (2,588)
5. Primary	4.2 (210)	4.0 (122)	2.6 (103)	3.3 (87)	4.1 (155)	3.9 (150)	3.80 (827)	3.57 (3,073)
1-2 Bachill.	4.8 (113)	4.0 (57)	4.0 (31)	4.2 (30)	4.7 (36)	5.1 (41)	4.54 (308)	4.72 (1,115)
6. Bachill.	6.9 (76)	7.2 (25)	4.2 (27)	6.5 (36)	7.2 (40)	5.6 (47)	6.38 (251)	14.08 (1,087)
1-2 Univers.	9.9 (68)	9.1 (42)	7.3 (23)	8.0 (21)	8.7 (29)	10.3 (32)	9.17 (215)	15.79 (849)
3-4 Univers.	14.3 (7)	10.4 (4)	8.4 (3)	14.4 (3)	4.8 (2)	10.1 (5)	11.25 (24)	18.76 (141)
5-6 Univers.	13.5 (11)	24.2 (2)	12.2 (2)	11.5 (4)	2.6 (7)	10.8 (7)	13.06 (33)	24.93 (210)
Average	4.80 (673)	3.91 (428)	2.72 (355)	3.19 (334)	4.38 (410)	3.94 (447)	3.96 (2,647)	5.44 (10,715)

Source: CEDE

Note: Figures in parenthesis show the number of observations.

of the other schooling levels<sup>1/</sup>. The fact that wage differences between illiterates and individuals with primary schooling are roughly similar in Bogota and other cities means that the above rates are relevant for other urban areas of Colombia.

On the other hand, the rate of return to university education is extremely low even when estimated at earnings in Bogota, meaning that it still overestimates the true rate of return to invest in this level.

When analyzing the rates of return to bachillerato, we face an ambiguous situation. Those rates are quite high but so are the earnings of people with that level in Bogota vis-a-vis other cities. This could mean that those rates of return could diminish substantially when including other urban areas.

2. One of the conclusions from this study is that the introduction of more complex estimations of the internal rate of return, which take into account unemployment and growth of both the economy and the educational sector, does not change the priorities provided by more simple estimations. Under all sorts of adjustments by unemployment and growth, the rates of return to primary and university education remain extremely high and extremely low, respectively.

---

<sup>1/</sup>The internal rate of return to elementary education is 24.3% and 17.2% for Mexico and Chile, respectively. See the studies by Carnoy and Selowsky quoted previously.

The effect of adjusting by unemployment or by differences between market and shadow wages turned out to be much more important than the effect of adjusting by growth. The reasons are the following:

- a) Given the high rates of return to primary and bachillerato education, the adjustments "for the future" had a small effect given the high discounting to which the future flows of the educational project are subjected.

With high rates of return the flows that become important are the relatively initial ones or the ones relevant when the individual we are educating is relatively young. Given that unemployment is higher the lower the age and the lower the amount of schooling, the adjustment by unemployment had an important effect on the returns to primary schooling.

- b) The low rates of return to university education were not affected by future growth, the reason being that the real wages of this category did not change through time.

3. The behavior of the rates of return through time (Graph 10) turns out to be very little sensitive to alternative projections of the educational supply.

Projections 1 and 2 imply different changes in the educational distribution of the labor force, the latter being of a much more aggressive nature: Nevertheless, its effect is a slight diminishing returns to invest in primary and bachillerato education.

From this analysis we can conclude that, in the case of Colombia, today's rates of return are good indices for investment decisions in education even if they imply strong changes in the educational distribution of the labor force.

## X. Policy Recommendations

The earlier results lead us to the following policy recommendations:

1. The first priority in Colombia's education should be given to primary schooling. Concretely we suggest:

- a) To expand the capacity of primary education, in terms of school equipment and teachers, so as to absorb the population of that schooling age.

Even without having data to evaluate the effects of education in the rural areas, we think the above recommendation is also valid for the agricultural sector. The reasons are the possible effect of education on the mobility of labor toward the urban area<sup>1/</sup>, the capacity of absorbing new agricultural techniques<sup>2/</sup>, and most important, the effects on the incentives and political participation of the members of that sector.

- b) The expansion of the capacity of the primary school system does not guarantee an automatic increase in the voluntary enrollment of students. This implies the need of additional policies in order to increase the incentives for enrollment in primary school.

---

<sup>1/</sup> It could be argued that one of the effects of a higher mobility could be a higher rate of unemployment in the urban sector. However, we showed that even correcting for urban unemployment the rate of return to primary schooling was substantially high.

<sup>2/</sup> See T. Shultz: Transforming Traditional Agriculture (Yale University Press, 1964).

Concrete policies which have been successful in other countries are those of providing free transportation and meals at school, the former of great importance for the rural areas<sup>1/</sup>. These types of policies are many times disregarded by being considered, erroneously, as current expenditures instead of part of the investment package in education.

Another important effect of these kind of policies is the increase in the incentives of continuing at school, in other words, of diminishing the amount of dropouts. This is especially relevant for the case of Colombia where primary school graduates represent 44% and 3% of the first-year enrollment in the urban and rural areas, respectively.

We believe that any policy of expansion of primary education in the rural areas of Colombia will be ineffective if it is not implemented with direct subsidies to the student.

- c) The suggested expansion of primary education should be carried out at a much faster pace than the one observed in the past, particularly for the rural areas.

The following table shows the increase in the schooling rate (population at school over total population) of the population

---

<sup>1/</sup> If the quality of the food diet is correlated with performance at school, the policy of providing free meals could be considered as a joint investment in education and health.

between 7 and 12 years-old for the decade 1955-1965.

---

	<u>SCHOOLING RATE</u>		
	(In Percentages)		
	<u>1955</u>	<u>1960</u>	<u>1965</u>
Urban Areas	76.0	83.4	87.0
Rural Areas	42.7	46.3	54.1
COUNTRY	57.0	65.0	71.5

---

For these age groups the schooling rate increased in this decade at an average of approximately 1.5 percentage points per annum. To maintain this growth means that for achieving a schooling rate of 90%, we need 12 years. If we want to arrive at this rate of schooling in 6 years, we need to double the growth of this rate to 3.0 percentage points per year. This means .5 and 6.0 percentage points per year for the urban and rural sector, respectively.

2. Bachillerato education should have the second priority in Colombia's educational policy. The fact that the rates of return estimated through the wages of Bogota seem to overstate the true returns leads us to a more conservative set of recommendations.

The characteristics of the Colombian case are such that the recommendations for expansion of this sector are closely linked to the expansion of primary education. The reason is that the enrollment

in bachillerato represents already a relatively high fraction of primary school graduates: Total enrollment in bachillerato in 1965 was equal to 70% of the primary school graduates in the period 1959-64. We do not think this percentage could increase substantially in the future, so the main source of expansion of bachillerato has to be the expansion in the number of primary school graduates itself. In other words, the bottleneck of bachillerato education is not a low percentage of enrollment over elementary school graduates but the small number of graduates itself being this a function of the low retention rate at elementary schools.

Our recommendations for bachillerato and secondary education in general in Colombia, are the following:

- a) To expand secondary education, given the rate of 70% discussed earlier, as a function of the increase in primary school graduates resulting from a higher enrollment and retention at that level.
  - b) To carry out additional research with the purpose of determining priorities within secondary education particularly between specialized (technical) secondary education and bachillerato.
3. The rate of return to university education, even evaluated at wages of Bogota, does not justify new investment in this level of schooling. However, the figures obtained for university represented an average for the sector as a whole, and therefore, does not provide

information by specific professions. Our recommendations are to avoid significant investments in this sector as long as we do not have precise information about the rates of return by professions. This implies that, as far as future research is concerned, this educational sector has the first priority.

STATISTICAL APPENDIX

TABLE I-4

## EXPENDITURE ON TEACHERS IN URBAN PUBLIC PRIMARY SCHOOLS: 1964

DEPARTMENTS	Number of Teachers by Wage Level					Wage Levels ( In Current Pesos )					Monthly Wage Bill by Depart- ment	Annual Wage Bill (14 Months) (a)
	1t.	2d.	3d.	4t.	Un- clas- si- fied	1t.	2d.	3d.	4t.	Un- clas- si- fied		
Bogotá, D. E.	1.603	1.122	356	90	38	1.130	1.080	1.030	940	940	3.510.150	48.142.100
Antioquia	1.577	1.012	517	143	153	970	800	700	600	480	2.860.430	40.046.020
Atlántico	630	390	108	74	18	920	820	720	650	650	1.036.960	14.517.440
Bolívar	443	299	163	95	458	1.000	850	700	600	440	1.069.770	14.976.780
Boyacá	378	435	478	50	182	935	880	846	768	531	1.275.660	17.859.240
Caldas	629	311	380	151	1.020	790	740	690	680	640	1.744.730	24.426.220
Cauca	168	130	198	41	84	690	650	490	540	490	380.540	5.327.560
Córdoba	76	153	94	26	184	920	820	620	570	440	349.440	4.892.160
Cundinamarca	503	457	543	162	84	1.040	910	850	520	470	1.524.260	21.339.640
Chocó	154	77	52	13	16	920	840	750	650	550	262.610	3.676.540
Huila	169	83	183	73	236	810	730	670	610	510	484.980	6.789.720
Guajira	14	44	30	26	44	670	570	520	470	450	82.080	1.149.120
Magdalena	253	148	229	166	336	900	850	800	700	400	787.300	11.022.200
Mérea	45	42	123	14	65	960	860	760	660	610	221.690	3.103.660
Nariño	316	220	110	13	139	720	670	620	570	520	522.810	7.319.340
Norte de Santander	269	279	297	54	296	865	790	715	640	565	867.250	12.141.500
Santander	340	376	606	72	263	850	750	700	600	500	1.169.900	16.378.600
Tolima	290	176	183	124	845	900	800	730	680	600	1.126.710	15.773.940
Valle del Cauca	735	482	547	105	768	950	890	840	820	790	2.361.530	33.061.420
Arauca	4	1	8	3	41	700	650	600	550	500	30.400	425.600
Caquetá	3	6	26	5	31	920	720	620	520	520	41.920	586.880
Sn. Andrés y Prov.	9	5	3	4	14	750	700	650	600	550	22.300	312.200
Amazonas	4	0	6	1	1	627	620	620	620	620	7.440	104.160
Guainia	0	0	0	0	0	0	0	0	0	0	0	0
Putumayo	10	5	8	1	38	700	600	500	400	300	25.800	361.200
Vaupés	0	0	0	1	12	620	620	620	620	520	6.860	96.040
Vichada	0	0	0	0	13	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>8.622</b>	<b>6.253</b>	<b>5.248</b>	<b>1.607</b>	<b>5.379</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>22.150.800</b>	<b>310.111.200</b>

Source: DANE

(a) Social Security amounts to 2 months of salary.

TABLE I

## EXPENDITURE ON TEACHERS IN URBAN PUBLIC PRIMARY SCHOOLS: 1965

DEPARTMENTS	Number of Teachers by Wage Level					Wage Levels (In Current Pesos)					Monthly Wage Bill by Depart- ment	Annual Wage Bill (14 Months)
	1t.	2d.	3d.	4t.	Unclas- si- fied	1t.	2d.	3d.	4t.	Unclas- si- fied		
Bogotá, D. E.	1.877	1.280	348	82	28	1.300	1.250	1.200	1.150	1.100	4.582.800	64.159.200
Antioquia	1.676	1.122	563	146	113	1.320	1.100	1.010	920	780	4.237.610	59.326.540
Atlántico	676	380	115	104	22	1.000	900	800	700	560	1.198.200	16.774.800
Bolívar	480	324	183	93	409	1.000	850	700	600	440	1.119.260	15.669.640
Boyacá	408	514	342	37	151	1.028	968	930	844	585	1.355.215	18.973.010
Caldas	700	410	402	175	1.010	1.100	990	880	778	669	2.341.500	32.781.000
Cauca	162	164	211	38	100	750	700	650	600	550	451.250	6.317.500
Córdoba	113	231	83	18	113	950	850	650	600	450	419.300	5.870.200
Cundinamarca	606	496	599	137	36	1.200	1.040	950	830	520	1.944.520	27.223.280
Chocó	142	106	61	13	10	920	840	750	650	550	279.380	3.911.320
Huila	170	135	157	67	218	810	730	570	510	510	493.490	6.908.860
Guajira	20	53	32	31	45	770	655	598	540	517	109.256	1.529.584
Magdalena	307	167	205	202	101	1.170	898	845	750	422	876.503	12.271.042
Meta	57	62	102	20	81	1.110	1.010	910	810	760	295.900	4.142.600
Nariño	322	240	143	14	68	720	620	620	570	520	512.640	7.176.960
Norte de Santander	320	314	269	53	167	913	834	755	676	597	892.658	12.497.212
Santander	424	459	646	68	185	900	800	750	650	550	1.379.250	19.309.500
Tolima	271	201	227	131	685	900	800	730	830	600	1.096.690	15.353.650
Valle del Cauca	842	595	534	167	776	1.050	990	940	920	890	2.819.390	39.471.450
Arauca	4	1	12	2	59	805	747	690	632	575	47.436	664.104
Caquetá	4	8	16	9	40	1.058	828	713	598	598	51.566	721.924
Sn. Andrés y Prov.	10	7	5	4	12	862	805	747	690	632	22.334	312.676
Amazonas	2	0	8	0	8	713	713	713	713	713	12.834	179.676
Guainia	0	0	0	0	0	0	0	0	0	0	0	0
Putumayo	10	7	6	9	25	805	690	575	460	345	29.095	407.330
Vaupés	2	3	3	3	0	713	713	713	713	713	7.843	109.602
Vichada	1	0	6	2	8	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>9.606</b>	<b>5.278</b>	<b>5.278</b>	<b>1.627</b>	<b>4.470</b>						<b>26.575.920</b>	<b>372.062.880</b>

Source: DANE

TABLE III-A

## EXPENDITURE ON TEACHERS IN URBAN PUBLIC PRIMARY SCHOOLS: 1966

DEPARTMENTS	Number of Teachers by Wage Level					Wage Levels ( In Current Pesos)					Monthly Wage Bill by Depart- ment Current Pesos	Annual Wage Bill (14 Months) Current Pesos
	1st.	2d.	3d.	4t.	Unclas- si- fied	1st.	2d.	3d.	4t.	Unclas- si- fied		
Antioquia	1.804	1.700	549	173	77	1.470	1.250	1.150	1.040	880	5.030.910	70.432.740
Atlántico	703	411	105	95	16	1.278	1.078	970	875	760(b)	1.540.883	21.572.362
Bolívar	512	391	180	121	443	1.278	1.023	859	743	540	1.538.072	21.533.008
Boyacá	447	623	254	52	136	1.305	1.142	1.093	992	685	1.717.167	24.040.338
Caldas	679	423	327	145	585	1.250	1.073	960	934	760	2.196.579	30.752.106
Cauca	152	162	209	31	116	1.038	872	808	743	650	576.725	8.074.150
Córdoba	100	248	63	17	96	1.230	1.023	808	743	550	493.039	6.902.546
Bogotá, D. E.	2.347	1.509	330	20	82	1.470	1.420	1.370	1.320	1.200	6.169.770	86.376.780
Cundinamarca	669	618	619	156	43	1.400	1.250	1.150	1.000	620	2.603.610	36.450.540
Chocó	181	116	63	27	14	1.201	1.013	909	774	650	422.154	5.910.156
Huila	174	148	151	86	209	1.100	943	847	788	610	654.119	9.157.666
Guzirí	21	40	30	39	52	862(a)	733(a)	669(a)	604(a)	579(a)	121.156	1.696.184
Magdalena	316	177	221	216	188	1.230	1.105	1.006	910	500	1.097.151	15.360.114
Meta	61	98	103	24	61	1.310	1.184	1.077	958	880	383.030	5.362.420
Nariño	373	297	160	8	56	1.000	890	800	745	620	806.010	11.284.140
Norte de Santander	358	467	237	31	59	1.195	1.007	914	820	697	1.181.240	16.537.360
Quindío	99	100	101	39	274	1.250(a)	1.073(a)	960(a)	934(a)	760(a)	572.676	8.017.464
Santander	455	601	674	84	228	1.150	1.010	900	795	650	1.951.840	27.325.760
Tolima	280	256	239	120	651	1.130	1.050	900	840	700	1.356.800	18.995.200
Valle del Cauca	829	715	565	163	791	1.324	1.164	1.106	1.082	950	3.482.562	48.755.868
Arauca	4	1	14	0	62	901(a)	836(a)	772(a)	707(a)	644(a)	55.176	772.464
Caquetá	12	14	23	10	46	1.184(a)	927(a)	798(a)	669(a)	669(a)	83.004	1.162.056
San Andrés y Providenc.	7	10	1	17	9	965(a)	901(a)	836(a)	772(a)	707(a)	36.088	505.232
Amazonas	0	0	4	2	10	798(a)	798(a)	798(a)	798(a)	798(a)	12.768	178.752
Guainia	0	0	0	0	0	0	0	0	0	0	0	0
Putumayo	7	6	12	2	37	901(a)	772(a)	644(a)	515(a)	386(a)	33.979	475.706
Vaupés	2	3	3	3	0	798(a)	798(a)	798(a)	798(a)	798(a)	8.778	122.892
Vichada	1	3	7	4	7	0	0	0	0	0	0	0
<b>TOTAL</b>	<b>10.603</b>	<b>8.637</b>	<b>5.244</b>	<b>1.685</b>	<b>4.348</b>						<b>34.125.286</b>	<b>477.754.004</b>

Source: DANE

(a) Equal to the 1965 one plus 12%; 12% is the average increase in teachers' salaries between 1965-66.

(b) 80% of the wage of the 4th category

URBAN PRIMARY PUBLIC SCHOOLS CLASSIFIED BY NUMBER OF CLASSROOMS: 1966

DEPARTMENTS	Schools by No. of Classrooms						(a)	Number of Classrooms						Annual Rent Per Classroom (Current Pesos)	
	1	2	3	4	5	6+		1	2	3	4	5	6+		Total
	Antioquia	14	12	35	31	106		302	14	24	105	124	530		2.416
Atlántico	6	24	25	33	46	78	6	48	75	132	230	624	1.115	2.128.535	
Bolívar	22	67	58	69	50	81	22	134	174	276	250	648	1.504	1.914.592	
Boyacá	88	82	63	44	80	64	88	164	189	176	400	512	1.159	1.945.417	
Caldas	20	18	15	11	35	165	10	36	45	44	175	1.320	1.630	3.111.670	
Cauca	5	14	11	11	33	46	5	28	33	44	165	369	643	818.539	
Córdoba	9	23	8	13	25	32	9	46	24	52	125	256	512	651.776	
Distrito Especial	29	57	51	86	98	288	29	114	153	344	490	2.304	3.434	8.742.964	
Cundinamarca	114	83	55	62	80	110	114	166	165	248	400	880	1.973	2.511.629	
Chocó	8	12	2	5	15	26	8	24	6	20	75	208	341	434.093	
Huila	6	23	20	15	25	39	6	46	60	60	125	312	609	775.257	
Guajira	1	2	2	3	3	9	1	4	6	12	15	72	110	140.030	
Mogdalena	8	30	16	23	35	55	8	60	48	92	175	440	823	1.047.679	
Meta	0	5	6	8	8	26	0	10	18	32	40	208	308	392.084	
Nariño	3	24	24	14	34	55	3	48	72	56	170	440	789	1.004.397	
Norte de Santander	16	15	28	36	52	68	16	30	84	144	260	544	1.078	1.372.294	
Quindío	4	9	4	8	18	49	4	18	12	32	90	392	548	697.604	
Santander	35	38	60	46	65	111	35	76	180	184	325	888	1.688	3.222.392	
Tolima	15	35	32	25	35	104	15	70	96	100	175	832	1.283	1.639.624	
Valle del Cauca	30	41	37	41	100	226	30	82	111	164	500	1.808	2.695	5.144.735	
Arauca	2	2	2	6	3	5	2	4	6	24	15	40	91	115.843	
Sn. Andrés y Prov.	7	13	6	2	6	2	7	26	18	8	30	16	105	133.665	
Caquetá	2	0	1	2	2	1	2	0	3	8	10	8	31	39.463	
Amazonas	0	0	0	0	0	2	0	0	0	0	0	16	16	20.368	
Guainia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Putumayo	0	1	0	2	3	6	0	2	0	8	15	48	73	92.929	
Vaupés	1	0	1	0	0	1	1	0	3	0	0	8	12	15.276	
Vichada	0	0	0	0	0	2	0	0	0	0	0	16	26	20.368	
<b>TOTAL</b>	<b>435</b>	<b>630</b>	<b>562</b>	<b>596</b>	<b>957</b>	<b>1.953</b>	<b>435</b>	<b>1.260</b>	<b>1.636</b>	<b>2.384</b>	<b>4.785</b>	<b>15.624</b>	<b>26.174</b>	<b>44.267.860</b>	

Source: DANE

(a) For the group 6+ we used a total of 8 classrooms. This value was obtained through a sample provided by DANE.

75

TABLE V-A

PUBLIC PRIMARY SCHOOLS (URBAN AREA): COST PER STUDENT YEAR

( In Current Pesos )

Year	Annual Expenditure on Teachers (thousands)	Annual Expenditure on Rent (thousands)	Total Expenditure (thousands)	STUDENTS Average Attendance (a) (in thous)	COST PER STUDENT YEAR		
					Professors	Rent	TOTAL
1964	310.111						
1965	372.063			1.009	307		
1966	477.745	44.268	522.022	1.060 1.142	351 418	39	457

( In Pesos of 1966 (b) )

1964	387.638						
1965	435.314			1.009	384		
1966	477.754	44.268	522.022	1.060 1.142	411 418	39	457

(a) Average of initial enrollment and students presented to final examinations.

(b) The Consumer Price Index was used as a deflator.

Source: Tables I-A, II-A, III-A, and IV-A.

TABLE VI-A

EDUCATIONAL DISTRIBUTION OF PRIMARY SCHOOL TEACHERS: 1965

( Urban Schools )

<u>Level of Schooling</u>	<u>Public Schools</u>	<u>Private Schools</u>
Primary	2.82	1.65
Technical Secondary Education	4.22	9.87
Bachillerato without Degree	20.88	15.66
Bachillerato with Degree	7.44	18.96
Normalista without Degree	9.87	9.26
Normalista with Degree	52.43	30.49
University	2.34	14.11

Source: Republica de Colombia, Ministerio de Educacion Nacional,  
Oficina de Planeamiento, "Institutos Nacionales de  
Educacion Media", Tomo VII.

TABLE VII-A

COST OF SCHOOLING MATERIALS PER STUDENT YEAR  
IN PRIMARY SCHOOLS (URBAN AREA): 1967

(Current Pesos)

	<u>Public Schools</u>	<u>Private Schools</u>	<u>Average</u>
First Year	\$ 51	\$165	\$108
Second Year	\$ 73	\$198	\$135
Third Year	\$133	\$265	\$199
Fourth Year	\$141	\$275	\$208
Fifth Year	\$151	\$275	\$213

Source: Concentracion Escolar de Primaria dependiente del  
Departamento de Cundinamarca, Barrio Restrepo.

TABLE VIII-A

BACHILLERATO

COST PER STUDENT YEAR: PUBLIC SCHOOLS

(Current Pesos)

	<u>Total Cost</u> <u>(thousands) (a)</u>	<u>Average</u> <u>Attendance</u>	<u>Cost Per</u> <u>Student</u>
1965	114.573	104.968	1.091
1966	151.522	122.997	1.232

(a) Current pesos

Source: Nacion: Informe Financiero de la Contraloria General  
de la Republica

Departamentos: Tabulados del DANE

**TABLE IX-A**

**BACHILLERATO**

**COST PER STUDENT YEAR: PRIVATE SCHOOLS, 1963**

( Current Pesos )

DEPARTMENT	No. of Schools	No. of Students	EXPENDITURES		Cost Per Student-Year
			Personal Services	Other Expenses	
Antioquia	12	4.706	3.313.728	1.708.017	1.067
Atlántico	5	1.693	868.177	664.148	905
Bolívar	1	175	105.012	102.072	1.183
Boyacá	8	1.738	1.583.962	102.750	1.700
Caldas	12	3.000	2.527.963	1.243.328	1.256
Córdoba	2	269	191.507	76.675	997
Cundinamarca	3	485	599.266	257.019	
Huila	1	237	135.123	17.076	642
Nariño	7	2.651	1.629.377	684.092	873
Norte de Santander	4	635	573.265	198.369	1.215
Santander	6	1.888	1.437.353	597.429	1.078
Tolima	6	1.793	1.146.328	411.855	869
Valle	3	527	355.697	44.710	937
Bogotá, D. E.	18	5.810	6.376.721	2.538.027	1.534
<b>TOTAL</b>	<b>88</b>	<b>25.607</b>	<b>20.843.479</b>	<b>9.045.567</b>	<b>1.167</b>

Source: Sample of 88 schools of the Federacion de Colegios Catolicos.

TABLE X

STUDENT-TEACHER RATIO BACHILLERATO 1964

	<u>Public Schools</u>	<u>Private Schools</u>
1) Student (thousands)	89.7	138.9
2) Full-time teachers	3882	5440
3) Part-time teachers	1803	5233
4) Total full-time teachers (assuming part-time teachers work 1/2 day)	4783	8057
5) Student-teacher ratio (1)/(4)	18.7	17.2

Source: DANE: Anuario General de Estadísticas, Tomo III.

TABLE XI-A

EDUCATIONAL DISTRIBUTION OF TEACHERS OF BACHILLERATO

	<u>Public Schools</u>		<u>Private Schools</u>	
	Total	(%)	Total	(%)
Technical Secondary	266	4.68	664	6.22
Bachillerato without Degree	544	9.56	643	6.03
Bachillerato with Degree	1.704	29.97	2.594	24.30
University without Degree	265	4.68	1.135	10.63
University with Degree	1.407	27.74	3.166	29.66
Normalists	<u>1.499</u>	<u>26.37</u>	<u>2.471</u>	<u>23.16</u>
<b>TOTAL</b>	<b>5.685</b>	<b>100</b>	<b>10.673</b>	<b>100</b>

Source: DANE

TABLE XII-A

BACHILLERATO

COST OF SCHOOLING MATERIALS PER STUDENT YEAR: 1967

( In Pesos of 1966 )

First Year	232
Second Year	250
Third Year	278
Fourth Year	306
Fifth Year	352
Sixth Year	389

Source: Externado Nacional "Camilo Torres"

TABLE XIII-A

EXPENDITURES IN THE UNIVERSITIES OF THE PUBLIC SECTOR: 1966

(Current Pesos)

<u>UNIVERSITIES</u>	<u>Personal Services</u>	<u>General Expenditures</u>	<u>Transfers</u>	<u>Total Cost</u>	<u>No. of Enrolled Students</u>	<u>Cost Per Student Year</u>
<u>National Ones:</u>						
1. Universidad Nacional	83.985.299.00	13.538.321.00	8.562.404.00	106.086.024.00	10.179	10.422
2. Universidad Pedagógica Nacional	8.771.201.00	1.474.432.00	1.859.200.00	12.104.833.00	927	13.058
3. Universidad Pedagógica y Tecnológica	10.774.504.64	2.145.305.80	1.422.240.47	14.342.050.91	1.092	13.173
<u>Departmental Ones:</u>						
4. Universidad de Caldas	9.208.564.90	418.411.98	685.983.00	10.312.959.88	977	10.555
5. Universidad de Córdoba	1.569.000.00	2.918.500.00	-o-	4.487.500.00	218	20.584
6. Universidad de Cartagena	11.008.604.00	882.000.00	1.252.568.00	13.143.172.00	972	13.249
7. Universidad de Nariño	4.244.071.00	980.593.95	457.680.00	5.682.344.98	571	9.951
8. Universidad del Quindío	1.455.324.19	365.862.81	62.114.60	1.881.301.60	231	8.144
9. Universidad del Tolima	5.255.531.59	923.686.98	388.577.76	6.567.796.33	638	10.294
10. Universidad del Valle	28.358.956.96	7.117.492.76	-o-	35.476.449.72	1.798	19.731
11. Universidad Industrial de Santander	9.569.696.35	1.241.390.32	770.138.33	11.581.225.00	914	12.670
12. Universidad Tecnológica de Pereira	3.549.374.00	1.137.588.00	937.983.00	5.624.945.00	620	9.072
13. Universidad Tecnológica del Magdalena	1.072.365.83	155.079.00	-o-	1.227.445.03	114	10.767
<b>TOTAL</b>	<b>178.820.493.46</b>	<b>33.298.664.60</b>	<b>16.398.889.76</b>	<b>228.518.047.42</b>	<b>19.271</b>	<b>11.858</b>

Source: Fondo Universitario Nacional

TABLE XIV-A

UNIVERSIDAD NACIONAL: RETENTION RATES

1964 - 1965

Semester (1)	No. of Students(a) (2)	% of Students (3)	Rate of Retention (b) (4)	(3) x (4) (5)
1-3	3.074	36.0	73.5	26.46
3-5	1.959	23.0	83.3	19.16
5-7	1.297	15.1	87.5	13.21
7-9	1.150	13.5	95.8	12.93
9-11	760	9.0	87.7	7.89
11-13	296	3.4	94.2	3.20
<b>TOTAL</b>	<b>8.536</b>	<b>100.0</b>		<b>82.85</b>

a. Source: Estadísticas Básicas- Año 1966-  
Asociación Colombiana de Universidades,  
Fondo Universitario Nacional.

b. Source: Departamento de Planeación- Universidad Nacional.

**TABLE XV-A**

1963

**BOGOTA: HOURLY WAGES BY SCHOOLING AND ECONOMIC ACTIVITY (CURRENT PESOS)**

**MALES AND FEMALES**

No. of Observations: 2418

Schooling	Sector	03	04	05	06	07	08	09	10	Weighted Average
Illiteracy		1.0	1.1	2.5	1.2	1.1				
1. Primary		1.1	1.6	2.0	1.2	1.2	0.1	--	--	0.59
2.3 Primary		2.0	1.7	2.5	1.3	1.6	0.4	2.1	2.0	0.65
5. Primary		2.4	2.3	4.6	3.1	3.1	2.2	4.0	3.0	1.12
1.2 Bachillerato		3.3	2.0	2.5	2.8	3.8	5.2	5.3	4.0	2.73
3.4 Bachillerato		5.7	3.6	4.0	5.8	6.6	3.8	5.1	3.2	3.88
6. Bachillerato		10.1	21.1	12.0	14.3	9.5	10.4	7.5	4.6	5.25
1.2 University		17.9	--	--	7.3	3.0	14.4	7.0	9.4	11.25
3.4 University		13.5	8.0	--	13.7	32.0	15.5	7.2	8.0	12.88
5.6 University		20.8	16.5	16.3	30.6	--	17.8	15.5	--	13.60
Weighted Average		3.87	3.02	6.23	5.82	3.88	2.40	6.31	5.08	4.10
Code of Sectors:	03	Industries of Transformation (manufacturing)								
	04	Construction								
	05	Electricity, Water, Gas, and Health Services								
	06	Retail								
	07	Transport, Storing and Communications								
	08	Services								
	09	Government Services								
	10	Armed Forces								

Source: CEDE

TABLE XVI-A

1964

BOGOTA: HOURLY WAGES BY SCHOOLING AND ECONOMIC ACTIVITY (CURRENT PESOS)

MALES AND FEMALES

No. of Observations: 2263

Schooling \ Sector	03	04	05	06	07	08	09	10	Weighted Average
Illiteracy	2.7	1.4	--	0.1	1.7	0.1	2.0	--	0.64
1. Primary	2.0	1.4	--	1.6	1.0	0.5	1.6	--	0.86
2.3 Primary	2.9	2.5	3.0	3.1	1.7	0.8	1.8	--	1.86
5. Primary	2.6	3.9	3.0	3.8	3.2	2.4	3.9	2.4	2.95
1.2 Bachillerato	3.8	3.8	5.5	4.4	5.7	1.8	4.0	3.2	3.89
3.4 Bachillerato	5.2	6.7	--	7.0	8.1	9.3	6.0	6.2	6.92
6. Bachillerato	11.6	6.5	3.0	14.4	32.4	8.4	9.0	5.0	14.28
1.2 University	18.3	--	--	11.3	9.0	15.7	10.1	--	14.08
3.4 University	26.1	--	16.0	22.0	5.0	15.5	13.0	--	17.34
5.6 University	16.5	17.0	16.0	69.6	24.0	18.0	16.2	16.0	23.74
Weighted Average	4.53	3.25	5.21	8.49	9.38	3.10	6.60	6.30	5.07

Code of Sectors:

- 03 Industries of Transformation (manufacturing)
- 04 Construction
- 05 Electricity, Water, Gas and Health Services
- 06 Retail
- 07 Transport, Storing and Communications
- 08 Services
- 09 Government Services
- 10 Armed Forces

Source: CEDE

TABLE XVII-A

1965

BOGOTA: HOURLY WAGES BY SCHOOLING AND ECONOMIC ACTIVITY (CURRENT PESOS)

MALES AND FEMALES

No. of Observations: 3202

Schooling	Sector	03	04	05	06	07	08	09	10	Weighted Average
Illiteracy		1.6	1.8	2.5	1.2	1.6	0.2	1.2	--	0.69
1. Primary		2.0	1.8	1.0	4.5	4.4	0.2	1.0	--	1.74
2.3 Primary		2.3	2.1	2.4	2.3	2.9	0.5	2.7	2.7	1.53
5. Primary		2.8	2.8	3.3	3.4	4.0	2.8	3.5	3.5	2.29
1.2 Bachillerato		3.4	2.6	5.5	4.7	3.5	4.4	3.6	4.6	4.00
3.4 Bachillerato		6.3	3.2	--	6.7	4.4	6.8	6.6	4.0	6.26
6. Bachillerato		11.0	12.0	9.5	13.0	10.3	9.4	11.3	8.7	11.65
1.2 University		16.3	7.0	16.0	8.8	10.0	8.3	10.8	--	10.83
3.4 University		16.3	15.0	5.0	11.5	26.0	12.3	9.2	7.0	12.17
5.6 University		28.1	14.6	16.0	24.7	14.6	17.8	17.1	--	18.95
Weighted Average		4.00	3.02	5.48	5.64	4.78	3.42	7.00	5.10	4.42

Code of Sectors:

- 03 Industries of Transformation (manufacturing)
- 04 Construction
- 05 Electricity, Water, Gas and Health Services
- 06 Retail
- 07 Transport, Storing and Communications
- 08 Services
- 09 Government Services
- 10 Armed Forces

Source: CEDE

TABLE XVIII-A

1966

BOGOTA: HOURLY WAGES BY SCHOOLING AND ECONOMIC ACTIVITY (CURRENT PESOS)

MALES AND FEMALES

No. of Observations: 3231

Schooling	Sector	03	04	05	06	07	08	09	10	Weighted Average
Illiteracy		2.3	2.4	2.0	1.6	1.2	0.2	2.7	--	0.97
1. Primary		2.4	2.4	--	4.0	4.3	0.3	9.0	--	2.10
2.3 Primary		2.6	2.4	4.3	2.1	2.6	0.6	3.1	3.0	1.73
5. Primary		3.5	4.0	4.2	4.1	4.9	3.2	5.5	4.5	3.83
1.2 Bachillerato		4.5	4.0	--	4.9	4.9	2.9	7.3	4.0	4.54
3.4 Bachillerato		6.7	6.0	13.0	8.0	6.7	5.8	7.1	7.0	7.11
6. Bachillerato		14.6	10.5	10.0	14.2	9.7	9.6	9.4	13.0	12.34
1.2 University		17.2	--	--	18.0	6.0	10.7	12.0	--	14.13
3.4 University		12.5	--	--	14.9	9.0	21.9	12.8	22.0	16.18
5.6 University		29.3	22.0	18.0	28.3	17.2	22.3	28.0	14.5	24.58
Weighted Average		5.14	3.45	7.16	6.30	5.34	4.06	9.15	8.33	5.30
Code of Sectors:	03	Industries of Transformation (manufacturing)								
	04	Construction								
	05	Electricity, Water, Gas and Health Services								
	06	Retail								
	07	Transport, Storing and Communications								
	08	Services								
	09	Government Services								
	10	Armed Forces								

Source: CEDE

BOGOTA, MALES: HOURLY WAGES BY SCHOOLING AND AGE

1963 - 1966

(In Pesos of 1966)

Schooling \ Age	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	TOTAL
Illiteracy	1.00 (1)	1.04 (24)	1.46 (15)	1.82 (23)	1.84 (33)	2.28 (50)	2.05 (19)	2.31 (41)	2.16 (24)		1.95 (240)
1. Primary	0.81 (4)	0.92 (13)	2.36 (25)	2.10 (28)	3.13 (29)	2.82 (28)	2.46 (15)	2.78 (19)	2.18 (17)	2.30 (2)	2.45 (180)
2.3 Primary	0.42 (42)	1.48 (154)	2.64 (213)	2.87 (218)	2.83 (171)	2.86 (162)	4.20 (153)	2.71 (110)	3.89 (82)	2.62 (35)	2.78 (1,340)
5. Primary	0.80 (20)	1.63 (234)	3.30 (312)	4.21 (339)	4.10 (289)	4.70 (259)	5.00 (192)	5.85 (154)	6.00 (122)	5.25 (61)	4.12 (1,982)
1.2 Bachillerato		3.43 (124)	4.40 (166)	5.43 (141)	5.56 (113)	5.53 (96)	6.69 (42)	5.97 (44)	4.96 (27)	7.63 (11)	5.05 (764)
3.4 Bachillerato		3.50 (52)	4.51 (100)	6.90 (134)	10.15 (89)	9.62 (86)	11.00 (72)	10.91 (58)	14.40 (36)	11.44 (29)	8.26 (695)
6. Bachillerato		3.88 (9)	7.04 (81)	11.60 (111)	16.45 (94)	18.88 (71)	21.14 (67)	21.36 (52)	22.85 (56)	21.25 (35)	16.18 (576)
1.2 University		6.1 (2)	7.83 (37)	13.12 (31)	25.41 (17)	20.00 (13)	20.00 (1)	18.57 (7)	26.23 (1)		14.46 (109)
3.4 University			10.40 (13)	14.63 (47)	27.00 (30)	20.72 (22)	27.36 (22)	29.62 (8)	32.00 (8)		21.22 (150)
5.6 University			16.48 (25)	21.67 (78)	22.84 (86)	31.71 (66)	29.16 (31)	25.73 (38)	32.00 (33)		25.48 (362)
<b>TOTAL</b>	<b>0.56 (67)</b>	<b>2.13 (612)</b>	<b>4.32 (1,026)</b>	<b>6.90 (1,150)</b>	<b>8.52 (951)</b>	<b>8.64 (853)</b>	<b>9.28 (614)</b>	<b>8.84 (531)</b>	<b>10.84 (406)</b>	<b>9.11 (188)</b>	<b>7.14 (6,396)</b>

Source: Muestras de Desempleo CEDE.

Note: Figures in parenthesis represent number of observations.

TABLE XX-A

## BOGOTA, MALES AND FEMALES: HOURLY WAGES BY SCHOOLING AND AGE

1963 - 1966

(In Pesos of 1966)

Schooling	Age	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	TOTAL
Illiteracy		0.10 (8)	0.17 (120)	0.59 (133)	0.50 (117)	0.96 (112)	1.12 (127)	0.94 (66)	1.47 (81)	1.32 (56)	2.36 (44)	0.88 (864)
1. Primary		0.35 (18)	0.15 (64)	0.82 (74)	1.38 (59)	2.12 (47)	1.93 (46)	1.54 (32)	2.33 (26)	2.18 (17)	4.75 (8)	1.36 (391)
2.3 Primary		0.14 (103)	0.93 (573)	1.46 (509)	1.95 (369)	2.18 (278)	2.22 (254)	2.99 (192)	2.51 (156)	3.12 (99)	1.78 (51)	1.75 (2,588)
5. Primary		0.54 (32)	1.62 (483)	3.22 (591)	3.39 (518)	3.92 (422)	4.41 (351)	4.44 (258)	5.50 (197)	5.21 (148)	4.35 (73)	3.57 (3,073)
1.2 Bachillerato		0.35 (3)	3.78 (184)	4.05 (268)	4.96 (204)	5.19 (147)	5.15 (142)	5.71 (69)	5.92 (51)	5.61 (32)	6.67 (15)	4.72 (1,115)
3.4 Bachillerato			3.90 (111)	5.47 (259)	6.63 (221)	8.48 (133)	8.53 (130)	10.75 (89)	10.52 (65)	11.76 (46)	12.42 (33)	7.49 (1,087)
6. Bachillerato			6.00 (28)	6.80 (174)	10.52 (163)	14.33 (130)	21.92 (110)	15.40 (83)	19.70 (59)	21.50 (61)	19.34 (41)	14.08 (849)
1.2 University			6.10 (4)	10.17 (47)	14.02 (41)	26.26 (19)	18.35 (17)	15.00 (2)	29.70 (8)	23.60 (3)		15.79 (141)
3.4 University				10.00 (28)	13.95 (60)	22.65 (44)	18.78 (28)	24.09 (27)	33.00 (9)	31.20 (9)	18.60 (5)	18.76 (210)
5.6 University				15.88 (35)	20.90 (88)	23.00 (91)	31.10 (69)	29.16 (31)	27.70 (39)	31.50 (34)	21.27 (11)	24.93 (398)
<b>TOTAL</b>		0.24 (169)	1.70 (1,567)	3.67 (2,118)	5.47 (1,840)	6.90 (1,423)	7.52 (1,274)	7.22 (848)	7.84 (691)	9.21 (505)	7.76 (281)	5.44 (10,715)

Source: Muestras de Desempleo CEDE.

Note: Figures in parenthesis represent number of observations.

**TABLE XXI-A**

**WEEKLY HOURS OF "FULL EMPLOYMENT" BY SEX AND SCHOOLING**

	M E N					M E N A N D W O M E N				
	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>Average</u>	<u>1963</u>	<u>1964</u>	<u>1965</u>	<u>1966</u>	<u>Average</u>
Illiteracy	50.2	53.3	50.8	47.5	50.5	59.8	61.0	57.3	59.9	59.5
1. Primary	51.9	52.2	51.7	50.6	51.6	57.5	64.0	59.0	56.8	54.2
2.3 Primary	50.5	54.4	53.0	52.2	52.5	65.7	60.6	56.7	56.6	59.7
5. Primary	54.1	51.1	53.2	50.6	52.0	53.7	55.0	52.3	50.9	53.0
1.2 Bachillerato	52.8	50.6	51.4	49.4	51.0	52.5	50.8	50.8	48.5	50.6
3.4 Bachillerato	54.2	53.9	51.5	47.2	51.7	50.2	51.6	49.6	46.3	49.4
6. Bachillerato	58.4	47.1	48.0	47.3	50.2	58.1	51.2	46.9	46.0	50.5
1.2 University	40.7	46.7	45.0	40.0	43.0	39.7	43.8	45.4	40.2	42.2
3.4 University	46.2	47.4	45.2	46.0	46.0	45.8	44.8	45.4	45.3	45.3
5.6 University	55.7	46.5	45.4	44.4	48.0	55.1	46.4	45.3	43.9	47.6

Source : CEDE. Muestras de desempleo.

TABLE XXII-A

RATE OF PARTICIPATION OF THE POPULATION NOT AT  
SCHOOL IN THE ECONOMICALLY ACTIVE POPULATION

1964

<u>Age Groups</u>	<u>Men</u>	<u>Men and Women</u>
15-19	83.8	58.2
20-24	92.9	61.0
25-29	95.7	58.8
30-34	96.5	59.1
35-39	97.1	58.1
40-44	96.0	58.8
45-49	95.7	56.2
50-54	92.7	54.4
55-59	89.0	50.5

Source: DANE - Census of 1964