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THE DETERMINANTS OF LABOUR EARNINGS IN DEVELOPING METROPOLI: ESTIMATES FROM BOGOTA AND CALI, COLOMBIA

By

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ABSTRACT

This study examines the patterns of behaviour implicit in the variation of labour earnings in Bogota and Cali, Colombia. The conventional earnings function is adapted to explore the heterogeneity which characterizes the urban labour market. Equations for both male and female workers are developed incrementally noting at each stage the independent effects of each set of explanatory variables. The returns to different levels of education are critically examined while attempts are made to control for schooling quality and individual ability. The returns to firm specific and occupation specific experience are compared with the returns of general work experience. Locational variables are used to act as proxies for the individuals' background characteristics. Immigrants are distinguished by the size of their settlement of origin. The location of current residence is included to assess the impact of neighborhood effects on earnings potential. Various firm characteristics are examined to establish the extent to which labour market segmentation exists. The equations are consistently estimated for different time periods to note the inter-temporal behaviour of the determinants of earnings.

The conventional earnings function performs well in explaining earnings variability in Bogota and Cali. The traditional education and experience variables are by far the most important determinants of earnings variation while the region of origin, the location of residence and the characteristics of employment are only of second order of importance. Nonetheless, the empirical findings indicate that the locational variables and the employment characteristics are systematically related to earnings differentials even after the individuals' human capital has been taken into account. Various interpretations for the existence of these effects are offered and a case is made for the consideration of spatial effects in urban labour markets.

PREFACE

A rather large amount of data handling, documentation and preparation has gone into the work leading to this paper. I would like to thank Alan Carroll for the original cleaning and documentation of the 1975 and 1977 Household Surveys; Nelson Valverde for making the 1973 Population Census Sample ready for me; Nancy Hartline for wrestling with the 1977 Household Survey, preparing its final documentation, and putting the income imputing method into effect; Sung Yong Kang and M. Wilhelm Wagner for making the 1978 Sample ready for me.

All the computations appearing in this paper have been laboriously done for all the samples by Yoon Joo Lee. A word of special thanks goes for his labors.

I have benefitted from useful discussions on various points with Gary Fields, Gregory Ingram, Alvaro Pachon, Jose Fernando Pineda and Miguel Urrutia. Al Berry's encyclopaedic works on Colombia and his constant encouragement have been particularly helpful.

A special word of appreciation goes to the Staff of DANE (the Colombian Statistical Office) for having painstakingly included all the surveys in Colombia and for making them available in almost raw form so readily. The high quality of the 1978 City Study DANE Household Survey owes much to the diligence of Roberto Pinilla and Maria Christina Jimenez of DANE and Gary Losee, Alfredo Aliaga, Alvaro Pachon and Jairo Arias for CCRP-World Bank.

1. Rakesh Mohan "The People of Bogota: Who They Are, What They Earn, Where They Live" Washington, D.C. World Bank Staff Working Paper No. 390, May 1980 (City Study Project Paper No. 6)

2. Gary Fields "How Segmented is the Bogota Labor Market" Washington, D.C. World Bank Staff Working Paper (forthcoming) (City Study Project Paper No. 9).

3. Rakesh Mohan and Nancy Hartline "The Poor of Bogota: Who They Are, What They Do, Where They Live." Washington, D.C. World Bank City Study Project Paper No. 11, 1980.

4. Rakesh Mohan, Jorge Garcia Garcia and M. Wilhelm Wagner "Measuring Urban Malnutrition and Poverty: A Case Study of Bogota and Cali, Colombia" Washington, D.C. World Bank City Study Project Paper No. 12, September 1980.

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I. INTRODUCTION

1.1 Objectives

The development of the human capital model of labour earnings by Schultz (1961), Becker (1964), and Mincer (1974) has resulted in an explosion of research through the 60s and 70s attempting to estimate the returns to education in the U.S. Although somewhat belatedly, estimating earnings functions for less developed countries has also become a minor industry.[1/] Why am I then adding to this impressive volume of research? This paper is in the nature of a consolidation of a great amount of work that has already been conducted on Colombia.[2/] As work forming part of the Bogota City Study we have been fortunate in having access to a number of different micro data sets for different years so that estimations could be made consistently for different time periods.

The City Study is concerned with intra-urban variations within the urban labour market. Mohan (1980) laid out descriptively the key characteristics of the Bogota labour market. This paper attempts to establish the patterns found there more systematically through the use of earnings functions. In so doing more light is thrown on the return to schooling distinguished by different levels of education achieved which has not been done before in as direct a fashion. As in Mohan (1980), particular attention is paid to the location of residence of the worker and to his origin as proxies for background characteristics not otherwise measured directly. Different categories of migrants are

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1/ See Psacharopoulos (1973), Berry (1980) and Fields (1980).

2/ See Bourguignon (1980), Fields (1979) for literature reviews and Berry and Soligo (1980) for summaries of Colombia work.

therefore specified to investigate if their performance is in any way different in the labour market.[1/]

Attention is also paid to the issue of segmentation in the labour market to complement the work already done by Fields (1980). This continues to be an important issue in the discussion of urban labour markets in developing countries despite the murkiness (as demonstrated by Fields) of the concept itself. It is perhaps clearer to talk of the "protected sector" as a portion of the labour market where entry is restricted and returns higher. Various formulations of the problem are attempted in this study to illuminate this admittedly murky area.

The final distinguishing characteristic of this study is that all estimations have been done for women as well as for men (though all are not reported here). While estimates of the returns to education abound for male workers, there are few available for women. I have attempted to fill this lacuna despite the greater hazards associated with interpreting similar earnings functions for women.

The general approach adopted is to use the conventional earnings function (with a few wrinkles added on) as a device to explore the heterogeneity which characterizes the urban labour market. My view is as

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1/ Helena Ribe (1978) has dealt with this subject exhaustively but she used a sample for the whole country.

eclectic as in Anand (1980): although the earnings function grew out of the human capital framework it is in fact consistent with other theories of earnings such as "screening", "job competition" and "segmentation". It is difficult to find tests which can distinguish between these different models. Nonetheless, the estimation of earnings functions for different groups is instructive in summarizing labour market information and in separating out statistical regularities which are, at a minimum, suggestive as to the determinants of earnings.

1.2 Theoretical Background

A full fledged investigation of the determinants of earnings in an urban labour market would ideally involve the articulation of a model of labour supply, earnings, consumption and education investments such as those developed by Heckman (1976) and Ben Porath (1967). Such a model would determine the education level chosen by an individual (or for him by his parents); it would develop a model of household behaviour which determines labour/leisure choices for both husband and wife (and others); and finally the determinants of earnings given these earlier choices. Such a merger of the labour supply, human capital and household economics literature would give a rounded understanding of the operation of the urban labour market. While the decision to participate in the labour force is investigated in another paper of this series, this study does not attempt a comprehensive investigation such as the one suggested above. A more "labour intensive" approach is adopted to probe the life cycle and other effects on labour earnings. The data are stratified in various ways to suggest results which would otherwise be obtained from a structural model.

The basic human capital model may be expressed as follows (Griliches, 1977):

$$Y = P_h \cdot H \cdot e^{\upsilon} \tag{1}$$

$$H = e^{\beta S} \cdot e^{v} \tag{2}$$

$$y = \ln Y = \ln p_h + \beta S + \upsilon + v \, . \tag{3}$$

where Y is labour earnings,

H is the unobserved quantity of human capital

p_h is the market rental price of a unit of human capital (which may vary over time and space)

u represents other influences on wages.

Equation (2) is a production function for human capital using schooling (S) as input and ability, efficiency, etc., denoted by v. Substituting Equation (2) in Equation (1) yields Equation (3) which is the traditional earnings function which is the basic formulation used here. Much debate centers around the content of the u and v variables and this is discussed briefly below.

One of the key criticisms of the traditional human capital earnings function attempting to estimate the returns to education has been the omission of a measure of "ability". This omission not only leads to the well known biases resulting from omitted variables in a least squares estimation but is also important because of its interaction with the level of schooling achieved. Attempts to include ability as measured directly in tests such as IQ tests have been made often in the context of the U.S. literature - as (among others) by Griliches and Mason (1972), and Hause (1972).. A common procedure is to include ability (or IQ) as an instrumental variable in a simultaneous equation framework. Ability itself is then explained by family background variables, sometimes along with schooling. To complete the circle, the level of schooling achieved is itself determined by ability as well as background variables. It is argued, therefore, that in a reduced form

earnings function of the equation (3) type, u and v should at a minimum contain measures of ability as well as background variables.

Another criticism has revolved around measurement of the schooling variable. There are two aspects to this problem. In the formulation of the model in equations (1) to (3) it is the stock of human capital that is the relevant determinant of earnings. Conventionally measured years of schooling is an input which produces this stock. Leibowitz (1976) attempted to account for variations in the intensity of schooling. Individuals vary on how intensively they conduct their schooling. Some people pursue their education full time while others do part time jobs as well. She argues that these variations depend on the person's ability as well as his background. Welch (1966) and Summers and Wolfe (1977) attempted to measure differences in the quality of schooling. Clearly different schools are of varying quality and 5 years of schooling in one school are not equivalent to 5 years in another. There are thus two types of measurement problems in the measurement of schooling. The first is measurement of the input itself as affected by the intensity of schooling and the second is the efficiency with which this input is transformed into human capital. The results of Summers and Wolfe suggest that students of high ability are less affected by the quality of schooling than their less able counterparts. In other words, the value added of high quality schooling is relatively higher for less able students than for the more able ones.

As for the intensity of schooling, it is ability and background variables (which influence choice of school) that are the determining factors.

Willis and Rosen (1979) and Hoffman (1979) address another type of problem that biases the results estimated from an earnings function. This problem may be characterised as that of positive sorting. If individuals are classified into two types - type A are college graduates and type B are high school graduates - it is found that type B individuals would have done less well than type As with similar backgrounds had they also decided to go to college. More importantly, type As would have done less well than type Bs with similar backgrounds had the type As not gone to college. The implication of these findings is that by and large people sort themselves out according to their aptitudes and background and resulting aspirations. For most who do not go to college, in fact it would not have been justified for them to forego earnings in order to go to college because the increase in future earnings would not have compensated for their opportunity cost. The argument is therefore that estimated returns to education are biased upward because of this positive sorting. Hoffman discussed a different kind of sorting problem. He argued that because of past experience with discrimination blacks have lower expectations and consequently it is rational for them to under-invest in education. Once again it is seen that a person's background and ability affects his choices on the education level he achieves

and aspirations that he has - which ultimately affect his life cycle earnings.

Many of these problems have begun to be addressed for U.S. data because a number of panel cross-section data sets trace the life histories of particular cohorts of workers. Griliches (1977), Leibowitz (1976), Hoffman (1979) Schiller (1977), Nickell (1979) and others have all had access to such data sets which have information on individuals' employment records and variables such as intelligence test scores, and quality of schools attended, so that some of the aforementioned biases can be measured and corrected.

In a lucid review of econometric problems associated with estimating earnings functions Griliches (1977) focuses on the bias caused by the omission of ability. He demonstrates convincingly that the results of more sophisticated models which use schooling and ability as instrumental variables in a simultaneous equation framework are seldom too different from the estimation of simple earnings functions which include schooling and experience as variables. He concludes that :

> (i) Treating the problem asymmetrically and including direct measures of "ability" in the earnings functions indicates a relatively small direct contribution of "ability" to the explanation of the observed dispersion in expected and actual earnings. The implied upward bias in the estimated schooling coefficient is about 0.01. (ii) Allowing for errors in measurement in such ability measures does little to change these conclusions except increase the estimated bias by about 0.005 or so. But (iii) when schooling is treated symmetrically with ability measures, allowing it, too to be subject to

> errors of measurement and to be correlated to the disturbance in the earnings function, the conclusions are reversed. The implied net bias is either nil or negative. In addition, (iv) a more detailed examination of data on brothers indicates that if we identify "ability" with the thing that is measured (albeit imperfectly) by test scores, and if we accept the underlying genetic model which postulates that such a variable has a family components of variance structure, then the "unobservable" that fits these requirements seems to have little to do with earnings beyond its indirect effect via schooling.1/

In summary, the, Griliches' view is that it is unlikely that the coefficients of education derived from simple earnings functions would be biased by more tahn 5 to 10 percent. The amount of information contained in any data set is limited and the more variables that are entered into an equation to protect against biases the more serious becomes the measurement problem.

All of these observations are very relevant to this study because one of the phenomena that is sought to be explained is that systematic differences appear to exist between people residing in different parts of Bogota. These characteristics were documented in

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1/ Griliches (1977), p. 18.

Mohan (1980) and Mohan and Hartline (1980). If Bogota is divided into 8 pie slices or sectors it was found that the rich live predominantly in the Northern sector and the poor dominate the South with various gradations in between. Associated differential patterns were found to exist in the occupational and industrial distributions between the various sectors in the city. According to the descriptive data, people of similar human capital endowment appeared to earn different wages according to the location of their residence.

The data sets used in the Bogota City Study are rich but lack panel data. However, somewhat comparable data sets are available for 4 different years so some time trends can be observed. Moreover, there are no direct ability, family background or schooling quality variables available in these data sets. Being aware of the various problems mentioned above that are concerned with the omission of these variables in earnings functions it may be noted that, in the reduced form, family background and status can be used as proxies for ability and school quality. The only background variables that are available are the location of current residence, the previous residence and place of birth. This study mainly utilizes two of these sets. First, in view of the distinct characteristics observed for different parts of the city, the sector of the location of residence is regarded as a good background proxy. This is somewhat risky because of high intra-urban mobility (Hamer, 1980) which would imply that current residence is no indicator of where the worker might have been during his formation years. The same data, however, show that the great portion

of household movements are lateral movements within close distances and within sectors. Thus it is defensible to use current location of residence as a family background and schooling quality proxy. Second, since the birthplace is available the background of migrants can be controlled for. Defining all people born in Bogota and all others who arrived in Bogota before the age of ten as natives of Bogota, the origin of the remaining people are divided into four sets: cities over about 1 million people (Cali, Barranquilla, Medellin); towns of over 100,000 population; other urban and other rural. The hypothesis is that schooling quality and intensity of schooling might vary positively with city size as might the aspirations of the individual. In concurrence with Griliches, however, the addition of these background variables is not expected to affect the estimated schooling coefficients much and nor are they expected to add significantly to the explanatory power of simple earnings functions.

The normal causation on location of residence is regarded as going the other way: high incomes induce people to live in high income neighbourhoods and the poor in poor neighbourhoods. This line of causation is not being challenged here but it is being suggested that there might be feedback effects of the type hypothesized above which need to be taken into account.

1.3. Structure of the Paper

After this introduction, the following section will lay out the earnings function being estimated in this paper along with an explanation of the specific variables used. Section III presents the key results for the determinants of earnings of male workers in Bogota. The earnings functions are developed in steps and the estimated returns to schooling examined critically in relation with estimates for other countries as well as with other estimates for Colombia for different time periods. Particular attention is paid to the specification of the education variable in estimating returns to the different levels of education. The next section reports the returns to work experience. The returns to firm specific and occupation specific experience are compared with the returns to general work experience.

Section V examines the influence of background on earnings. The size of the settlement of origin is taken as a proxy for school quality and, possibly, ability. In addition, it serves to separate different types of migrants and tests for possible city size effects on a workers' unmeasured productivity characteristics. The other background variable tested for its effect on earnings in the location of current residence within the city. This is again interpreted as a proxy for schooling quality and ability but also for family class, status and occupational background.

Section VI attempts to identify the extent to which the Bogota labour market may be segmented. The existing of unions, of contributions to social security and of written contracts are taken as proxies for the organized sector. In addition the sample of workers is stratified by the nature of employment of workers in an attempt to find possibly segmented portions of the labour market. Finally, Section VII gives the results of the estimates of earnings functions for women discussing similar issues as for the men.

II. MODEL AND ESTIMATION

2.1 Interpreting the Earnings Functions

The last section reviewed some of the key issues involved in the measurement of the returns to education through the estimation of human capital based earnings functions. The derivation of the earnings function from human capital theory has been done in a detailed fashion by Mincer (1970, 1974) so only a brief derivation will be done here. This exposition follows Rosen (1977).

Assume that earnings (y) are a function solely of schooling (years of education; S) and ability (A)

$$y = f(S; A). \tag{4}$$

Assume that schooling is a full time activity and individuals earn zero labour incomes while in school. Then the present value at birth of all future incomes is

$$V(S) = \int_S^N y(S;A)\, e^{-rt}\, dt \tag{5}$$

$$= y(S;A)\, \frac{1}{r}\, (e^{-rS} - e^{-rN})$$

where r is the rate of discount expressing peoples rate of time preference and N is the age at retirement.

S may be chosen so as to maximize V(S) i.e. when

$$V'(S) = 0 \tag{6}$$

or

$$\left(1 - e^{-r(N-S)}\right)\frac{y'}{y} = r \tag{7}$$

An individual would then invest in schooling until the internal rate or return equals the interest rate. Now, if N is large, equation (5) can be simplified to

$$V(S) = y \cdot \frac{1}{r}\, e^{-rs} \tag{8}$$

Hence $\ln y = \ln(rv) + rs$ (9)

The maximum point of V is given by the point of tangency between equation (4) which is parametrized by A and equation (9) parametrized by V. To the extent that A and r vary between individuals, the point of tangency will occur at different values of y and S. The implication is that if earnings functions are estimated for people with different abil.ty levels, the estimated r will be the common value of r. If the estimation is for people with similar abilities, equation (4) is identified. If information is available for both A and r, the model of equations (4) to (9) is recursive and exactly indentified and summarized by the following 3 equations:

$$y = F(S;A) \quad (10)$$

$$S = G(r, A) \quad (11)$$

$$r = F_S(S,A) \quad (12)$$

Equation (10) is the normally used earnings function which, by implication, involves assumptions about (11) and (12) if they are not explicitly specified. The discussion in the last section on the biases likely to arise in the estimation of (10) essentially involved the relationship between S and A and the difficulties caused by not including A in (10).

These considerations have to be connected with the demand side of the labour market to arrive at a better interpretation of the earnings functions. One interpretation begins with the assumption that labour can be measured as homogeneous efficiency units and that the labour market equilibrates returns to these efficiency units - if the market is competitive. Then, if all workers were alike they would

have the same schooling and, consequently, no variance in earnings would be observed. The implication is that if there is variance in earnings it is solely due to differences in the initial stock of ability A or in differences in access to financial markets for different people. Inequality is then due to inequalities in A and r and not in S.

The second interpretation is due to Mincer (1970, 1974). Here the assumption is that if different levels of schooling impart different types of skills and ability to conduct different work activities which are only imperfectly substitutible, then people who undergo greater schooling earn more in later years to compensate for earnings foregone in earlier years. According to this interpretation, if A and r are equal for everyone, (and N is large)

$$V(S) = y(S)\ \frac{e^{-rs}}{r} = V_o \text{ for } \underline{\text{all}}\ S \qquad (13)$$

and the present value of income streams are equalized by everyone. Equation (13) may be written as

$$y(S) = E_o\ e^{rS} \qquad (14)$$

where $E_o = V_o r$.

This is the fundamental earnings function:

$$\ln y = \ln E_o + rs \qquad (15)$$

justifying the semilog specification normally used. While everyone's human wealth would be the same, earnings will be different in particular years. Estimated r should then merely reflect the prevailing real rate of interest.

The second interpretation is an extreme view in that people do have ability differences, they do have different financial market constraints and markets are not completely perfect. An estimate of r that differs from the prevailing market interest rates can then be said to be a measure of how much out of long term equilibrium (in this sense) the labour market is. In view of the argument associated with equation (7) estimated r is also interpreted as the internal rate of return to schooling [1/] given the assumptions that schooling was pursued full time, that the marginal cost of schooling was only the earnings foregone and that after completion of schooling the earnings profile is flat for a long period of time. To the extent that these assumptions do not hold, estimated r is only an approximation of the internal rate of return.

In light of the above discussions it is defensible to use earnings functions in order to delineate segmented markets if these are believed to exist. If returns to schooling are highly associated with prevailing interest rates, estimated r for different groups of people can reflect the different financial markets they face, as between blacks and whites, rural and urban people and people in different countries or cities. Similarly, shift variables controlling for areas of origin or family background as proxies for ability are justified on theoretical grounds. The equality of estimated coefficients between different samples can be interpreted as the absence of segmentation.

1/ In a well operating market this should, according to the arguments above be the same as the rate of interest.

2.2 Model Specification and Variables Used

The bare bones of the justification behind earnings functions have been given above with emphasis on the determinants and effects of schooling on earnings. The other key component of human capital theory, on-the-job training, has been neglected so far since it is a straightforward extension of the schooling variable except that experience is acquired on the job. The equations estimated in this study are then of the form:

$$y = f \text{ (Schooling; Experience; Ability, Background)} \quad (16)$$

More specifically,

$$y = f \text{ (Schooling; Experience; Region of Origin, Current Location of Residence; Characteristics of Employment)} \quad (17)$$

The region of origin and current location of residence act as proxies for ability differences (if they themselves are related systematically to these background variables) and for differences in access to financial markets. Furthermore if ability and quality as well as length of schooling are correlated these would be greater justification in regarding these background variables as reasonable proxies. The characteristics of employment have been included as shift variables attempting to measure imperfection on the demand side of the market - the existence of a protected sector.

The equation estimated is

$$\ln y = X_1 \beta_1 + X_2 \beta_2 + X_3 \beta_3 + X_4 \beta_4 + X_5 \beta_5 + \varepsilon \quad (18)$$

where X_1 - education variables

X_2 - experience variables

X_3 - region of origin shift variables

X_4 - location of residence shift variables

X_5 - characteristics of employment

and ε is the error term with the normal assumptions associated with ordinary least squares estimation.

A complete list of variables X_1 to X_5 is given below along with explanations of their characteristics, followed by Table 1 giving the mean values of the whole sample for all variables used in estimations for 1978. Appendix Table A.1 gives the correlation matrix for 1978. Also in Appendix 1 is a brief description of all the data sets used in this study. All the observations in the regressions have been weighted according to the procedure described in Appendix 1.

Variables Used

Education Variables (X_1)

Two sets of education variables were used: the first was the usual number of years of schooling completed. In order to estimate the differential rates of return to different levels of schooling as well as to test for the value of credentials the number of years of schooling was spliced into the following 7 variables.

DUMP = 1 if 5 years of primary schooling are completed but secondary not completed. 0 otherwise.

DUMS = 1 if 6 additional years of secondary education are completed but higher education not completed. 0 otherwise.

DUMH = 1 if 4 additional years of higher education are completed. 0 otherwise.

PRIMED No. of years of primary schooling completed. If schooling is greater than primary, PRIMED = 5.

SECED No. of years of secondary schooling completed. If schooling is greater than secondary, SECED = 6.

HIGHED No. of years of higher education completed. If more than 4 years completed. HIGHED = 4.

POSTED No. of years of post graduate education completed.

Experience Variables (X_2)

A number of proxies for the "on-the-job" (o.j.t.) component of human capital were attempted. First was the traditional variable,

EXPER = Age - YRSEDU - 6 (years)

and

EXPSQ = $(\text{EXPER})^2$ $(\text{years})^2$.

which was used in most regressions.

There were two other experience variables that were available in the data. The respondents were asked how long they had been in their current occupation and how long they had been working in the

same firm. The other 2 sets of experience variables are therefore

YRSOCCUP years spent in current occupation.

YRSOCCUPSQ (years in current occupation)^2.

YRSFIRM years spend in current firm.

YRSFIRMSQ (YRSFIRM)^2.

There was one other firm specific variable that was available. People were asked if they had received formal job training while working. A dummy variable is therefore used.

DTRAIN = 1 if formal training was received while working.

0 otherwise.

Origin Variables (X_3)

These are a set of dummy variables designed to control for the origin of the individual. The data records every individual's place of birth. Since the interest is in controlling for the quality of schooling, environment, etc., Bogota is regarded as the origin of everyone who migrated there before the age of 10 plus all those who were born there.

DBOG = 1 if the individual was born in Bogota or migrated there before age 10. 0 otherwise.

DCITY = 1 if migrant was born in the three next largest cities of Colombia, each of about 1 million population.[1/]

DTOWN = 1 if migrant was born in towns over 100,000 people (according to the 1973 census)[2/] 0 otherwise.

1/ Cali, Medellin, Barranquilla.

2/ Bucaramanga, Cartagena, Cucuta, Manizales, Pereira, Ibague, Armenia, Palmira, Pasto, Buenaventura, Neiva, Santa Marta.

DURB = 1 if migrant was born in other urban places.

The excluded category is migrants from rural areas.

Location of Residence (X_{4a})

The location of residence has been controlled in two ways, Maps 1 and 2 give the division of Bogota and Cali into radial sectors and rings. The location of residence of each worker can be classified according to which sector he lives in and by the distance from the city centre (thereby controlling for ring of residence). The residential sectors are controlled for by a set of 7 dummy variables with sector 2 (the poorest sector located in the South) acting as the reference sector. The 7 dummy variables are

RSECT1
RSECT3
RSECT4
RSECT5
RSECT6
RSECT7
RSECT8.

Each takes the value 1 if the worker lives in that sector. 0 otherwise.

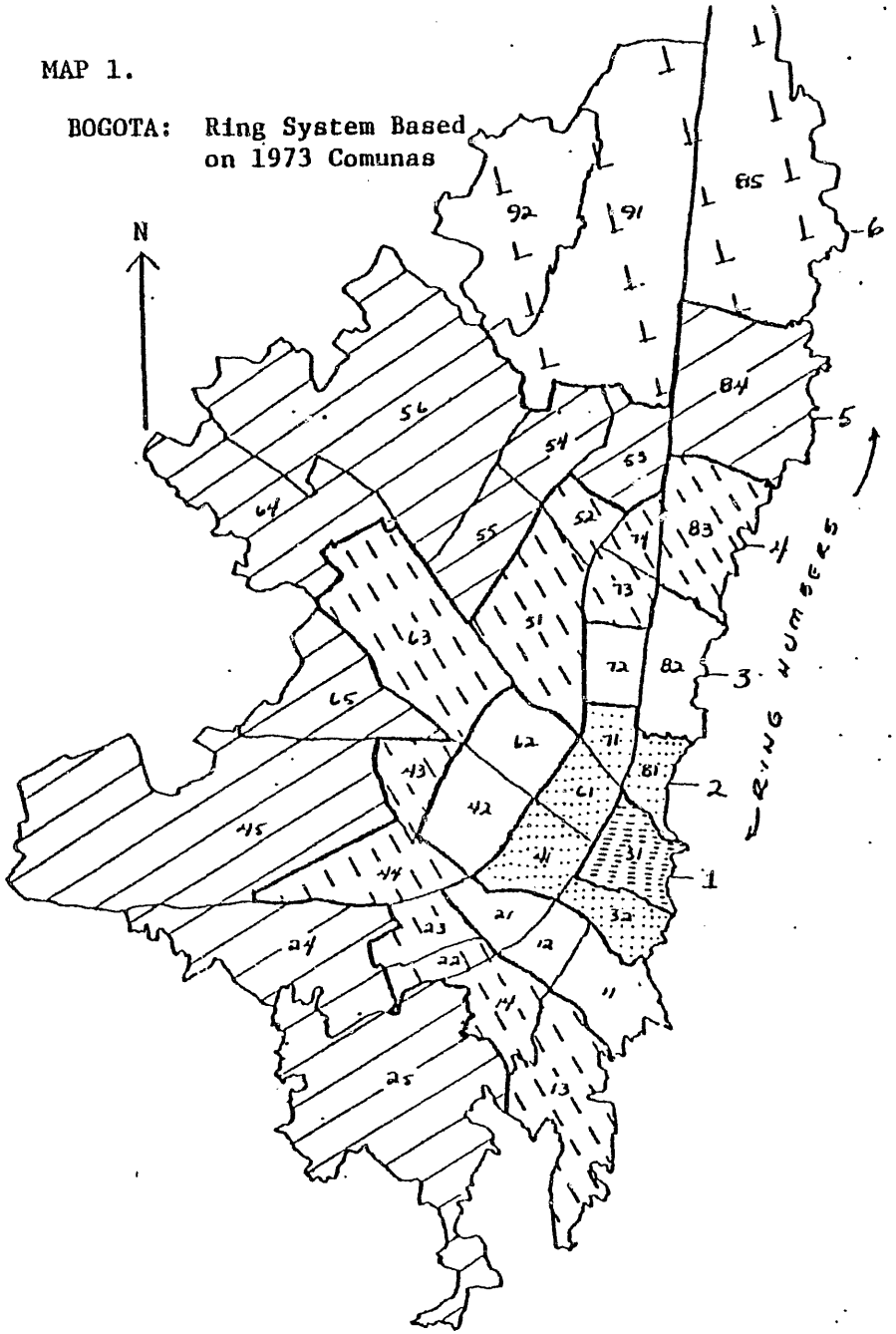
DIST is a measure of the distance of residence from the city centre (Sector 1 and Ring 1) (measured in kilometers).

Mobility Variables (X_{4b})

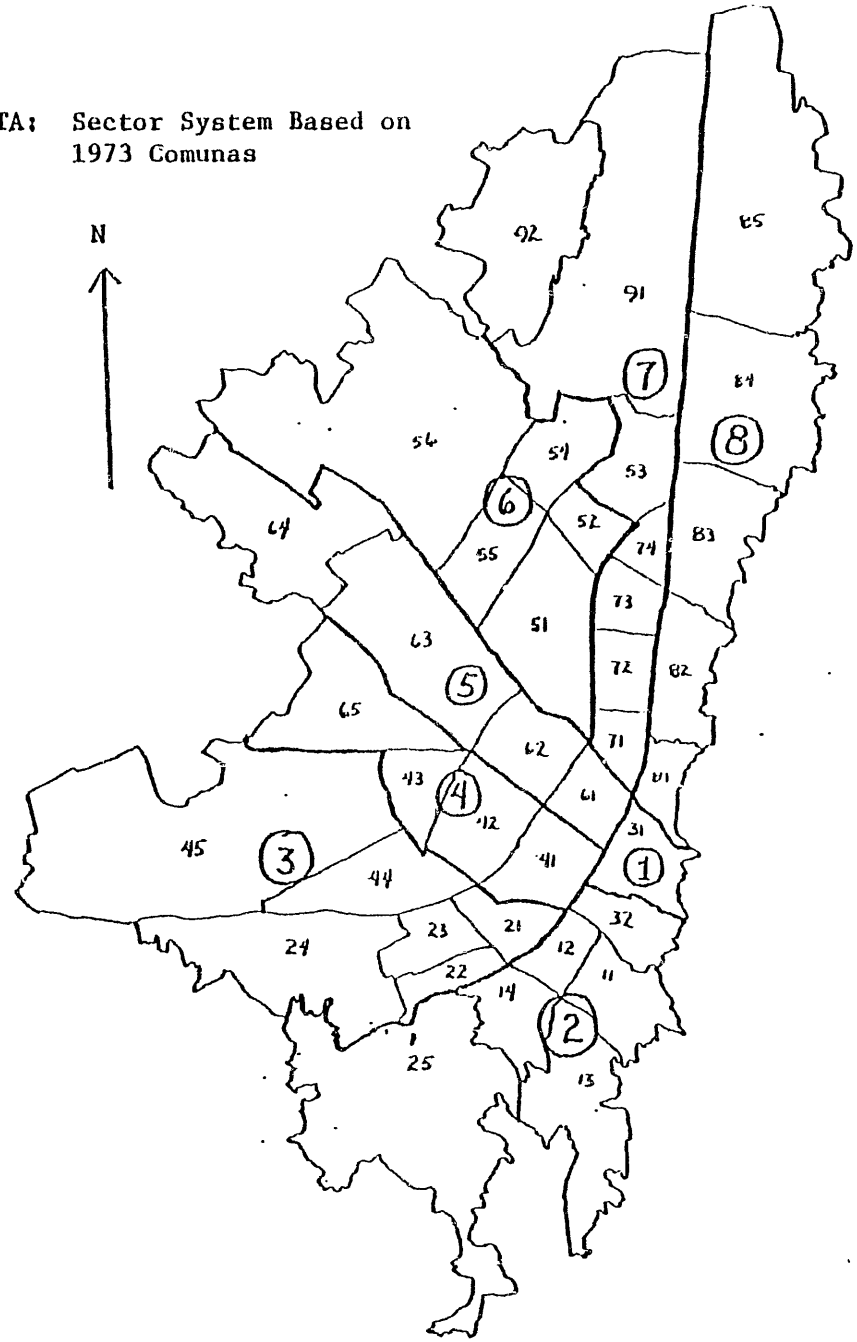
Information on the location of former residence was also available. Movers were classified as "upwardly" mobile people and "downwardly" mobile people. The ranking of sectors is 2, 3, 6, 4, 5, 7, 8 in

MAP 1.

BOGOTA: Ring System Based on 1973 Comunas

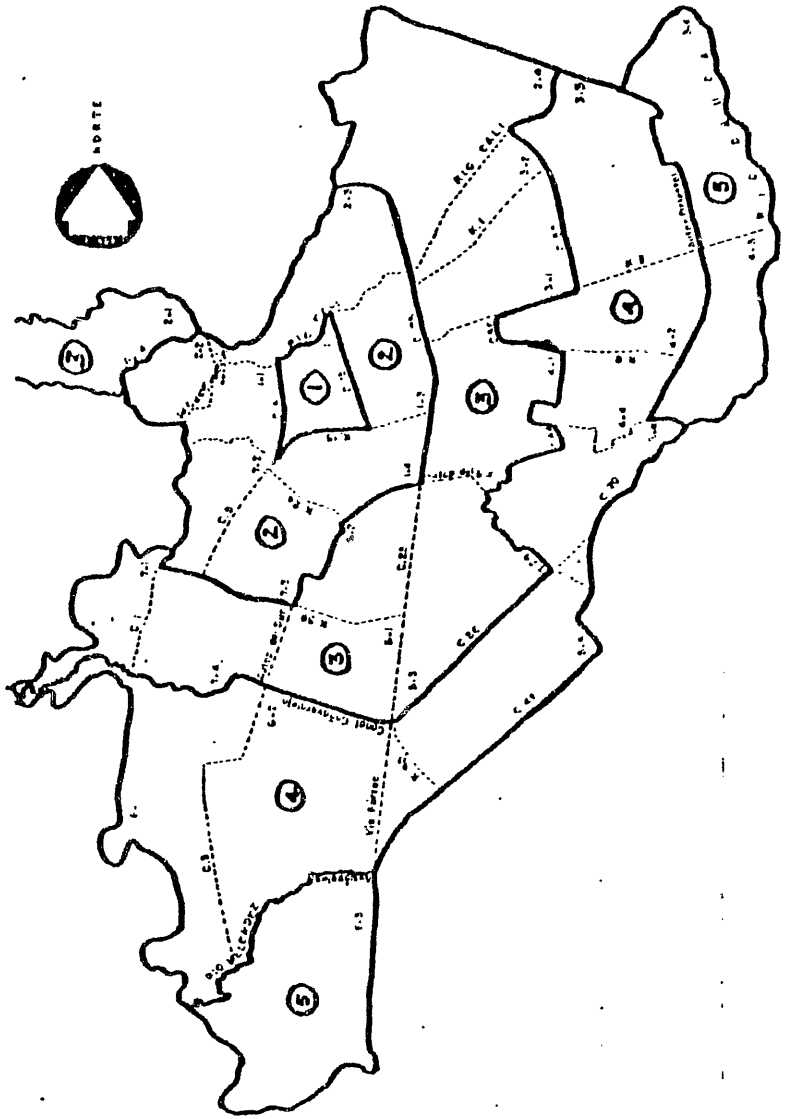


BOGOTA: Sector System Based on 1973 Comunas



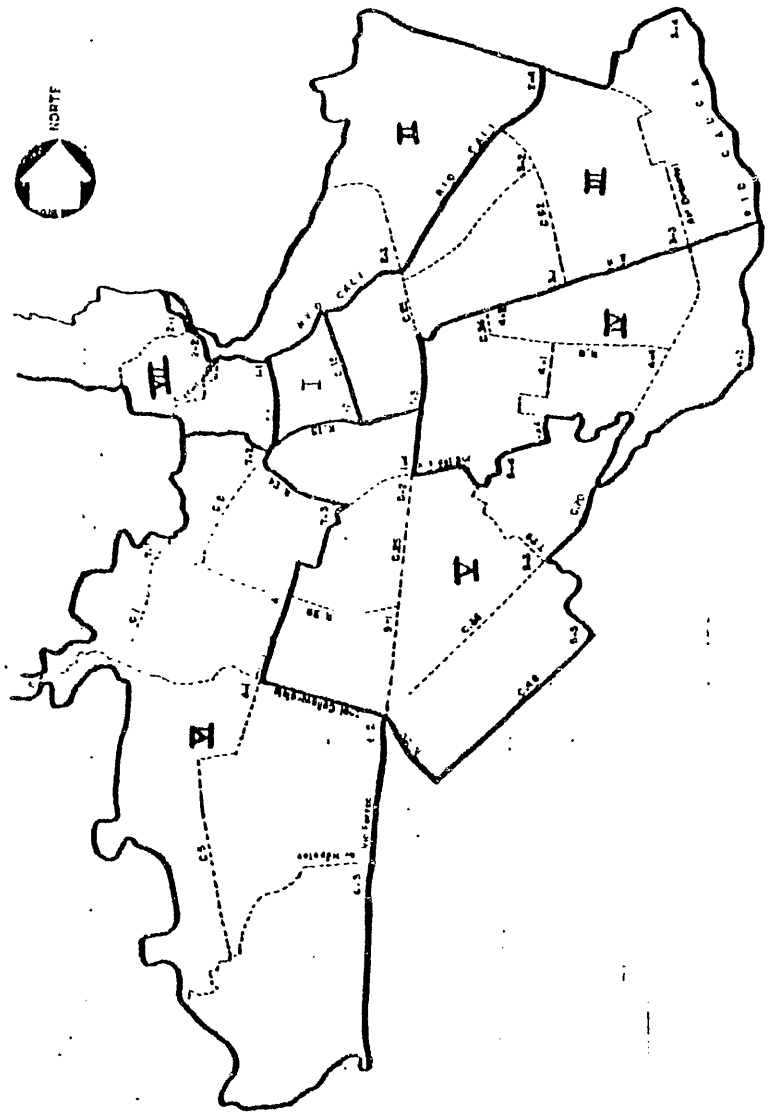
Map A.2a

CALI: Ring System



Map A.2b

CALI: Sector System



ascending order or mean household income per capita with sector 1 being small and rather heterogeneous. Movers were defined as those who moved within the previous 10 years. Mobility was therefore characterized by the following 2 dummy variables:

DUP = 1 for people who moved into a sector with higher average income than their previous sector of residence and all whose last move was from outside Bogota. 0 otherwise.

DDOWN = 1 for people who moved from relatively high income sectors to low income ones.

The reference was non-movers defined as those who have not moved in the past 10 years or those who moved within their own sector.

Employment Variables (X_5)

Four variables were used as proxies of characteristics of what is usually called the "protected" sector or "formal" sector.

UNION = 1 if a union exists in the place of work of the worker. 0 otherwise.

CONTRACT = 1 if the worker has a written employment contract.

FSIZE = No. of workers in place of work.

LOGFSIZE = ln (FSIZE).

Dependent Variables (y)

Three dependent variables for earnings have been used. The main variable used is monthly earnings. Workers[1/] were asked the periodicity of their wage payments along with the unit wage. A second question was asked to elicit the same information: their total labour

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1/ Throughout this paper workers have been defined as those individuals who reported working to be their major activity during the week preceding the interview or who worked more than 15 hours per week. Maids have also been included.

earnings in the last month.[1/] Information was also available on weekly hours usually worked and the number of months worked in the last 12 months. The three income variables used are

LOG Monthly Earnings (1978 Colombian pesos)

$$\text{LOG HWAGE} = \ln \left(\frac{\text{monthly earnings}}{4 \times \text{weekly hours}} \right)$$

$$\text{LOG YRLYINC} = \ln \left(\frac{\text{monthly earning} \times \text{No. of months worked}}{1000} \right)$$

1/ The monthly earnings variable used in the derived monthly earnings for employees who report the periodicity of wage payment and unit wage. For others, it is the monthly earnings reported for the previous month.

Table 1. MEAN VALUES OF VARIABLES. BOGOTA 1978

	Males		Females	
	Mean	St. Dev.[1/]	Mean	St. Dev.
YRSEDU (yrs)	7.75	4.45	7.10	4.44
DUMP	0.50		0.44	
DUMS	0.15		0.17	
DUMH	0.13		0.10	
PRIMED (yrs)	4.48	1.15	4.19	1.47
SECED (yrs)	2.51	2.59	2.36	2.58
HIGHED (yrs)	0.61	1.39	0.49	1.25
POSTED (yrs)	0.14	0.45	0.06	0.29
EXPER (yrs)	20.49	13.36	17.62	12.92
EXPSQ	598.10	708.99	477.58	649.25
YRSOCCUP (yrs)	8.52	9.57	6.02	6.98
YRSOCCUPSQ	164.15	364.34	84.90	212.30
YRSFIRM (yrs)	5.60	7.54	3.83	5.43
YRSFIRMSQU	88.16	229.92	44.19	127.99
DTRAIN				
DBOG	0.459		0.439	
DCITY	0.025		0.015	
DTOWN	0.058		0.060	
DURB	0.262		0.264	
(Rural	0.196		0.222)	

1/ Standard Deviation not given for dummy variables.

Table 1. (Continued)

	Males		Females	
	Mean	St. Dev. 1/	Mean	St. Dev. 1/
RSECT1	0.018		0.014	
(RSECT2	0.205		0.154)	
RSECT3	0.250		0.207	
RSECT4	0.072		0.058	
RSECT5	0.063		0.067	
RSECT6	0.185		0.177	
RSECT7	0.094		0.117	
RSECT8	0.113		0.200	
DIST (Km)	7.35	3.50	7.15	3.46
DUP	0.37		0.40	
DDOWN	0.14		0.13	
(Stationary	0.49		0.47)	
UNION	0.24		0.18	
SOCSEC	0.53		0.50	
CONTRACT	0.45		0.45	
FSIZE				
log Monthly Earnings	8.70	0.89	8.20	0.78
log HWAGE	3.42	0.95	2.95	0.91
$\log\left(\frac{\text{YRLYINC}}{1000}\right)$	4.15	1.00	3.57	1.01

1/ Standard Deviation not given for dummy variables.

III. THE RETURNS TO EDUCATION

3.1 Some International Comparisons

Psacharopoulos (1980) has recently updated his earlier review of estimates of return to education for different countries. Among others, detailed work on micro data sets has been conducted in recent years by Anand (1980) and Mazumdar (1980) on Malaysia, by Bourguignon (1980) and Fields and Schultz (1980) for Colombia and by Chiswick (1976) for Thailand and by a host of others for the United States and United Kingdom. Psacharopoulos distinguishes between directly calculated rates of return and those derived from earnings functions.

Table 2 summarizes his results for private returns to an additional year of schooling by level as well as overall. The estimates from earnings functions are all lower than the direct estimates. All estimates for developed countries are lower than for developing countries. One reason for the higher direct estimates is that they do not account for returns to on the job training: all increases in earnings that occur with age are attributed to educational achievements. The earnings function method, however calculates returns while keeping years of experience constant. In that sense, perhaps, the earnings function estimates are better. Psacharopoulos also reports that social returns are lower than private returns and especially in the case of higher education. Out of pocket (tuition) costs are usually much higher for higher education (and often not accounted for in rates of return calculations) as is the government subsidy per student. The results reported in this study should be viewed in this context.

Table 2. THE PRIVATE RETURNS TO EDUCATION BY LEVEL AND REGION (Percent)

Region	Direct Methods			Earnings Function
	Primary	Secondary	Higher	All Levels
Developing				
Africa	29	22	32	13.4
Asia	32	17	19	12.8
Latin America	24	20	23	18.2
Average	29	19	24	14.4
Intermediate	20	17	17	9.7
Advanced	1/	14	12	7.7

1/ Not calculable due to absence of control group of illiterates.

Source: Psacharopoulos (1980) Table 2 and Table 4.

3.2 The Returns to Education, 1978.

Earnings functions were estimated for all individuals who reported any labor income. The samples included employees as well as those who were self employed or owners.[1/] This section reports on the main results for the 1978 data and concentrates on the results for education. Other variables will be discussed in succeeding sections as well as results for other years. Later, results from various stratification schemes will also be presented.

Tables 3 and 4 present the main results of this study. Earnings functions are developed incrementally, adding the X_1, X_2, X_3, X_4 and X_5 sets of variables in successive steps in order to test for the stability of coefficients and to obtain indications of possible biases. The major portion of variance in earnings is explained by the traditional education and experience variables. There is an addition of only about 7 percent in the explained variance of the logarithm of earnings after all the additional variables are used -- though all are significant at the 5 percent level.

Table 3 reports the regressions for male workers using the conventional years of schooling variable YRSEDU. The region of origin variables do not affect the education coefficient significantly but the residential sector variables do. The coefficient is reduced by about 20 percent from 0.147 to 0.119, the main cause being that the residential Sector 8 dummy is somewhat correlated with years of education (the simple correlation coefficient being about 0.4: See Appendix Table A.1).

1/ Estimations were also done separating employees from the self-employed and owners. See section VI below. Income from capital assets is not included in the earnings variable used.

Table 3. THE DETERMINANTS OF EARNINGS OF MALE WORKERS IN BOGOTA - 1978

Variable Name	1	2	3	4
YRSEDU	0.147 (52.7)	0.144 (49.8)	0.124 (38.7)	0.119 (36.5)
EXPER	0.068 (23.3)	0.067 (22.1)	0.064 (21.5)	0.063 (21.1)
EXPSQ	-0.0009 (17.2)	-0.0009 (16.6)	-0.0009 (16.5)	-0.0009 (16.1)
DBOG		0.113 (3.4)	0.099 (3.1)	0.108 (3.4)
DCITY		0.151 (1.9)	0.167 (2.2)	0.178 (2.4)
DTOWN		0.227 (4.0)	0.189 (3.4)	0.186 (3.4)
DURB		0.100 (2.9)	0.084 (2.5)	0.079 (2.4)
RSECT1			0.003 (0.04)	-0.014 (0.2)
RSECT3			0.130 (3.9)	0.115 (3.5)
RSECT4			0.219 (4.4)	0.212 (4.3)
RSECT5			0.184 (3.6)	0.159 (3.1)
RSECT6			0.096 (2.6)	0.089 (2.4)
RSECT7			0.163 (3.6)	0.169 (3.6)
RSECT8			0.618 (13.0)	0.612 (12.9)
UNION				0.063 (3.1)
SOCSEC				0.071 (2.6)
CONTRACT				0.046 (1.9)
CONST	6.72	6.66	6.72	6.69
R^2	0.486	0.490	0.519	0.525
Number of Observations (N)	3014	3014	3014	3014

Dependent Variable Mean Log Monthly Earnings = 8.70

(t statistics in parenthesis).

Table 4. THE DETERMINANTS OF EARNINGS IN BOGOTA - 1978
DISTINGUISHING DIFFERENT EDUCATION LEVELS
Male Workers

Variable Name	1	2	3	4	5	6
DUMI	0.085	0.072	0.056	0.055	0.022	0.025
	(1.5)	(1.2)	(1.0)	(1.0)	(0.4)	(0.4)
DUMS	0.299	0.290	0.266	0.258	0.226	0.227
	(3.5)	(3.4)	(3.2)	(3.1)	(2.6)	(2.7)
DUMH	0.627	0.616	0.558	0.573	0.526	0.525
	(4.2)	(4.1)	(3.8)	(3.9)	(3.5)	(3.5)
PRIMED	0.075	0.073	0.071	0.068	0.071	0.071
	(3.7)	(3.7)	(3.6)	(3.5)	(3.5)	(3.5)
SECED	0.095	0.091	0.083	0.078	0.073	0.073
	(10.1)	(9.6)	(8.9)	(8.4)	(7.5)	(7.5)
HIGHED	0.131	0.131	0.106	0.099	0.099	0.103
	(4.5)	(4.5)	(3.7)	(3.5)	(3.4)	(3.5)
POSTED	0.136	0.133	0.100	0.097	0.110	0.097
	(3.1)	(3.1)	(2.3)	(2.3)	(2.4)	(2.2)
EXPER	0.064	0.064	0.063	0.062	0.063	0.063
	(21.9)	(21.8)	(21.3)	(20.8)	(20.4)	(20.4)
EXPSQ	-0.0009	-0.0009	-0.0009	-0.0009	-0.0009	-0.0009
	(16.8)	(16.9)	(16.7)	(16.2)	(15.8)	(15.8)
DBOG		0.144	0.129	0.138	0.120	0.122
		(4.4)	(4.0)	(4.3)	(3.6)	(3.7)
DCITY		0.182	0.192	0.204	0.180	0.193
		(2.4)	(2.5)	(2.7)	(2.4)	(2.5)
DTOWN		0.249	0.211	0.208	0.162	0.169
		(4.5)	(3.9)	(3.9)	(2.9)	(3.0)
DURB		0.116	0.100	0.095	0.077	0.082
		(3.4)	(3.0)	(2.9)	(2.2)	(2.4)
RESECT1			0.006	-0.012	0.023	0.013
			(0.1)	(0.2)	(0.2)	(0.1)
RSECT3			0.145	0.129	0.201	0.196
			(4.4)	(4.0)	(5.7)	(5.6)
RSECT4			0.234	0.228	0.223	0.221
			(4.8)	(4.7)	(4.5)	(4.4)
RSECT5			0.207	0.183	0.255	0.247
			(4.1)	(3.6)	(4.9)	(4.7)
RSECT6			0.105	0.098	0.207	0.206
			(2.9)	(2.7)	(5.1)	(5.1)
RSECT7			0.143	0.145	0.243	0.243
			(3.1)	(3.2)	(5.0)	(5.0)
RSECT8			0.534	0.524	0.601	0.593
			(11.1)	(10.9)	(12.1)	(11.9)
UNION				0.065	0.054	0.034
				(3.2)	(2.6)	(1.6)
SOCSEC				0.079	0.089	0.052
				(2.9)	(3.2)	(1.7)
CONTRACT				0.041	0.049	0.029
				(1.7)	(2.0)	(1.1)
LOG SIZE						0.023
						(3.3)
DIST					-0.025	-0.025
					(6.4)	(6.4)
DTRAIN						0.011
						(0.3)
CONST	7.08	6.97	6.93	6.90	7.05	7.02
R^2	0.505	0.509	0.530	0.536	0.536	0.538
N	3014	3014	3014	3014	2819	2819

Dependent Variable: Log Monthly Earnings. Mean = 8.70
(t statistics in parenthesis)

Table 4 reports comparable results using the splined education variable. R^2 increases by about 0.01 as a result of splitting the various levels of education. The three dummy variables represent an attempt to test the screening hypothesis[1/]. It is hypothesized that each additional year of education has a return in terms of additional marginal earnings but there is also a value to certification: a completed level of education, primary, secondary or higher brings a bonus over and above the marginal return to each year of schooling. The coefficients of DUMP, DUMS and DUMH then measure the percentage increase in earnings solely due to certification $\left(\frac{\partial \log y}{\partial DUM} .\right)$ PRIMED, SECED, HIGHED and POSTED are more like the conventional YRSEDU and the interpretation of their coefficients is similar to the rate of return to education interpretation. To clarify the structure of this splined variable the predicted income from regression 1 in both Tables 3 and 4 is given below for two types of individuals.

i). Age = 40. Graduated from college.

1 year of postgraduate education

DUMP = 0, DUMS = 0, DUMH = 1.

PRIMED = 5, SECED = 6, HIGHED = 4, POSTED = 1

YRSEDU = 16

EXPER = 18

From regression (1), Table 3.

$\ln y = 0.147\ (16) + 0.068(18) - 0.0009(18)^2 + 6.72$

$= 10.04$

$y = 22{,}123$

1/ Smith and Welch (1977) also used a splined education variable but did not include the certification dummy variables.

From regression (1) Table 4

$$\ln y = 0.085\ (0) + 0.299\ (0) + 0.627(1)$$
$$+ 0.075\ (5) + 0.095\ (6) + 0.131(4)$$
$$+ 0.136\ (1) + 0.064(18) - 0.0009(18)^2$$
$$+ 7.08$$
$$= 10.17$$

$$y = \underline{26,170}$$

ii). Age = 40 Graduated from High School.

1 year of college.

DUMP = 0, DUMS = 1, DUMH = 0.

PRIMED = 5, SECED = 6, HIGHED = 1, POSTED = 0

YRSEDU = 12

EXPER = 22

From regression (1) Table 3

$$\ln y = 0.147\ (12) + 0.068\ (22) - 0.0009(22)^2 + 6.72$$
$$= 9.54$$
$$y = \underline{13,905}$$

From regression (1), Table 4

$$\ln y = 0.085(0) + 0.299(1) + 0.627(0)$$
$$+0.075(5) + 0.095(6) + 0.131(1) + 0.136(0)$$
$$+0.064(22) - 0.0009(22)^2 + 7.08$$
$$= 9.43$$
$$y = \underline{12,456}$$

The two methods give somewhat comparable results but the splined method clearly implies a higher rate of return to higher education. Thus predicted incomes for college graduates are lower while those for others are higher using the YRSEDU variable as compared with the splined method.

That returns to higher education are greater than secondary education which themselves are greater than primary education is rather surprising in light of the clear pattern implying the opposite in Table 2. Other estimates for Colombia[1/] are quite consistent with these results, thus giving confidence to the splined specification.

Table 4 shows that the estimate of the bonus due to completion of primary education is about 2 - 8 percent but not statistically significant, the additional bonus for high school graduation is about 20 percent (DUMS - DUMP) and for college graduation about 25 percent (DUMH - DUMS - DUMP), the latter two estimates being significant. These are quite plausible numbers though perhaps a trifle on the high side. I have not seen any comparable estimates for the U.S. or for developing countries so it is difficult to be confident about their magnitude: the implications from these estimates are, however, clear.

In comparing the education estimates in regressions (1) to (5) in Table 4, the change in coefficients is not statistically significant (given the comparatively lower 't' value) though each of them declines when the residential location variables are added, as was the case with YRSEDU. The largest change is in the higher education coefficients, reflecting correlation with RSECT8. Note that the smallest change is in the PRIMED coefficient implying that less educated people are spread all over and not concentrated in any one part of the city. Once again the addition of all the variables increases the level of explanation (R^2) by only about 7 percent as compared with equation (1), a result quite similar to that obtained in Table 3. The best equation is equation (5) in

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1/ See Bourguignon (1980) and Fields and Schultz (1980).

Table 4 and all the coefficients are significant at the 5 percent level except for DUMP. Note that in both Tables 3 and 4 the simple earnings function explains about 50 percent of logvariance of earnings -- a rather high proportion for such a simple formulation.

These results are quite consistent with the conclusions reached by Griliches (1977) on the magnitude and nature of biases in the estimated coefficients of education in earnings functions. First, the addition of background variables adds little to the level of explanation. Second, if the background variables used here are indeed good proxies for schooling quality and ability it is clear that they do correct for over-estimates of the return to schooling but their correlation with schooling may be causing opposite biases of comparable magnitudes. If Griliches is correct in claiming that the biases are of the order of 5 to 10 percent, these results would be quite consistent with his findings. That having been said, it is equally important to emphasize that all the additional variables being significant imply that their addition is defensible.

The certification variables are of interest in that they provide some direct evidence on education being used as a screening device. That the DUMP coefficient is not significant is not surprising since the completion of primary schooling is not accompanied with the issuance of a "degree" or document as the completion of secondary and higher education is. The key interest in these estimates is the high return to higher education: a result consistent with the high observed indices of inequality in Colombia.

The regressions in Tables 3 and 4 were estimated for female workers as well but will be reported later in section VII.

Table 5 reports estimates equivalent to regression (5) using the three different measures of earnings: monthly earnings, hourly wage and annual earnings. It is not obvious which is the correct measure but the evidence in Table 5 indicates that the choice is not very important at least for male workers since none of the estimated coefficients change significantly. The education cofficients do increase somewhat for the hourly wage equation except for POSTED, implying that hours of work are negatively correlated with the level of education. If that is the case, it may be argued that the value of leisure time may have also increased as a result of increased schooling. It would then be defensible to assert that the HWAGE estimates are better estimates of the return to schooling. The certification coefficients register increases for YRLYINC implying that the school completers have more stable jobs i.e., work more months in a year. The other point worth noting is the increase in the UNION coefficient for the HWAGE equation (although the change is not statistically significant). Unions then have a greater effect on hourly wages but they can also work fewer hours, a quite plausible result.

Table 6 gives the comparable results for Cali[1/]. The t statistics have been omitted for convenience. The results are somewhat different from Bogota. Regression (4) shows that the average return to education in Cali is almost identical to that in Bogota (Regression 4 in Table 3). The proportion of logvariance of earnings explained is less than that for Bogota and the splined education specification does less well than the conventional specification. None of the certification variables are statistically significant and the coefficients of PRIMED, SECED and HIGHED are all higher than for Bogota though the differences are not statistically

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1/ The mean values for the variables in Cali are given in Appendix Table A-2.

Table 5. EARNINGS FUNCTIONS FOR BOGOTA - MALE WORKERS USING DIFFERENT INCOME VARIABLES - 1978

Variable Name	Log Monthly Earnings	Log 1/ HWAGE	Log 2/ YRLYINC
	1	2	3
DUMP	0.022	0.022	0.034
	(0.4)	(0.4)	(0.5)
DUMS	0.226	0.235	0.281
	(2.6)	(2.7)	(2.8)
DUMH	0.526	0.624	0.693
	(3.5)	(3.9)	(4.0)
PRIMED	0.071	0.090	0.067
	(3.5)	(4.1)	(2.9)
SECED	0.073	0.086	0.067
	(7.5)	(8.4)	(6.8)
HIGHED	0.099	0.109	0.075
	(3.4)	(3.5)	(2.6)
POSTED	0.110	0.026	0.085
	(2.4)	(0.6)	(2.2)
EXPER	0.063	0.055	0.083
	(20.4)	(16.7)	(23.3)
EXPSQ	-0.0009	-0.0008	-0.0012
	(15.8)	(12.4)	(18.0)
DBOG	0.120	0.161	0.103
	(3.6)	(4.6)	(2.7)
DCITY	0.180	0.191	0.182
	(2.4)	(2.3)	(2.1)
DTOWN	0.162	0.171	0.092
	(2.9)	(2.9)	(1.4)
DURB	0.077	0.125	0.076
	(2.2)	(3.4)	(1.9)
RSECT1	0.023	0.131	-0.092
	(0.2)	(1.3)	(0.9)
RSECT3	0.201	0.225	0.236
	(5.7)	(6.0)	(5.8)
RSECT4	0.223	0.163	0.260
	(4.5)	(3.1)	(4.5)
RSECT5	0.255	0.273	0.277
	(4.9)	(4.9)	(4.5)
RSECT6	0.207	0.245	0.190
	(5.1)	(5.7)	(4.1)
RSECT7	0.243	0.282	0.292
	(5.0)	(5.4)	(5.2)
RSECT8	0.601	0.584	0.593
	(12.1)	(11.0)	(10.3)
UNION	0.054	0.081	0.066
	(2.6)	(3.6)	(2.8)
SOCSEC	0.089	0.067	0.137
	(3.2)	(2.2)	(4.1)
CONTRACT	0.049	0.044	0.083
	(2.0)	(1.7)	(3.0)
DIST	-0.025	-0.025	-0.031
	(6.4)	(6.1)	(7.0)
CONST	7.05	1.69	2.26
R^2	0.536	0.533	0.513
N	2819	2928	2921
Mean Dep. Variable:	8.70	3.42	4.15

(t statistics in parenthesis)

1/ HWAGE = $\frac{\text{Monthly Earnings}}{4 \times \text{weekly hours}}$

2/ YRLYINC = $\frac{\text{Monthly Earnings} \times \text{Months worked}}{1000}$

Table 6. THE DETERMINANTS OF EARNINGS OF MALE WORKERS IN CALI - 1978

Variable Name	Education by Levels			YRSEDU	
	1	2	3		4
DUMP	-0.134	-0.148	-0.140		
DUMS	-0.117	-0.156	-0.181		
DUMH	0.165	0.121	0.100		
PRIMED	0.099*	0.100*	0.094*		
SECED	0.165*	0.152*	0.147*		
HIGHED	0.197*	0.154*	0.152*		
POSTED	-0.361*	-0.312*	-0.294*	(YRSEDU)	0.120*
EXPER	0.081*	0.078*	0.076*		0.074*
EXPSQ	-0.0012*	-0.0012*	-0.0011*		-0.0010*
DCALI	0.086	0.062	0.063		0.054
DCITY	0.024	-0.043	-0.010		0.071
DTOWN	0.119	0.099	0.117		0.064
DURB	0.077	0.068	0.068		0.096
RSECT1		-0.341	-0.304		-0.159
RSECT2		0.520*	0.504*		0.508
RSECT3		0.042	0.034		0.047
RSECT4		-0.030	-0.034		-0.007
RSECT6		0.206*	0.199*		0.209*
RSECT7		0.440*	0.447*		0.597*
UNION			0.125*		0.131*
SOCSEC			0.035		0.036
CONTRACT			0.016		0.027
DIST	-0.018	-0.009	-0.011		-0.004
CONST	6.91	6.91	6.93		6.67
R^2	0.417	0.439	0.443		0.469
N	946	946	946		946
Mean Log Earnings	8.54	8.54	8.54		8.54

* Significant at the 5 percent level.

significant. POSTED has a significantly negative coefficient. The means of DUMS and DUMH i.e., the proportion of high school and college graduates in the labor force, is much lower in Cali as compared with Bogota. These may be characterized as "city size" effects. There simply isn't enough demand for highly educated persons. It may be the case that of Cali natives who do get postgraduate education, the better ones migrate to Bogota (or abroad), so only the less able ones are left behind. They cannot get jobs commensurate with their qualifications -- hence the negative coefficient of POSTED. Once again, the addition of the residence location variables causes the greatest change in the HIGHED coefficients because of correlation between the rich Sectors 2 and 6 with higher education.

3.3 Some Intertemporal Comparisons

Bourguignon (1980) collected the results from various studies and added his own estimates to obtain a profile of the returns to education in Bogota from the mid-sixties to mid-seventies. This paper adds the estimates for 1973, 1975, 1977 and 1978 to his series to obtain a somewhat longer term picture. It is gratifying to note that these results are fully consistent with his work and only serve to reinforce his conclusions.

Table 7 gives results for selected years from Bourguignon as well as the new estimates. It is clear that the declining trend of the magnitude of the coefficient on YRSEDU has continued. The results in Table 7 are slightly misleading, however, because the reported regressions for 1973 to 1978 include the background as well as residential location variables, which decrease the YRSEDU coefficient as noted in the last section.

Table 7. EARNINGS FUNCTIONS FOR BOGOTA MALE WORKERS, 1965-1978

Variable Name	Schultz[1/] 1965	Bourguignon[1/] 1971	Bourguignon[1/] 1974	This Study 1973	This Study 1975	This Study 1977	This Study 1978
	1	2	3	4	5	6	7
YRSEDU	0.173	0.167	0.151	0.171	0.147	0.136	0.124
	(13.4)	(38.9)	(59.2)	(167.1)	(51.4)	(47.4)	(38.7)
EXPER	0.121	0.078	0.068	0.078	0.057	0.062	0.064
	(8.8)	(17.6)	(25.8)	(79.8)	(21.9)	(22.3)	(21.5)
EXPSQ	-0.0018	-0.0011	-0.0009	-0.0010	-0.0008	-0.009	-0.0009
	(7.3)	(12.6)	(19.3)	(59.4)	(16.7)	(16.9)	(16.5)
DBOG				0.036	-0.049	-0.019	0.099
				(4.6)	(2.1)	(0.8)	(3.1)
DCITY				0.113			0.167
				(4.2)			(2.2)
DTOWN				0.086			0.189
				(5.3)			(3.4)
DURB							0.084
							(2.5)
RSECT1				-0.054	0.193	0.047	0.003
				(2.8)	(2.2)	(0.6)	(0.04)
RSECT3				0.094	-0.010	0.077	0.130
				(8.7)	(0.3)	(2.3)	(3.9)
RSECT4				0.145	0.065	0.216	0.219
				(10.4)	(1.5)	(4.9)	(4.4)
RSECT5				0.093	0.167	0.186	0.184
				(6.1)	(3.4)	(3.8)	(3.6)
RSECT6				0.120	0.051	0.124	0.096
				(10.1)	(1.5)	(3.5)	(2.6)
RSECT7				0.218	0.177	0.176	0.163
				(16.4)	(4.2)	(4.4)	(3.6)
RSECT8				0.366	0.241	0.396	0.618
				(22.1)	(5.1)	(7.9)	(13.0)
CONST	4.8	5.08	5.88	5.03	5.89	6.25	6.72
R^2	0.881[2/]	0.629	0.508	0.492	0.456	0.495	0.519
N	722	1016	3640	37,311	3999	3289	3014
Mean Dependable Variable: Log Monthly Earnings					7.72	8.18	8.70

(t-Statistics in parenthesis)

NOTES

1/ From Bourguignon (1980). Original Schultz source in Schultz (1968).

2/ Regression run on 47 aggregate age education groups: hence the high R^2.

3/ Sources: 1973 Population Census Sample. 1975, 1977 DANE Household Surveys (EH8E, EH15). See Appendix 1 for details.

The general picture does not change, however, if comparisons are made between equivalently specified regressions with only YRSEDU, EXPER and EXPSQ variables. The relevant coefficients on YRSEDU are then:

1965[1/]	1971[1/]	1973[2/]	1974[1/]	1975[2/]	1977[2/]	1978[2/]
0.173	0.167	0.176	0.151	0.154	0.144	0.144

Table 8 shows the comparable results for the splined education variable along with Bourguignon's calculations for the rate of return to different levels of education. The two sets of estimates are not directly comparable because of two problems. First, Bourguignon's results were obtained by running regressions using only dummy variables for Primary, Secondary and Higher education completers along with age dummy variables. The reported coefficients are the estimated education dummy coefficients divided by the appropriate number of years in each schooling category[3/]. The second problem is that given the structure of the splined variable used here it is difficult to decide how the certification bonuses should be apportioned to each education level. It is clear that the correct interpretation of the PRIMED, SECED and HIGHED coefficients is the marginal return to each additional year of schooling at that level, and that this is in some sense the "correct" rate of return estimate. But since the certification variables imply an increase in earnings due to completion of each level, it can be argued that the marginal return estimates underestimate the "gross" return derived from each level of education. According to my specification, the strict interpretation is that the certification bonus should only be added as a return to the last year of the level

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1/ From Bourguignon (1980).

2/ My estimates from log earnings = $\beta_o + \beta_1$ YRSEDU $+ \beta_2$ EXPER $+ \beta_3$ EXPSQ $+ \varepsilon$

3/ He used 5 years for Primary
10 years for Secondary
and 16 years for Higher.

Table 8. ESTIMATING RETURNS TO DIFFERENT LEVELS OF EDUCATION FOR BOGOTA MALE WORKERS

1973 - 1978

Variable Name	Schultz	Bourguignon		This Study			
	1965 [1]	1971 [2]	1974 [3]	1973	1975	1977	1978
DUMP				0.063	0.087	0.038	0.056
				(4.5)	(1.7)	(0.7)	(1.0)
DUMS				0.140	0.131	0.038	0.266
				(5.3)	(1.7)	(0.4)	(3.2)
DUMH				0.262	0.570	0.254	0.558
				(4.8)	(3.7)	(1.8)	(3.8)
PRIMED	0.126	0.069	0.062	0.116	0.073	0.089	0.071
	(3.7)	(6.2)	(11.1)	(25.9)	(4.1)	(4.8)	(3.6)
SECED	0.130	0.082	0.088	0.172	0.141	0.132	0.083
	(7.9)	(14.7)	(25.6)	(55.4)	(15.8)	(15.0)	(8.9)
HIGHED	0.123	0.117	0.109	0.157	0.074	0.096	0.106
	(9.2)	(25.0)	(41.8)	(5.2)	(2.4)	(3.5)	(3.7)
POSTED				0.162	0.122	0.138	0.100
				(8.4)	(2.5)	(3.4)	(2.3)
EXPER				0.078	0.057	0.062	0.063
				(80.2)	(21.4)	(22.4)	(21.3)
EXPSQ				-0.0011	-0.0008	-0.0009	-0.0009
				(60.6)	(16.9)	(17.3)	(16.7)
DBOG				0.041	-0.043	-0.017	0.129
				(5.2)	(1.8)	(0.7)	(4.0)
DCITY				0.115			0.192
				(4.4)			(2.5)
DTOWN				0.086			0.211
				(5.4)			(3.9)
DURB							0.100
							(3.0)
RSECT1				-0.054	0.131	-0.048	0.006
				(2.4)	(1.5)	(0.5)	(0.1)
RSECT3				0.103	0.045	0.146	0.145
				(9.5)	(1.3)	(4.3)	(4.4)
RSECT4				0.152	0.081	0.225	0.234
				(11.0)	(1.9)	(5.1)	(4.8)
RSECT5				0.095	0.202	0.254	0.207
				(6.2)	(4.1)	(5.1)	(4.1)
RSECT6				0.122	0.137	0.241	0.105
				(10.4)	(3.5)	(6.1)	(2.9)
RSECT7				0.207	0.251	0.260	0.143
				(15.7)	(5.6)	(6.1)	(3.1)
RSECT8				0.336	0.306	0.500	0.534
				(20.2)	(5.7)	(9.2)	(11.1)
CONST	3.30	1.58	6.36	5.20	6.4	6.55	6.93
R^2	0.881	0.577	0.497	0.497	0.465	0.502	0.530
N	722	1016	3640	37,311	3950	3289	3014
Mean Dependable Variable: Log Monthly Earnings					7.72	8.18	8.70

(t-Statistics In parenthesis)

1/ Regression run on 47 aggregate age education groups. Dependent variable is log weekly earnings.

2/ The dependent variable in this regression is log hourly wage.

3/ The dependent variable is log monthly earnings. Regressions 1 to 3 also had age cohort dummies not reported here.

4/ Mean values of all variables for 1973-1978 are reported in Appendix Table A.2.

concerned and not to the preceding years. Whatever the correct interpretation of these estimates the key results are clear.

The estimated returns to each level of education have been declining over time. Unlike many other countries, the private returns to each year of higher education seem to be greater than those for primary education. The returns to secondary education are higher in some years and not in others. In 1978, however, the returns to primary education are consistently lower than secondary education which themselves are lower than those to higher education in all the regressions estimated. One reason for this result may be that private direct (tuition) costs are being neglected in these calculations. Jallade (1974) reports the percentage enrollment in public and private schools in Colombia for each income level. The proportions over all are as follows:

	Public	Private	Total
Primary	72.5	27.5	100
Secondary	49	51	100
Higher	55	45	100

He also shows that, as might be expected, the proportions enrolled in private schools increase with the level of income. Thus earnings functions estimates for the private return to secondar- and higher education probably overstate the actual returns. Accounting for public subsidies to all levels of education and particularly to higher education would decrease the social rates of return even further. The high proportion of private secondary as well as higher level schooling in Colombia might then account for the atypically greater rates of return to these levels of education.

Bourguignon has attributed the declining rates of return to education over time to the increasing relative supply of educated workers at each level. Appendix Table A.2 gives the mean values of all variables used for the 1973 to 1978 regressions. The change in stock of workers at different education levels is reflected in the DUMP, DUMS and DUMH means. The percentage of the male work force at each level has changed as follows:

	Less Than Primary	Primary	Secondary	Higher	Total
1973	33	52	9	6	100
1975	26	53	12	9	100
1977	20	52	16	12	100
1978	22	50	15	13	100

Note that these percentages are for the completion of each level. It is interesting to note that the proportion of all secondary school leavers who then complete college has been increasing over time. If these trends continue it can be predicted with some confidence that the private returns to higher education will continue to decline in Colombia. Given the large proportion of private schools, it is likely that this decline will continue until the rates of return become comparable to those for other investments.

3.4 Age Cohort Effects

Separate regressions were run for different age cohorts (15 - 24, 25 - 34, 35 - 44, 45 - 54, 55 - 64 and 65+) to test for possible vintage effects in the returns to education. Appendix Table A.4 reports the results from these regressions. An inverse U shaped pattern is revealed. Excluding the small sample of the post 65 age group, the YRSEDU coefficient first increases up to the middle age group of 35 - 44 and then declines. This

pattern would be consistent with the combined effects of two conflicting processes. The average years of schooling for each age group were:

Age Group	15 - 24	25 - 34	35 - 44	45 - 54	55 - 64
Mean Years of Schooling	7.5	8.6	7.5	7.3	6.9

Thus each successive age cohort has a higher mean level of schooling (members of the youngest age group 15 - 24 would be a biased group with many of the most qualified members of the cohort not having entered the labor force yet). Similar to the explanation for declining returns to education over time, one may expect that with increasing supplies of educated manpower each successive age cohort would get lower returns to schooling -- over its life time. There should then be a narrowing down of the differences in age income profiles between groups with different education levels.[1/] The second process taking place is that as workers get older the education specific value-added to productivity or skill declines. Individual specific skills (not quantifiable by merely years of experience), the exigencies of luck, on-the-job training, etc. all become more important as determinants of earnings than education. One would then expect differences in education levels to explain less of the variance in earnings and for the YRSEDU coefficient to be correspondingly lower for older workers. The first process is important in explaining differences in the returns to education in lifetime earnings of individuals and the second in explaining differences observed in cross-sections.

The particular pattern shown in Table A.3 would appear to be consistent with these observations. The relatively low coefficient of YRSEDU for the youngest cohort may be explained by the biased selection of

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1/ Mohan (1980) documented the large divergences between the primary, secondary and higher educated groups.

workers alluded to before as evidenced by the lower mean of YRSEDU as compared with the next cohort. The coefficient of the 25 - 34 cohort being lower than the 35 - 44 cohort may be a result of the higher mean level of education and the subsequent pattern of declining returns with age would be the result of the declining importance of education mentioned above. Once the population reaches a steady state, in terms of education levels for each cohort, if these observations are correct, then the education coefficient should decline monotonically with age in a cross section sample. Return to education for each cohort should, however, be the same when calculated from life time earnings. The life time returns will then vary only when the size of each cohort is different as shown by Welch (1979) for the post-war baby boom cohort in the U.S.

3.5 Summary

This section has presented estimates of earnings functions for male workers in Bogota and Cali, laying emphasis on the estimates for the returns to schooling. The traditional variables - years of schooling and of work experience - above account for almost half of the log-variance of labour earnings. The addition of background variables like region of origin and the location of current residence, and of employment characteristic adds little to the level of statistical explanation of the variance of earnings though they do have statistically significant effects.

If the background variables are interpreted as proxies for schooling quality and ability, then the results are quite consistent with studies in the U.S. which conclude that the omission of ability and

background variables in earnings functions does not cause biases of large magnitudes.

The education variable was also specified somewhat differently in an attempt to measure the marginal returns to each distinct level of education (primary, secondary, higher, postgraduate) as well as to measure the certification bonus received on completing each level of education. Unlike most other countries the returns to higher education were found to be greater than to secondary education which were higher than those to primary education. The results appear to indicate that education does act as a screening device as well and people receive 20-25 percent premiums for graduating from high school and from college.

The availability of data sets from different years enable the estimation of the same earnings function over time. A declining trend in the returns to education on the whole as well as to each level was observed -- a finding which is consistent with other estimates for Colombia. In observing different average private rates of return for different levels of schooling note should be made of the fact that the proportion of private education increases with level of education as well as income. Thus, if tuition costs were accounted for, it is likely that the observed differentials in rates of return to higher and lower levels of schooling would diminish.

Returns to schooling vary between workers of different vintages with younger middle age workers receiving greater returns than their younger and older counterparts. The increasing stock of higher educated workers might account for the lower rate of return to schooling among

younger workers; while for older workers it may be the case that education is a less important determinant of earnings than other factors such as experience and plain luck.

Overall, the simple human capital based specification of earnings functions does well in explaining the variance in labour earnings in Bogota and Cali. The addition of other variables does not affect the education coefficient much giving confidence in the estimates of the rates of returns to schooling observed. Consistent estimates are obtained for different years as well as to different levels of education.

IV. THE RETURNS TO EXPERIENCE

The basic human capital formulation of the earnings function explains the increase in earnings with age as due to the investment in human capital which occurs on the job after the worker has started working and ceased full time education. It is hypothesized that learning by doing is an equivalently important activity in terms of investment in human capital and perhaps becomes a more important determinant of earnings with increases in age.

The various problems associated with using years of schooling as a measure of educational investment have been discussed earlier. The problems of measuring on-the-job training (o.j.t.) are, if anything, even more intractable. The very nature of the concept makes it impossible to distinguish the training aspect from the "productive" work aspect of any work situation. Further, the intensity and quality of training acquisition is as difficult to measure as that of education. There are few direct measures. This paper follows the normal practice of using (AGE-YRSEDU-6) as the relevant proxy for experience - the assumption being that the individual goes full time to school until he finishes formal schooling and then gets a job soon after and commences full time work. As is conventional, both EXPER and EXPSQ ($EXPER^2$) are used.

The data provide three other variables which can be used as proxies for o.j.t. The first is the response to a question which asks the worker how long he has worked in his current occupation (YRSOCCUP). This variable would be a good proxy for EXPER if it is hypothesized that it is only occupation specific work that is useful for increasing a workers

productivity. Another variable is the number of years the worker has been working in the same firm (YRSFIRM). It may be argued that it is only firm specific experience which is relevant for improvements in a worker's performance in his job. The coefficient on this variable could also be an indication of how strongly the internal labour market in a firm operates. Doeringer and Piore (1971) suggested that firms reward longevity, loyalty and firm specific experience much more than general work experience gained outside. As a result internal labour markets get formed within firms to the detriment of inter-firm mobility. The implication of such behaviour on the demand side can be that otherwise equivalent workers can be observed to earn very different labour earnings depending on which firm they work in and what their work history has been within the firm: the labor market can then be said to be segmented in this fashion. A comparison of the coefficients of EXPER, YRSOCCUP and YRSFIRM can therefore give some indication of which is the more appropriate proxy for o.j.t.

Workers were also asked if they had received specific training while working - paid by or sponsored by their employers. This included vocational training that might have been provided by the Government or SENA[1/] but with the concurrence of the employer. This variable could only be introduced as a dummy DTRAIN on whether or not training was received. It should get a strongly positive coefficient if such vocational training is indeed a significant determinant of earnings.

1/ SENA = Servicio Nacional de Aprendizaje, is the Government sponsored agency for promoting technical training in Colombia.

Refer back to Tables 3 and 4 which reported the basic earnings functions estimated for 1978 in this study. The coefficients of EXPER and EXPSQ are remarkably stable through the addition of all the background and other variables in successive stages. Furthermore, these coefficients do not change even when the education variable is splined in Table 4. Unlike the education coefficients, the EXPER coefficients do not appear to be affected by the addition of the residential location variables. The gains through years of experience are then not correlated with location of residence.

Now $$\ln y = X_1 \beta_1 + X_2 \beta_2 + X_3 \beta_3 + X_4 \beta_4 + X_5 \beta_5 + \varepsilon \quad (18)$$

X_1 = (1, YRSEDU) or (1; DUMP, DUMS, etc.) and

X_2 = (EXPER, EXPSQ)

and $\beta_1 = (b_o, b_1)$

$\beta_2 = (b_2, b_3)$

are the respective coefficients with b_o being the constant term.

Now

$$\frac{\partial \ln y}{\partial EXPER} = b_2 + 2b_3 \text{ (EXPER)}$$

but EXPER = AGE - YRSEDU - 6

Hence $$\frac{\partial \ln y}{\partial AGE} = b_2 + 2b_3 \text{ (AGE - YRSEDU -6)}$$

For maximum earnings,

$$\frac{\partial \ln y}{\partial AGE} = 0$$

i.e. $$AGE = -\frac{b_2}{2b_3} + YRSEDU + 6$$

From tables 3 and 4

$$\hat{b}_2 = 0.064$$

$$\hat{b}_3 = -0.0009$$

Hence maximum earnings for workers with just completed primary, secondary and higher education are estimated to occur at the age of 46, 52 and 57 respectively.[1/]

The marginal contribution to earnings of a year of additional experience $\left(\frac{\partial \ln y}{\partial EXPER}\right)$ is 4.6, 2.8, 1.0 percent at 10, 20 and 30 year levels of experience.[2/]

Tables 7 and 8 reinforce the stability of the EXPER coefficients in that except for 1973, the coefficients for other years in the 1970's are not significantly different.

YRSOCCUP and YRSFIRM

Table 9 reports the regressions estimated using the YRSOCCUP and YRSFIRM variable in lieu of EXPER as proxies for o.j.t. The comparable regression using EXPER is also reported for comparison. The mean values of the three variables and the relevant estimated coefficients are

	EXPER	YRSOCCUP	YRSFIRM
Mean (Yrs)	20.4	8.5	5.6
$\hat{b}_2$	0.063	0.040	0.044
$\hat{b}_3$	-0.0009	-0.0006	-0.0008

1/ From Table 6, for Cali $\hat{b}_2 = 0.080$ $\hat{b}_3 = -0.0012$. Hence maximum earnings occur at similar ages as in Bogota: at 45, 51 and 56 years.

2/ The similar percentage increases are 5.7, 3.3 and 0.9 for Cali.

Table 9. EARNINGS FUNCTION FOR BOGOTA MALE WORKERS USING DIFFERENT EXPERIENCE VARIABLES

Variable Name	EXPER	YRSOCCUP	YRSFIRM	EXPER
	1	2	3	4
DUMP	0.022	-0.003	-0.019	0.025
	(0.4)	(0.0)	(0.3)	(0.4)
DUMS	0.226	0.230	0.220	0.227
	(2.6)	(2.6)	(2.5)	(2.7)
DUMH	0.526	0.717	0.670	0.525
	(3.5)	(4.7)	(4.3)	(3.5)
PRIMED	0.071	0.068	0.065	0.071
	(3.5)	(3.3)	(3.2)	(3.5)
SECED	0.073	0.047	0.042	0.073
	(7.5)	(4.9)	(4.3)	(7.5)
HIGHED	0.099	0.042	0.41	0.103
	(3.4)	(1.4)	(1.4)	(3.3)
POSTED	0.110	0.066	0.107	0.097
	(2.4)	(1.5)	(2.4)	(2.2)
EXPER	0.063	0.040	0.044	0.063
	(20.4)	(13.0)	(11.9)	(20.4)
EXPSQ	-0.0009	-0.0006	-0.0008	-0.0009
	(15.8)	(8.1)	(6.2)	(15.8)
DBOG	0.120	-0.048	-0.041	0.122
	(3.6)	(1.4)	(1.3)	(3.7)
DCITY	0.180	0.133	0.089	0.193
	(2.4)	(1.7)	(1.1)	(2.5)
DTOWN	0.162	0.144	0.143	0.169
	(2.9)	(2.6)	(2.5)	(3.0)
DURB	0.077	0.043	0.042	0.082
	(2.2)	(1.2)	(1.2)	(2.4)
RSECT1	0.023	0.057	0.059	0.013
	(0.2)	(0.6)	(0.6)	(0.1)
RSECT3	0.201	0.191	0.183	0.196
	(5.7)	(5.3)	(5.1)	(5.6)
RSECT4	0.223	0.252	0.244	0.221
	(4.5)	(4.9)	(4.8)	(4.4)
RSECT5	0.255	0.258	0.245	0.247
	(4.9)	(4.8)	(4.6)	(4.7)
RSECT6	0.207	0.195	0.215	0.206
	(5.1)	(4.7)	(5.2)	(5.1)
RSECT7	0.243	0.230	0.245	0.243
	(5.0)	(4.6)	(4.9)	(5.0)
RSECT8	0.601	0.627	0.647	0.593
	(12.1)	(12.3)	(12.7)	(11.9)
UNION	0.054	0.086	0.051	0.034
	(2.6)	(4.1)	(2.4)	(1.6)
SOCSEC	0.089	0.126	0.099	0.052
	(3.2)	(4.4)	(3.5)	(1.7)
CONTRACT	0.049	0.039	0.032	0.029
	(2.0)	(1.5)	(1.3)	(1.1)
FSIZE				0.023
				(3.3)
DIST	-0.025	-0.023	-0.022	-0.025
	(6.4)	(5.8)	(5.7)	(6.4)
DTRAIN				0.011
				(0.3)
CONST	7.05	7.73	7.84	7.02
R^2	0.536	0.502	0.500	0.538
N	2819	2927	2929	2819
	EXPER	YRSOCCUP	YRSFIRM	EXPER
MEAN (EXPER)	20.4	8.52	5.60	20.4

Dependant Variable: Log Monthly Earnings. Mean: 8.70
(t-statistics in parenthesis).

all being highly significantly statistically.

First, note that the mean values of the occupation specific and firm specific experience variables are substantially less than the traditional experience variable. This implies that there is considerable mobility of workers between jobs or firms as well as between occupations. This fact itself would indicate that occupation and firm specific experience is not valued especially highly. The estimated coefficients confirm this indication. The maximum earnings with respect to YRSOCCUP and YRSFIRM occur after 33 years and 28 years respectively. The marginal contribution of an additional year of occupation specific and firm specific experience is only 2.8 percent after 10 years which is much less than the estimated contribution of the EXPER variable. There is thus little evidence that occupation specific experience or the operation of labour markets in the firm offer significantly higher advantages than general work experience.

Inspecting the changes in other coefficients between regressions 1 to 3 in Table 9 reveals that, by and large, they are quite stable. There are two exceptions: both DUMH and HIGHED decline as does DBOG. The implication is that it is highly educated workers along with Bogota natives who are more likely to hold the same occupations and jobs for longer periods of time. This is not surprising since it is quite plausible that the longer one invests in formal education the more specialized one is and that there are returns to be had from specialization.

Regression 4 in Table 9 reports the addition of DTRAIN to the determinants of earnings. The magnitude of the coefficient is negligible

and not significant indicating that, at least measured in this manner, job or firm specific training has little effect on a person's earnings. This conclusion is surprising and it maybe that DTRAIN is just not a good measure of job specific training.

V. THE INFLUENCE OF BACKGROUND ON EARNINGS

5.1 The Region of Origin

The rationale for including certain kinds of indicators of workers' backgrounds in explaining the variance in labour earnings was discussed in Section I. To recap, the essential argument is that the region of origin of a person determines the kind of schooling he must have received. In U.S. related work, for example, the common practice is to suppose that people who grew up in the South or in non-SMSA[1/] areas received worse schooling as compared with others and dummy variables controlling for these are usually found to be significantly negative.

The region of origin variables used here (DBOG, DCITY, DTOWN, DURB) are at least a plausible starting point. In addition to the quality of schooling argument it is reasonable to hypothesize that people who grow up in metropolitan areas are exposed to more varied influences and are recipients of a wider variety of information. The schools in larger cities, especially in developing countries, are likely to have higher quality teachers, etc. Thus the inclusion of these city-size origin variables is in part designed to correct for bias in the education variables. Secondly, it is also often suggested that migrants struggle at a disadvantage in competing with natives in the urban labour market. It is argued that natives are more likely to be

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1/ SMSA Standard Metropolitan Statistical Areas. This is the U.S. Census term for large urban agglomerations.

"street-wise"; have more contacts; are more familiar with sources of information, etc. It would then be reasonable to suppose that the s ller the town of origin of the worker the more disadvantaged he will be in a large metropolitan area. There is now, however, a different view of migrants beginning to gain wide acceptance. Helena Ribe (1979, 1980) has probably expounded this view best and demonstrated it empirically most ably. It is apt to quote her:

> "The analysis of income profiles reported in this paper gives a favourable picture of the relative income position of migrants with respect to natives at destination. Most migrants have larger incomes than comparable natives and their relative income advantage increases with time after migration. It had been expected that migrants would initially be at a relative economic disadvantage because of their lack of location specific experience. However, comparisons of predicted incomes for migrants and natives indicate that most migrants have larger incomes even immediately after moving. The analysis indicates that in urban locations the relative income advantage of migrants does not seem to be explained by their observed characteristics. Education or total post schooling experience alone would give migrants no advantage with respect to comparable natives. Thus, migrants' higher incomes must be accounted for by their unobserved productivity-related characteristics.

> This finding is consistent with a characteristic of migration as a process which draws especially capable and motivated people away from their origins 1/

She did, however, find that migrants from larger cities tend to do better than those from smaller towns who in turn do better than their rural counterparts. She also found that location specific experience after arrival in the large city was positive and statistically significant.

Her specifications are much more careful than mine but the region of origin variables are designed to perform much the same function as her work. The descriptive information on migrants earnings contained in Mohan (1980) corroborated her findings in large measure.

Again refer back to Tables 3 and 4. First note that the addition of the region variables does not affect the education coefficients for neither the YRSEDU specification nor the splined specification. The first hypothesis does not then seem to be borne out by the data. All the region coefficients are positive and statistically significant at the 5 percent level:

		Education Specification	
	Percent in Bogota	YRSEDU	Splined (DUMP etc.)
DBOG	46	0.10 to 0.11	0.12 to 0.14
DCITY	3	0.15 to 0.18	0.18 to 0.20
DTOWN	6	0.19 to 0.23	0.16 to 0.25
DURB	26	0.28 to 0.10	0.08 to 0.12

(From Tables 3 and 4)

1/ Ribe (1980) p. 24.

Given that the t-statistics are all between about 2 and 4, these coefficients must be regarded as stable between the different specified regressions. Recall that the Bogota natives (DBOG) also include all those who immigrated to Bogota before the age of 10. The comparison is with migrants from rural areas. These results indicate that the immigrants from larger towns and cities (population 100,000 to 1 million people) are better off (all other characteristics being equal) than the Bogota natives who are similar to immigrants from other smaller urban areas. All seem to be about 10 to 20 percent better off than the rural immigrants. These results are essentially consistent with those of Ribe and lend support to her ideas that migrants are often better off than natives but the migrants from larger towns are the best off. A glance at the results for Cali in Table 6, however, indicates that none of these coefficients are statistically significant and migrants and natives must be regarded as essentially similar.

Another cut at the same issue was taken by estimating earnings functions separately for each group. The results from these regressions are reported in Appendix Table A.5. First there is little to distinguish between the returns to education for the Bogota, big city and other urban migrants. The rural migrants do get significantly lower returns which presumably must be related to their quality of schooling and other negative influences mentioned above. In summary there is little difference between all the urban folk but

the rural folk are clearly somewhat behind. The least logvariance in earnings explained is for the rural migrants, presumably because of the lower variance in their education levels. The within city locational differences are somewhat different for each group but these will be discussed in the next sub-section.

Other points worth mentioning are that membership in a union seems to make a significantly positive contribution only to the migrants from rural and smaller urban areas; and that the returns to education are significantly lower for female migrants from rural and smaller urban areas as compared with the Bogota natives. The union effect for the rural and small town migrants is of interest because it is the first indication of the existence of some kind of protected sector where the successful entrants are clearly better off than those not similarly successful.

In summary, there are clear indications that the education of rural migrants if of inferior quality than their urban counterparts or that their ability is lower There is little to distinguish between the returns to education to urban migrants and natives. Finally, it seems that one way for the rural and small farm migrants to improve their lot is by gaining union membership.

5.2 The Location of Residence

The inclusion of the location of current residence variables (RSECT1 to RSECT8) is, perhaps, the most controversial aspect of the estimation of earnings functions in this study and therefore needs to be discussed beyond the rationale given in Section I.

Earlier papers (Mohan (1980), Mohan and Hartline (1980), Mohan, Garcia and Wagner (1980)) have amply documented the systematic differences that exist between different parts of the city of Bogota. Somewhat similar patterns are found in Cali. It is clear that the rich largely live in particular parts of these two cities while other parts are particularly poor. Apart from the extremes the other parts of the city are relatively heterogenous. Bogota is bounded on the East by high mountains and runs from North to South along the mountains. It extends West in a semi-circular fashion. The rich residential area of the city lies in the North extending from almost the centre of the city to its Northern tip - what is termed sector 8 in Map 1. The diametrically opposite area in the South, Sector 2 is the poorest. The ranking of these radial sectors, or pie-slices of the city, by average household income per capita is 2, 3, 6, 4, 5, 7, 8 in ascending order, i.e., income increases as one rotates from the South to North except for Sector 6. There are virtually no rich people in the extreme South but there are some poor people in almost every part of the city. Most large cities in the world have their rich and

poor neighbourhoods. In general, people choose their location according to their incomes, location of work and preferences regarding availability of amenities and other neighbourhood characteristics. The normal course of causation is regarded as income determining, the choice of residential location. Furthermore, people sort themselves out according to ethnic origin and to some extent by occupational and class status (which, of course, is correlated with income). The issue then is if there is also a feedback mechanism which to some extent reverses the causation such that a person's location of residence affects his earnings potential. The implications of the inclusion of the location variables in earnings functions is that clearly it does. An ideal framework would be the combination of residential location theory with the determinants of earnings in a simultaneous equation framework. The location of residence would then become endogenous. This is difficult because residential location theory is not developed enough to interrelate household location decisions with the characteristics of the labour market. A necessary part of such a link would be the elaboration of a within household decision making model where labour force participation decisions would be made, simultaneously with location decisions. The discussion quickly leads one to the kind of comprehensive model referred to in Section I with residential location thrown in for good measure! The state of the art is simply not advanced enough for such a model which can also be estimated with normally available data. One is then left with the kind of reduced form earnings

functions approach adopted here where somewhat indirect evidence is examined to probe the underlying causation process.

As mentioned above, every city has its rich and poor neighbourhoods but what is more striking in Bogota is the relatively systematic nature of income gradation. Hoyt (1939, 1966) documented the structure of American cities by income and the movement of rich and poor neighbourhoods over time. Amato (1968) did the same for Bogota in particular. Hoyt's idea was essentially that the rich happen to live in one part of the town at the beginning. As the town expands into a city and then into a metropolitan area, and as incomes increase, the rich progressively demand new and larger houses. The new rich neighbourhoods then get built adjacent to the old ones so that the rich end up expanding in one or particular directions of the city, usually the more desirable ones in term of environment, and the poor fill up the interstices. This kind of story simultaneously explains the central city decay common in American cities as well as the flight of the rich further and further away from the centre. While many American cities comform to this pattern, more recent urban economic theory has emphasized the ring structure of cities.[1/] The trade-off between transportation costs and income elastic desire for greater space results in the rich locating in relatively large houses further away from the city centre with progressively lower income people locating nearer the centre. The most recent work on this issue appears to reach conclusions nearer Hoyt's (although stated in different terms) than the prevailing urban economic model (Wheaton, 1977). Amato's work

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1/ See Mohan (1979) Chapter 2 for a summary of this literature.

documented the movement of the elite in Bogota from the Northern part of the city centre in the late part of the last century and early part of this century in successive steps to neighbourhoods further and further North of the city in what is called sector 8 here.

If the above is a good characterization of the processes which determine the structure of a city there is more reason to suppose that there would be feedback effects of residential location on potential earnings. If certain parts of the city have always had high income people it would be more likely that the same parts would have better quality schools. In addition, those parts would also have higher demand for goods so that business would be more likely to locate in locations convenient to these areas. This, indeed, is the case in Bogota where the rich sectors have more employment than resident labour while the poor sectors have net deficits [1/] in employment. Another result can also be a screening effect. Peoples' addresses can be used as a screening device by employers to gauge an applicants likely characteristics. The more income segregated a city is the more such screening would be likely to be used. Thus if the residential location variables are found to have a significant effect on earnings, there are at least 3 kinds of explanations. First, in the human capital tradition, it may be argued that these location variables are acting as proxies for ability,

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1/ See Mohan (1980) and Pachon (1980).

schooling quality etc., which are unmeasured otherwise. Second, also in the human capital tradition, it may be argued that they are acting as proxies for other productivity characteristics of workers which are correlated with their residence location (class, status, aspirations, attitudes, contacts, etc.)[1/] Third is the argument that they are being used as screening devices and that people from poorer areas are being discriminated against, and that the labour market is in this sense segmented.

Refer back once again to Tables 3 and 4, the basic earnings functions. There are two location variables that have been used. First are the dummies for each residential sector using Sector 2, the poorest, as the comparator base and second, DIST, the distance from the city center. Given that Bogota employment is relatively centralized the hypothesis is that people living at the periphery are disadvantaged in terms of access. The coefficients appear as follows:

	1978
Sector 1	-
Sector 3	0.12 to 0.20
Sector 4	0.22
Sector 5	0.16 to 0.26
Sector 6	0.09 to 0.20
Sector 7	0.14 to 0.24
Sector 8	0.53 to 0.62

The coefficients are quite stable over different regressions except when DIST is added in regression 5 (Table 4). They are not significantly different between sectors 3 to 7, all

1/ McGregor (1977) examines a low income public housing project in Glasgow and finds significantly higher than expected rates and duration of unempolyment for poor neighborhood youths.

being between about 0.15 and 0.2. The addition of DIST makes them all around 0.2. Sector 8 is obviously different with coefficients of about 0.6. Note that these coefficients measure the deviation in log income from Sector 2 means, with all other variables held constant. Thus people residing in Sectors 3 to 7 receive about 20 percent more in earnings as compared with otherwise equivalent workers in sector 2. Workers in Sector 8 receive 50 to 60 percent more. The center of the city (Sector 1) is too heterogeneous and has no measurable effect. The addition of these variables does not add appreciably to the R^2 - or variance of log income explained by the estimated equations. All the coefficients (except for Sector 1) are significantly positive. On the basis of these results, it would appear that people living in Sector 8 of otherwise equivalent characteristics earn substantially more than those in all other sectors; that people in sector 2 earn significantly less than otherwise equivalent people living elsewhere. Note that about 20 percent of the people live in Sector 2 and about 10 percent in the rich Sector 8.

It was shown in Mohan (1980) that migrants are not over-represented in any area of the city and nor are they as a group, different from natives. Further the region of origin has been controlled for as detailed in the last section. Thus, it is reasonable to assume that these results are not due to these kinds of adverse selection. The estimated coefficients are not significantly different

in the two types of schooling specifications. Finally, regression 5 in Table 4 controls for distance from the city centre, and interestingly, almost all the coefficients increase and become more statistically significant. DIST itself receives a significantly negative coefficient of -0.025 i.e. workers incomes decrease (ceteris paribus), an average by 2.5 percent per kilometer from the city centre. Thus, adjusting for distance, the differences in earnings between otherwise equivalent workers are even more pronounced between different locations of residence.

In order to investigate the residential location effect, further the earnings functions were estimated separately for workers in each sector and the results are reported in Appendix Table A.6. The coefficients on YRSEDU are as follows:

Sectors	Coefficient
1	0.095
2	0.081
3	0.086
4	0.104
5	0.111
6	0.114
7	0.137
8	0.163

They show a remarkably consistent pattern of increase as one moves clockwise from sector 2 to sector 8. The differences

are not statistically significant between sectors 2 and 3, and between sectors 4 and 5, and 6 but the overall pattern is clear. The low coefficient of sector 2 may be partly due to truncation bias since there are few high income people in that sector. Furthermore, it is interesting to note that the UNION coefficient is significant for only sectors 2 and 6 - both sectors having large proportions of blue collar workers. The log variance of earnings explained is of a much lower magnitude in the sectors with low YRSEDU coefficients.

A further test performed was by estimating the same earnings function separately for the top and bottom halves of the workers' income distribution. Such a procedure suffers from the obvious econometric problems arising from truncation of the dependent variable.[1/] The R^2 for the bottom half is only about 0.09. The top half results are not very different from the overall results. But, none of the sector coefficients are significant for the low income sample. Despite the truncation problem, the indication is that if the location of residence matters, it is only for the better paid and better educated workers. Incidentally, these results also suggest that the truncation bias is not too severe in the sector regressions of Table A.6.

Before reaching many conclusions from this evidence consideration needs to be given to the extent of mobility between

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1/ See Gary Fields (1980b) for a brief exposition of truncation bias.

different types of neighbourhoods. As demonstrated by Hamer (1980), there is considerable intra-city mobility in Bogota: about 20 percent of all households move every year which is a figure quite similar to movers rates in the U.S. However, he shows that the bulk of the movement is within sectors or to adjacent sectors. In any case, it is difficult to decide what constitutes high upward mobility since there are few norms to be compared with. This issue is important since if it is relatively easy for households to move up in the neighbourhood ladder and buy into whatever neighbourhood effects that exist, the less reason there is to worry about the negative neighbourhood effects on earnings potential. Since it is difficult to resolve this issue even with the consideration of mobility data only a limited experiment could be done with the available information. An attempt was made to purge the effects of different kinds of movers. People were divided into 3 categories: those who have not moved between dwellings in the past 10 years, those who have moved upwards (DUP) and those who have moved downwards (DDOWN) in neighbourhoods.[1/] Using the stationary workers as the comparator group dummy variables DUP and DDOWN were added to regression 5 of Table 4. There were no significant changes in the original coefficients

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1/ See exact definitions in Section II.

but DDOWN was significantly positive while DUP was positive but not statistically significant:

	Coefficient	t-Statistic
DUP	0.045	1.48
DDOWN	0.103	3.03

$R^2 = 0.545$

R^2 increased from 0.536 to 0.545. The indication then is that people who move down from higher income locations to lower income ones appear to retain some of the higher income characteristics. This result would argue against the labelling or segmentation hypothesis and support the background effect of location.

What can be concluded from all these quantitative results? It is first well to emphasize that not much is gained in the level of explanation of earnings when these location variables are added to the traditional human capital variables. However, the magnitudes of their effects are quantitatively as well as statistically significant. Some of this is undoubtedly due to positive sorting. Workers who do well are prone to move to higher income locations: thus only the less successful otherwise equivalent workers are left behind in the low income neighborhoods. The lower coefficients on YRSEDU in the separate sector regressions are close to the PRIMED coefficients for the whole sample. Thus part of the explanation is merely that it is only less educated and low income people who live in the apparently disadvantaged sectors. The truncated regressions indicate that the location effect is more relevant for the higher educated people. This points both to the screening hypothesis as well as

the quality of education argument. People from poorer areas who do achieve higher education levels probably do suffer from lower schooling quality end may also be discriminated against on account of negative labelling. This is in the nature of a vicious circle in that the negative labelling is probably statistically correct but militates against the brighter individual and is therefore self-propagative. The evidence from U.S. studies mentioned in Section I does show that school quality matters and more so to the more disadvantaged students. It may be concluded that the high spatial income segregation in Bogota does contribute negatively to potential earnings of workers from disadvantaged areas of the city: the background quality of education effect perhaps being more important than the segmentation or labelling effect. The effects may then be more important for the next generation[1/] and therefore may be self-propagating.

1/ Pachon (1980) gives evidence for the fact that the large majority of children go to school within walking distance from home.

5.3 Summary

This section has examined the extent of the influence of a person's background on his earnings after having accounted for education and experience. Two types of background variables were considered: the region of origin of the individual according to the size of settlement where he was born and the location of his current residence within the city.

The hypothesis was that the quality of schooling would differ according to the size of settlement where the individual came from. The inclusion of these variables did not affect the estimates of the return to schooling: these estimates are therefore not biased by the exclusion of such variables. It is found that migrants are no worse off than natives in general though natives as well as migrants from other towns and cities do seem to earn 10 to 20 percent more than the rural migrants. The immigrants from large cities are the best off. The rates of return to education are essentially similar for natives and immigrants from urban areas but rural migrants do receive significantly lower returns. One interesting feature of these estimations is that union membership seems to be especially beneficial to migrants from rural areas.

Among the determinants of the location of residence of households the level of income is generally regarded as the most important. Rich people generally go and live in rich neighborhoods and the poor in poor neighbourhoods. As people get better off they move to better neighbourhoods. The results from the estimation of these earnings functions, however imply that there might be income feedback effects as well such that an individual location of residence might affect his potential earnings. Various interpretations for the existence of these effects have been offerred. Similar to the region of origin variables, the location of

residence acts as a proxy for schooling quality and ability. Even if the individual has not lived all his life in his current location, mobility data indicate that he is likely to have lived in similar types of neighborhoods earlier. Hence neighbourhood also acts as proxy for class and status and, perhaps, for other unmeasured productivity characteristics. Finally, in a city as segregated by income as is Bogota, it is also possible that a person's address can be used as a screening or labelling device by employers.

Whatever the explanation, differences according to location of a worker's residence are found to be statistically significant in Bogota and Cali. Workers with otherwise equivalent characteristics are observed to earn more or less according to where they live. Workers in the northern rich part of the city earn about 50-60 percent more than equivalent workers in the poor South, while workers in the rest of the city earn about 20 percent more than them. Stratifying the sample by location of residence and estimating the returns to education adds further credence to the hypothesized neighborhood effects. Although the differences are not statistically significant, the rates of return to schooling follow closely the gradation of neighbourhoods. Furthermore, it is found that spatial segmentation seems to affect better educated individuals more: the neighbourhood differentials are less important for blue-collar workers.

In summary, it is clear that the region of origin as well as the location of current residence matter as determinants of a worker's potential earnings. The exact nature of the chain of causation needs much further investigation. In particular, the question worth exploring is whether cities with higher levels of spatial segregation by income exacerbate these location or neighbourhood effects.

VI. HOW SEGMENTED IS THE BOGOTA LABOUR MARKET [1/]

6.1 Introduction

This section addresses the issue of workers of similar characteristics earning different incomes. Gary Fields (1980b) discussed this problem at some length for the City Study and clarified various conceptual as well as empirical matters. One of his key conclusions was that if it is asserted that a labour market is indeed segmented, the segmenting variable should be identified and that it should not be an endogenous variable. The results reported in this section are mindful of these distinctions.

The issue is sometimes posed as the existence of a formal or protected sector in urban labour markets in developing countries where workers earn more than other workers because of various kinds of restrictive practices. The restrictive practices can be due to the Government setting a minimum wage which has the effect of restricting employment and of keeping wages in the "legal" or formal sector higher than the rest. Similar effects can be caused by government legislated social security payments which employers may be required to make. On the supply side, the existence of unions in some industries or firms can serve to restrict supply and cause wages to be kept higher than in non-union firms. It is common to suggest that these characteristics are highly correlated and exist mostly in larger firms, often owned by foreign enterprises. The size of firm is then used as the indicator variable separating the formal from the informal sector. All of government is usually assigned to the formal sector as are all higher educated people.[2/] The essential idea is

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1/ With apologies to Gary Fields (1980b).

2/ See Dipak Mazumdar (1976) for a succinct review of work on the "Informal Sector"

to identify intervening or segmenting variables which serve to restrict mobility within the labour market and can then help to explaning the observed variance in earnings between people who would otherwise be regarded as equivalent.

6.2 The "Protected" Sector

Four variables were used in an attempt to test whether usually accepted segmenting variables help in identifying the protected sector and in explaining the observed variance in earnings. The first variable used is the existence of a UNION in the place of work of the worker. The existence of a UNION in the place of work was regarded as sufficient to have an effect on earnings regardless of the worker's own membership. The second variable tested, SOCSEC, was the worker's membership in any kind of social security scheme. On the one hand, this variable is used as a proxy for "formal" characteristics of a firm, and on the other, the minimum wage type effect alluded to above. One problem with the use of this variable is that if social security contributions are legislated for employers of certain size firms, the employers may regard them as compensating differentials and pay the workers a lower cash wage. A negative coefficient on the dummy SOCSEC would then be expected. A similar variable tested to capture the "formal" nature of a job was the response to a question whether the worker had a written CONTRACT in his job.

The fourth test variable attempted was the size of firm (FSIZE) of the worker. Every worker was asked to enumerate the number of people working in his place of work: the size of firm then refers to branch size rather than of the whole enterprise. It is impossible to tell, however, if this distinction was observed well in the survey.

Refer back to Tables 3 and 4 once again to examine the performance of these variables. Examination of the correlation matrix (Appendix Table A.1) reveals, surprinsingly, that the four variables are not highly correlated. Moreover, when introduced separately, and step by step, the coefficient estimates do not change appreciably. The coefficients are:

Education Specification
(From Tables 3 and 4)

	YRSEDU	With DUMP, etc.
UNION	0.063	0.054
	(3.1)	(2.6)
SOCSEC	0.071	0.089
	(2.6)	(3.2)
CONTRACT	0.046	0.049
	(1.9)	(2.0)
LOG FSIZE	-	0.023
		(3.3)

(t statistics in parenthesis)

Thus union employees seem to get about 6 percent higher earnings than comparable non-union workers. The SOCSEC and CONTRACT variables are significant as well implying the existence of some kind of formal/protected sector, but the differences are not very strong. Only the UNION coefficient is significant in Cali and is about twice the Bogota estimate in magnitude. About a quarter of all workers are in unions in both Bogota and Cali and about a half subscribe to some form of social security. Similarly, about a half say they have written contracts in Bogota, though only about 35 percent in Cali.

The separate age group regressions were of interest in that they implied that the union effect is significant only for the middle aged and older workers (age 35+) and that SOCSEC was significant for only younger workers. In the separate region of origin estimates, only

the rural migrants and those from small firms viewed to gain from union membership. As has been remarked in the last section, union membership appears to be of greater importance for workers in sectors 2 and 6 where there is a relatively high concentration of blue collar workers (Mohan, 1980). Results from other stratified regressions suggest that unions are more effective in the public sector, but also for production and service workers, though not for sales workers. Further, consistent with the finding that older workers gain more from union membership, households heads and married workers gain more than secondary workers and single workers.

The composite picture is then as follows. Union membership gives greater job stability. At early stages of the life cycle, for new entrants in the labour force, for example, union membership appears to be unimportant and the earnings of union and non-union workers cannot be distinguished. At later stages it appears that membership in a union gives definite earnings advantages: the principle of positive sorting may also work here, of course, but it may also merely reflect luck of the draw. Those who became union members early perhaps have a smoother employment history and end up earning higher incomes. The union earnings differential may be more important for the somewhat less skilled rural and small town migrants for whom union membership might become a screening device. This finding gives some support to the idea that migrants come to urban areas and then wait to get into the protected sector. On the whole, union membership appears to be more important where there are fewer other distinctions of labour skill or quality and therefore acts as a rationing or screening device.

Two points need to be emphasized here. First, although these effects have been discussed at some length, they are not found to be as important as is often supposed. The three variables together contribute only about 1 percent of the total log variance explained (R^2 increases from 0.530 to 0.536). Second, UNION effects seem to be stronger than the two other proxies for the formal sector. The positive coefficient of SOCSEC indicates that the contribution to social security is probably not regarded as a compensating differential and is more of an indication of the "formal" nature of an enterprise.

Regression 6 in Table 4 adds the logarithm of firm size - log FSIZE (along with DTRAIN) to all the other variables in the earnings function. There is little change in R^2 but the coefficient is significantly positive (0.023). The implication is that for every doubling of firm size (assuming the relationship holds over the whole range of the size distribution of firms) the earnings increase by 2.5 percent.[1/] An employee of a firm of 100 people would then earn about 10-12 percent more than an employee of a firm of 5 people. There is then some basis to believe that the formal sector, as distinguished by size of firm, does pay somewhat higher than the unorganized sector. The differences, once again, are not large and one does not find the big dichotomy between the formal or protected sector and the rest of the economy as is sometimes suggested.

In summary, given the proxy variables available, there is some evidence that the organized or protected sector does tend to pay its employees more than the unorganized sector but the differences are not

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1/ FSIZE itself was also tried but the coefficient was found to be negligible and insignificant.

large enough to warrant excessive concern. Little is added to the explanation of the log variance of earnings by consideration of these variables. If the labour market is segmented in Bogota, the formal/informal or the organized/unorganized dichotomy is not a very useful one to utilize.

6.3 Stratification by Nature of Employment

Another way of looking for segmentation is to estimate earnings functions for different groups of workers and test if the returns to schooling are significantly different for the different groups.

Appendix Tables A.7 to A.10 report the estimated regressions stratified by type of job, occupation, employment in public or private sectors and by industry of activity.

The interesting feature of Table A.7 which stratifies the sample into blue collar [1/] and white collar[1/] employees, and owners or self-employed is that the returns to education are not significantly different for the self-employed and white collar employees. It is often suggested that urban labour markets in developing countries are segmented because of the existence of a large self-employed sector which is unorganized while jobs in the large firms are protected and pay higher than the rest of the market. The low coefficient of YRSEDU for blue collar workers is partly due to the the truncation bias[2/]: there are few high earners and the variance of years of education is low as well. The earnings function for white collar workers explains as much as 61 percent of the log variance of earnings. A few other results are of interest:

1/ Obrero - blue collar
Empleado - white collar
} These are somewhat inexact translations from the Spanish terms but as near as one can get.

2/ The mean (geometric) of blue collar earnings is about half of the white collar mean.

- The residential location differentials are least for blue collar workers and most for the self-employed.
- The union differential is most important for blue collar workers.
- The SOCSEC coefficient is highest for the self-employed.
- All the DIST coefficients are significantly negative and the one for the self-employed is greatest.

These observations support points made in previous sections. Residential location appears to matter for relatively higher paid individuals and for the self-employed. The self-employed are probably more dependent on their location for their income: central locations are more desirable than peripheral ones and richer neighbourhoods are better than poorer ones for business. Demand is simply higher in these locations.

Table A.8 reports earnings functions estimated for the sample stratified by type of occupation. Few conclusions can be drawn from such a stratification because of econometric problems. Once again, the occupational classification being correlated with earnings, the estimates are biased on the low side because of truncation problems. Thus the administrative and managerial workers get a low coefficient of YRSEDU (all with high income as well as high levels of education) as do production workers (low incomes, low education).

Table A.9. shows how the earnings function performs better for government workers than for the private sector in terms of the log variance of earnings explained. Interestingly, as would be expected

of a codified wage structure in the public sector, location of residence is not important as it is in the private sector. Similarly, the background variables are not significant either in the public sector. The returns to education are virtually equal, but, again, as might be expected, experience brings somewhat higher rewards in the private sector. Union members in the public sector earn considerably more than others - almost 20 percent, but those who subscribe to a social security scheme seem to be subject to compensating differentials and earn less. It is clear then that the public sector wage structure conforms more to the human capital model of earnings and is, perhaps, also more dependent on screening and certification methods, an observation that has also been made by Berry (1980) in his recent review article. The returns to education are similar indicating that the two sectors are competitive.

Lastly, in this section, consider Table A. 10 which reports earnings function estimates for the sample stratified by industry of employment. All the industry groups have a "respectable" R^2 and the coefficients for YRSEDU are not significantly different except for transport and communication workers. I have no explanation for this specially in view of the fact that the construction workers YRSEDU coefficient is not low. It is interesting that the region of origin effects are significant mainly for the most unskilled of the industry groups: construction. It is reassuring that the public administration and other services estimates correspond closely with the previous public sector estimates: this is the only industry category with a significant union effect.

In summary, the evidence from this set of experiments with stratification by different types of employment categories, there is little evidence of significant segmentation in the labour market in Bogota. The self-employed and employee estimates indicate that there is pretty much free entry between the two sectors: it is difficult to argue that the organized sector is protected. The estimates for occupational categories suffer from econometric problems due to truncation so little can be said about differences due to occupation choice except that there are some low skill, low income occupations and other high skill, high income ones which are naturally correlated with different levels of educational achievement. The estimates for industry groups as well as the ones distinguishing employment in the public and private sectors reveal that returns to education are virtually equal in all industries. There is, however, a very significant union effect in the public sector - union employees appear to get a 15-20 percent advantage over their peers.

The last set of stratifications attempted were by status in the family. Appendix Tables A.11 and A.12 report estimates for household heads and others, and for those who are single and others. Mazumdar (1979) had reported for the labour market in Bombay that married workers are paid more than equivalent single workers because of their alleged greater reliability.[1/] One of the characteristics of the informal sector is said to be the employment of secondary workers (non-household heads). These data indicate no significant difference in the returns to education between any of these groups. Similar observations hold for the female workers as well.

1/ Griliches and Mason (1972) also reported somewhat higher earnings for married workers.

6.4 Summary

This section has attempted to investigate the degree to which the Bogota labour market can be said to be segmented. It is often argued that urban labour markets in less developed countries are characterized by somewhat non-competing or segmented sectors: some workers belong to the protected or organized sector where they earn much more than they would in the rest of the labour market doing similar jobs. The evidence from Bogota, while not conclusive, indicates that on the whole the Bogota labour market is pretty competitive and the protected sector is not easy to find.

The protected sector is usually characterized as being more "formal" or organized. Four variables were used to proxy the protected sector. The existence of a union, or of a written employment contract, or of social security contributions were regarded as indications of the formal nature of an enterprise. Workers with such employment characteristics were found to earn more but only about 3 to 6 percent more than others. The fourth proxy used was the size of firm and (ceteris paribus) earnings increase by only about 2.5 percent for every doubling of firm size. Membership in a union seems to affect the less skilled and blue collar workers more than others and, interestingly, older workers rather than new entrants to be labour force. The evidence suggests that union membership might give greater job stability and higher earnings later in a permanent career. Union membership might even be used as a screening device by prospective employers. Unions have a greater effect on earnings in the public sector than in the private sector.

The second approach to identifying the protected sector was to examine the returns to schooling for different categories of workers. There were virtually no differences between employees and the self-employed; between the public and private sector workers and between different industries. The level of explanation of the variance in earnings was better for some categories as opposed to others but not significantly different. Moreover, the earlier evidence on the returns to firm specific and occupation specific experience also indicated that mobility between jobs must be relatively easy.

The overall conclusion is that the labour market in Bogota is not characterized by a strong protected sector and that different portions of it appear to be competitive.

VII. ESTIMATING EARNINGS FUNCTIONS FOR WOMEN

7.1 Introduction

The average earnings of women characteristically range from about two thirds to a half of the average for men in most countries of the world. In Bogota they are nearer a half. The ratio declines with age: young women earn almost as much as the men but the older women earn less and less comparatively. It has often been suggested that discrimination by employers against females may be the probable source of this differential. It is difficult to test for this since it requires the estimation of an earnings function which takes adequate account of the somewhat different characteristics of the supply of labour by women.

In a good exposition on the subject, Frank (1978) focuses on the supply side phenomena that could account for equally qualified males and females being paid different wages by a non-discriminating employer. As a group, husbands possess larger stocks of human capital: education, training, experience and the like, than do women. Thus, within the household, male chauvinist decision principles are typically in force. For a couple, if both husbands and wives are in the labour force, the joint search for jobs is constrained geographically to be in the same area (town or city) for both of them. Usually, the husband's stock of human capital and hence earnings potential is higher and hence his job usually takes precedence over the wife's. The wife then has to optimise her job choice constrained by her husband's prior choice and often has to end up taking a job for which she may be over-qualified. Her decision rule might have to be to take the job where her qualifications are the least over requirements, within the area which she is constrained to. If, of course, male chauvinist principles did not prevail, a truly joint choice might lead to

both husband and wife taking jobs which are sub-optimal for each singly but which are optimal for a joint choice. A supply process with essentially male dominating decision rules sketched above would lead to women earning less than men with identical personal characteristics. While such a chain of reasoning has undoubted merit, it begs the prior causation of the existence of typically lower human capital stock in women than in men. It presumably has to do with the expectation of lower life time earnings for women which then becomes a self fulfilling expectation.

It is the interruption in careers necessitated by child bearing and child care that are probably more important as an explanation for the lower earnings of women. Interruption in work careers makes the o.j.t. investments in human capital less productive. It also provides employers "objective" reasons for discriminating against women. And the combination of the effect of these "objective" reasons on supply along with possible resulting discrimination make the expected earnings lower for women and hence they invest less in education as well.

The key problem in estimating earnings functions for women then lies in the specification of the experience variable. The standard definition of (AGE - YRSEDU - 6) is obviously not a good one for married women who have had children. Attempts were made in the estimations to account for the number of children for married women still in the labour force, but without notable success. The results presented here are flawed because of my inability to find an adequate specification of the experience variable. The most important problem is that women are much more likely to have part time or occasional employment but this is somewhat easier to correct, at least partially, by using hourly wages as the income variable rather than monthly earnings.

7.2 The Returns to Education and Experience

Tables 10 and 11 give the estimates for women for equations identical to those for men in Tables 3 and 4. A number of observations are immediately apparent. First, the level of explanation is clearly less than for men - because of the reasons discussed above. The education and experience variables are both highly significant but their magnitudes are substantially lower than those for men - about 40 percent for the return to education and more than 50 percent for experience. The coefficient estimates are affected significantly by the addition of the protected sector variables - UNION, SOCSEC and CONTRACT - much more so than those for the men. The results for the splined education variable are also of interest. The certification variables DUMP, SUMS and DUMH are all statistically insignificant as are those for PRIMED. It is the returns to secondary education that are the most significant and greater than those to higher education unlike for the men. The returns to postgraduate education, however, are very large indeed. The women who do go on to post-graduate education are more likely to work as professionals and, perhaps, less prone to interrupt their careers. The SECED coefficient is the one most affected by the addition of the protected sector variables: either the women with secondary education are more likely to be union members or that union membership is the better explanation for earnings differentials. All the other coefficients are quite stable across different specifications of the earnings function.

Table 12 gives the estimates of identical earnings functions but using the different measures of earnings: monthly earnings, hourly wage and yearly earnings. It is encouraging to note that the HWAGE estimate

Table 10: THE DETERMINANTS OF EARNINGS OF BOGOTA FEMALE WORKERS 1978

Variable Name	1	2	3	4
YRSEDU	0.102 (27.0)	0.104 (25.3)	0.097 (23.5)	0.073 (17.0)
EXPER	0.025 (6.4)	0.024 (6.0)	0.025 (6.4)	0.021 (5.6)
EXPSQ	-0.0004 (5.8)	-0.0004 (5.8)	-0.0004 (5.8)	-0.0004 (5.2)
DBOG		-0.045 (1.0)	-0.027 (0.6)	-0.062 (1.5)
DCITY		-0.300 (2.3)	-0.209 (1.6)	-0.213 (1.7)
DTOWN		0.057 (0.8)	0.025 (0.4)	-0.038 (0.6)
DURB		-0.020 (0.4)	-0.033 (0.8)	-0.040 (1.0)
RSECT1			0.170 (1.3)	0.244 (2.0)
RSECT3			0.202 (4.1)	0.163 (3.5)
RSECT4			0.144 (2.0)	0.154 (2.3)
RSECT5			0.319 (4.7)	0.243 (3.7)
RSECT6			0.260 (5.1)	0.209 (4.3)
RSECT7			0.244 (4.3)	0.250 (4.6)
RSECT8			0.425 (8.4)	0.495 (10.2)
UNION				0.218 (5.3)
SOCSEC				0.242 (6.2)
CONTRACT				0.116 (3.7)
CONST	7.26	7.27	7.08	7.10
R^2	0.306	0.306	0.331	0.391
N	1887	1887	1887	1887

Dep. Variable: Log Monthly Earnings Mean: 8.21.
(t- Statistics in parenthesis)

Table 11: THE DETERMINANTS OF EARNINGS OF BOGOTA FEMALE WORKERS DISTINGUISHING DIFFERENT EDUCATION LEVELS - 1978

	1	2	3	4	5	6	7
DUMP	-0.014	-0.010	0.040	0.040	0.052	0.046	
	(0.2)	(0.1)	(0.6)	(0.6)	(0.8)	(0.7)	
DUMS	0.019	0.021	0.043	0.103	0.106	0.114	
	(0.2)	(0.2)	(0.4)	(1.0)	(1.0)	(1.1)	
DUMH	-0.026	-0.024	-0.030	0.107	0.075	0.060	
	(0.1)	(0.1)	(0.2)	(0.6)	(0.4)	(0.3)	
PRIMED	0.044	0.043	0.030	0.019	0.015	0.015	
	(2.1)	(2.1)	(1.5)	(1.0)	(0.7)	(0.7)	
SECED	0.117	0.120	0.116	0.070	0.068	0.063	
	(9.0)	(9.0)	(8.9)	(5.4)	(5.1)	(4.7)	
HIGHED	0.075	0.074	0.072	0.050	0.056	0.066	
	(2.0)	(1.9)	(1.9)	(1.4)	(1.5)	(1.8)	
POSTED	0.427	0.431	0.403	0.381	0.377	0.348	
	(6.6)	(6.6)	(6.3)	(6.2)	(6.0)	(5.5)	
EXPER	0.026	0.026	0.027	0.022	0.021	0.021	
	(6.7)	(6.4)	(6.7)	(5.9)	(5.5)	(5.6)	
EXPSQ	-0.0005	-0.0005	-0.0005	-0.0004	-0.0004	-0.0004	
	(6.5)	(6.3)	(6.5)	(5.8)	(5.6)	(5.6)	
DBOG	.....	-0.040	-0.032	-0.056	-0.075	-0.077	
		(0.9)	(0.7)	(1.4)	(1.8)	(1.9)	
DCITY	.....	-0.288	-0.212	-0.191	-0.201	-0.195	
		(2.2)	(1.6)	(1.6)	(1.6)	(1.6)	
DTOWN	.....	0.067	0.028	-0.013	-0.037	-0.037	
		(0.9)	(0.4)	(0.2)	(0.5)	(0.5)	
DURB	.....	0.003	-0.015	-0.021	-0.034	-0.033	
		(0.1)	(0.4)	(0.5)	(0.8)	(0.8)	
RSECT1	.....	.....	0.180	0.238	0.169	0.153	
			(1.4)	(2.0)	(1.3)	(1.2)	
RSECT3	.....	.....	0.211	0.176	0.205	0.203	
			(4.3)	(3.8)	(4.2)	(4.2)	
RSECT4	.....	.....	0.154	0.171	0.168	0.162	
			(2.2)	(2.5)	(2.4)	(2.4)	
RSECT5	.....	.....	0.317	0.243	0.264	0.251	
			(4.7)	(3.8)	(4.0)	(3.8)	
RSECT6	.....	.....	0.269	0.223	0.281	0.284	
			(5.3)	(4.6)	(5.2)	(5.3)	
RSECT7	.....	.....	0.237	0.245	0.287	0.297	
			(4.2)	(4.5)	(5.0)	(5.2)	
RSECT8	.....	.....	0.399	0.461	0.486	0.497	
			(7.8)	(9.4)	(9.6)	(9.8)	
UNION	.....	.....	.....	0.202	0.204	0.133	
				(4.2)	(4.7)	(2.9)	
SOCSEC	.....	.....	.....	0.254	0.268	0.203	
				(6.6)	(6.8)	(4.8)	
CONTRACT	.....	.....	.....	0.117	0.102	0.074	
				(3.8)	(3.2)	(2.2)	
LOG FSIZE	.....	.....	.....	.....	.....	0.040	
						(3.8)	
DIST	.....	.....	.....	.....	-0.015	-0.017	
					(3.1)	(3.5)	
DTRAIN	.....	.....	.....	.....	.....	0.067	
						(1.3)	
CONST	7.47	7.48	7.29	7.27	7.39	7.38	
R^2	0.322	0.324	0.345	0.405	0.406	0.411	
N	1887	1887	1887	1887	1807	1807	

Dependent Variable: Log Monthly Earnings Mean: 8.21
(t-statistics in parentheses)

Table 12. EARNINGS FUNCTIONS FOR BOGOTA FEMALE WORKERS USING DIFFERENT INCOME VARIABLES - 1978

Variable Name	Log Monthly Earnings 1	Log HWAGE 1/ 2	Log YRLYINC 2/ 3
DUMP	0.052	0.108	0.099
	(0.8)	(1.5)	(1.0)
DUMS	0.106	0.162	0.185
	(1.0)	(1.5)	(1.3)
DUMH	0.075	0.278	0.352
	(0.4)	(1.4)	(1.4)
PRIMED	0.015	0.021	-0.003
	(0.7)	(1.0)	(0.1)
SECED	0.068	0.117	0.056
	(5.1)	(8.5)	(3.1)
HIGHED	0.056	0.095	0.054
	(1.5)	(2.5)	(1.1)
POSTED	0.377	0.436	0.366
	(6.0)	(6.7)	(4.3)
EXPER	0.021	0.033	0.43
	(5.5)	(8.2)	(8.1)
EXPSQ	-0.0004	-0.0006	-0.007
	(5.6)	(6.9)	(7.0)
DBOG	-0.075	-0.002	-0.116
	(1.8)	(0.0)	(2.0)
DCITY	-0.201	-0.263	-0.450
	(1.6)	(2.0)	(2.6)
DTOWN	-0.037	-0.052	-0.060
	(0.5)	(0.7)	(0.6)
DURB	-0.034	-0.011	-0.072
	(0.8)	(0.2)	(1.3)
RSECT1	0.169	0.189	0.262
	(1.3)	(1.4)	(1.5)
RSECT3	0.205	0.166	0.273
	(4.2)	(3.3)	(4.1)
RSECT4	0.168	0.-82	0.170
	(2.4)	(1.1)	(1.8)
RSECT5	0.264	0.236	0.335
	(4.0)	(3.5)	(3.7)
RSECT6	0.281	0.271	0.358
	(5.2)	(4.9)	(4.9)
RSECT7	0.287	0.179	0.387
	(5.0)	(3.0)	(4.9)
RSECT8	0.486	0.316	0.513
	(9.6)	(6.0)	(7.3)
UNION	0.204	0.207	0.291
	(4.7)	(4.7)	(5.1)
SOCSEC	0.268	0.270	0.411
	(6.8)	(6.6)	(7.6)
CONTRACT	0.102	0.121	0.134
	(3.2)	(3.6)	(3.1)
DIST	-0.015	-0.009	-0.027
	(3.1)	(1.8)	(4.1)
CONST	7.39	1.75	2.52
R^2	0.406	0.525	0.324
N	1807	1868	1857
Mean Dependent Variable	8.21	2.95	3.57

(t statistics in parenthesis)

1/ HWAGE = $\frac{\text{Monthly Earnings}}{4 \times \text{weekly hours}}$

2/ YRLYINC = $\frac{\text{Monthly Earnings} \times \text{Month Worked}}{1000}$

performs as well as the earnings functions for men explaining 50 percent of the log variance of womens' earnings. The YRLYINC estimate is the least satisfactory, indicating that not only is there a high variance of work hours per week among women but also in months worked in a year. The certification variables are still insignificant but the returns to SECED and HIGHED increase significantly in the HWAGE estimates and are now higher than for the men. Accounting for part time workers and irregularity of women's work patterns it would appear that the returns to their education are at least as great as for men at the secondary and higher education levels - but not for the primary level.

Appendix Table A.13 gives the comparable estimate for women in Cali and the results corroborate those for Bogota, except that the returns to primary education are significant there and comparable to SECED. As for men, the POSTED variable is insignificant for women in Cali as well because of what might be termed the "city size" effect.

Appendix Table A.14 gives the results for the different measures of experience: EXPER, YRSOCCUP and YRSFIRM. Unlike the estimates for men, firm specific experience for women appears to give higher returns than the traditional experience variable. This is reassuring because of the unsatisfactory nature of the EXPER measure for women. An attempt was made to adjust the EXPER measure by the number of years lost to work due to child bearing but the results did not make the returns to EXPER significantly different.[1/] Of the women with children

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1/ The standard earnings functions is

$$\log y = \beta_o + \beta_1 \text{ YRSEDU} + \beta_2 \text{ EXPER} + \beta_3 \text{ EXPER}^2$$

If γ years are taken out of work per child born to married women

$$\text{EXPER}_1 = \text{EXPER} - \gamma \cdot \text{CHILDREN}$$

i.e. $\log y = \beta_o + \beta_1 \text{ YRSEDU} + \beta_2 (\text{EXPER} - \gamma\text{children}) + \beta_3 (\text{EXPER} - \gamma\text{Children})^2$

Estimates were made for this specification but γ was insignificant and β_2 did not change.

who work, almost 35 percent are divorced, separated, widowed or free union - indicating a necessity to work rather than desire to work - and their returns to experience are substantially lower than for currently married women.

Frank (1978) suggested that because of the geographical constraints faced by married women, their earnings would be less than those for equivalent single women. The separate regressions for single and married women (Appendix Table A.12) indicate that this is not true for women in Bogota: returns to education are almost equal. The returns for experience are higher but happen to be the same when compared with currently married women. The divorced, widowed women perhaps show lower returns to experience because they have to take whatever job they can find and probably because they have had to enter the labour market suddenly after a break - making the EXPER variable particularly inappropriate for them.

The time series estimates for 1973 to 1978 (Table 13 and Appendix Table A.15) reveal few surprises. The coefficient estimates are somewhat more unstable than for the men, implying the relatively unsatisfactory nature of the earnings functions specification used. One surprising feature is the relatively higher level of explanation (R^2 = 0.491) for womens' earnings in the 1973 census: such an R^2 is remarkable in a cross-section sample of more than 18,000 observations. The explanation appears to be that many part time workers have been missed out in the census: an observation supported by the participation

Table 13. EARNINGS FUNCTIONS FOR BOGOTA FEMALE WORKERS 1973-1978

	1973	1975	1977	1978
YRSEDU	0.174 (123.2)	0.088 (25.0)	0.086 (21.5)	0.097 (23.5)
EXPER	0.054 (42.8)	0.019 (5.1)	0.013 (3.2)	0.025 (6.4)
EXPSQ	-0.0008 (32.2)	-0.0004 (5.2)	-0.0002 (2.7)	-0.0004 (5.8)
DBOG	0.147 (14.2)	-0.051 (1.8)	-0.048 (1.5)	-0.027 (0.6)
DCITY	0.295 (6.9)			-0.209 (1.6)
DTOWN	0.169 (7.4)			0.025 (0.4)
DURB				-0.033 (0.8)
RSECT1	0.042 (1.4)	0.378 (3.6)	0.092 (1.0)	0.170 (1.3)
RSECT3	0.043 (2.7)	0.141 (3.2)	0.136 (2.8)	0.202 (4.1)
RSECT4	0.093 (4.6)	0.131 (2.4)	0.206 (3.1)	0.144 (2.0)
RSECT5	0.100 (4.7)	0.291 (4.9)	0.254 (3.7)	0.319 (4.7)
RSECT6	0.065 (3.8)	0.137 (3.7)	0.123 (2.4)	0.260 (5.1)
RSECT7	0.093 (5.6)	0.136 (6.1)	0.347 (6.3)	0.244 (4.3)
RSECT8	0.136 (7.6)	0.407 (8.0)	0.474 (8.6)	0.425 (8.4)
CONST	4.88	6.47	6.85	7.08
R^2	0.491	0.275	0.262	0.331
N	18,503	2163	1915	1887
Mean dependent variable	6.58	7.37	7.73	8.21

(t statistics in parenthesis)

rates of women observed[1/] in different years.

Female Participation Rates

Year	AGE						
	12-14	15-24	25-34	35-44	45-54	55-64	65+
1973	0.09	0.36	0.37	0.34	0.27	0.17	0.14
1978	0.04	0.39	0.48	0.48	0.39	0.21	0.07

The 1973 sample then probably consists mostly of female full time workers and the estimated coefficients are more comparable to the HWAGE estimates of Table 12. One difference from the men is that there is no noticeable decline in the returns to education for women as there was for men. This may be a hopeful sign that the labour market is being relatively more open for educated women.

7.3 The Influence of Background Variables

Tables 3 and 4 reveal that the region of origin has almost no effect on the earnings of women. The effect of these region variables was significant for men though small.

The residential location effects are broadly similar to those for men with one difference. The effect of the rich sector 8 is not as great but this is explained by the existence of a high proportion of domestic servants in this sector.

1/ This would be yet another reason for the under-coverage of household incomes in the 1973 census.

7.4 The Protected Sector

The effect of the UNION variable has been alluded to above. It seems that membership in a UNION has much greater effect for women - about 20 percent higher earnings - than for men. The level of explanation of the log variance of earnings also increases by about 20 percent. Presumably, union members work more regular and longer hours than the others. But the coefficient is not significantly different in the HWAGE equation. Hence it must be concluded that union membership makes a great difference to female workers. The effect of the SOCSEC and CONTRACT variables is also large and highly significant.

It would then appear that the concept of a segmented labour market is of relevance for women workers. The organized sector is probably able to discriminate less than the unorganized sector. Furthermore, UNION membership for women is correlated with firm size (more so than it was for men) so the firm size effect is also larger than was the case for men. These findings are indicative of a greater need for greater protection of women in the unorganized labour market. This must be balanced against the greater flexibility in terms of work hours and work patterns that exist there.

7.5 Summary

Estimating earnings functions for women is intrinsically more hazardous than for men because their decision to participate is more complicated. In general, while all prime age males participate in the labour force, only a small proportion of prime age married women do. It is them much more desirable to estimate earnings functions for women conditional on their participation decision. Within their participation decision is the number of hours of work that they do in a week. This, however, was not done in this study in an attempt at preserving simplicity. Post facto, it appears even more desirable that further investigation should have been attempted in specifying the earnings functions for women. The functions estimated for women were essentially similar to those for men.

Male dominance, lower expected life time earnings, interruptions in work careers due to child bearing and child care, and sex discrimination are all likely factors which affect women's earnings. Attempts were made to account for the effect of child bearing on the work experience variable but without much success. The estimates of the earnings functions for women are therefore not as good as for the men: the coefficients are less stable over different specifications and time periods, and the variance in earnings explained is not as high.

As compared with those for men, the returns to schooling and experience are much lower for women than those for men, and especially for primary education, however, the returns are not observed to decline over time as they were for the men. The hourly wage measure of earnings performs much better as a dependent variable than monthly income: the returns to secondary higher education are then comparable to those for

men. Clearly, women lose in the labour market because of interruptions in their careers, but also because of the nature of the jobs that they take.

There is much greater evidence of the existence of a protected sector for women. Firstly, firm specific experience is more effective for women than general experience. Secondly, union membership increases womens' earnings by as much as 20 percent. Thirdly, firm size is also much more important as a determinant of earnings than it was for men.

In conclusion, women workers in Bogota appear to be worse off than the men in general. The labour market is more fragmented for them and entrance into the protected sector brings significantly greater rewards.

VIII. Summary and Conclusions

This paper has attempted to investigate the determinants of labour earnings in two fast growing cities in the developing world as part of a larger study that seeks to explain the economic structure of cities in a poor country. Earlier papers have documented the historical context in which the growth of these cities has taken place. This paper has sought to examine more systematically earlier conjectures concerning the workings of the labour market in Bogota and Cali, Colombia. Conventional earnings functions have been used in order to isolate systematic patterns in earnings behaviour. This study is distinguished by the inclusion of a few special features: consistent estimates were presented for the same specification across a number of data sets for different years; earnings functions were estimated for both men and women; and there was a specific focus on the spatial characteristics of the labour market in large cities. This section brings together the key results from the study and suggests fruitful areas for future research.

The traditional human capital model utilizing education and experience variables was complemented by other factors to further explore the heterogeneity which characterizes the urban labour market. Specifically, the effects of workers' backgrounds and employment characteristics were considered in specifying the earnings function. Issues relating to the existence of labour

market segmentation and to the intertemporal behaviour of the determinants of earnings were also discussed. The earnings functions were developed incrementally starting from the basic education and experience specification. The independent impact of the additional variables included at each stage was considered as well as the stability of the estimated coefficients.

8.1 The Returns to Education and Experience

As in most other studies the level of education achieved is the single most important determinant of potential labour earnings. If the background variables are interpreted as proxies for schooling quality and ability, then the results are quite consistent with studies in the U.S. which conclude that the omission of ability and background variables in earnings functions does not cause biases of large magnitudes in the coefficient of the education variable. The estimated private real rates of returns to schooling continue to be very high: between 10 to 15 percent. There is, however, strong evidence to suggest that these rates have been declining over time though the reasons for this decline are not entirely obvious. The last two decades have undoubtedly witnessed an explosion in the numbers of people undergoing schooling and the evidence indicates that, by and large, they have benefited enormously from this schooling.

The education variable was specified somewhat differently from most other similar studies in an attempt to measure the differences in the marginal returns to each level of schooling as well as to measure the certification or screening bonus received

on completing each level of education. Unlike most other countries, the returns to higher education were found to be greater than those to secondary education which themselves were higher than those to primary education. Part of this difference is owing to the fact that tuition costs are not accounted for. The proportion of people undergoing private education increases with the level of education as well as income. Thus average private returns to the secondary and higher levels of education would decrease if adequate account was taken of the direct tuition costs.

While significantly high returns are found for every marginal year of schooling, the bonus received by workers for completing high school or college is of the order of 25 percent. It is clear then that education is also used as a screening device. There is virtually no bonus for completing primary education. Colombia is now approaching universal primary education at least in urban areas. It is this deepening of the stock of educated manpower that may be responsible for declining marginal returns to the lower levels of schooling. If these estimates are correct, the evidence indicates that further investments in secondary and higher education are still justified, indeed desirable, in Colombia.

The finding of the declining rates of return to schooling needs further research. The demand side of the labour market has not been considered adequately in this study. Independent

estimates of the demand for different levels of skilled jobs should be balanced against the supply side in order to understand what is really driving the labour market. This is naturally more difficult to do than the current exercise but I believe this to be quite feasible given the increasing availability of data in developing countries.

The estimated returns to experience are very consistent across different years and different specifications and must therefore be regarded as very robust. It is often suggested that a major explanation of the variance in earnings between otherwise equally endowed workers is the operation of internal labour markets. Firm specific experience is regarded as more important than general work experience. Workers who have been employed with the same firm are regarded as much more valuable than outsiders because of the greater knowledge of the particular firm's procedures and products. Jobs are tagged with specific salaries and workers ascend to these higher paying jobs quicker in their own firms. The evidence from Bogota and Cali does not support this view. The estimated returns to occupation specific work experience and to firm specific experience are lower than for general work experience. The mean number of years spent in each job or occupation indicates that job mobility is considerable in Bogota and Cali. It is then not surprising that returns to firm specific experience are not particularly

high. The conclusion must be that the labour market in these cities is relatively open and there seems to be few barriers to labour mobility.

8.2 The Influence of Background on Earnings

The region of origin and the location of current residence were included in the earnings functions to act as proxies for ability, schooling quality and other unmeasured productivity characteristics. The results show that the inclusion of these variables does not affect the estimated returns to schooling. Therefore the omission of these variables in the estimation of earnings functions should not be regarded as a serious problem.

Although these variables do not add much to the level of explanation of the log variance of earnings their effects are highly significant statistically and do add to an understanding of the operations of labour markets. As is becoming increasingly clear from other studies as well, migrants are not particularly disadvantaged. Except for rural immigrants, they are, if anything, marginally better off than the natives. The rates of return to education are essentially similar for natives and immigrants from other urban areas while rural migrants do receive significantly lower returns. Part of this is simply a reflection of the lower returns to primary education which is all the majority of rural migrants have. It was also shown in an earlier paper that migrants

do not concentrate in a specific area of the city as is often supposed. They are not especially concentrated in either the periphery of the city or in the centre. They are distributed pretty much as others.

Perhaps the most controversial part of this paper is the inclusion of current urban residence location as a determinant of earnings. The general causation is arguably the opposite. It is the level of a household's income which is a key determinant of its location in a city. Rich people generally go and live in rich neighbourhoods and the poor in poor neighbourhoods. As people get better off they move to better neighbourhoods. The results from this study, however, imply that there might be income feedback effects as well such that an individual's location of residence might affect his potential earnings. Various interpretations can be given for the existence of these effects. Similar to the region of origin variables, the location of residence acts as a proxy for schooling quality and ability. Even if the individual has not lived all his life in his current location, mobility data indicate that he is likely to have lived in similar types of neighbourhoods before. Hence neighbourhood also acts as proxy for class and status and, perhaps, for other unmeasured productivity characteristics. In a city as segregated as Bogota is, it is also possible that a person's address may be used as a screening device by employers. It appears that the

neighbourhood differentials are less important for blue collar workers. This gives further credence to the screening hypothesis. It is in white collar and service jobs where a person's class and status may be regarded as important: in cities with the kind of income gradations that Bogota and Cali have, the address of a person clearly gives this kind of information to an employer. The level of spatial inequality by income is being examined systematically in another paper in this series. The evidence is clearly that of relatively high spatial inequality and that the differentiation between areas of the city may well be increasing.

Whatever the explanation, differences according to location of a worker's residence are found to be statistically significant in Bogota and Cali. Workers with otherwise equivalent characteristics are observed to earn more or less according to where they live. Workers in the northern rich part of the city earn about 50-60 percent more than equivalent workers in the poor South, while workers in the rest of the city earn about 20 percent more than them. Stratifying the sample by location of residence and estimating the returns to education adds further credence to the hypothesized neighborhood effects. Although the differences are not statistically significant, the rates of return to schooling follow closely the gradation of neighbourhoods by mean household income per capita.

This is clearly a question worth further exploration. Do cities with higher level of spatial segregation by income exacerbate location or neighbourhood effects? Does the spatial integration of different income groups improve matters? The parallel in the U.S. is the black/white dichotomy between the central city and the suburbs. The policy action that has been used there has been the attempted integration of schools by busing. The verdict on whether this has been successful is still out. Nevertheless, it is important that policy makers be aware that such problems might exist in cities with highly unequal distributions of income along with significant spatial segregation which may be showing a tendency to increase. The rich/poor dichotomy would then be manifested in spatial terms which itself might have long lasting effects for the performance in the labour market of individuals who grow up in these poor parts of the city.

8.3. Segmentation

The evidence for Bogota indicates that the labour market is not characterized by a strong protected sector. The results show that individuals working in establishments with formalized employment arrangements (unions, social security schemes, written contracts) and in large enterprises earn only slightly more than others. Moreover, the stability of the estimated rates of return to schooling and experience across the different

occupational and industrial categories argues against the existence of a highly segmented labour market in Bogota and Cali.

Union membership has a small positive impact on earnings. Unions affect certain groups of workers more than others: public sector employees, manual workers and rural immigrants appear to gain the most from union membership. There is some suggestion that union membership might be used as a screening device by employers in occupations requiring low levels of skills. Large firms do seem to pay more (ceteris paribus) than their smaller counterparts but the difference are not as large as are often suggested.

Further evidence on the labour market in Bogota and Cali being relatively well integrated comes from separate estimations of the earnings functions for employees and for the self-employed. It is often argued that one of the distinguishing characteristics of urban labour markets in developing countries is the large proportion of the labour force which is self employed. The estimates here indicate that there are virtually no differences between the returns to schooling for the self-employed and the employees. There must therefore be high and easy labour mobility.

The overall conclusion is that the labour market in Bogota and Cali is not characterized by a strong protected sector and that different portions of it are competitive. A concern for poverty should then examine directly the low paid workers

and their correlates rather than focusing on the protected sector or the informal sector.

8.4 Women in the Urban Labour Market

The least satisfactory part of this study is the section on women. The estimation of the determinants of women's earnings need to be done in connection with a model of their participation in the labour force. It is much more desirable to estimate earnings functions for women conditional on their participation decision. Male dominance, lower expected life time earnings, interruptions in work careers due to child bearing and child care, and sex discrimination are all likely factors which affect womens' earnings. Attempts were made to account for the effect of child bearing on the work experience variable but without much success. The estimates of the earnings functions for women are therefore not as good as for the men: the coefficients are less stable over different specifications and time periods, and the variance in earnings explained is not as high.

As compared with those for men, the returns to schooling and experience are much lower for women than those for men, and especially for primary education, however, the returns are not observed to decline over time as they were for the men. The hourly wage measure of earnings performs much better as a dependent variable than monthly income: the returns to secondary and higher

education are then comparable to those for men. Clearly, women lose in the labour market because of interruptions in their careers, but also because of the nature of the jobs that they take.

There is much greater evidence of the existence of a protected sector for women. Firstly, firm specific experience is more effective for women than general experience. Secondly, union membership increases womens' earnings by as much as 20 percent. Thirdly, firm size is also much more important as a determinant of earnings than it was for men.

It is clear that much more detailed work needs to be done on the determinants of earnings for women. An examination of their specific work patterns is necessary. As more women get educated, as fertility rates decline and as incomes rise more and more women will be entering the labour force. Urgent work therefore needs to be done on both the demand and supply sides. How can work patterns be modified such that this transition can be made relatively more smoothly? How can the poor be aided in their child care responsibilities? It is the poor who need greater income through greater female participation in the labour force and it is they who have relatively high opportunity costs in terms of child care. Connected with this is the spatial structure of the city in terms of the separation of workplace and residence. If the poor are increasingly segregated in specific areas of the city,

women are particularly disadvantaged spatially: the kind of spatial emphasis in analyzing labour markets in cities of developing countries might be even more relevant for women.

APPENDIX I

THE DATA

The City Study has assembled a data bank of existing sources of data in Bogota and Cali, Colombia in the form of copies of the original computer tapes prepared by the respective originators of the data. All have been documented in detail by Nelson Valverde (1978) and Y.J. Lee (1978). This study utilizes 4 of these data sets; all originally collected by DANE.[1/] The 1978 survey was conducted jointly by the City Study and DANE.

1973 Population Census

The last census undertaken was in 1973 and the one immediately preceding was in 1964. Unfortunately the 1964 census does not report incomes nor does it have intra-city spatial detail. There has been wide skepticism concerning the coverage of the 1973 census [2/] but Potter and Ordoñez (1976) concluded after a careful demographic analysis that the information they analyzed from the advance sample appeared to be of good quality, at least in relation to previous censuses. They estimated that the overall under-enumeration for Colombia as a whole was probably about 7 percent.

1/ DANE: Departamento Adminsitrativo Nacional de Estadistica (National Statistical Agency, Colombia).

2/ One example of such skepticism is Lubell and McCallum (1978) (p. 126) who regard the Bogota 1973 results as "simply not useable" and therefore place no reliance on the census. For their calculations and projections they prefer the 1972 Urban Development Study Household Survey covering 4675 households.

The public use tape provided by DANE is a 4% sample of households. However, for Bogota the tape contains all households living in the buildings which happen to have the households in the 4% sample. We have used the whole sample for tabulations in this paper but the sample has been expanded to reflect the size of the city accounting for estimated under-numeration. Since this study is particularly concerned with the spatial distributions within the city, the sample was expanded appropriately to be representative of the city. Details of this methodology have been given in Appendix (3) of Mohan (1980).

The census contains information on dwelling characteristics, household characteristics, demographic information on all individuals, labor force information for workers and fertility information on females. While I cannot comment on its coverage the overall quality of the information in the sample appears to be good and I am therefore in agreement with Potter and Ordoñez (1976). Non-responses appear to be distributed randomly; the only obvious bias is that single member households predominate in the no information categories in income and labor force information. One of the distinguishing features of this data set which makes it very useful for us is that the location of respondents is coded down to the block (manzana) of residence in the city. The following section will describe the consistent geo-coding system used by DANE in all of its work. The income was obtained from only one question "what was your income from all sources last month?" Only about 12 percent of the sample did not report income information--a proportion which compares well with non-responses in the U.S. census.

Appendix (2) of Mohan (1980) reported the results of an estimation of the income coverage of the 1973 census as well as the 1977 Household Survey (see below). A summary of the method is given in Table A.a. It appears that an aggregation of all incomes reported in the census amounted to no more than 50 percent of the estimated total personal income for Bogota. Various factors responsible for this under-reporting can be enumerated:

- 12% of the people gave no income information.
- When only one question is asked, much of the non-labor earnings are probably not reported.
- Income in kind, e.g. as received by domestic servants, is probably not reported.
- Many earners receive end of the year bonuses: these are characteristically not covered in one shot cross-section surveys such as the census unless the question is asked specifically.

Keeping these factors in mind it is then not surprising that the income coverage of the census was only about 50%.[1/]

Household Surveys

DANE has conducted a regular program of household surveys from 1970 with the main objective of collecting information on the labor force. Since 1975 these surveys have been quarterly and are conducted alternatingly in the four largest cities and in the seven largest cities [2/] along with

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1/ This may be compared with a recent estimate of under-coverage in the Brazil 1960 and 1970 censuses where Pfefferman and Webb (1978) estimate that the censuses cover about 57 - 58 percent of the income. (p. 16).

2/ Bogota, Cali, Medellin, Bucamaranga, Barranquilla, Manizales and Pasto. The first four are the four largest.

an occasional national survey. We have obtained the computer tapes for 1972 (Encuesta de Hogares - Fuerza de Trabajo: EH 6-FT), 1975 (EH8E), and 1977 (EH15). The 1972 survey was a national one and covered 6371 households of whom 1348 were in Bogota. It contains information on housing as well as demographic and labor force characteristics. This survey does not provide the intra-city location of the respondents. The 1975 survey was a special one for the city of Bogota and sampled 3953 households and contains information on demographic and labor force characteristics only. The 1977 survey was conducted in the four largest cities and sampled 6082 households of whom 3161 households, were in Bogota. Starting with this survey DANE has begun to use "rotational sampling" such that 67% of dwelling units sampled remain in the next survey and 33% are new. Both the 1975 and 1977 surveys contain the location of residence of the respondents. The 1972 and 1975 surveys also have firm size information on the number of employees working in each respondents' work place. This question was not included in the 1977 sample. In carrying out these samples DANE classifies neighborhoods into 6 socio-economic strata: 1 low-low, 2 low, 3 medium low, 4 medium, 5 medium high and 6 high. At the conclusion of a survey weights are assigned to each of these strata which are then applied to the members of these strata for all expansions of the sample. These "expansion factors" are supposed to account for over and under sampling that might occur over the course of the survey. The expanded sample should then be correctly representative of the city as a whole.

The 1977 survey is unusual in that as many as 20 percent of the working respondents did not report their inocomes: a proportion which compares very unfavorably with the census. Because of this high proportion a method was devised to impute incomes to the non-respondents. Appendix (1) of Mohan (1980) described the calculation of incomes for all respondents and imputation method for non-respondents.

The coverage of income in this survey is not much better than that in the census despite the more detailed questions asked. Labor income and non-labor income data are taken separately and income in kind is estimated as well. Even when the imputed incomes are included the survey covers only about 61 percent of estimated total personal income of Bogota. It also appears that the highest incomes are either under-reported or undersampled. If the incomes reported in the 1977 sample are converted to 1973 pesos it is found that, on average, there is little real growth in incomes, while those in the highest categories actually decline.

The 1978 City Study - DANE Survey

The World Bank City Study and DANE jointly conducted a survey of about 3000 households in Bogota and 1000 households in Cali. This was an expanded as well as more carefully conducted survey than previous ones. The survey had 5 main parts: i) Household and dwellings characteristics. ii) Demographic characteristics of all individuals. iii) Worker characteristics including information on their place of work. iv) Information on the unemployed. v) Information on vehicle ownership as well as journey to work characteristics for the workers.

A few points are worth noting with regard to this survey. A partial recount of dwelling units was done to account for the expansion of Bogota since the 1973 census (earlier surveys were all based on a 1972 sample frame). Information on income was elicited more carefully. In earlier surveys, earnings of all workers in a household were usually obtained from any adult respondent available in the household. In this survey, all worker information was obtained from each worker directly even if it required re-visits to the household. Furthermore, income questions were asked of all members of the household even if they did not work. Two questions were asked to obtain labour income: the wage and periodicity of wage payments and also total earnings in the previous month. Income in kind was imputed. Various non-labour sources of income were specifically mentioned to obtain non-labour income. As a result, the income coverage of this survey is about 90 percent (as shown in Table A.a below) which is a great improvement over previous surveys.

The percentage of no information on income was only and these have been imputed by the same method as for the 1977 Household Survey referred to earlier. All regressions have been conducted after weighting each observation with expansion factors similar to the procedure for 1973 described above. These expansion factors account for ex-post over and under sampling as compared with the sample frame.

Household Survey Samples and the Spatial Disaggregation of Bogota

Map 1 (in Section II) shows a representation of the map of Bogota. The basic socio-economic spatial unit in Bogota is a "barrio"

or neighborhood of which there were about 500 in 1973 and about 700 now as a result of rapid growth of the city. DANE geo-codes this unit in a 4 digit number of which the first 2 digits identify a comuna - a collection of barrios. The last 2 digits then identify barrios within a comuna. These were then further aggregated into "rings" and "sectors." The boundaries of the comunas shown in the map are principal streets in Bogota. The city is bounded in the East by mountains and therefore has an approximately semi-circular shape, although it is longer going North to South as is evident from the map. As an aid to understanding the numbering system, note that the first digit goes from 1 to 9 and roughly rotates (increasing) from South to North by sectors (or pie slices). The second digit ranges from 1 to 6 and corresponds roughly to rings centered in comunas 31 and 81 and increasing from South to North.

DANE along with the Ministry of Health compiled an inventory of blocks ("manzanas") and of dwelling units within the city before the census in 1973 and that inventory has continued to form the sample frame of all subsequent surveys in Bogota. Thus none of these surveys had sampled the new neighborhoods that have developed in the past 5 years. The sampling is designed to make it equi-probable that any dwelling unit in the city according to the 1972 inventory may be selected. The basic unit of sampling (unidad primaria de muestra) is a block within which all households in all dwelling units are interviewed. Provision is made for different sizes of blocks. Since all the sampling was based on the 1972 sample frame it was difficult to trace time trends in the changes within the city. Moreover, any conclusions that are

drawn about the changing character of neighborhoods must be cautios. If different regions of the city differ from one another systematically and if one region changes character over time the later samples would longer be representative. Sampling is based on the classification of neighborhoods into the 6 socio-economic strata. If neighborhoods change character i.e., filter up or down in the socio-economic scale, the resulting sample would then no longer be representative. Hence, drawing conclusions about fine changes in come distribution from two household surveys at two points of time is a hazardous business without detailed knowledge of the sampling procedures used. If, however, rates of change are not high, such difficulties are minimal: but even one would have less interest in tracing time trends anyway! These remarks may be extended to the coverage of national surveys where the heterogeneity of regions is perhaps typically more pronounced than within a city.

These details have been offered here since they are seldom given by users of household survey data. They became particularly important when comparisons are made between surveys of different years and information on each data source is necessary in order to be aware of biases that may arise from differences in survey design and coverage.

Table A. a. THE COVERAGE OF INCOME IN BOGOTA IN HOUSEHOLD SURVEYS

There is considerable skepticism concerning the coverage of income in household surveys. Detailed estimates of the coverage of Bogota have been made by comparing the total personal income from regional accounts, national income accounts and incomes as revealed in surveys. 1/ The results are as follows:

Survey	Income Covered
1973 Census	49.3 percent
1977 Household Survey	61.3 percent
1978 Household Survey	92.0 percent

Outline of Method	Millions of 1978 Colombian Pesos		
1978 Colombia GDP	(1)	870,000	
Bogota GRP	(2)	200,100	(.22 of 1)
Personal Income	(3)	130,065	(.65 of 2)
From Survey	(4)	119,634	
Survey Coverage		92.0%	(4/3)

1/ Details in Rakesh Mohan (1980), Appendix 2.

APPENDIX II - Tables A.1 - A.15

APPENDIX II (List of Tables continued)

Table A. 1a. MATRIX OF CORRELATION COEFFICIENTS FOR BOGOTA MALE WORKERS

	LOGINC	EXPER	EXPSQ	DBOG	DCITY	DTOWN	DURB	DUMP	DUMS	DUMH	PRIMED	SECED	HIGHED	POSTED
LOGINC	1.00000	0.02119	-0.02501	-0.02279	0.06119	0.09794	0.08603	0.25439	0.16677	0.55477	0.26060	0.51958	0.57211	0.47981
EXPER	0.02119	1.00000	0.95499	0.33322	-0.01143	-0.00853	0.16413	0.03065	0.16187	-0.18451	-0.36748	-0.37371	0.22117	0.14793
EXPSQ	-0.02501	0.95499	1.00000	-0.27283	0.01571	-0.02655	0.14165	0.04993	0.12577	-0.16474	-0.36003	-0.32095	0.19012	0.13130
DBOG	-0.02279	-0.33322	-0.27283	1.00000	-0.14989	-0.22045	-0.55157	0.04879	0.07190	0.02948	0.16106	0.14307	0.04534	0.01619
DCITY	0.06119	-0.01143	-0.01571	-0.14989	1.00000	-0.03895	-0.09746	-0.02345	0.05632	0.03670	0.03397	0.08448	0.03489	0.02699
DTOWN	0.09794	-0.00853	-0.02655	-0.22045	0.03895	1.00000	-0.14334	0.01782	0.03656	0.04887	0.05132	0.07619	0.05864	0.04693
DURB	0.08603	0.16413	0.14165	-0.55157	-0.09746	-0.14334	1.00000	0.01662	0.01105	0.05401	0.00877	0.00719	0.04529	0.05722
DUMP	-0.25439	-0.03065	-0.04993	0.04879	-0.02345	-0.01782	-0.01662	1.00000	-0.42473	-0.38510	0.46553	0.34092	-0.43950	-0.31373
DUMS	0.16677	-0.16187	-0.12577	0.07190	0.05632	0.03656	-0.01105	-0.42473	1.00000	-0.15916	0.19240	0.57584	0.00118	0.12966
DUMH	0.55477	-0.18451	-0.16474	0.02948	0.03670	0.04887	0.05401	-0.38510	-0.15916	1.00000	0.17445	0.52211	0.94499	0.81468
PRIMED	0.26060	-0.36748	-0.36003	0.16106	0.03397	0.05132	-0.00877	0.46553	0.19240	0.17445	1.00000	0.43891	0.19909	0.14212
SECED	0.51958	-0.37371	-0.32095	0.14307	0.08448	0.07619	0.00719	0.34092	0.57584	0.52211	0.43891	1.00000	0.59586	0.42535
HIGHED	0.57211	-0.22117	-0.19012	0.04534	0.03489	0.05864	0.04529	-0.43950	0.00118	0.94499	0.19909	0.59586	1.00000	0.76986
POSTED	0.47981	-0.14393	-0.13130	0.01619	0.02699	0.04693	0.05722	-0.31373	-0.12966	0.81468	0.14212	0.42535	0.76986	1.00000
RSECT1	-0.00698	0.00543	0.01565	-0.05085	0.05776	0.09592	0.01067	0.02499	0.01558	-0.00993	0.02430	0.02717	-0.01098	-0.01051
RSECT3	-0.08174	0.00640	0.00091	-0.01813	-0.01186	-0.00267	-0.03809	0.06958	-0.00961	-0.13497	-0.03099	-0.08338	-0.13618	-0.12489
RSECT4	0.04088	0.00882	-0.00126	-0.02924	-0.03170	0.04694	0.01516	0.00510	0.05404	-0.02207	0.03652	0.03838	-0.01111	-0.02107
RSECT5	-0.01585	-0.01876	-0.02021	-0.03436	-0.03063	0.01078	0.00606	0.06563	0.00523	-0.06198	0.02001	-0.01966	-0.05088	-0.04983
RSECT6	-0.02673	0.04345	0.03657	-0.02150	0.03446	-0.01542	0.03332	0.04819	0.01274	-0.03775	0.04077	-0.00416	-0.03931	-0.04169
RSECT7	0.05300	-0.03164	-0.01632	0.02362	-0.02205	-0.02229	0.04894	-0.07774	0.06129	0.10253	0.03429	0.11170	0.10466	0.09323
RSECT8	0.42183	-0.05254	-0.04160	0.04475	0.02619	0.04501	0.03479	-0.20958	0.02452	0.45600	0.11561	0.31675	0.46202	0.40991
UNION	0.18114	-0.01088	-0.03298	-0.06201	-0.00780	0.04124	0.07747	-0.07324	0.09400	0.09233	0.06250	0.15247	0.12729	0.07412
SOCSEC	0.22217	-0.08903	-0.09729	-0.04938	0.02720	0.04327	0.04761	-0.05290	0.12653	0.14482	0.15104	0.24297	0.16272	0.12612
CONTRACT	0.15245	-0.15458	-0.15413	-0.00839	-0.00183	0.03102	0.03373	-0.04129	0.10853	0.11818	0.13412	0.18982	0.12525	0.09522
DIST	-0.15087	0.04293	0.02778	-0.02140	-0.01026	-0.06912	-0.00250	0.04349	-0.07155	0.11154	-0.09059	-0.15736	-0.11905	-0.07691
DTRAIN	0.12823	-0.10534	-0.10972	0.02549	-0.03197	0.07223	0.00975	-0.02561	0.10461	0.07632	0.10901	0.15665	0.08181	0.06912
FSIZE	0.12089	-0.00187	-0.02004	-0.06592	-0.03297	0.00435	0.08332	-0.02120	-0.01410	0.12078	0.06211	0.08215	0.11369	0.17735
LOGFSIZE	0.21155	-0.13051	-0.14093	-0.00645	-0.02030	0.01215	0.01986	-0.06495	0.08297	0.14839	0.11550	0.19305	0.15761	0.16189

	RSECT1	RSECT3	RSECT4	RSECT5	RSECT6	RSECT7	RSECT8	UNION	SOCSEC	CONTRACT	DIST	DTRAIN	FSIZE	LOGFSIZE
LOGINC	-0.00698	-0.08174	0.04088	-0.01585	-0.02673	0.05300	0.42183	0.18114	0.22217	0.15245	-0.15087	0.12823	0.12089	0.21155
EXPER	0.00543	0.00640	0.00882	-0.01876	0.04345	-0.03164	-0.05254	-0.01088	-0.08903	-0.15458	0.04293	-0.10534	-0.00187	-0.13051
EXPSQ	0.01565	0.00091	-0.00126	-0.02021	0.03657	-0.01632	-0.04160	-0.03298	0.09729	-0.15413	0.02778	-0.10972	-0.02004	-0.14093
DBOG	-0.05085	-0.01813	-0.02924	-0.03436	-0.02150	0.02362	0.04475	-0.06201	-0.04938	-0.00839	-0.02140	0.02549	-0.06592	-0.00645
DCITY	0.05776	-0.01186	-0.03170	-0.03063	0.03446	-0.02205	0.02619	0.00780	0.02720	-0.00183	-0.01026	-0.03197	-0.03297	-0.02030
DTOWN	0.09592	-0.00267	0.04694	0.01078	-0.01542	-0.02229	0.04501	0.04124	0.04327	0.03102	-0.06912	0.07223	0.00435	0.01215
DURB	0.01067	-0.03809	0.01516	0.00606	0.03332	0.04894	0.03479	0.07747	0.04761	0.03373	-0.00250	0.00975	0.08332	0.01986
DUMP	0.02499	0.06958	0.00510	0.06563	0.04819	-0.07774	-0.20958	-0.07324	-0.05290	-0.04129	0.04349	-0.02561	-0.02120	-0.06495
DUMS	0.01558	-0.00961	0.05404	0.00523	0.01274	0.06129	0.02452	0.09400	0.12653	0.10853	0.07155	0.10461	-0.01410	0.08297
DUMH	-0.00993	-0.13497	-0.02207	-0.06198	-0.03775	0.10253	0.45600	0.09233	0.14482	0.11818	-0.11154	0.07632	0.12078	0.14839
PRIMED	0.02430	-0.03099	0.03652	0.02001	0.04077	0.03429	0.11561	0.06250	0.15104	0.13412	-0.09059	0.10901	0.06211	0.11550
SECED	0.02717	-0.08338	0.03838	-0.01966	-0.00416	0.11170	0.31675	0.15247	0.24297	0.18982	-0.15736	0.15665	0.08215	0.19305
HIGHED	-0.01098	-0.13618	-0.01111	-0.05088	-0.03931	0.10466	0.46202	0.12729	0.16272	0.12525	-0.11905	0.08181	0.11369	0.15761
POSTED	-0.01051	-0.12489	-0.02107	-0.04983	-0.04169	0.09323	0.40991	0.07412	0.12612	0.09522	-0.07691	0.06912	0.17735	0.16189
RSECT1	1.00000	-0.07743	-0.03745	-0.03563	-0.06375	-0.04312	-0.04662	-0.03734	-0.04655	-0.04445	-0.24389	0.00777	-0.00743	-0.02972
RSECT3	-0.07743	1.00000	-0.15953	-0.15179	-0.27157	-0.18368	-0.19857	0.04329	0.01942	0.02613	0.07752	0.01029	0.01504	0.04374
RSECT4	-0.03745	-0.15953	1.00000	-0.07342	-0.13135	-0.08884	-0.09604	0.03353	-0.00814	0.00231	0.16957	0.01066	0.01664	-0.00027
RSECT5	-0.03563	-0.15179	-0.07342	1.00000	-0.12498	-0.08453	-0.09138	-0.00277	0.06607	0.07771	0.05958	0.02569	0.00373	0.06583
RSECT6	-0.06375	-0.27157	-0.13135	-0.12498	1.00000	-0.15123	-0.16349	-0.01641	0.01013	-0.00898	0.30937	-0.03201	-0.01205	-0.02568
RSECT7	-0.04312	-0.18368	-0.08884	-0.08453	-0.15123	1.00000	-0.11058	-0.00578	-0.01405	-0.01839	0.15536	-0.01751	-0.02612	-0.02341
RSECT8	-0.04662	-0.19857	-0.09604	-0.09138	-0.16349	-0.11058	1.00000	0.08528	0.08429	0.04263	-0.08673	0.08158	0.10565	0.10310
UNION	-0.03734	0.04329	0.03353	-0.00277	0.01641	-0.00578	0.08528	1.00000	0.27598	0.21295	-0.01121	0.19133	0.22858	0.37953
SOCSEC	-0.04655	0.01942	-0.00814	0.06607	0.01013	-0.01405	0.08429	0.27598	1.00000	0.53882	0.02309	0.29983	0.21470	0.55353
CONTRACT	-0.04445	0.02613	0.00231	0.07771	0.00898	-0.01839	0.04263	0.21295	0.53882	1.00000	0.03551	0.23670	0.13999	0.47585
DIST	-0.24389	0.07752	-0.16957	0.05958	0.30937	0.15536	-0.08673	-0.01121	0.02309	0.03551	1.00000	-0.02744	-0.02149	0.02599
DTRAIN	0.00777	0.01029	0.01066	0.02569	-0.03201	0.01751	0.08158	0.19133	0.29983	0.23670	-0.02744	1.00000	0.22458	0.32682
FSIZE	-0.00743	0.01504	0.01664	0.00373	-0.01205	-0.02612	0.10565	0.22858	0.21470	0.13999	-0.02149	0.22458	1.00000	0.59782
LOGFSIZE	-0.02972	0.04374	-0.00027	0.06583	-0.02568	-0.02341	0.10310	0.37953	0.55353	0.47585	0.02599	0.32682	0.59782	1.00000

TABLE A.1b. MATRIX OF CORRELATION COEFFICIENTS FOR BOGOTA FEMALE WORKERS

	LOGINC	EXPER	EXPSQ	DBOG	DCITY	DTOWN	DURB	DUMP	DUMS	DUMH	PRIMED	SECED	HIGHED	POSTED
LOGINC	1.00000	-0.21309	-0.21623	0.14037	-0.00727	0.09293	-0.04619	0.11263	0.24953	0.38125	0.30673	0.51558	0.41562	0.33562
EXPER	-0.21309	1.00000	0.95273	-0.30293	0.02897	0.01091	0.18062	-0.07230	0.21713	0.18741	-0.45447	0.40414	0.23607	0.13955
EXPSQ	-0.21623	0.95273	1.00000	-0.25355	0.01552	-0.03416	0.15459	0.10630	0.17327	0.14862	-0.45112	0.34175	0.18016	-0.11261
DBOG	0.14037	-0.30293	-0.25355	1.00000	-0.10564	-0.22366	0.52658	0.04144	0.18165	0.13524	0.25744	0.33607	0.16509	0.14008
DCITY	-0.00727	0.02897	0.01552	-0.10564	1.00000	-0.03109	-0.07320	0.00314	0.07133	0.01508	0.04141	0.06556	0.01209	-0.01357
DTOWN	0.09293	-0.01091	-0.03416	-0.22366	-0.03109	1.00000	-0.15498	0.02761	0.09072	0.00291	0.09209	0.10650	0.00009	0.02157
DURB	-0.04619	0.18062	0.15459	-0.52658	-0.07320	-0.15498	1.00000	0.01772	-0.09382	-0.03187	-0.06288	0.13361	0.04507	-0.06451
DUMP	-0.11263	-0.07230	-0.10630	0.04144	0.00314	0.02761	0.01772	1.00000	-0.39703	-0.29298	0.50097	0.24556	0.34747	-0.18577
DUMS	0.24953	-0.21713	-0.17327	0.18165	0.07133	0.09072	-0.09382	-0.39703	1.00000	-0.14361	0.24556	0.63475	0.03115	-0.09106
DUMH	0.38125	-0.18741	-0.14862	0.13524	-0.01508	-0.00291	-0.03187	-0.29298	-0.14361	1.00000	0.18120	0.46839	0.93321	0.63408
PRIMED	0.30673	-0.45447	-0.45112	0.25744	0.04141	0.09209	-0.06288	0.50097	0.24556	0.18120	1.00000	0.50105	0.21490	0.11490
SECED	0.51558	-0.40414	-0.34175	0.33607	0.06556	0.10650	-0.13361	0.21689	0.63475	0.46839	0.50105	1.00000	0.55550	0.29700
HIGHED	0.41562	-0.23607	-0.18016	0.16509	-0.01209	-0.00009	-0.04507	-0.34747	0.03115	0.93321	0.21490	0.55550	1.00000	0.59173
POSTED	0.33562	-0.13955	-0.11261	0.14008	-0.01357	0.02157	-0.06451	-0.18577	-0.09106	0.63408	0.11490	0.29700	0.59173	1.00000
RSECT1	-0.00908	0.07958	0.07716	-0.02552	0.10829	-0.00039	0.00754	0.03134	-0.01334	0.01718	0.02234	-0.01186	0.00749	0.01467
RSECT3	-0.01147	-0.02772	-0.04075	0.04265	-0.02905	-0.03923	-0.03153	0.10512	-0.00645	-0.05361	0.04957	0.00948	-0.04630	-0.05685
RSECT4	-0.01817	-0.03400	-0.03446	-0.00355	-0.01071	-0.01583	-0.00521	0.01852	0.03347	-0.02820	0.03631	0.02322	-0.00973	-0.03017
RSECT5	0.02032	-0.03695	-0.02205	-0.01653	-0.03303	0.00725	0.00447	0.00878	-0.01294	-0.02212	0.00022	-0.01248	-0.00221	-0.00143
RSECT6	0.01837	-0.00781	-0.00756	0.05976	-0.02189	-0.03202	0.03458	0.06805	0.03371	-0.04793	0.03631	0.02409	-0.05880	-0.07169
RSECT7	0.02628	-0.02443	-0.02820	-0.03664	0.07883	-0.02358	0.01750	-0.05067	0.02822	0.04548	-0.00194	0.03897	0.06357	0.01198
RSECT8	0.19555	-0.03125	-0.01982	0.04268	-0.05998	0.11899	0.02046	-0.19542	0.03772	0.20884	0.00976	0.10658	0.19558	0.20495
UNION	0.33132	-0.12054	-0.12007	0.10269	-0.03681	0.08953	-0.05169	-0.01231	0.14109	0.17359	0.18445	0.32082	0.21617	0.13446
SOCSEC	0.41617	-0.20834	-0.19527	0.22172	0.01793	0.05515	-0.08848	0.00958	0.28044	0.17020	0.31812	0.46182	0.21674	0.10996
CONTRACT	0.35382	-0.17521	-0.16056	0.17784	0.05394	0.04871	-0.05316	0.01374	0.22503	0.14857	0.26355	0.38874	0.18323	0.10011
DIST	-0.09109	0.01820	0.01048	-0.01837	-0.06854	-0.09795	0.00320	0.07358	-0.09280	-0.09858	-0.05652	-0.15506	-0.11029	-0.06148
DIRAIN	0.20440	-0.11909	-0.12395	0.06140	-0.01937	0.06676	-0.03163	0.04962	0.12481	0.05931	0.17674	0.21580	0.06390	0.06603
FSize	0.15704	-0.07251	-0.07954	0.04144	-0.00024	0.03568	0.00209	0.05648	0.09196	-0.00575	0.11740	0.15039	0.00521	0.03172
LOGFSIZE	0.40862	-0.25031	-0.23843	0.22543	0.00454	0.04760	-0.09756	0.05634	0.21255	0.17475	0.31633	0.42955	0.20472	0.17420

	RSECT1	RSECT3	RSECT4	RSECT5	RSECT6	RSECT7	RSECT8	UNION	SOCSEC	CONTRACT	DIST	DIRAIN	FSIZE	LOGFSIZE
LOGINC	-0.00908	-0.01147	-0.01817	0.02032	0.01837	0.02628	0.19555	0.33132	0.41617	0.35382	-0.09109	0.20440	0.15704	0.40862
EXPER	0.07958	-0.02772	-0.03400	-0.03695	-0.00781	-0.02443	-0.03125	-0.12054	-0.20834	-0.17521	0.01820	-0.11909	-0.07251	-0.25031
EXPSQ	0.07716	-0.04075	-0.03446	-0.02205	-0.00756	-0.02820	-0.01982	-0.12007	-0.19527	-0.16056	0.01048	-0.12395	-0.07954	-0.23843
DBOG	-0.02552	0.04265	-0.00355	-0.01653	0.05976	-0.03664	-0.04268	0.10269	0.22172	0.17784	-0.01837	0.06140	0.04144	0.22543
DCITY	0.10829	-0.02905	-0.01071	-0.03303	-0.02189	0.07883	-0.05998	-0.03681	0.01793	0.05394	-0.06854	-0.01937	-0.00024	0.00454
DTOWN	-0.00039	-0.03923	-0.01583	0.00725	-0.03202	-0.02358	0.11899	0.08953	0.05515	0.04871	-0.09795	0.06676	0.03568	0.04760
DURB	0.00754	-0.03153	-0.00521	0.00447	0.03458	0.01750	0.02046	-0.05169	-0.08848	-0.05316	0.00320	-0.03163	0.00209	-0.09756
DUMP	0.03134	0.10512	0.01852	0.00878	0.06805	-0.05067	-0.19542	0.01231	0.00958	0.01374	0.07358	0.04962	0.05648	0.05634
DUMS	-0.01334	-0.00645	0.03347	-0.01294	0.03371	0.02822	0.03772	0.14109	0.28044	0.22503	-0.09280	0.12481	0.09196	0.21255
DUMH	0.01718	-0.05361	-0.02820	-0.02212	-0.04793	0.04548	0.20884	0.17359	0.17020	0.14857	-0.09858	0.05931	-0.00575	0.17475
PRIMED	0.02234	0.04957	0.03631	0.00022	0.03631	-0.00194	0.00976	0.18445	0.31812	0.26355	-0.05652	0.17674	0.11740	0.31633
SECED	-0.01186	0.00948	0.02322	-0.01248	0.02409	0.03897	0.10658	0.32082	0.46182	0.38874	-0.15506	0.21580	0.15039	0.42955
HIGHED	0.00749	-0.04630	-0.00973	-0.00221	-0.05880	0.06357	0.19558	0.21617	0.21674	0.18323	-0.11029	0.06390	0.00521	0.20472
POSTED	0.01467	-0.05685	-0.03017	-0.00143	-0.07169	0.01198	0.20495	0.13446	0.10996	0.10011	-0.06148	0.06603	0.03172	0.17420
RSECT1	1.00000	-0.06137	-0.03013	-0.03279	-0.05522	-0.04374	-0.05955	-0.02613	-0.03316	-0.03400	-0.21467	-0.00795	-0.01383	-0.02198
RSECT3	-0.06137	1.00000	-0.12772	-0.13902	-0.23407	-0.18543	-0.25246	0.05138	0.09851	0.02977	0.04638	0.03027	0.05838	0.08964
RSECT4	-0.03013	-0.12772	1.00000	-0.06825	-0.11492	-0.09104	-0.12395	0.02050	0.02799	-0.02107	-0.14450	-0.00692	0.04158	0.00987
RSECT5	-0.03279	-0.13902	-0.06825	1.00000	-0.12508	-0.09909	-0.13491	0.03976	0.07063	0.09161	-0.00971	0.02225	0.05016	0.09969
RSECT6	-0.05522	-0.23407	-0.11492	-0.12508	1.00000	-0.16684	-0.22715	0.11164	0.07426	0.07104	0.30479	0.06457	0.07109	0.09083
RSECT7	-0.04374	-0.18543	-0.09104	-0.09909	-0.16684	1.00000	-0.17995	0.01255	-0.01135	-0.01828	0.09273	0.02958	-0.03875	-0.04210
RSECT8	-0.05955	-0.25246	-0.12395	-0.13491	-0.22715	-0.17995	1.00000	0.07689	-0.09238	-0.04768	0.04630	0.04953	-0.08208	-0.10518
UNION	-0.02613	0.05138	0.02050	0.03976	0.11164	0.01255	-0.07689	1.00000	0.43171	0.36819	0.01010	0.34111	0.35926	0.53153
SOCSEC	-0.03316	0.09851	-0.02799	0.07063	0.07426	-0.01135	-0.09238	0.43171	1.00000	0.62733	-0.01772	0.25704	0.26487	0.66810
CONTRACT	-0.03400	0.02977	-0.02107	0.09161	0.07104	-0.01828	-0.04768	0.36819	0.62733	1.00000	-0.03555	0.22629	0.20329	0.56796
DIST	-0.21467	0.04638	-0.14450	-0.00971	0.30479	0.09273	-0.04630	0.01010	-0.01772	-0.03555	1.00000	0.05865	0.03237	0.02223
DIRAIN	-0.00795	0.03027	-0.00692	0.02225	0.06457	0.02958	-0.04953	0.34111	0.25704	0.22629	0.05865	1.00000	0.22267	0.34392
FSIZE	-0.01383	0.05838	0.04158	0.05016	0.07109	-0.03875	0.08208	0.35926	0.26487	0.20329	0.03237	0.22267	1.00000	0.59440
LOGFSIZE	-0.02198	0.08964	0.00987	0.09969	0.09083	0.04210	-0.10518	0.53153	0.66810	0.56796	0.02223	0.34392	0.59440	1.00000

Table A.2.: MEAN VALUES OF VARIABLES: BOGOTA 1973-1978 - CALI 1978

(Male Workers)

	Bogota				Cali	
	1973	1975	1977	1978	1978	
YRSEDU	6.02	7.01	7.58	7.75		
DUMP	0.52	0.53	0.52	0.50	0.55	
DUMS	0.087	0.12	0.16	0.15	0.11	
DUMH	0.057	0.092	0.12	0.13	0.05	
PRIMED	4.13	4.40	4.48	4.48	4.27	
SECED	1.54	2.07	2.42	2.51	1.80	
HIGHED	0.28	0.44	0.56	0.61	0.28	
POSTED	0.060	0.097	0.12	0.14	0.05	
EXPER	20.20	22.17	21.73	20.49	22.55	
EXPSQ	562.02	673.91	657.67	598.10	725.09	
DBOG	0.36	0.31	0.34	0.46	0.43	(DCALI)
DCITY	0.019			0.03	0.03	
DTOWN	0.053			0.06	0.08	
RSECT1	0.026	0.017	0.019	0.018	0.016	Cali Sectors
(RSECT2	0.184	0.181	0.184	0.205)	0.038	
RSECT3	0.250	0.280	0.250	0.250	0.160	
RSECT4	0.100	0.092	0.089	0.072	0.180	
RSECT5	0.078	0.065	0.066	0.063	0.426	
RSECT6	0.180	0.190	0.190	0.185	0.120	
RSECT7	0.120	0.100	0.130	0.094	0.060	
RSECT8	0.062	0.075	0.070	0.113		
DIST	6.53	7.51	7.54	7.35		
Log Monthly Earnings	7.17	7.72	8.18	8.70	8.55	

Table A.3.: MEAN VALUES OF VARIABLES BOGOTA 1973-1978 - CALI 1978

(Female Workers)

	Bogota				Cali	
	1973	1975	1977	1978	1978	
YRSEDU	5.64	6.46	6.56	7.10		
DUMP	0.47	0.48	0.48	0.44	0.51	
DUMS	0.09	0.11	0.16	0.17	0.09	
DUMH	0.04	0.07	0.06	0.10	0.04	
PRIMED	3.87	4.12	4.15	4.19	3.98	
SECED	1.52	1.90	2.05	2.36	1.58	
HIGHED	0.23	0.36	0.32	0.49	0.19	
POSTED	0.018	0.085	0.043	0.06	0.024	
EXPER	17.72	17.03	17.60	17.62	18.37	
EXPSQ	465.37	433.92	467.74	477.58	495.15	
DBOG	0.36	0.32	0.33	0.44	0.42	(DCALI)
DCITY	0.01			0.015	0.014	
DTOWN	0.05			0.06	0.078	
RSECT1	0.029	0.017	0.028	0.014	0.010	Cali Sectors
(RSECT2	0.145			0.154)	0.099	
RSECT3	0.210	0.240	0.220	0.207	0.170	
RSECT4	0.086	0.098	0.070	0.058	0.120	
RSECT5	0.080	0.074	0.064	0.067	0.363	
RSECT6	0.180	0.190	0.170	0.177	0.150	
RSECT7	0.160	0.120	0.180	0.117	0.088	
RSECT8	0.110	0.120	0.130	0.200		
DIST	6.88	7.11	6.98	7.15		
Log Monthly Earnings	6.63	7.37	7.73	8.20		

Table A.4. EARNINGS FUNCTIONS FOR BOGOTA MALE WORKERS BY AGE GROUP - 1978

	Age Groups					
	15-24	25-34	35-44	45-54	55-64	65+
YRSEDU	0.103*	0.118*	0.126*	0.105*	0.085*	0.134*
EXPER	0.069*	0.137	-0.063	0.109	0.078	0.132
EXPSQ	-0.0006	-0.0010	0.0016*	-0.0016	-0.0010	-0.0011
DBOG	0.118	0.132*	0.304*	-0.007	-0.030	-0.024
DCITY	0.403*	0.344*	0.206	-0.263	0.140	-
DTOWN	0.736*	0.143	0.109	0.062	-0.363	-2.295
DURB	0.143	0.078	0.168*	-0.013	-0.007	-0.191
RSECT1	0.188	0.053	-0.167	0.138	-	0.131
RSECT3	0.163*	0.282*	0.108	0.366*	0.108	0.268
RSECT4	0.089	0.307*	0.139	0.213	0.555*	1.090
RSECT5	0.144	0.198*	0.250*	0.510*	1.24*	0.179
RSECT6	0.103	0.230*	0.240*	0.363*	0.446*	0.078
RSECT7	0.154*	0.291*	0.272*	0.598*	0.491*	0.785
RSECT8	0.287*	0.769*	0.228*	1.172*	1.504*	0.803
UNION	0.022	-0.0003	0.092*	0.274*	0.428*	0.009
SOCSEC	0.064	0.177*	0.166*	-0.129	-0.095	-0.048
CONTRACT	0.055	0.037	-0.070	-0.0002	-0.029	0.300
DIST	-0.015*	-0.027*	-0.026*	-0.037*	-0.027	-0.036
CONST	6.80	7.03	8.22	6.15	6.54	3.75
R^2	0.318	0.533	0.479	0.559	0.616	0.359
N	786	936	694	393	168	60
Mean Log. Earnings	8.22	8.80	8.92	8.97	8.88	8.48
YRSEDU (Females)	0.077*	0.062*	0.098	0.017	-0.040	0.516*
	(Coefficients for female workers from similar regressions)					

*Significant at the 5 percent level.

Table A.5: EARNINGS FUNCTIONS FOR BOGOTA MALE WORKERS BY REGION OF ORIGIN 1/ - 1978

	BOGOTA	CITY	TOWN	URBAN	RURAL
YRSEDU	0.122*	0.128*	0.105*	0.116*	0.092*
EXPER	0.073*	0.029	0.055*	0.064*	0.059*
EXPSQ	-0.0010*	-0.0003	-0.0010	-0.0009*	-0.0007*
RSECT1	0.107	0.153	-0.238	0.265	-0.270
RSECT3	0.136*	-0.839	0.192	0.250*	0.300*
RSECT4	0.190*	0.890	0.288	0.233*	0.203
RSECT5	0.308*	-0.793	0.253	0.145	0.304*
RSECT6	0.197*	0.136	0.639*	0.165*	0.201*
RSECT7	0.246*	0.045	0.548*	0.316*	0.354*
RSECT8	0.621*	0.796*	0.965*	0.762*	0.034
UNION	-0.0002	-0.033	-0.034	0.074*	0.170*
SOCSEC	0.078*	-0.226	0.003	0.122*	0.081
CONTRACT	0.072*	0.515*	0.149	-0.026	0.099
DIST	-0.017*	-0.0004	-0.058*	-0.021*	-0.036
CONST	6.26	7.13	7.41	6.87	6.98
R^2	0.595	0.599	0.560	0.553	0.240
No. of Observations	1393	77	176	796	595
Mean Log. Earnings	8.69	9.00	9.09	8.82	8.41
YRSEDU (Females)	0.091*	0.093*	0.062*	0.057*	0.051*

(Coefficients for female workers from similar regressions).

*Significant at the 5 percent level.

1/ Region of origin according to place of birth.
BOGOTA also includes all resident in Bogota since age 10.
CITY includes cities of about 1 million, i.e, Cali, Medellin, Barranquilla.
TOWN includes all town with population over 100,000.
URBAN includes all other urban.

Table A.6: EARNINGS FUNCTIONS FOR BOGOTA MALE WORKERS BY SECTOR OF RESIDENCE - 1978

	SECTORS							
	1	2	3	4	5	6	7	8
YRSEDU	0.095*	0.081*	0.086*	0.104*	0.111*	0.114*	0.137*	0.163*
EXPER	0.040*	0.052*	0.059*	0.072*	0.086*	0.075*	0.060*	0.053*
EXPSQ	-0.0006*	-0.0008*	-0.0009*	-0.0010*	-0.0012*	-0.0011*	-0.0007*	-0.005*
DBOG	0.586*	0.054	-0.023	0.180	0.265*	0.250*	0.115	0.639*
DCITY	0.562*	0.156	-0.018	1.089*	-0.809	0.369*	0.057	0.926*
DTOWN	0.449*	0.156	-0.101	0.231	0.053	0.420*	0.224	0.856*
DURB	0.450*	0.052	0.047	0.152	-0.121	0.085	0.101	0.679*
UNION	0.186	0.188*	0.035	-0.017	0.219	0.151*	0.113	0.004
SOCSEC	-0.091	0.130*	0.008	0.026	-0.116	0.150*	0.223*	0.105
CONTRACT	0.187	0.034	0.080	0.005	0.007	0.067	-0.136	0.215*
DIST	-1.75	-0.027	-0.037*	0.024	-0.034	-0.036	-0.007	-0.035
CONST	8.55	7.20	7.53	6.75	7.03	6.89	6.66	6.34
R^2	0.527	0.269	0.297	0.277	0.423	0.451	0.605	0.519
N	53	628	759	217	192	561	284	343
Mean Log Earnings	8.67	8.24	8.55	8.80	8.64	8.65	8.88	9.78
YRSEDU (Females)	0.096*	0.046*	0.038*	0.068*	0.066*	0.091*	0.063*	-.100*
	(Coefficients for female workers from similar regressions).							

*Significant at the 5 percent level.

Table A.7: EARNINGS FUNCTIONS FOR BOGOTA WORKERS BY TYPE OF JOB - 1978

	Males			Females			
	Blue Collar	White Collar	Owner/ Self-Employed	Blue Collar	White Collar	Owner/ Self-Employed	Maids
YRSEDU	0.065*	0.121*	0.115*	0.008	0.088*	0.068*	0.028
EXPER	0.058*	0.058*	0.065*	0.023*	0.046*	-0.019	0.014
EXPSQ	-0.0008*	-0.0008*	-0.0009*	-0.0004*	-0.0008*	0.0002	-0.0003
DBOG	0.152*	-0.007	0.136	0.071	0.062	-0.280*	-0.014
DCITY	0.331*	0.154	-0.038	-0.345	-0.117	-0.928*	0.049
DTOWN	0.116	0.148*	0.047	0.039	0.091	-0.012	-0.327
DURB	0.072	-0.036	0.147	0.045	-0.029	-0.062	0.047
RSECT1	0.188	-0.110	0.040	-	0.144	-0.63	0.387
RSECT3	0.193*	0.100*	0.313*	0.080	0.115	0.154	0.359*
RSECT4	0.181*	0.156*	0.318*	0.091	0.075	0.125	0.157
RSECT5	0.091	0.178*	0.573*	0.043	0.273*	0.345	0.093
RSECT6	0.117*	0.204*	0.313*	0.195*	0.172*	0.188	0.329
RSECT7	0.158*	0.257*	0.341*	0.005	0.152*	0.237	0.261
RSECT8	0.184	0.641*	0.780*	0.072	0.384*	0.869*	0.342*
UNION	0.148*	0.075*	0.034	0.049	0.207*	1.560	-
SOCSEC	0.076*	0.093*	0.226*	0.276*	0.138*	0.144	0.118
CONTRACT	0.041	0.138	-	0.125*	0.058	-	-
DIST	-0.016*	-0.027*	-0.037*	-0.005	-0.017*	-0.012	-0.004
CONST	7.10	6.88	6.86	7.39	6.98	7.66	7.47
R^2	0.327	0.610	0.414	0.299	0.438	0.218	0.016
N	822	1286	823	238	940	334	357
Mean Log Earnings	8.28	8.94	8.72	8.04	8.53	7.70	7.96

*Significant at the 5 percent level.

Table A.8: EARNINGS FUNCTIONS FOR BOGOTA MALE WORKERS BY OCCUPATION - 1978

(ILO Code)	Professional and Technical (1-19)	Admin. and Manager (20-29)	Clerk and Typist (30-39)	Sales Workers (40-49)	Service Workers (50-59)	Production Workers (70-98)
YRSEDU	0.135*	0.035	0.082*	0.117*	0.086*	0.069*
EXPER	0.078*	0.031	0.059*	0.067*	0.034*	0.058*
EXPSQ	-0.0012*	-0.0007	-0.0008*	-0.0009*	-0.0006*	-0.0009*
DBOG	0.056	0.101	0.062	0.130	0.024	0.118*
DCITY	0.352	-0.034	0.284	-0.130	0.128	0.111
DTOWN	0.001	0.096	0.192	0.270	-0.062	0.108
DURB	-0.044	0.259	0.065	0.149	-0.098	0.077
RSECT1	0.416*	-	0.248	-0.312	-0.127	0.144
RSECT3	0.325*	0.497	0.162*	0.095	-0.049	0.242*
RSECT4	0.263	0.504	0.270*	0.193	-0.107	0.299*
RSECT5	0.687*	0.526	0.191	0.489*	0.023	0.167*
RSECT6	0.487*	0.368	0.269*	0.234	-0.037	0.202*
RSECT7	0.586*	0.372	0.346*	0.226	0.142	0.188*
RSECT8	0.846*	0.879*	0.594*	0.647*	-0.280	0.193*
UNION	-0.076	-0.002	0.115*	-0.040	0.274*	0.144*
SOCSEC	0.041	-0.054	-0.124	0.264*	0.185	0.050
CONTRACT	0.164*	-0.030	0.164*	0.070	0.008	0.015
DIST	-0.040	0.221	-0.032*	-0.058*	-0.013	-0.020*
CONST	6.47	8.47	7.24	6.92	7.31	7.14
R^2	0.566	0.210	0.463	0.359	0.141	0.288
N	377	124	337	488	219	1331
Mean Log Earnings	9.59	10.02	8.75	8.74	8.32	8.34
YRSEDU (Females)	0.061*		0.086*	0.049*	0.042*	0.027

(Coefficient for female workers from similar regressions).

*Significant at the 5 percent level.

Table A.9: EARNINGS FUNCTIONS FOR BOGOTA WORKERS BY TYPE OF FIRM - 1978

	Males		Females	
	Government	Private	Government	Private
YRSEDU	0.113*	0.118*	0.072*	0.066*
EXPER	0.052*	0.066*	0.045*	0.017*
EXPSQ	-0.0006*	-0.0009*	-0.0009*	-0.0003*
DBOG	0.004	0.102*	-0.004	-0.072
DCITY	-0.160	0.180*	-0.203	-0.265*
DTOWN	0.245*	0.137*	0.203	-0.168*
DURB	-0.009	0.085*	0.070	-0.053
RSECT1	-0.013	-0.017	0.284	0.160
RSECT3	-0.074	0.219*	-0.122	0.225*
RSECT4	0.065	0.214*	-0.140	0.16-*
RSECT5	-0.087	0.284*	0.023	0.271*
RSECT6	0.119	0.202*	0.072	0.272*
RSECT7	0.233*	0.262*	0.118	0.292*
RSECT8	0.482*	0.730*	0.279*	0.528*
UNION	0.196*	0.058*	0.214*	0.113*
SOCSEC	-0.130*	0.112*	0.288*	0.206*
CONTRACT	0.143*	0.029	-0.004	0.169*
DIST	-0.021*	-0.027*	-0.024	-0.014*
CONST	7.12	6.81	7.34	7.26
R^2	0.679	0.486	0.447	0.305
N	482	2429	300	1562
Mean Log. Earnings	9.14	8.60	8.84	8.09

*Significant at the 5 percent level.

Table A.10: EARNINGS FUNCTIONS FOR BOGOTA MALE WORKERS BY INDUSTRY OF EMPLOYMENT - 1978

(SIC Code)	Manufacturing 30-39	Construction 50-59	Trade and Commerce 60-69	Transport and Communication 70-79	Financial Establishments 80-89	Public Administration Other Services 90-96
YRSEDU	0.123	0.103*	0.111*	0.082*	0.123*	0.123*
EXPER	0.072*	0.063*	0.067*	0.040*	0.071*	0.067*
EXPSQ	-0.0010*	-0.0009*	-0.0009*	-0.000-*	-0.0011*	-0.0010*
DBOG	0.100*	0.167*	0.126	-0.113	0.041	0.096
DCITY	0.224	0.600*	-0.023	0.092	0.225	0.138
DTOWN	0.059	0.224	0.204	0.410*	0.012	0.153
DURB	0.131*	0.074	0.140	0.113	-0.104	-0.019
RSECT1	0.198	-	-0.214	-0.410	0.743*	0.010
RSECT3	0.255*	0.169*	0.141	0.262*	0.146	0.098
RSECT4	0.290*	0.256	0.200	0.110	0.138	0.173
RSECT5	0.244*	0.071	0.521*	0.159	0.202	-0.046
RSECT6	0.240*	0.219*	0.212	0.395*	0.204	0.119
RSECT7	0.194*	0.247*	0.259*	0.773*	0.551*	0.112
RSECT8	0.921*	0.284	0.569*	0.609*	1.027*	0.355*
UNION	0.037	0.116	-0.030	0.078	-0.053	0.168*
SOCSEC	0.094*	0.050	0.178*	0.199*	0.046	-0.012
CONTRACT	0.020	0.142*	-0.315	-0.131*	0.204*	0.066
DIST	-0.013	-0.028*	-0.049*	-0.047*	-0.036*	-0.022*
CONST	6.61	6.94	6.93	7.62	6.81	6.81
R^2	0.550	0.433	0.360	0.491	0.709	0.617
N	768	331	649	244	259	609
Mean Log. Earnings	8.57	8.29	8.62	8.76	9.23	8.84
YRSEDU (Females)	0.085*		0.062*		0.138*	0.073*

(Coefficients for female workers from similar regressions).

*Significant at the 5 percent level.

Table A. 11. EARNINGS FUNCTIONS FOR BOGOTA WORKERS BY STATUS IN HOUSEHOLD -1978

	Males		Females	
	Householdhead	Other	Householdhead	Other
YRSEDU	0.113*	0.105*	0.067*	0.072*
EXPER	0.050*	0.062*	-0.008	0.026*
EXPSQU	-0.0007*	-0.0009*	0.0002	-0.005*
DBOG	0.096*	0.066	0.090	-0.106*
DCITY	0.134	0.213	0.005	-0.305*
DTOWN	0.123	0.146	0.098	-0.174*
DURB	0.048	0.063	0.057	-0.090*
RSECT1	-0.081	0.160	0.306	0.069
RSECT3	0.223*	0.105*	0.178	0.196*
RSECT4	0.298*	0.062	0.024	0.182*
RSECT5	0.345*	0.017	0.047	0.314*
RSECT6	0.264*	0.072	0.506*	0.218*
RSECT7	0.350*	0.113	0.188	0.314*
RSECT8	0.682*	0.662*	0.702*	0.470*
UNION	0.081*	0.0	0.224*	0.203*
SOCSEC	0.059	0.107*	0.194	0.260*
CONTRACT	0.038	0.087*	0.356*	0.069*
DIST	-0.027*	-0.017*	-0.038	-0.011*
CONST	7.08	6.91	7.50	7.18
R^2	0.511	0.469	0.485	0.380
N	2010	922	350	1525
Mean Log Earnings	8.86	8.34	8.19	8.21

*Significant at the 5 percent level.

Table A. 12. EARNINGS FUNCTIONS FOR BOGOTA WORKERS BY MARITAL STATUS - 1978

	Males		Females	
	Single	Married[1/]	Single	Married[1/]
YRSEDU	0.108*	0.112*	0.074*	0.079*
EXPER	0.067*	0.052*	0.031*	0.017*
EXPSQ	-0.0012*	-0.0007*	-0.0006*	-0.0002*
DBOG	0.034	0.094*	-0.094	-0.018
DCITY	0.126	0.161	-0.241	-0.269
DTOWN	0.215*	0.111	-0.143	0.070
DURB	0.105	0.045	-0.069	-0.010
RSECT1	0.094	-0.063	0.154	0.180
RSECT3	0.118*	0.216*	0.234*	0.108
RSECT4	0.014	0.293*	0.126	0.126
RSECT5	0.027	0.323*	0.320*	0.109
RSECT6	0.038	0.271*	0.276*	0.208*
RSECT7	0.068	0.372*	0.301*	0.174
RSECT8	0.682*	0.688*	0.456*	0.505*
UNION	0.016	0.076*	0.223*	0.213*
SOCSEC	0.096*	0.059	0.139*	0.379*
CONTRACT	0.083*	0.036	0.133*	0.085*
DIST	-0.019*	-0.027*	-0.019*	-0.006
CONST	6.92	7.06	7.22	7.01
R^2	0.531	0.501	0.347	0.436
N	908	2023	963	913
Mean Log Earnings	8.37	8.84	8.17	8.26

1/ Married includes divorced, separated, widowed and free union.

2/ Currently married does not include separated, widowed, and free union.

*Significant at the 5 percent level.

Table A.13: EARNINGS FUNCTIONS FOR CALI FEMALE WORKERS
1935-1978

	Dependent Variable: Log Monthly Earnings			Log HWage		YRSEDV as Education Variable	
	1	2	3	4	5	6	7
DUMP	0.0026	-0.008	-0.065	-0.092			
DUMS	-0.162	-0.154	-0.059	-0.088			
DUMH	-0.476	-0.359	-0.277	-0.108			
PRIMED	0.079*	0.090*	0.072*	0.104*			
SECED	0.133*	0.107*	0.069*	0.106*			
HIGHED	0.230*	0.204*	0.160	0.157			
POSTED	0.161	0.163	0.202	0.062	(YRSEDV)	0.068*	
EXPER	0.014	0.012	0.005	0.013		0.006	
EXPSQ	-0.0003	-0.0002	-0.0001	-0.0001		-0.0001	
DCALI	-0.167*	-0.110	-0.155	-0.131		-0.139	
DCITY	0.286	0.282	0.161	0.168		0.134	
DTOWN	-0.034	-0.016	-0.081	0.0001		-0.059	
DURB	-0.141	-0.105	-0.095	0.102		-0.060	
RSECT1		0.345	0.421	0.666		0.389	
RESECT2		0.339*	0.418*	0.237*		0.413*	
RSECT3		0.211*	0.174*	0.168*		0.069	
RSECT4		-0.135	-0.174*	0.093		-0.191*	
RSECT6		0.064	0.145	0.102		0.201*	
RSECT7		0.263*	0.227*	0.227*		0.196*	
UNION			0.222*	0.181*		0.238*	
SOCSEC			0.309*	0.360*		0.341*	
CONTRAC1			0.073	0.015		0.079	
FSIZE							
DIST	-0.051*	-0.025	-0.030	-0.018		-0.050*	
CONST	7.72	7.49	7.53	1.93		7.52	
R^2	0.219	0.244	0.301	0.359		0.350	
N	5.92	5.92	5.92	5.92		5.92	
Mean Dep. Variable	8.07	8.07	8.07	2.81		8.07	

* Significant at the 5 percent level.

Table A.14: EARNINGS FUNCTIONS FOR BOGOTA FEMALE WORKERS USING DIFFERENT EXPERIENCE VARIABLES - 1978

	EXPER	YRSOCCVP	YRSFIRM	4	5	6	7
	1	2	3				
DUMP	0.052	0.006	-0.007				
	(0.8)	(0.1)	(0.1)				
DUMS	0.106	0.058	0.024				
	(1.0)	(0.6)	(0.2)				
DUMH	0.075	0.044	0.047				
	(0.4)	(0.2)	(0.3)				
PRIMED	0.015	0.039	0.038				
	(0.7)	(2.0)	(2.0)				
SECED	0.068	0.061	0.065				
	(5.1)	(4.8)	(5.1)				
HIGHED	0.056	0.040	0.037				
	(1.5)	(1.1)	(1.0)				
POSTED	0.377	0.397	0.385				
	(6.0)	(6.5)	(6.3)				
EXPER	0.021	0.028	0.044				
	(5.5)	(5.8)	(7.3)				
EXPSQ	-0.0004	-0.007	-0.0014				
	(5.6)	(4.4)	(5.7)				
DBOG	-0.075	-0.074	-0.074				
	(1.8)	(1.8)	(3.1)				
DCITY	-0.0201	-0.194	-0.161				
	(1.6)	(1.6)	(1.8)				
DTOWN	-0.037	-0.013	-0.032				
	(0.5)	(0.2)	(1.3)				
DURB	-0.034	-0.034	-0.029				
	(0.8)	(0.8)	(0.4)				
RSECT1	0.169	0.182	0.163				
	(1.3)	(1.5)	(1.3)				
RESECT3	0.205	0.193	0.207				
	(4.2)	(4.0)	(4.4)				
RSECT4	0.168	0.156	0.163				
	(2.4)	(2.3)	(2.3)				
RSECT5	0.264	0.226	0.241				
	(4.0)	(3.5)	(3.8)				
RSECT6	0.281	0.249	0.257				
	(5.2)	(4.7)	(4.9)				
RSECT7	0.287	0.264	0.278				
	(5.0)	(4.7)	(5.0)				
RSECT8	0.486	0.464	0.486				
	(9.6)	(9.3)	(9.8)				
UNION	0.204	0.201	0.159				
	(4.7)	(4.9)	(3.9)				
SOCSEC	0.268	0.256	0.239				
	(6.8)	(6.6)	(6.2)				
CONTRACT	0.102	0.117	0.102				
	(3.2)	(3.7)	(3.3)				
FSIZE							
DIST	0.015	-0.015	-0.014				
	(3.1)	(3.2)	(3.1)				
CONST	7.39	7.43	7.45				
R^2	0.406	0.411	0.418				
N	1807	1867	1866				
Mean Experience Variable	17.6	6.02	3.83				
Mean Dep. Variable	8.21						

(t statistics in parenthesis)

Table A.15: EARNINGS FUNCTION FOR BOGOTA FEMALE WORKERS DISTINGUISHING DIFFERENT EDUCATION LEVELS - 1975-1978

	1973	1975	1977	1978			
	1	2	3	4	5	6	7
DUMP	0.124	0.080	-0.030	0.040			
	(6.7)	(1.4)	(0.4)	(0.6)			
DUMS	-0.029	0.009	-0.161	0.043			
	(0.9)	(0.1)	(1.6)	(0.4)			
DUMH	0.067	0.099	0.004	-0.030			
	(0.9)	(0.5)	(0.0)	(0.2)			
PRIMED	0.114	0.008	0.052	0.030			
	(22.1)	(0.5)	(2.7)	(1.5)			
SECED	0.224	0.136	0.108	0.116			
	(54.9)	(12.5)	(8.8)	(8.9)			
HIGHED	0.075	0.097	0.088	0.072			
	(5.0)	(2.6)	(2.4)	(1.9)			
POSTED	0.266	-0.154	0.193	0.403			
	(8.2)	(2.7)	(2.5)	(6.3)			
EXPER	0.055	0.021	0.014	0.027			
	(44.3)	(5.8)	(3.5)	(6.7)			
EXPSQ	-0.0008	-010004	-0.0003	-0.0005			
	(33.9)	(6.0)	(3.2)	(6.5)			
DBOG	0.121	-0.059	-0.042	-0.032			
	(11.7)	(2.0)	(1.3)	(0.7)			
DCITY	0.236			-0.212			
	(5.5)			(1.6)			
DTOWN	0.147			0.028			
	(6.5)			(0.4)			
DURB				-0.015			
				(0.4)			
RSECT1	0.037	0.365	0.094	0.180			
	(1.3)	(3.5)	(1.0)	(1.4)			
RESECT3	0.036	0.140	0.147	0.211			
	(2.2)	(3.2)	(3.0)	(4.3)			
RSECT4	0.083	0.135	0.210	0.154			
	(4.1)	(2.5)	(3.2)	(2.2)			
RSECT5	0.091	0.284	0.235	0.317			
	(4.2)	(4.8)	(3.5)	(4.7)			
RSECT6	0.060	0.169	0.131	0.269			
	(3.5)	(3.7)	(2.5)	(5.3)			
RSECT7	0.083	0.298	0.333	0.237			
	(5.0)	(5.8)	(6.5)	(4.2)			
RSECT8	0.139	0.418	0.409	0.399			
	(7.7)	(8.3)	(8.5)	(7.8)			
CONST	5.01	6.67	6.98	7.29			
R^2	0.503	0.298	0.271	0.345			
N	18503	2163	1915	1887			
Mean Dep. Variable	6.58	7.37	7.73	8.21			

(t- statistics in parenthesis)
(log monthly earnings)

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