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SOURCES OF INCOME VARIATION IN COLOMBIA:

PERSONAL AND REGIONAL EFFECTS

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ABSTRACT

A sample of 860,000 individuals from the 1973 Colombian Census of Population is used to study income determinants and income inequality. Men and women are analyzed separately, as are employees and employers. Within these groups, education, age, region, and rural/urban differences in income are distinguished using a variety of procedures including simple cross tabulations and decompositions of the log variance of income by analysis of variance and by regression techniques. By standard statistical conventions, the four way classification by educational attainment is much the most important determinant of the logarithm of monthly income, while the seven age categories are generally somewhat more significant than the six regions. The fourteen parameters used to model these main effects account for a third of the log variance in incomes of employees and a quarter of that of employers. Each year of schooling is on the average associated with about 20 percent more income for male employees and employers. The restricted specification of a conventional earnings function increases the standard error of estimate by only .1 percent. Within education and age classes relative dispersions of incomes across regions are larger for the less educated, and for the very young and old.

I. Introduction

This paper analyzes the determinants of incomes and income inequality in Colombia. Both personal and regional effects are examined. Knowledge of the sources of income variation may help to assess both the social implications of economic inequality and the economic consequences of imperfect factor mobility among regional labor markets.

Economists attribute dispersion in personal incomes to many factors. Evidence has been presented on the association between particular factors and aggregate measures of dispersion for cross-sections of countries or regions (Kuznets, 1955, 1963; B. Chiswick, 1974; Adelman and Morris, 1973; Chenery, et. al., 1974) and for time series within countries (Kuznets, 1963; Schultz, 1968; B. Chiswick and Mincer, 1972).

Another approach at the aggregate level is to decompose measures of income inequality into elements that appear to have relevance for particular analytic or policy questions. Kuznets' mean relative difference (Swamy, 1967), the Gini coefficient (Fei and Ranis, 1974; Pyatt, 1976), Theil's information index of inequality (Fishlow, 1972; Chiswick, 1976a), and variance of income in absolute or logarithmic form (Schultz, 1965; C. Chiswick, 1976a) have all been subdivided into components representing within class dispersion and between class differences, analogous to classical analysis of variance (ANOVA).

At the individual level, it is increasingly common to analyze the association between income levels and personal and regional characteristics of the income recipient unit on the assumption that these characteristics are central determinants of income. Here our focus is on the individual income recipient rather than the family, because our primary goal is to offer some measures of regional disparities in labor earnings for similar

groups of workers in a low income country. This microeconomic approach is readily reinterpreted as a means of resolving the variance in personal incomes into variances in income determinants and the covariation among determinants, e.g., accounting for income inequality by educational attainments and labor market experience (Mincer, 1974). An advantage of this microeconomic approach is that the partial association between income and many factors which cannot be statistically distinguished because of their collinearity at the aggregate level can be more confidently inferred from data available at the individual level.

The aggregate and micro approaches are complementary to the extent that decompositions of the aggregate can be specified to parallel the individual income generating function, and vice versa. In this paper, we adopt the variance of the logarithms of personal (money) income as an aggregate measure of income dispersion. Standard procedures of analysis of variance (Fisher, 1938; Scheffe, 1959) are then applied to decompose the log variance into main effects, interaction effects, and residual within-cell variances. For other questions, we proceed at the micro level to quantify the effect of particular factors on income and to determine which interactions matter. Equivalent regression techniques are employed in which the linear statistical model is the basis for testing a sequence of restrictions. A parsimonious representation of an income model can thus be examined with respect to Colombian data; the simplified earnings function proposed by Mincer (1974) is a special case.

To interpret such associative analysis as evidence of a causal model, the factors conditioning income must be separated into predetermined and jointly simultaneous factors. Past researchers may have been somewhat guilty of expending too much effort in trying to obtain

a larger R^2 at the cost of combining many jointly and probably simultaneously determined variables; causal interpretations of estimated parameters are thus biased and probably misleading. We follow the opposite course by selecting relatively few explanatory variables. which we feel justified in regarding as exogenous. Clearly age and sex are given and are a common basis for economic and perhaps social differentiation in the labor market. From the individual's point of view, we presume that educational attainment is also predetermined, although the resources, preferences, and location of the individual's parents undoubtedly influence the nature and extent of schooling obtained, and education partly proxies personal abilities and parental status as well. Current residence is regarded here as predetermined even though a more comprehensive approach might treat migration explicitly in order to measure how economic rewards differ by duration of current residence and by unobserved traits that ultimately distinguish self-selected migrants from nonmigrants. On the other hand, occupation and to some degree industry represent aspects of jobs for which workers qualify according to age, sex, education and region of residence. For this reason, occupational status is not included among the predetermined variables affecting personal incomes.

Pronouncements of public policy in Colombia have regularly stressed the importance of improving the economic position of the poorer half of the population and reducing income inequality. In a recent study of the income distribution in Colombia, Berry and Urrutia (1976) interpret scattered sectoral and time series information to infer how the distribution has changed historically and what factors may be responsible for these changes; unfortunately, there are no unified nationally representative data sets on personal incomes against which to test competing hypotheses concerning

changing income distribution over time.

Incomes in Colombia are associated with education, place of residence, and age. A widely-held perception is that education is central and the extension, improvement, and reform of education would lead to greater social and economic equality by permitting many to escape poverty (Muñoz, 1976). Geographic conditions, in particular Colombia's mountainous terrain and substantial size, have retarded economic integration, leaving some regions in stagnant poverty while others experience dynamic prosperity with its associated problems of unemployment, congestion, shortages of housing, and difficulties in assimilating migrants into the modern economy. Departments (states) differ in per capita income by as much as three to one (Berry and Urrutia, 1976, Table 5-2) but surprisingly little is known about what precisely is behind these seemingly large regional differences in income and wealth. Is it educational opportunity, the backwardness of traditional agriculture, the disruptive pace of selective rural-urban migration, or something else? Finally, some would argue that unemployment and dualism reflect serious injustices and costly institutional inefficiencies in Colombia, while others see urban unemployment as a poor indicator of poverty because it is disproportionately incurred by young, reasonably educated, new entrants to the labor force (Nelson, et. al. 1971, Table 38; Berry, 1975). In this latter view, age is another essential determinant of income, which in Colombia today reflects both a stable element of life cycle variation in income and a disequilibrium burden on the young that may be attributable to the recent acceleration in population and labor force growth.

A sound policy response to these many manifestations of poverty and income inequality in a rapidly developing country such as Colombia should

benefit from a descriptive dissection of the sources, or at least correlates, of income inequality. Data do not permit investigation of changes in the distribution of income over time, as has been attempted in Brazil by Fishlow (1972, 1973)   and Langoni (1972, 1975). But as a starting point for empirical investigation of the issues and hypotheses related to the personal distribution of income, we report here some basic regularities found in the most recent national Census of Colombia.

Our objectives are to measure the relative importance of personal and regional effects on income variation in Colombia and to determine within relatively homogeneous segments of the labor force distinguished by sex, age, and education, how place-of-residence is associated with personal income levels and dispersion. The remainder of the paper is ordered as follows. Section II discusses the data and describes the strengths and limitations of our working sample of the 1973 Colombian Census, the first Colombian Census to collect information on income. In Section III, we explore income differences across a number of dimensions (education, sex, age, type of employment, and region) and where possible compare the Colombian data with figures for Venezuela. Section IV outlines analysis of variance techniques and links these to the more familiar regression framework used to fit earnings functions. These procedures are then used in Section V to analyze our data with the aim of quantifying the effects of various factors and certain interactions among age, education, type of employment and regions. The paper concludes with a recapitulation and interpretative discussion of the empirical findings.

II. The Data

The 14th Colombian Census of Population was conducted in October, 1973. It enumerated approximately 21.56 million persons. From this preliminary manual count a four percent sample of returns was converted to machine readable form for purposes of statistical analysis. The computer tapes containing the sample returns were generously provided to us by the Departamento Administrativo Nacional de Estadística (DANE) for analysis. These 860,000 cases form the statistical base for our study.

The Census questionnaire obtained information on sex, age, marital status, nationality, education, labor force status, occupation, months worked, economic sector, income, fertility, place of current and previous residence, place of birth, and information about the residence. A description of the sample and some basic cross-tabulations may be found in a report by DANE (1974). Estimates of fertility and mortality levels based on the Census are consistent with external evidence; enumeration appears to have been complete, and distortion in age and sex reporting moderate (Potter, Ordoñez, and Meacham, 1976). Thus, we start with some confidence in the Census' basic accuracy, at least in the dimensions cited.

Our concern in this paper is with the distribution of personal incomes and its correlates. Accordingly, children under the age of ten and persons not in the labor force are eliminated. To determine income, the Census asked: "What was your income in pesos last month?" Thus, one cannot distinguish labor earnings from other forms of non-labor incomes. As a partial control for receipt of labor income versus non-labor income, we distinguished several types of income recipients. One category is day workers (jornaleros), wage laborers (obreros), and salaried

employees (empleados), whom we call "employees." Self-employed (trabajadores independientes) and employers (patrones) are combined in a second category called "employers." Other types of workers (principally domestic servants and unpaid family workers) comprise a residual category.

For the group of "employees," the income reported includes for the most part labor earnings. For "employers," though, the income reported in the Census is likely to include not only returns to their labors and their entrepreneurial talents but also payments for other cooperating factors of production such as land and reproducible wealth. For this reason, we prefer to treat the two groups separately even though procedures have recently been proposed to merge employers and employees in estimating a combined earnings function (C. Chiswick, 1975). In interpreting the results, it should be recognized that large numbers of Colombian workers shift from employee to employer status over the life cycle. In our sample, 14 percent of the income recipients in the 20-24 age group are employers, whereas the fraction rises to 47 percent at age 55-64. Consequently, if employers earn more (less) than employees, the within- employment type age-income profiles would systematically understate (overstate) the actual increase in income anticipated by a representative worker.

Unpaid family workers are not included for lack of income data, though again others have proposed procedures for estimating (C. Chiswick, 1976b) or imputing (Fishlow, 1973) them an income from that received by the head of the household. Domestic servants and other unspecified workers were also omitted from this analysis in the belief that income

in kind, both food and lodging, makes up a substantial but unmeasured fraction of their labor earnings. Also omitted from the working sample are individuals who reported themselves employed but having zero incomes (about one percent), presumably because they failed to respond to the Census income question.

Several other income adjustments are desirable, but could not be carried out with the available data. Ideally, we would like to analyze labor earnings per unit of time worked (or in search of work) but this is not possible since the information on income refers to income in the previous month and there is no indication how much time the individual worked in that month. Another desirable adjustment is to allow for the value of food received by agricultural workers, since wages are often quoted with and without the provision of food, with large differences between the two rates.[1] Also, it is thought that there are sizeable differences in relative prices in different regions and sections of the country which cause the real value of money income to vary, particularly between rural and urban areas, but information on relative price levels is lacking.

What we are left with then is a working sample of individuals stratified by employer/employee status (36,177 and 105,664 respectively) and by sex (115,581 males, 26,260 females). We analyze the following variables: income, educational level, sex and age group, residence by rural/urban and department,[2] and type of employment.

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[1] See, for example, a sample of 131 municipalities in 1956 which reported average quarterly agricultural day wages 63 percent larger without food than with food. Similar differentials are found in other years. The distribution of workers by the two classes of payment is not available. Source: Schultz (1969, p. 97).

[2] Colombia is divided into 22 departments, analogous to states, and the special district of Bogota. A number of frontier territories and small islands (less than 2% of the population) are excluded from the Census sample.

III. Income Variation: Cross-Tabulations

Table 1 and Figure 1 present for the 23 departments of Colombia the
sample estimates of average monthly incomes of men and women by four
educational classes: no schooling, some primary schooling (1-5), some
secondary schooling (6-11), and some higher education (12+). Em-
ployers and employees are treated here together. Beneath each entry
in parentheses is the number of individuals on which the average income
is based.

Income increases with education, not only in the country as a
whole, but for men and women in every department. Similar data have also
been estimated from published tabulations on monthly income from the
Venezuelan Census of 1961 and are reported for comparison in Table 2
(Schultz, 1975). The same regularity exists in Venezuela, but in a few instances
workers with no schooling receive higher incomes than those with some pri-
mary schooling, e.g., in the Federal District of Caracas. Another similarity
between the two countries is that women's incomes are much less than men's.
Once again, this is true for each educational group in a given department
or province as well as in a comparison of the aggregate means. Yet another
parallel between the two countries is the substantial variation in average
incomes across regions. For Colombian males with no education, for example,
the average income in the richest department (Bogotá) is more than three
times higher than in the poorest department (Chocó).[1] Wider interregional
differences are observed in all educational categories for both sexes.

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[1]Somewhat surprisingly, for males with university education, incomes
are higher in two departments (César and Valle) than in Bogotá. We cannot
tell whether this is because of greater relative scarcity of highly-edu-
cated workers in those departments or because of measurement error.

Table 1

Male and Female Monthly Incomes, October 1973, for Colombia

By Department and Education (in Pesos)

|	MALE Education				ALL MALES	FEMALE Education				ALL FEMALES	TOTAL
DEPARTMENT	NONE	PRIMARY	SECONDARY	HIGHER		NONE	PRIMARY	SECONDARY	HIGHER		
Antioquia	703 (3429)	1092 (10542)	2732 (3566)	7997 (629)	1580 (18166)	468 (223)	769 (1564)	1755 (1637)	3386 (156)	1315 (3580)	1536 (21746)
Atlantico	820 (600)	1358 (2570)	2710 (1434)	7104 (295)	2034 (4899)	572 (83)	842 (567)	1588 (674)	2801 (93)	1310 (1417)	1872 (6316)
Bogotá D.E.	912 (815)	1337 (8744)	2974 (5910)	8370 (2081)	2702 (17550)	559 (323)	776 (2818)	1852 (3205)	3678 (583)	1508 (6929)	2694 (21479)
Bolívar	753 (978)	1091 (1611)	2304 (647)	7317 (86)	1389 (3322)	466 (127)	651 (320)	1500 (278)	3421 (28)	1036 (753)	1324 (4075)
Boyacá	343 (910)	654 (2920)	2478 (484)	5474 (89)	888 (4403)	252 (92)	497 (253)	1509 (237)	3568 (20)	960 (602)	897 (5005)
Caldas	712 (665)	961 (2639)	2447 (585)	7754 (84)	1282 (3973)	390 (42)	608 (305)	1514 (301)	3116 (22)	1084 (670)	1253 (4643)
Cauca	412 (573)	633 (1564)	1887 (236)	5758 (50)	809 (2423)	325 (83)	500 (194)	1574 (143)	3228 (8)	876 (428)	819 (2851)
César	918 (422)	1182 (767)	2542 (196)	8466 (28)	1436 (1413)	547 (48)	714 (98)	1823 (76)	4060 (4)	1111 (226)	1391 (1639)
Córdoba	616 (1268)	849 (1446)	2791 (294)	6919 (43)	1025 (3051)	377 (112)	602 (164)	2192 (152)	2724 (7)	1134 (435)	1039 (3486)
Cundinamarca	518 (1313)	760 (4310)	2098 (695)	5175 (103)	926 (6421)	481 (100)	635 (384)	1662 (370)	2524 (20)	1095 (874)	946 (7295)
Chocó	248 (307)	714 (359)	1795 (91)	6621 (14)	763 (771)	89 (207)	253 (69)	1550 (58)	4180 (3)	410 (337)	656 (1108)
Huila	750 (664)	867 (1681)	2464 (281)	6066 (46)	1095 (2672)	477 (43)	731 (166)	1404 (202)	3450 (8)	1081 (419)	1093 (3091)
La Guajira	912 (99)	1592 (294)	2798 (121)	7800 (10)	1860 (524)	486 (18)	781 (53)	1732 (64)	3500 (1)	1209 (136)	1726 (660)
Magdalena	710 (816)	1100 (1130)	2518 (362)	6362 (44)	1281 (2352)	445 (50)	841 (127)	1651 (187)	3896 (9)	1268 (373)	1279 (2725)
Meta	750 (307)	1070 (906)	2730 (246)	6863 (26)	1380 (1485)	655 (20)	874 (103)	1563 (106)	4100 (5)	1236 (234)	1360 (1719)
Nariño	390 (930)	513 (2907)	1937 (349)	5606 (59)	674 (4245)	206 (173)	370 (561)	1548 (184)	3434 (20)	636 (938)	667 (5183)
Norte de Santander	523 (994)	881 (2371)	2390 (481)	6373 (72)	1076 (3918)	316 (71)	603 (295)	1591 (272)	2915 (22)	1056 (660)	1073 (4578)
Quindío	802 (284)	1066 (1216)	2276 (370)	6604 (49)	1402 (1919)	347 (33)	510 (162)	1424 (140)	2982 (18)	983 (353)	1337 (2272)
Risaralda	673 (396)	1083 (1840)	2576 (505)	6572 (66)	1423 (2807)	484 (30)	828 (329)	1376 (230)	3869 (25)	1140 (614)	1372 (3421)
Santander	472 (1580)	927 (4206)	2706 (891)	6517 (159)	1184 (6836)	304 (180)	630 (643)	1429 (585)	3488 (41)	993 (1449)	1151 (8285)
Sucre	569 (654)	1076 (615)	3109 (175)	5228 (23)	1158 (1467)	481 (70)	588 (81)	1449 (78)	3243 (4)	890 (233)	1121 (1700)
Tolima	753 (1143)	962 (2894)	2489 (579)	7870 (86)	1226 (4702)	401 (73)	597 (247)	1425 (360)	3058 (16)	1061 (696)	1205 (5398)
Valle	666 (1755)	1162 (8698)	2569 (3012)	8502 (540)	1685 (14005)	479 (216)	819 (1530)	1660 (1387)	3737 (139)	1277 (3272)	1608 (17277)
TOTAL	634 (20902)	1027 (66230)	2670 (21504)	7806 (4682)	1546 (113318)	398 (2417)	713 (11033)	1681 (10926)	3504 (1252)	1232 (25628)	1488 (138946)
Regional Mean Income	649.	997.	2492.	6840.		406.	653	1597	3407		
Variance	33,339	67,511	126,103	1,389,357		20,987	30,265	38,025	217,184		
Coefficient of Variation	.288	.253	.133	.151		.364	.244	.116	.133		
Regional Mean Logarithm of Income	6.43	6.87	7.81	8.82		5.97	6.45	7.37	8.12		
Variance of Logarithm of Income	.115	.0708	.0197	.0233		.179	.0850	.0118	.0183		
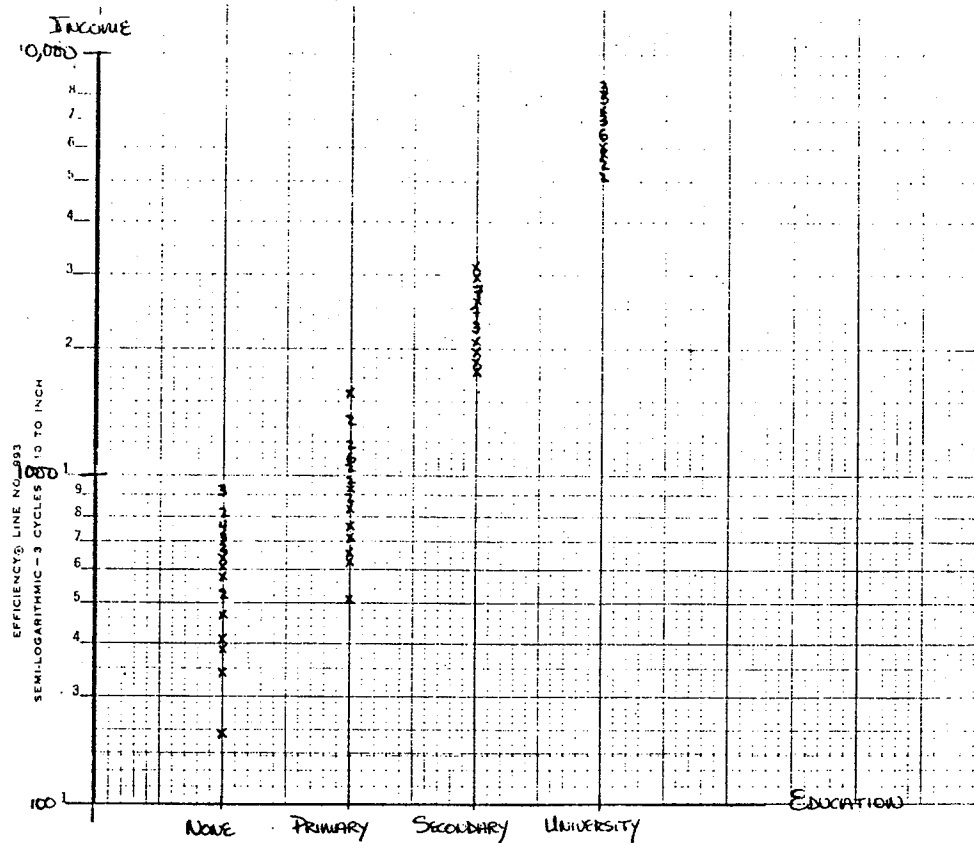
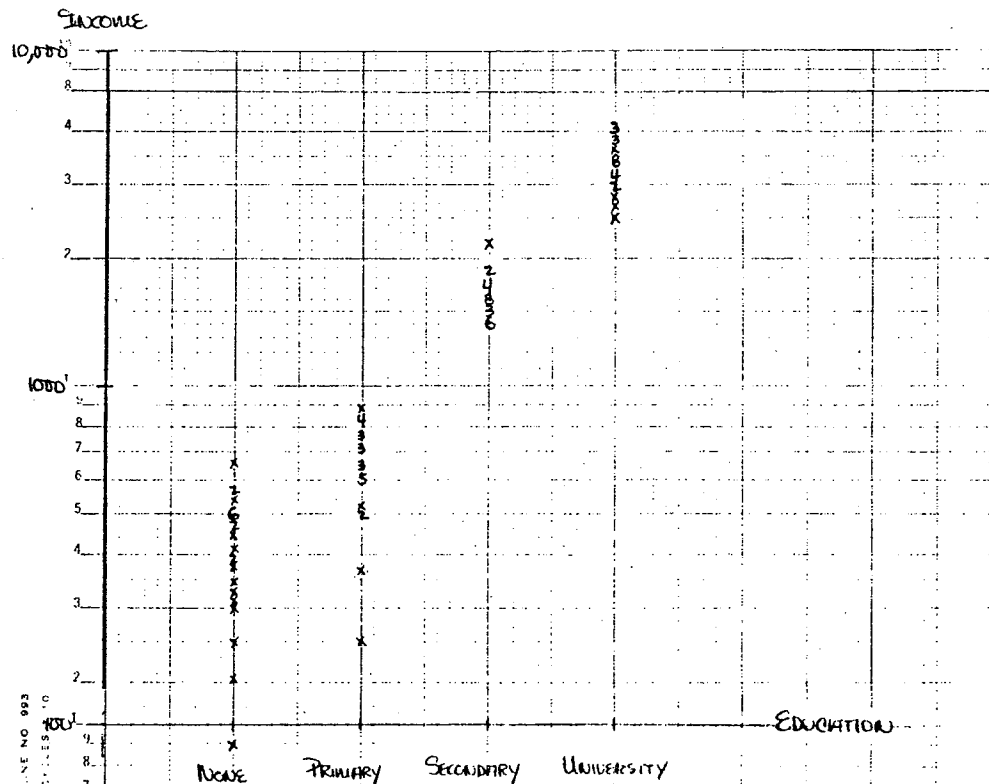FIGURE 1a. MALE MONTHLY AVERAGE INCOME WITHIN DEPARTMENTS BY EDUCATION

FIGURE 1b. FEMALE MONTHLY AVERAGE INCOME WITHIN DEPARTMENTS BY EDUCATION

Note: x = one department with the specified mean income.

2,3,... = number of departments with the specified mean income.

TABLE 2   -11a-

MALE AND FEMALE MONTHLY ESTIMATED INCOMES, FEBRUARY 1961 FOR VENEZUELA

BY DEPARTMENT AND EDUCATION (in Bolívars).

	MALE Education				FEMALE Education			
DEPARTMENT	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Federal District	833	787	1731	5851	457	455	989	1418
Anzoátegui	425	728	1892	6539	269	359	1038	1825
Apure	308	537	1510	6631	212	377	934	1481
Aragua	471	607	1627	6054	297	352	859	1546
Borinas	294	489	1565	6141	212	357	840	1688
Bolívar	485	648	1802	6331	340	390	1016	1721
Carabobo	462	613	1656	5980	317	348	853	1406
Cojedes	282	535	1521	5801	225	372	861	1546
Falcón	340	592	1853	6520	228	350	985	1655
Guárico	339	565	1643	6358	216	345	886	1760
Lara	287	488	1606	5704	146	275	908	1431
Mérida	222	389	1349	5699	171	309	848	1423
Miranda	578	737	2164	6593	384	411	1066	1614
Monagas	308	608	1797	6655	242	318	989	1585
Nueva Esparta	271	454	1532	6215	151	243	888	1737
Portuguesa	295	522	1468	6367	196	342	830	1704
Sucre	246	451	1541	6350	203	295	840	1634
Táchira	232	327	1324	4263	175	229	794	1453
Trujillo	217	432	1151	6306	163	348	824	1571
Yaracuy	270	440	1349	5794	229	335	932	1881
Zulia	475	678	1678	6354	347	370	958	1557
Region mean income	368	558	1629	6119	251	347	912	1574
Variance	6,029	13,862	40,147	280,800	6,371	2,227	6,267	19,055
Coefficient of variation	.394	.211	.123	.0866	.318	.136	.0868	.0877
Region mean Logarithm of Income	5.84	6.30	7.39	8.71	5.48	5.84	6.81	7.36
Standard Deviation of Logarithm of Income	.345	.220	.120	.096	.297	.143	.085	.084

Source: Schultz (1975 , Tables 4b, Λ^{-1} and A2).

It may be observed that interregional income variation by education group follows a common pattern in the two countries. The summary statistics at the bottom of Tables 1 and 2 show: (i) The absolute variance of incomes increases with education attainment, but (ii) The variance of the logarithms of income and the coefficient of variation, which measure relative inequality independently of the mean, decline in both countries as educational level increases, though a reversal is noted among the higher educated in Colombia. (For Colombia, Figure 1 shows the greater concentration of department means at higher educational levels.) Relative variation in regional incomes is thus greater for the least educated, which is consistent with the hypothesis that skilled labor markets are closer to equilibrium because of greater mobility of the highly educated (Schwartz, 1971; Schultz, 1975).

Urban-rural income disparities have been widely-noted in Colombia and elsewhere. In the 1973 Census data, for male employees, the mean rural income is found to be 536 pesos, the mean urban income 1,676 pesos, a ratio of more than three to one. These comparisons do not standardize for possible differences in the makeup of the rural and urban populations, however.

Another important factor influencing income is age. Table 3 reports mean incomes for the Colombian sample broken down by age and education for male and female employees and employers. Figure 2 illustrates the totals for employees and employers combined.[1] The age income profiles for men peak in the cross section in the age groups 45-54 for both employees and employers. For women the peak incomes are recorded from
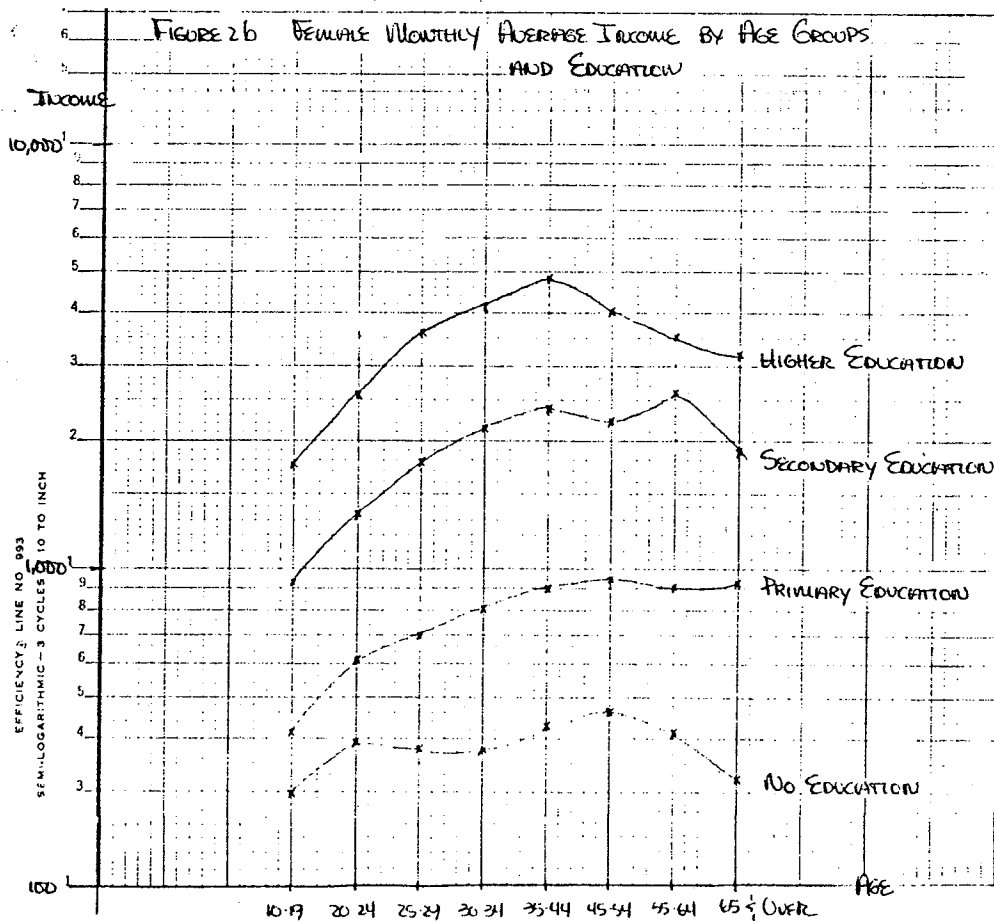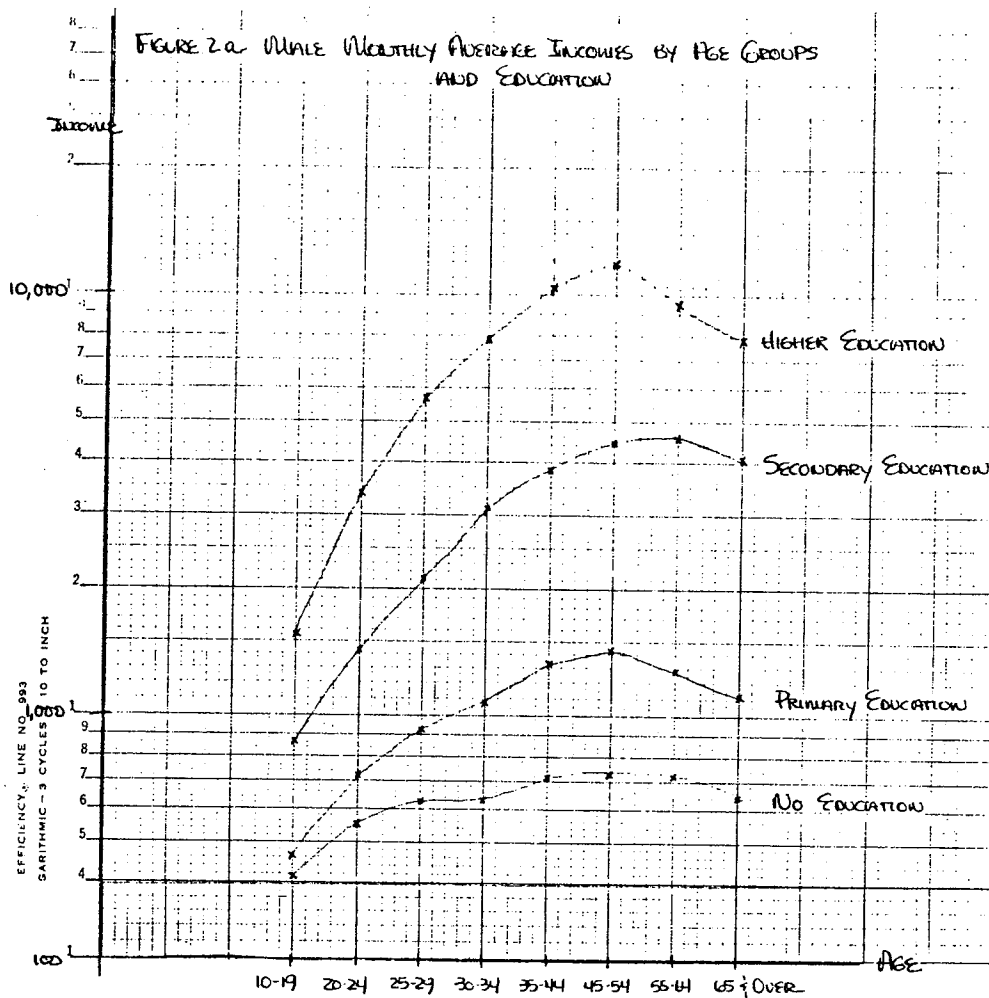
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[1] The Venezuelan data did not include age tabulations, so inter-country comparisons on this dimension are not possible.

TABLE 3

MALE AND FEMALE INCOMES BY EMPLOYMENT STATUS WITHIN AGE GROUPS AND EDUCATION (in Pesos)

Age Group/ Employment Status	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
10-19								
Employee	413 (2677)	454 (9140)	823 (2050)	1426 (24)	316 (260)	429 (1875)	907 (1485)	1747 (31)
Employer	422 (334)	535 (967)	1345 (193)	5000 (1)	232 (68)	289 (183)	1577 (47)	— —
Subtotal	414 (3011)	462 (10107)	868 (2243)	1569 (25)	299 (328)	417 (2158)	927 (1532)	1747 (31)
20-24								
Employee	527 (1934)	695 (8133)	1360 (4146)	2996 (515)	387 (156)	628 (1875)	1337 (3535)	2497 (371)
Employer	645 (329)	870 (1519)	2064 (623)	5994 (80)	402 (47)	528 (263)	2044 (130)	4901 (13)
Subtotal	545 (2263)	722 (9652)	1452 (4769)	3399 (595)	391 (203)	616 (2138)	1362 (3665)	2576 (384)
25-29								
Employee	576 (1576)	863 (6939)	1994 (3367)	5363 (966)	386 (154)	697 (1377)	1747 (2086)	3537 (397)
Employer	836 (433)	1151 (1983)	2664 (783)	7248 (197)	366 (63)	712 (284)	2365 (158)	4588 (30)
Subtotal	632 (2009)	927 (8922)	2120 (4147)	5682 (1163)	380 (217)	700 (1661)	1791 (2244)	3611 (427)
30-34								
Employee	593 (1554)	999 (5939)	2764 (2165)	7168 (711)	384 (146)	808 (999)	2020 (1059)	4025 (164)
Employer	742 (470)	1321 (2273)	4158 (757)	9719 (240)	368 (103)	793 (316)	2956 (151)	5359 (22)
Subtotal	628 (2024)	1088 (8212)	3125 (2922)	7812 (951)	377 (249)	805 (1315)	2137 (1210)	4183 (186)
35-44								
Employee	623 (3197)	1149 (9225)	3257 (2591)	9440 (685)	486 (354)	878 (1456)	2121 (1115)	4737 (133)
Employer	933 (1348)	1653 (4696)	4947 (1415)	11628 (377)	364 (249)	943 (699)	3421 (290)	5168 (31)
Subtotal	715 (4545)	1319 (13921)	3854 (4006)	10217 (1062)	435 (603)	899 (2155)	2390 (1405)	4818 (164)
45-54								
Employee	593 (2274)	1142 (5455)	3592 (1224)	10009 (293)	464 (220)	886 (623)	2123 (462)	3814 (41)
Employer	977 (1199)	1834 (3759)	5440 (979)	13825 (264)	457 (216)	1018 (463)	2476 (172)	5700 (5)
Subtotal	726 (3473)	1424 (9214)	4413 (2203)	11818 (557)	461 (436)	942 (1086)	2219 (634)	4019 (46)
55-64								
Employee	571 (1370)	939 (2288)	3587 (403)	7764 (98)	393 (91)	778 (167)	2208 (123)	2144 (7)
Employer	928 (910)	1645 (2166)	5362 (527)	10717 (153)	434 (142)	994 (230)	3240 (76)	6867 (3)
Subtotal	714 (2280)	1282 (4454)	4593 (930)	9564 (251)	418 (223)	903 (397)	2602 (199)	3561 (10)
65 and over								
Employee	595 (687)	739 (780)	2130 (97)	7936 (25)	311 (50)	565 (38)	1685 (21)	2000 (1)
Employer	695 (610)	1435 (968)	5231 (187)	7803 (53)	333 (98)	1068 (85)	2178 (16)	3617 (3)
Subtotal	642 (1297)	1124 (1748)	4172 (284)	7846 (78)	326 (148)	913 (123)	1898 (37)	3213 (4)

Figure 2a. Male Monthly Average Incomes by Age Groups and Education

Figure 2b. Female Monthly Average Income by Age Groups and Education

age 35-44 among employees with no schooling and some higher education,
to age 55-64 among employees with some secondary schooling. The sys-
tematic positive relationship between education and income is found for
all age groups.

As anticipated, employer incomes are somewhat higher
than employee incomes for men, but among several age groups of women
with less than a secondary education, the reverse is true. The added
returns to being an employer appear to grow systematically with age
even though, as noted earlier, a growing fraction are becoming employers.

Table 4 and Appendix Table A-1 carry out further cross-classifications.
Table 4 shows rural and urban income differences standardizing for educa-
tion, age, and employer-employee status. Even within these cells, pro-
nounced income differences may be noted. Interestingly, the absolute
differentials appear to increase with education up through the secondary
level. Note too the virtual absence of persons with higher education in
rural areas. This may be because higher education is only offered in
the cities or because migration is selective of the most
highly-qualified rural persons. (Kuznets, 1964; Turnham, 1971). The
increase in the rural-urban income differential with educational level
and the lack of highly-educated rural workers provide evidence that such
a selective migration process is going on in Colombia.

Table A-1 presents a detailed cross-classification of the population
by sex-education-age-department subgroupings (1,472 cells in all).
Several researchers have examined interregional inequality in Colombia
(e.g., Berry and Urrutia, 1976, Chapter 5; Musgrove, 1974; Prieto, 1971)
and elsewhere (Williamson, 1965). Extreme interregional income inequality
is noted. It is often suspected that these regional differences arise
due to failure to hold constant for various factors which influence

TABLE 4A

Rural and Urban Mean Incomes by Age and Education

Male Employees

Age	None Rural	None Urban	Primary Rural	Primary Urban	Secondary Rural	Secondary Urban	Higher Rural	Higher Urban
10-19	400 (361)	412 (143)	377 (914)	513 (945)	632 (36)	835 (418)	-- (--)	1156 (4)
20-24	485 (291)	634 (118)	492 (722)	820 (923)	923 (47)	1375 (783)	-- (--)	3054 (99)
25-29	459 (202)	673 (84)	561 (499)	1020 (798)	1322 (41)	2046 (684)	8500 (2)	5236 (161)
30-34	517 (184)	685 (94)	565 (401)	1181 (733)	1195 (17)	2595 (415)	3000 (2)	6590 (159)
35-44	494 (398)	886 (214)	763 (621)	1343 (1258)	1019 (14)	3309 (525)	-- (--)	9211 (136)
45-54	483 (274)	767 (196)	615 (392)	1397 (771)	2464 (7)	3766 (235)	8000 (1)	9551 (54)
55 +	426 (268)	623 (160)	560 (252)	1131 (377)	950 (4)	3206 (76)	1000 (1)	7601 (28)
Total	463 (1978)	688 (1009)	543 (3801)	1053 (5805)	1060 (166)	2158 (3136)	5333 (6)	6520 (641)

TABLE 4B

Rural and Urban Mean Incomes by Age and Education

Male Employers

Age	None Rural	None Urban	Primary Rural	Primary Urban	Secondary Rural	Secondary Urban	Higher Rural	Higher Urban
10-19	361 (42)	404 (29)	545 (98)	701 (93)	550 (2)	1044 (32)	--	--
20-24	594 (40)	507 (18)	505 (115)	1086 (184)	1005 (5)	2813 (115)	--	4417 (12)
25-29	820 (50)	2061 (28)	706 (158)	1653 (231)	1683 (17)	2972 (139)	--	8338 (42)
30-34	665 (65)	888 (27)	730 (190)	1616 (290)	2308 (10)	3680 (148)	--	8425 (45)
35-44	798 (165)	1047 (111)	957 (325)	1938 (635)	2348 (15)	4777 (275)	--	11276 (62)
45-54	832 (144)	1462 (92)	900 (262)	2281 (457)	1519 (16)	5698 (186)	9175 (4)	11427 (48)
55 +	659 (191)	977 (93)	832 (239)	2178 (372)	1311 (9)	5759 (128)	--	7714 (36)
Total	718 (697)	1116 (398)	798 (1387)	1856 (2262)	1745 (74)	4326 (1023)	9175 (4)	9419 (245)

incomes, among them sex, education, type of employment, (whether an employee or employer), and age. Yet, after standardizing for each of these variables singly and together in Colombia, we find noticeable differences within sex-education-employment status-age cells across departments.

Remaining regional income differences could arise from various sources. First, they could be attributed to omitted characteristics of workers, such as their actual job experience; an agricultural worker and a factory worker are not substitutes for one another once each has accumulated a lifetime of vocational skills in different fields. Second, regional price variations and amenity levels could represent a form of compensating variation for observed money income differences. Third, regional labor markets may be in disequilibrium, paying different real wages for similar services. Such disequilibria could be a short run consequence of structural changes in location of production or longer run distortions in factor markets linked to government wage and employment policies, union influence, and dissimilar firm demands for specific training. Finally, errors in measurement and functional form in addition to purely random variability will be impounded in the residual.

Recapitulation

As stated at the outset, the goal of this paper is to quantify personal and regional effects on income variation. The gross differentials (without cross-classification) yield the following orders of magnitude: ten-to-one ratio between persons with higher education and persons with none; three-to-one between the richest department and the poorest; three-to-one between prime age workers and the very young; two-to-one between men and women; three-to-one between urban workers and rural workers; and

25% more for employers and the self-employed than for wage and salary

employees. Successively finer cross-classifications into sex-education-

age-department subgroupings produce non-trivial differentials across

any of the four dimensions. To summarize systematically these many

comparisons, a statistical framework is needed. For this purpose,

the familiar linear model with interaction effects is adopted. Section

IV presents the analytic techniques and Section V the empirical results.

IV. Description of Analysis of Variance (ANOVA) and Restrictions

Analysis of Variance

ANOVA procedures have long been used to analyse experimental data, (Fisher, 1938; Snedecor, 1934), but their application to economic problems is quite limited. In particular, on the problem of determining income and income inequality, work is just beginning; see Schultz (1965), Langoni (1972, 1975), Fishlow (1973), and C. Chiswick (1976a).

Analysis of variance is the "separation of variance ascribable to one group of causes from the variance ascribable to other groups" (Fisher, 1938, p. 216). The variance of a dependent variable (which is the sum of squared deviations from the overall mean) is decomposed into two types of effects: those due to variation between different groups and those due to variation within each of the groups. For example, if the dependent variable is income (or its logarithm) for each of I individuals and the independent variable is the region of the country in which they live (J), the total sum of squares (of deviations from the mean) of income is decomposed as follows:

$$(1) \quad \sum_{i=1}^{I} (y_{ij} - \bar{y})^2 = \sum_{i=1}^{I} (y_{ij} - \bar{y}_j)^2 + \sum_{j=1}^{J} n_j (\bar{y}_j - \bar{y})^2$$

where n_j and $\bar{y}_j$ are respectively, the number of persons in region j, and their average income (or mean logarithmic income), and $\bar{y}$ is the overall mean income. In other words, (1) tells us the relative importance of income variance within regions as compared with diversity in mean incomes across regions (appropriately weighted).

In this example the only explanatory category is region. ANOVA may be extended to multiple explanatory categories, say region, j, and education,

k. We then obtain a decomposition of variance as follows:

$$(2) \qquad \sum_{i=1}^{I} (y_{ijk} - \bar{y})^2 = \sum_{j=1}^{J} n_j (\bar{y}_j - \bar{y})^2 + \sum_{k=1}^{K} n_k (\bar{y}_k - \bar{y})^2$$

$$+ \sum_{j=1}^{J} \sum_{k=1}^{K} (y_{ijk} - \bar{y}_j - \bar{y}_k + \bar{y})^2$$

The first term on the right hand side of (2) represents the sum of squares explained by the regional categories, the second term the explanation due to the education categories, and the third is a residual within category measure of variance. The resolution of variance represented in (2) is readily interpreted in classical ANOVA form if region and education categories are independent of one another and the dependent variable is normally distributed. Only in the case of experimentally generated data, for which the different sets of categories (or treatments) are designed to be independent (randomly administered) can the explained variation thus be exhaustively partitioned into specific main effects and residual within group variation. In the study of most social and economic data such as we have here, the explanatory categories tend to be correlated and probably not independent, in which case the explanation of the dependent variable may be partly ascribable to the covariation between explanatory categories. Hence, if high income regions contain more educated persons, the joint explanatory effect of education and region is likely to differ from the sum of the two specific main effects, the difference reflecting covariation.

Analysis of variance can also be applied to test for non-additive interactions between the explanatory categories. For example, primary

education may be particularly well-rewarded in high income regions. In this event, the sum of the region and education main effects systematically underpredicts incomes in high income regions, and conversely, overpredicts incomes in low income regions. These two-way interactions may be introduced into the ANOVA model with the implicit fitting of additional parameters. As more than two categorical variables are considered to explain the variance in incomes, higher order interaction effects may also be considered as sources of the variation in personal incomes.

Tests can be conducted on each set of categories, any group of sets of categories, each two-way set of interactions, any group of interactions, and so on, to determine if they contribute a statistically significant amount to the explanation of the variance of the dependent variable. This test is based on the calculation of the F ratio, defined as the marginal reduction in the mean squared error associated with the effect being assessed per degree of freedom required to parameterize the effect, divided by the mean square error of the fully specified model (including various levels of interaction). This significance test is identical to the test of restrictions in linear statistical models (Graybill, 1961), and in the case of a two way categorical variable in ordinary regression analysis, the square of the t ratio for the binary variable coefficient is the respective F ratio.

For the empirical work in Section V, the logarithm of income is used as the dependent variable. This transformation of income seems advisable because statistical tests applied to ANOVA resolutions of variance are based on the assumption that the dependent variable is normally distributed; in most populations the log of income is more nearly normally distributed than is income itself. Furthermore, the log variance of income,

as an index of inequality, is more sensitive to inequality associated
with low incomes of the poor than are most other inequality measures
(Fishlow, 1973), the reason being that differences in the logarithms
of income are weighted by population shares.

In sum, analysis of variance procedures decompose overall variance
into within-category and between-category components, measure the direct
contribution of each set of categories to total variance, and test the
marginal statistical significance of these effects. In comparison with
other decomposable measures of inequality, specifically the Theil index
of inequality and the Gini coefficient, ANOVA has two advantages: (i)
Generally accepted tests of statistical significance are available, and
(ii) The log variance measure of inequality attaches greater importance
to the relative income status of the poor.[1]

The strength of standard ANOVA techniques is that they demonstrate
the importance of each explanatory factor and each interaction combination.
However, they do not indicate which of the set of explanatory categories
(e.g., higher education or basic literacy) is quantitatively more important,
how they are ordered, or the structure underlying interaction categories.
Because we are interested in the structure of explanatory effects captured
by the general linear model, regression analysis is also undertaken.

Regression Analysis

For the regression analysis, all categories are represented by dummy
explanatory variables where the dependent variable is the logarithm of income.
The ordinary regression coefficient indicates the proportionate effect of

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[1]See Fields (forthcoming) for a comparison of the various decomposition
procedures and a review of empirical studies in less developed countries.
Also see Fishlow (1973) and C. Chiswick (1976a).

the category measured as a deviation from the suppressed category (re-flected in the intercept). We have generally followed the practice of suppressing the category with incomes that are close to the population mean income. An ordinary t ratio provides one indication of whether the regression coefficient differs significantly from zero. The re-sulting tests of significance should be treated with caution when applied to individual categorical variables, however, since the choice of which category to suppress is arbitrary. Legitimately one can only test the full set jointly using the marginal F ratio test, the results of which are reported in the ANOVA.

Earnings Functions: Tests of Simpler Parameterization

The unrestricted linear model described above includes large numbers of dummy variables. It is desirable also to determine whether education and age categories might be specified in a more parsimonious form.

With regard to the education variable, Hanoch (1967), Mincer (1974) and others approximate the cost of schooling as the entire market opportunity value of the individual's time while in school; making a number of other specific assumptions, an expression is derived for the log-arithm of income as proportionate to number of years of schooling. Parameterizing the effects of schooling in this way reduces the four educational categories to one discontinuous variable that attributes the average years of schooling in a category to each individual in that category.

In dealing with differences in earnings across age groups, economists have fitted earnings functions using both age and labor market experience[1].

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[1]See, for example, the exchange between Rosenzweig and Morgan (1976) and Blinder (1976).

Research on the determinants of earnings in the United States conducted

by Mincer (1974), Heckman and Polachek (1974),

and on Sweden by Klevmarken and Quigley (1976) shows that experience

provides a better fit for income and wage data

than does age. But since actual labor market experience is not always

reported, a proxy for experience is often defined as the individual's age

minus his years of schooling minus the age of entry into the school system.

This approximation has been used in research on Colombia by Kugler (1975)

and Fields (1975).

For the experience proxy to accurately measure on-the-job experience,

there must be (i) a uniform age of entry into school, (ii) no interruption

in, or repetition of, schooling levels, and (iii) entry of all persons

upon leaving school into the labor force where they remain until retirement.

These assumptions are probably a less satisfactory description of reality

in Colombia than they are in the United States, and they clearly do not

adequately represent the accumulation of labor market experience by secon-

dary workers, such as women. Whether

age or a proxy for experience is used to explain life cycle variation

in labor earnings, a quadratic function in this "experience" variable

is generally found to provide a reasonable fit for cross sectional

observations on personal income, earnings or wages. This specification

collapses the seven age categories used in the unrestricted ANOVA frame-

work to two discontinuous variables, experience and experience squared.

Below, empirical evidence is presented on the relative merits of the

restricted and unrestricted models.

V. Empirical Evidence

This section presents empirical results for males. Women are excluded because they are thought more likely than men to work part time, which complicates interpretations of income variability. Also, age for men may be a reasonable proxy for labor force experience, whereas for a group of women in the same age group, actual labor market experience may vary substantially.

The working sample consists of every fifth individual in the four percent DANE Census file. Male employees engaged in wage or salary employment in the Census month were selected for initial study. For comparative purposes, all statistical exercises are also performed on male employers, which also includes independent workers. The respective sample sizes are 16,695 for employees and 6,090 for employers.

The dependent variable in the empirical research is the natural logarithm of monthly income in pesos. Persons without incomes and the unemployed are attributed one peso per month in order to include them in the log variance calculation. The explanatory categories are education, age, and place of residence. Four educational categories are distinguished: none, primary (some or all), secondary (some or all), and higher (some or all). There are seven age categories: 10-19, 20-24, 25-29, 30-34, 35-44, 45-54, 55 and over. Two place of residence variables are analyzed. One is rural/ urban. The other is department of residence at three different levels: the department itself (23 in number), groups of departments (11), and geographic regions (6). The geographic distinctions analyzed are shown in Table 5.

TABLE 5

Geographic Distinctions Analyzed

Department	Groups of Departments	Region
1. Atlántico	A	I
2. Bolívar	B	I
3. Córdoba	B	I
4. Sucre	B	I
5. Magdalena	C	I
6. La Guajira	C	I
7. César	C	I
8. Antioquia	D	II
9. Caldas	D	II
10. Quindío	D	II
11. Risaralda	D	II
12. Valle	E	III
13. Chocó	E	III
14. Cauca	F	III
15. Nariño	F	III
16. Tolima	G	IV
17. Huila	G	IV
18. Meta	H	IV
19. Boyacá	I	V
20. Santander	I	V
21. N. de Santander	I	V
22. Bogotá, D.E.	J	VI
23. Cundinamarca	K	VI

Analysis of Variance: Main Effects Model

A main effects model without interactions is reported in Table 6A
and 6B, separately for employees and employers. The first column indicates
the simple association between the logarithm of income and each set of
explanatory categories; it is comparable to the simple zero order correla-
tion in the two category case. The remainder of Table 6 presents five
analyses of variance (ANOVA) based on various alternative geographic
distinctions, also including age and education categories. All of the
main effects are by conventional statistical standards highly significant
at confidence levels in excess of .001. There are two ways of interpreting
the importance of these effects. First, there is reported the proportion of the
variance in the logarithms of income directly explained by each set of explanatory
categories . Second, the marginal F ratio is shown
which deflates the explained variance by the number of categories con-
sidered and formally expresses the resulting reduction in standard error
of estimate as a ratio to that anticipated from a random set of categories
in a normally distributed population. For employees, education provides
the most information in predicting personal incomes, in the sense of
explaining between 12 and 19 percent of log variance. Its statistical
significance is also the most notable with F's in excess of 1000. The
one-way rural/urban distinction accounts for 1.6 to 3.1 percent
of the log variance, and is attributed an F of 400 to 800. The seven
age categories account for six or seven percent of the log variance in
incomes and receive an F of around 300. The regional distinctions, though
still highly significant by conventional standards,[1] explain less than

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[1] Given the very large sample size virtually any basis for grouping
the data according to personal, demographic, economic, social or geographic
information would reduce the standard error of estimate sufficiently to
satisfy the F test for statistical significance. This test starts to
have discriminating power when many degrees of freedom are consumed to
parameterize interaction effects.

Table 6A

Analysis of Variance: Main Effects

Male Employees

Geographic Distinction

Main Effects	Zero Order Correlation (Eta)	(1) Rural/Urban		(2) Regions		(3) Groups of Depts.		(4) Departments Without Rural/Urban		(5) Departments With Rural/Urban	
		Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal
Education Level (4)	.48	.129	1131	.194	1656	.165	1388	.164	1388	.120	1038
Age Group (7)	.31	.064	282	.072	307	.071	298	.071	299	.064	278
Rural/Urban (2)	.37	.031	805							.016	404
Regions (6)	.21			.014	70						
Groups of Depts. (11)						.037	92				
Departments (23)	.32							.043	49	.028	33
Covariance		.115	--	.045	--	.073	--	.074	--	.140	--
Total Explained		.339	893	.326	595	.345	458	.352	288	.367	299

Logarithm of Income

Mean   6.52

Variance   1.54

Sample Size   16542

(Number of explanatory categories in parentheses)

Note: All effects statistically significant at .001 level.

Table 6B

Analysis of Variance: Main Effects

Male Employers

Main Effects	Zero Order Correlation (Eta)	(1) Rural/Urban Proportion of Variance Explained	(1) F Ratio, Marginal	(2) Regions Proportion of Variance Explained	(2) F Ratio, Marginal	(3) Groups of Depts. Proportion of Variance Explained	(3) F Ratio, Marginal	(4) Without Rural/Urban Proportion of Variance Explained	(4) F Ratio, Marginal	(5) With Rural/Urban Proportion of Variance Explained	(5) F Ratio, Marginal
Education Level (4)	.44	.103	294	.173	479	.148	403	.129	386	.091	281
Age Group (7)	.19	.026	37	.029	40	.029	39	.025	37	.022	35
Rural/Urban (2)	.38	.052	443							.024	227
Regions (6)	.21			.021	35						
Groups of Depts. (11)	.28					.031	25				
Departments (23)	.41							.099	41	.072	30
Covariance		.098	--	.030	--	.050	--	.073	--	.142	--
Total Explained		.279	238	.253	150	.258	111	.326	95	.350	102

(Geographic Distinction; columns (4) and (5) under "Departments")

Logarithm of Income

Mean	6.75
Variance	2.51
Sample Size	6090

(Number of explanatory categories in parentheses)

Note: All effects statistically significant at .001 level.

might have been anticipated given the prominence accorded interregional variation
in studies of income distribution in Colombia. The six regions account
for 1.4 percent of the log variance; the eleven labor market groupings
of departments account for 3.7 percent, and the full 23 departments explain
4.3 percent. In terms of the F test, the 11-way grouping of departments
appears the most significant. About one-third of the variance of the
logarithm of income is explained by these three or four sets of categories.
In Colombia and elsewhere equally parsimonious model specifications
generally explain between 25 and 50 percent of the log variance of income.[1]

Exploring covariation among the explanatory variables, we find that
the direct effect of age is not greatly influenced by the inclusion of
various regional distinctions, varying narrowly from 6.4 to 7.2 percent
of the explained variance. Education, however, differs between rural
and urban areas more than it does by department of region. When the rural-
urban distinction is considered (ANOVA 1) the direct effect of education
is 12.9 percent, but education's effect rises to 19.4 percent when only
the six regions are included (ANOVA 2). On the other hand, the covariance
effect falls from 11.5 to 4.5 percent, confirming the strong association
between education, age and the rural-urban categorization. Once the rural-
urban distinction has been included, it is clear from comparing ANOVAs (1)
and (5) that the 23 department categories increase the explanatory power
of the model modestly, from .339 to .367.

The same series of ANOVA models are reported in Table 6B for men

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[1]Fields (1975) obtained an R^2 of around .5 using a larger set of explana-
tory variables including education, experience, city of residence, and parents'
education. Comparably high R^2s have been obtained in Colombia by Kugler (1975)
and Musgrove (1974) using somewhat different independent variables. In Brazil,
Langoni (1975) reports a notably higher R^2 (nearly .6), but he includes as ex-
planatory variables sex, on which we stratified the sample, and sector; Fishlow
obtained an R^2 of .3, also using Brazilian census data. In the United States
for white nonfarm males, Mincer (1974) reports an R^2 of .3 based on schooling
and a quadratic in age.

reporting their job type as self-employed or employer. Qualitatively
the results are similar, though place of residence is somewhat more im-
portant (particularly departments) and age and education are somewhat
less capable of explaining the log variance in incomes. Overall, the
proportion of the variance explained is lower for employers than it is
for employees, a fact that is consistent with the presumed greater im-
portance of unobserved factors such as land and capital in determining
employers' incomes. The log variance of incomes is also substantially
greater for employers than it is for employees, 2.5 versus 1.5. In the
United States, too, the log variance of entrepreneurial and farm incomes
is found to exceed that for wage and salary employees (Friedman, 1957; Kravis, 1962).
This difference is probably more pronounced in Colombia since the employer
group includes not only a rich entrepreneurial and landowning class, but
also large numbers of poor farmers in the rural sector and poor self-
employed workers in the traditional urban sector. In addition, stochastic
variability in year-to-year incomes is probably greater for the self-
employed and farmers.

Two Way Interactions

The analysis of variance may be extended to include all two-way inter-
actions. Illustrative results for male employees and employers are given
in Tables 7A and 7B. Given the limitations of our computational program, only
the six major regions are distinguished in these ANOVA calculations.

The 77 two-way interactions added to the 15 main effects increases
the proportion of the log variance explained from .35 to .39 for employees,

Analysis of Variance with Interaction Effects
Male Employees

	Proportion of Variance Explained	F Ratio Marginal	df
Main Effects			
Education	.122	1103*	3
Age	.064	286*	6
Region	.011	58*	5
Rural/Urban	.027	738*	1
Covariance	.126	--	--
Main Effects, **Total**	.350	631*	15
Two Way Interactions			
Education x Age	.005	7.76*	18
Education x Region	.003	5.45*	15
Education x Rural/Urban	.005	45.7*	3
Age x Region	.003	2.35*	30
Age x Rural/Urban	.011	48.0*	6
Region x Rural/Urban	.009	48.8*	5
Covariance	.007		--
Two Way Interactions, Total	.043	15.0*	77
Main Effects and Interaction Effects, Total	.393	115*	92

Logarithm of Income

Mean	6.52
Variance	1.52
Sample Size	16,542

*Statistically significant at .001 level.

Table 7B

Analysis of Variance with Interaction Effects

Male Employers

	Proportion of Variance Explained	F Ratio Marginal	df
Main Effects			
Education	.099	293*	3
Age	.025	37*	6
Region	.016	29*	5
Rural/Urban	.047	414*	1
Covariance	.109	--	--
Main Effects, Total	.295	175*	15
Two Way Interactions			
Education x Age	.004	2.15*	17
Education x Region	.003	1.78*	15
Education x Rural/Urban	.002	4.50*	6
Age x Region	.004	1.31	30
Age x Rural/Urban	.002	2.54	6
Region x Rural/Urban	.001	20.4*	5
Covariance	.006	--	--
Two Way Interactions, Total	.032	3.73*	76
Main Effects and Interaction Effects, Total	.327	32.0*	91

Logarithm of Income

Mean	6.75
Variance	2.51
Sample Size	6,090

*Statistically significant at .001 level.

and from .30 to .33 for employers. These interaction effects meet conventional statistical standards of significance. Of the interactions that emerge as of considerable importance (i.e., F's exceed 40), all involve interactions with the rural-urban distinction. This confirms one's intuitive sense that rural and urban labor markets differ in more respects than in income level (i.e., in the main effect or intercept). The differential rates of technical change in the two sectors in the last thirty years, widening income gaps, and accelerating rural-urban migration have undoubtedly contributed to different wage structures in rural and urban areas of Colombia. It is unfortunately beyond the scope of this paper to explore further these rural-urban two-way interactions to determine what they imply for the structure of earnings, equity and efficiency, in Colombia. Relatively little predictive accuracy, about one-tenth, is gained by the inclusion of five times number of unrestricted two-way interactions as there were original main effects. For this reason, interaction effects are not considered further.

Quantification of Personal and Regional Effects

In order to evaluate the magnitude of various categorical effects, the unrestricted main effects model is estimated in equivalent regression form based on dummy variables. Both the rural-urban and department categories are reported in Table 8, part A for employees and part B for employers. In Regression (1) the coefficient on the rural dummy variable is -.981 indicating that measured in logarithms rural workers report 98 percent less income than urban workers. The rural-urban distinction alone accounts for 14.5 percent of the variation of the logarithm of income. Regression (2) includes only information on department of residence,

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TABLE 8A

Regressions on the Logarithm of Income Based on Categorical Data:
Unrestricted and Restricted Specifications
(t ratios reported in parentheses beneath coefficients)

Explanatory Variable	M A L E	E M P L O Y E E S					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EDUCATION:							
(Deviation from primary)							
None				-.453 (20.5)	-.300 (13.7)		
Secondary				.926 (45.5)	.709 (33.3)		
Higher				1.96 (45.9)	1.73 (41.5)		
Years						.170 (69.7)	.205 (79.8)
AGE :							
(Deviations from 25-29)							
10-19				-.624 (21.4)	-.575 (20.7)		
20-24				-.260 (9.16)	-.242 (8.94)		
30-34				.155 (4.94)	.144 (4.82)		
35-44				.257 (9.12)	.237 (8.83)		
45-54				.252 (7.88)	.218 (7.14)		
55 +				-.0329 (.87)	-.024 (.67)		
Years						.107 (31.2)	
Years^2						-.00121 (26.6)	
EXPERIENCE:							
Years							.0791 (35.7)
Years^2							-.00115 (29.0)
ZONE, Rural-Urban:							
(Deviations from Urban)							
	-.981 (53.1)		-.799 (39.8)		-.438 (22.8)		

- continued -

TABLE 8A (continued)

DEPARTMENTS: (Deviations from Tolima)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Antioquia		.367 (7.27)	.271 (5.60)		.206 (4.77)		
Atlántico		.663 (10.4)	.271 (4.41)		.125 (2.26)		
Bogotá D.E.		.850 (16.7)	.433 (8.72)		.207 (4.65)		
Bolívar		.355 (4.76)	.119 (1.67)		.803 (1.31)		
Boyacá		-.466 (7.10)	-.357 (5.69)		-.413 (7.38)		
Caldas		.206 (3.21)	.192 (3.14)		.179 (3.26)		
Cauca		-.245 (3.08)	-.210 (2.76)		-.253 (3.74)		
César		.205 (2.27)	.109 (1.26)		.189 (2.45)		
Córdoba		-.073 (1.02)	.026 (.38)		.071 (1.16)		
Cundinamarca		-.103 (1.72)	-.042 (.74)		-.095 (1.86)		
Chocó		-.462 (3.21)	-.571 (4.15)		-.577 (4.71)		
Huila		-.113 (1.47)	-.149 (2.04)		-.139 (2.14)		
La Guajira		.258 (1.78)	.066 (.47)		.064 (.52)		
Magdalena		.079 (.97)	.057 (.73)		.090 (1.30)		
Meta		.267 (3.01)	.130 (1.54)		.132 (1.75)		
Nariño		-.736 (10.8)	-.658 (10.1)		-.712 (12.3)		
Norte de Santander		-.186 (2.84)	-.184 (2.94)		-.150 (2.69)		
Quindío		.181 (2.20)	.054 (.68)		.012 (.17)		
Risaralda		.286 (3.86)	.196 (2.77)		.101 (2.55)		
Santander		-.129 (2.19)	-.187 (3.31)		-.170 (3.38)		
Sucre		-.122 (1.23)	-.173 (1.83)		-.088 (1.04)		
Valle		.469 (9.05)	.227 (4.55)		.174 (3.92)		
Intercept	6.88	6.28	6.71	6.41	6.54	3.84	4.74
R^2	.1455	.1071	.1852	.2865	.3531	.2843	.2898
SEE	1.141	1.167	1.115	1.043	.994	1.044	1.040

TABLE 8B

Regressions on the Logarithm of Income Based on Categorical Data:
Unrestricted and Restricted Specifications
(t ratios reported in parentheses beneath coefficients)

MALE EMPLOYERS

Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
EDUCATION: (Deviations from primary)							
None				-.667 (13.8)	-.406 (8.77)		
Secondary				1.15 (24.0)	.860 (18.6)		
Higher				2.17 (23.7)	1.82 (21.2)		
Years						.201 (38.4)	.221 (40.1)
AGE: (Deviations from 25-29)							
10-19				-.734 (7.50)	-.599 (6.61)		
20-24				-.158 (1.90)	-.168 (2.20)		
30-34				.205 (2.78)	.200 (2.94)		
35-44				.395 (6.12)	.348 (5.85)		
45-54				.369 (5.47)	.345 (5.56)		
55 +				.114 (1.65)	.140 (2.19)		
Years						.114 (13.8)	
Years^2						-.00125 (12.8)	
EXPERIENCE:							
Years							.0820 (14.9)
Years^2							-.00117 (13.5)
ZONE, Rural-Urban: (Deviations from Urban)	-1.27 (32.4)		-.981 (23.0)		-.625 (15.1)		

- continued -

TABLE 8B (continued)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
DEPARTMENTS: (Deviations from Tolima)							
Antioquia		.349 (3.48)	.145 (1.50)		.093 (1.03)		
Atlántico		.456 (3.66)	-.085 (.697)		-.093 (.818)		
Bogotá D.E.		.846 (8.45)	.292 (2.94)		.048 (.521)		
Bolívar		-.225 (1.75)	-.446 (3.62)		-.230 (2.01)		
Boyacá		-.823 (6.60)	-.740 (6.18)		-.797 (7.21)		
Caldas		.189 (1.35)	-.060 (.447)		.026 (.212)		
Cauca		-.627 (4.09)	-.610 (4.15)		-.581 (4.27)		
César		.210 (1.14)	-.039 (.220)		.004 (.022)		
Córdoba		.058 (.409)	.004 (.029)		.031 (.244)		
Cundinamarca		-.303 (2.59)	-.255 (2.27)		-.304 (2.93)		
Chocó		-4.09 (21.6)	-3.80 (20.9)		-3.56 (21.1)		
Huila		-.300 (2.20)	-.26 (2.01)		-.224 (1.87)		
La Guajira		4.25 (1.64)	.118 (.473)		.085 (.370)		
Magdalena		.169 (1.19)	.054 (.396)		-.019 (.153)		
Meta		.215 (1.23)	.179 (1.06)		.178 (1.14)		
Nariño		-.784 (6.44)	-.642 (5.49)		-.574 (5.30)		
Norte de Santander		-.166 (1.29)	-.328 (2.65)		-.336 (2.94)		
Quindío		.304 (1.76)	-.161 (.966)		-.135 (.880)		
Risaralda		.235 (1.56)	-.083 (.572)		-.127 (2.20)		
Santander		-.131 (1.18)	-.210 (1.98)		-.216 (2.20)		
Sucre		-.405 (2.50)	-.413 (2.66)		-.273 (1.90)		
Valle		.352 (3.39)	.098 (.966)		-.125 (1.33)		
Intercept	7.20	6.69	7.25	6.40	6.83	3.59	4.68
R^2	.1469	.1698	.2365	.2255	.3498	.2214	.2237
SEE	1.463	1.445	1.386	1.395	1.280	1.398	1.396

expressed as deviations from Tolima; the regression coefficients on the department dummy variables imply that, for example, Bogotá reports incomes 85 percent more than Tolima and Nariño 74 percent less. Regression (3) shows that when one holds constant for whether the individual resides in an urban or rural area, these department dummy variable coefficients diminish in absolute magnitude, e.g., Bogotá becomes +.43 and Nariño -.66.

Age and education categories are included without regional variables in regression (4). The coefficients on the education categories show that employees with no education receive incomes 45 percent less than those with some primary, while employees with secondary education earn nearly twice as much (.926) and employees with higher education earn nearly three times as much as those with a primary education (1.96). Workers aged 10-19 earn 63 percent less than workers aged 25-29. Incomes rise with age in the cross section, peaking between 35 and 55, at which age incomes tend to be some 25 percent higher than for those in the late twenties. Overall, the education and age categories account for about 29 percent of the log variance of incomes.

Regression (5) combines employee characteristics with geographic information. Because of covariation between these two pieces of information, the regression coefficients on all but the department dummies diminish in average absolute magnitude when combined. Comparing regressions (3) and (5) the rural-urban differential decreases from -.80 to -.44, a reduction of 45 percent. The average absolute value of the age dummies decreases 9 percent and the education coefficients decrease on average 18 percent. Adjusting for age and education, therefore, reduces substantially the gross rural-urban income differentials. Though a large fraction of

the interregional differences in incomes in Colombia can be explained simply

in terms of age and education, much remains to be accounted for by, on

the one hand, other aspects of workers' skills, job experience, and

training and, on the other hand, by long run factor market distortions

and short run quasi-rents to workers in specific regional labor markets.

Comparing regressions (4) and (5), 28.7 percent of the log variance

of incomes is explained by 10 categorical age and education variables,

whereas the addition of 23 rural-urban and department variables increases

the proportion explained only to 35.3 percent. Conversely, these 23

regional variables decrease the standard error of estimate by only .5

percent. Thus, recognition of place of residence, while informative, compli-

cates the simple linear model without adding substantially to its predictive

precision. Although a standard F ratio test would suggest the need to

include regional effects,[1] the search for a simpler income determination

model may justify neglecting geographic detail even in a country such as

Colombia where interregional disparities are pronounced.

Earnings Functions and Simplifying Restrictions

Research studies on the relationship between income and its determinants

commonly express education and age in years rather than as dummy cate-

gorical variables and then fit various functional forms.[2] Two restrictions

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[1]The marginal F ratio test of any restriction on the main effects model
is not likely to be accepted given the large size of the working sample
(16680) relative to the number of parameters being fitted (32 in regression
5). See Griliches (1976).

[2]Other efforts to search statistically for the best functional forms
for the dependent and independent variables in the earnings function have
been based on various data sets for the U.S. See Heckman and Polachek
(1974) and Welland (1976).

are considered here that transform the age and schooling categories from the unrestricted estimation of nine parameters (six age and three education dummy variables) to three (age, age squared and schooling), a saving of six degrees of freedom out of 16680. To maintain comparability with the ANOVA calculations, schooling and age are measured by the mean years in each category.[1] Moving from the unrestricted main effects model (regression (4) in Table 8) without regional effects to the restricted model in regression (6) the R^2 decreases .8 percent and the standard error of estimate increases .1 percent. Even in this case the F ratio test rejects the restriction given the sample size. An alternative is to approximate with a quadratic the effect of post-school experience on earnings; when direct information on experience is unavailable, a proxy may be used equal to age minus years of schooling completed minus age of school entry (in Colombia, seven). The earnings function specified in terms of a quadratic in this proxy for ex- perience is estimated in regression (7). This transformation of age not only fits the income data better than the quadratic in age (regression 6), but it also accounts for the Colombian data better than the unrestricted ANOVA main effects model (regression 4). Further, the experience trans- formation lends itself to analytic interpretation in the human capital framework in which the education coefficient can then be interpreted as a rate of return. The experience transformation appears to simplify the earnings function model without unduly restricting it.

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[1]The mean years of schooling completed by employers and employees with "primary education" is the same, 3.3; the "secondary education" category of employees has 8.2 and employers 8.3 years; and the "higher education" category of employees report 14.9 years and employers 15.5 years. With respect to age the midpoints of the categories are treated as the means from age 20 to 54, and the average age of the youngest and oldest age category is set equal to 17 and 62 years for both employees and employers.

The regression results presented in Table [8] are based on categorical information (e.g., knowledge that a particular individual is in age category 35-44) rather than more exact data (e.g., the individual is 43 years old). This was done in order to parallel the ANOVA specification discussed earlier. When instead the continuous education and age information is used (Table 9), the fit to the Colombian data is improved by about ten percent, the education coefficients change very little, but the age and experience coefficients are modified. Again, the experience proxy appears to account somewhat better for the logarithms of incomes than the age quadratic formulation. For employers, as shown in Table 8B and the second half of Table 9, restricting the general ANOVA formulation produces similar results. This suggests that the information loss associated with categorical rather than continuous data may be appreciable.

Influence of Education: Quantitative Estimates

The earnings functions and underlying tabulations cast some light on the relative private gains to schooling among employees in Colombia. Based on the main effects model represented in regression 5 of Table 8A, persons with primary schooling had incomes 45.3 percent higher than persons with no education. Since the difference in mean years of schooling between the two groups is 3.3 years, this suggests a gain of 14 percent (i.e., .453/3.3 = .137) percent per year. Employees in the secondary school category had an average of 8.3 years of school, and thus the relative gain in income associated with an average year of secondary school is 19 percent (i.e., .926/5). Employees in the higher education category had on average 14.9 years of school, yielding an estimated proportionate benefit per year of higher education on the order of 16 percent (i.e., (1.96 −.926)/6.6). For

TABLE 9

Earnings Functions Estimated from Continuous Information on

Schooling and Age: Employees and Employers

(t ratios reported in parentheses beneath coefficients)

Explanatory Variable	Male Employees		Male Employers	
	(1)	(2)	(1)	(2)
Schooling	.169 (44.2)	.201 (50.0)	.201 (41.8)	.219 (43.4)
Age	.0893 (19.2)		.0915 (14.3)	
Age^2	-.000955 (16.1)		-.000957 (13.3)	
Exp		.0685 (21.6)		.0660 (14.9)
Exp^2		-.000931 (17.3)		-.000878 (13.5)
Constant	4.12 (50.3)	4.85 (106.)	3.97 (30.0)	4.86 (64.3)
R^2	.3197	.3247	.2510	.2519
SEE	1.022	1.018	1.371	1.370

employers, even though their incomes include returns to capital as well as labor, the apparent relative shifts in earnings functions are quite similar: 20 percent for primary school, 23 percent for secondary school, and 14 percent for higher education. If one were willing to assume that the sole costs of schooling are the foregone market earnings incurred during the period in full time school, these relative shifts in the earnings function could be interpreted as an estimate of the private rate of return to schooling (Hanoch, 1967; Mincer, 1974; Rosenzweig and Morgan, 1976; Blinder, 1976).

In some contexts, it could be argued that the gains to education are appropriately estimated after adjusting for regional effects. If we allow for department and rural-urban categorical effects (regression (5), Table 8A), the returns to primary and secondary education decrease--- for primary education, by 51 percent for employees and 64 percent for employers; for secondary education, by 30 and 20 percent respectively; and for higher education, by 0.7 percent for employees and 6 percent for employers. One interpretation of this pattern is that the better educated have been disproportionately drawn to urban areas in relatively high income departments. If there were no migration, the relative shift in earnings function associated with education <u>within</u> a region could be interpreted as the private pecuniary benefits from obtaining an education in that region. But if migration is common, as it is in Colombia, particularly among the better educated, then those who obtain a primary education, say, in Boyacá, may anticipate migrating as an adult to Bogotá. The combined returns to education and migration are in this case the sum of the education effect (+.3) and the difference in the department effects (+.2 +.4), or a 90 percent increase in pecuniary income. To estimate the

average income gain associated with education, therefore, it may make

more sense to rely on the return estimates <u>without</u> adjusting for regional

effects, since the unadjusted figure is what a representative mobile

worker is able to obtain by migrating.

<u>Analysis of Variance Within Education and Age Categories</u>

It was noted in early tabulations that relative inequality measured

either by the coefficient of variation or the variance of the logarithm

of income is greater for the least educated (Table 1). Figure 1 showed

that the relative interregional variation in income is lower at higher

education levels. Figure 2 suggests age-income profiles are steeper for

the better educated. Thus we anticipate that as educational attainment

increases region is of diminished importance relative to age in accounting

for the log variance of income.

To determine the explanatory importance of regional differences in

log incomes the ANOVA model is reported in Table 10 <u>within education classes</u>

TABLE 10A

Analysis of Variance Within Education Classes, Male Employees

Main Effects	Degrees of Freedom	NONE		PRIMARY		SECONDARY		HIGHER	
		Proportion of Variance Explained	F Ratio Marginal	Proportion of Variance Explained	F Ratio Marginal	Proportion of Variance Explained	F Ratio Marginal	Proportion of Variance Explained	F Ratio Marginal
Age	6	.012	6.72*	.065	130.*	.187	130.*	.195	26.3*
Department Groups	10	.061	19.9*	.037	44.1*	.005	2.26	.035	2.81
Rural/Urban	1	.007	23.3*	.044	524*	.011	47.0*	.000	.00
Covariance		.012		.057		.010		-.010	
Total Main Effects	17	.092	17.7*	.203	144.*	.213	52.3*	.220	10.5*

Logarithm of Income:

		NONE		PRIMARY		SECONDARY		HIGHER	
Mean		5.92		6.43		7.26		8.44	
Variance		1.17		1.19		1.15		1.26	
Sample Size		2987		9606		3302		647	

*Statistically significant at .001 level.

TABLE 10B

Analysis of Variance Within Education Classes, Male Employers

Main Effects	Degrees of Freedom	NONE		PRIMARY		SECONDARY		HIGHER	
		Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal
Age	6	.024	4.95*	.023	16.7*	.129	28.4*	.061	3.07*
Department Groups	10	.071	8.73*	.023	9.76*	.015	1.96	.019	.49
Rural/Urban	1	.022	26.8*	.062	267.*	.029	38.8*	.004	.90
Covariance		.004		.046		.009		.001	
Total Main Effects	17	.121	8.71*	.154	39.0*	.182	14.1*	.085	1.34
Logarithm of Income:									
Mean		5.90		6.57		7.73		8.79	
Variance		2.94		1.97		1.41		1.25	
Sample Size		1095		3649		1097		249	

*Statistically significant at .001 level.

according to the 11 regional groups of departments, the rural-urban distinction, and age. The regional categories contribute more to explaining the variance in log incomes for male employees with primary education or less than for those with secondary or higher education. Age accounts for only 1.2 percent of the log variance of income for those with no schooling and rises to 19.5 percent among the higher educated (see Table 10-A). The department groups directly account for 6 to 7 percent of the log variance for employees and employers with no education, but between 1 and 4 percent for the better educated. The rural-urban distinction is also of less importance for men with no education than for those with primary and secondary education.[1]

We might hypothesize that regional differences in incomes would be more notable among older employees, given that the propensity to move declines with age. To explore this question, we performed analyses of variance within age groups, examining the relative contribution of education and place of residence to explained sum of squares (Table 11). The results show that less than six percent of the log variance of incomes within age groups is associated with department groupings, declining

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[1]With only 4 employers and 6 employees with higher education in rural areas the F test for the rural-urban effect is understandingly insignificant within the higher education class.

Table 11A

Analysis of Variance Within Age Groups, Male Employees

Age Group		10-19		20-24		25-29		30-34		35-44		45-54		55 and over	
Variable	(Degrees of Freedom)	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio Marginal	Proportion of Variance Explained	F Ratio Marginal
Education	(2/3)[1]	.030	32.0*	.053	63.1*	.148	193.0*	.179	203.6*	.162	284.0*	.179	189.4*	.117	63.7*
Department Groupings	(10)	.055	17.5*	.021	7.6*	.033	12.9*	.014	4.7*	.020	10.3*	.035	11.1*	.043	7.1*
Rural/Urban	(1)	.001	2.1	.018	64.3*	.030	116.4*	.047	160.8*	.044	231.5*	.032	102.5*	.024	39.3*
Covariance		.039	---	.082	---	.163	---	.174	---	.177	---	.152	---	.108	---
Total Explained		.124	28.4*	.174	44.7*	.374	104.6*	.415	100.9*	.402	151.5*	.398	90.4*	.294	34.2*

Logarithm of Income:

		10-19		20-24		25-29		30-34		35-44		45-54		55 and over	
Mean		5.86		6.41		6.76		6.86		6.82		6.72		6.32	
Variance		1.12		1.32		1.37		1.47		1.56		1.50		1.60	
Sample Size		2821		2983		2471		2005		3166		1930		1166	

*Statistically significant at .001 level.

[1]In the case of ages 10-19 there were no higher educated male employers and thus only three education groups represented in the sample and only two degrees of freedom employed.

Table 11B

Analysis of Variance Within Age Groups, Male Employers

Variable	(Degrees of Freedom)	10-19		20-24		25-29		30-34		35-44		45-54		55 and over	
		Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal	Proportion of Variance Explained	F Ratio, Marginal
Education	(2/3)[1]	.050	8.29*	.057	12.6*	.081	22.3*	.124	49.4*	.124	94.6*	.100	57.5*	.107	51.5*
Department Groupings	(10)	.077	2.54	.058	3.82*	.021	1.77	.039	4.63*	.016	3.64*	.021	3.63*	.031	4.44*
Rural/Urban	(1)	.026	8.69	.054	36.2*	.028	23.3*	.040	48.0*	.048	110.*	.066	113.*	.019	27.3*
Covariance		-.008	—	.117	—	.085	—	.164	—	.124	—	.119	—	.113	—
Total Explained		.145	3.69*	.286*	13.6*	.215	127*	.367	31.4*	.312	51.0*	.306	113*	.270	27.8*

Logarithm of Income:

	10-19	20-24	25-29	30-34	35-44	45-54	55 and over
Mean	5.63	6.50	6.73	6.88	6.95	6.92	6.55
Variance	2.63	1.64	1.77	2.01	2.29	2.62	3.10
Sample Size	296	489	665	775	1588	1209	1068

*Statistically significant at .001 level.

[1] In the case of ages 10-19 there were no higher educated male employers and thus only three education groups represented in the sample and only two degrees of freedom employed.

somewhat to age 30-34 and rising thereafter. The rural-urban distinction

accounts for two to five percent after age 20. Educational categories,

on the other hand, explain an increasing share of the log variance

within age groups, from 3 percent at age 10-19 to 18 percent by age 30-

34, and then diminishing to 12 percent within the oldest age group. Con-

sequently, the relative importance of education vis a vis region increases

sharply up to age 35, whereupon the ratio turns down. This is consistent

with the age-selectivity of migration in equilibrating labor markets,

young workers moving at high rates to take advantage of interregional

wage disparities but mobility diminishing beyond the midpoint of the life

cycle.

Combining Employees and Employers

We began by stratifying by employment-type (employees vs. employers)

in order to reduce probable bias that would arise by mixing returns to wealth

of the self-employed with returns from labor. As Fishlow (1972, 1973) has

argued in his study of the distribution of income in Brazil, it seems

likely that education in particular would be strongly associated with

the control of capital, ownership of land, and access to influential

institutions and people. Consequently, education's association with

income could capture not only an effect of skills on labor's productivity,

but also the influence of family social status and wealth on personal

income.[1] Without data on wealth or land ownership Fishlow (1973)

proposed holding constant for occupational position as a means for

partially controlling for the influence of these omitted variables in the

analysis of the logarithms of income. With 1960 Brazilian census data

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[1] For examination of intergenerational aspects of education in Colombia,
see Fields (1975) and Berry and Urrutia (1976).

his inclusion of a set of occupational categories (i.e., employee, employer, self-employed and sharecropper) explained 3.9 percent of the log variance of incomes and reduced the relative explanatory role of education categories (1973, Table 7).[1] Langoni (1975, Table 12) obtained parallel results working with the 1970 Census, i.e., 2.1 percent attributed to three occupations.

Given this evidence for Brazil, we combined the Colombian samples of male employees and employers, performing an analysis of variance with the addition of an employee/employer dummy variable. The results are summarized in Table 12. Considering the size of the sample and the noted differences in the level of income between employees and employers, we are hardly surprised that the employer dummy variable is statistically significant. However, it directly accounts for only 0.1 percent of the log variance in incomes among Colombian men.

In the equivalent regression (results not reported), the coefficient on the employer dummy variable is +.25, indicating that employers appear to receive about 25 percent higher incomes than employees, holding constant for the independent effects of age, region, rural-urban, and education. According to Chiswick's (1975) formulation of the earnings function, the

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[1]Fishlow (1973) also reported analysis of occupational categories including unpaid family workers. Since he had to impute part of the income of the head of households to unpaid family workers, and presumably this imputation was modest (they being largely teenagers in the poorest rural households), this five-way occupational division accounts for a substantial share of the log variance in imputed incomes. Indeed the share directly explained by occupation is 19.5 percent compared with education's share of only 14.3 percent (Table 6). When unpaid family workers are excluded, the four way occupational division accounts for 3.9 percent of the log variance in income, compared with 12.4 percent for education, 7.1 percent for age, 6.0 percent for region and 4.8 for a division by primary, secondary and tertiary sectors of the economy (Table 7).

Table 12

Analysis of Variance Results on Pooled
Sample of Employees and Employers

Main Effects	Zero Order Correlation	Proportion of Sum of Square Explained	ANOVA F Ratio
Education	.47	.113	1293*
Age	.29	.054	308*
Department Group	.29	.017	57*
Rural/Urban	.37	.020	669*
Worktype	.08	.001	46*
Covariance		.135	
Total		.340	554*

Logarithm of Income:

Mean	6.57
Variance	1.80
Sample Size	22,632

regression coefficient on the self-employment variable in an earnings function can be interpreted as $-\log\alpha$, where α is the labor share of income received by the self-employed employers. Among Colombia male self-employed and employers, approximately 78 percent of their incomes are imputed returns to their labor, holding constant for age, education and region effects.

In Colombia in contrast to what was found in Brazil using a somewhat more limited range of occupational categories, employees and employers are not found to have a different structure to the earnings function; rather, the level (intercept) of the function is one-fourth higher for employers. The relative effects of education and age are somewhat more pronounced among employees; as an explanation of incomes among employers region and particularly rural-urban are more important. One suspects that the self-employed in the rural and urban sectors warrant separate study. Nonetheless, pooling the two occupation groups does not alter the form of the earnings function greatly, other than in the intercept.[1]

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[1]The standard error of estimate is increased by only .5 percent when the restriction is imposed that all of the regional dummy variables, the schooling coefficient, and the age quadratic be identical for both employers and employees. This set of 13 parameter restrictions on the general ANOVA model implies an F ratio of 10.7 with 12 and 22808 degrees of freedom. These restrictions would not be accepted by standard statistical conventions, yet in terms of predictive adequacy of the model the pooled results are nearly as good as the stratified results.

The Relative Size of Regional Effects

Analysis of interregional differences in earnings are difficult
to interpret, first because of the heterogeneity of workers across regions,
and second because of the arbitrary nature of administrative "regions" that
determine the unit of analysis. In this paper we have standardized for
several important characteristics of workers: sex, age, education, and
employment type. But we still lack satisfactory criteria to evaluate remain-
ing regional income differences and decide whether they are large or small.
In one country regions may be defined by following ethnic or socioeconomic
populations, thereby exaggerating income differences, and in another
country by combining prosperous centers of growth with undeveloped hinter-
lands in a single regional grouping, diversity may be concealed. Given
department units, since there are no time series to compare current
regional inequality in Colombia with earlier years, the only basis for
comparison is with similar exercises performed for other countries.

From the several differently structured studies summarized in Table
13, it would appear that interregional income differences are not as sub-
stantial in Colombia in 1973 as they are in Brazil in 1970, and a fortiori
in 1960.[1] And though the findings are less comparable, it would appear that

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[1]Fishlow's (1973) results for Brazil in 1960 are similar to those ob-
tained here for Colombia in 1973; the four regions of Brazil account for 5.2
percent of the log variance in incomes whereas the 24 regions and rural/urban
distinction account for only 4.2 percent in Colombia. We suspect, moreover,
that the explanatory effect of "sector" in Brazil is largely due to lower in-
comes in the primary or agricultural sector, and would be analogous to the
rural-urban effect in Colombia. Treating the Colombian rural-urban effect
as is the sector effect in Brazil (Table 6A, ANOVA 5), 19.9 percent of the
log variance is accounted for by the personal characteristics in Colombia,
2.8 percent by the 23 departments, and 14.0 percent by their covariation.
Aggregating employees and employers in Table 12 reduces further the explanatory
role of regional categories to 1.7 percent, personal factors to 18.8, with

Table 13

Comparisons of Regional Effects in Country Studies

Sample	Date	Proportion of Log Variance Explained				Source
		Personal Characteristics	Regional Categories	Covariance	Total	
Colombia:						
Census	1973	.235[1] (11)	.043[1] (23)	.074	.352	Table 6A ANOVA (4) without rural-urban
Census	1973	.180[2] (11)	.042[2] (24)	.140	.367	Table 6A ANOVA (5) with rural-urban
Brazil:						
Census	1960	.254[3] (18)	.052[3] (4)	n.r.	.306	Fishlow, 1974 Table 7
Census	1960	.263[4] (19)	.061[4] (6)	.183	.507	Langoni, 1975 Table 8
Census	1970	.330[4] (19)	.049[4] (6)	.217	.523	Langoni, 1975 Table 8
USA:						
Army enlistees Whites only	1969	.086[5] (3)	.092[5] (150)	n.r.	.153	Hanushek, 1973 Table 1

n.r.: not reported in original study.

[1] The personal characteristics are four education and seven age categories. The regional categories are 23 departments. Sample includes male employees.

[2] The personal characteristics are four education and seven age categories. The regional categories are 23 departments and the rural/urban distinction. Sample includes male employees.

[3] The personal characteristics are six education, seven age, and five sectoral categories. Four major regions of the country are considered. The occupational distinction is omitted since it includes family unpaid workers for whom a low income was imputed. The sample of 11,000 families from the national demographic census excludes these unpaid family workers.

[4] The personal characteristics are five education, nine age, three sectoral, and two sex categories. Six regions of the country are distinguished. Both the 1960 and 1970 Census samples apparently refer to all persons with reported incomes.

(notes continued on next page)

Table 13

Notes

[5]The personal characteristics are years of schooling, Armed Forces
Qualification Test score, and a proxy for civilian experience.
126 urban regions and 24 rural regions are distinguished. The sample
consists of 180,000 enlistees who left the U.S. Army during fiscal
year 1969 after less than two years of service, responding to the
follow up survey and working at that moment full time. The relatively
low explanatory power of the personal characteristics is probably
due to the narrow range of ages in the sample and the unexplained
variability in incomes among young, recent entrants to the U.S. labor
force. The comparison reported here is based only on whites.

regional differences in Colombia are no larger than those in the U.S. labor

market for young white males.[1] Until more analyses along the lines followed

here are available from a range of countries, the most we can conclude is

that Colombia in 1973 does not exhibit unusually large interregional male

income differences, holding constant for age, education and employment type.

13.5 percent to their covariation.

Langoni (1975) considers six regions in Brazil and calculates the same ANOVA results for a sample of men and women from the 1960 and 1970 Censuses. In 1960 he finds 7.6 percent of the log variance explained directly by the six regions, whereas in 1970 only 4.9 percent is thus explained. In this decade the explanatory importance of education, age, and sector increase in Brazil, and in both years the share of the log variance explained is greater than we have obtained for Colombian males in 1973.

[1]The U.S. study is quite different, being restricted to a strata of young Army enlistees whose age, experience, and education are undoubtedly less variable than for the entire labor force. In that study 9.2 percent of the log variance in wages is attributed to differences across 150 rural and urban labor market regions.

VI. Summary and Conclusions

Recapitulation

Working with a 4 percent sample of the 1973 Colombian Census of Population,
we have sought to understand the determinants of income and income inequality.
Men and women are analyzed separately, as are employees and employers.
Within these groups, education, age, region, and rural/urban differences
in income are distinguished using a variety of procedures including simple
cross tabulations and decompositions of the log variance of income by analysis
of variance and by regression techniques.

Table 1, 3, 4, and A-1 and Figures 1 and 2 show noticeable differences
in income between men and women, between employees and employers, across
education categories, across regions, and between urban and rural workers.
These differences arise both in the simple tabulations and in the finer
cross classifications by age, education, region, and urban/rural simultaneously.

To interpret variation in income across such a large number of cells, a
formal statistical framework is helpful. For this purpose, we rely on the
linear model in the form of analysis of variance (ANOVA) and multiple regres-
sion. These are appied to logarithms of income rather than the absolute value
of the incomes, the variance of the logarithms of income being a commonly-
accepted measure of aggregate income inequality. The statistical analysis
is limited to males.

The ANOVA results summarized in Table 6 support the hypothesis that
education, age, region, and rural/urban contribute significantly in
accounting for the log variance of income in Colombia. By standard statistical
conventions, the four-way classification by educational attainment is much the
more important, while the single urban/rural dichotomy is next in importance

per degree of freedom used. The seven age categories are generally more significant statistically than the six, eleven, or twenty-three regional categories. One way of interpreting these results is that if you wanted to predict an individual's income and could ask only one question, knowing the individual's education would give a more accurate prediction than would either his age, region, or knowing whether he lived in an urban or rural area.

The fifteen parameters used to model the main effects of education, age, region, and rural/urban account for one-third of the log variance in incomes of employees and one-fourth of that of employers. This is reasonable by the standards of both high income and low income countries. As shown in Table 7, interaction effects represented by 76 additional parameters were found to account for only an additional 3 to 4 percent of the log variance of incomes in both employment groups. That is, a proportionate model of income determination which is linear in the variables and ignored interaction effects does almost as well as a more complex specification.

The next task was to quantify the various personal and regional effects, both singly and together. This was done by regression analysis, comparing geometric means. As compared with primary-educated workers, the uneducated earn only about half as much, secondary-educated workers nearly double and higher-educated nearly triple. Urban/rural differences are about 2 to 1. Differences between age categories are as great as 75 percent and between departments as high as 150 percent. When the various variables are included in a single regression, however, these differentials are altered. The standard error of estimate is only 0.5 percent lower in a regression when geographic aspects are present than in their absence. Thus, in the interest of a simpler income determination model, there might be some justification for ignoring geographic information.

The goodness of fit of a restricted earnings function was then examined, following standard conventions which restrict the effect of schooling on income to be proporational at all levels of education, and approximate life cycle proportionate variation in income in terms of a quadratic in age or years of labor force experience. As compared with the general model, the restricted earnings function results in only a small (0.1 percent) increase in the standard error of estimate when based on the same categorical age information. The standard error is actually reduced when the experience transformation of age and schooling is used in the regression. Replacing the categorical age and schooling data by the underlying continuous information available from the census increases the predictive power of this simple human capital framework by about a tenth.

We next turned our attention to the patterns of income inequality for different education and age groups and the correlates of those patterns. The tabulations of Section III suggested larger relative dispersion of incomes across regions for the less educated. This pattern is confirmed in Table 10 which also explored the relative importance of the various explanatory factors. Across education groups, region is most important for the lowest educational groups, and age gains in importance as education increases. In Table 11, across age groups, education becomes increasingly important up to middle age; the main regional effects are found to be small and exhibit no pronounced trend. These results suggest that if regional labor markets in Colombia are not clearing because of institutional restrictions or inertia of potential migrants, this problem is most severe among the least-educated and among prime age workers.

The employer and employee samples were then pooled. The work type distinction was found to contribute only one-tenth of one percent to the explanation of the log variance in incomes, even though employers received 25 percent more income than employees. This is because the income variation within employee and employer groups is so much greater than the variation between them. This constrasts with similiar calculations preformed on Brazilian census data (Fishlow, 1973; Langoni, 1975) in which occupational position was a major explanatory variable that reduced the magnitude of schooling's effect on the logarithm of income.

Policy Implications

Policies to alleviate poverty in Colombia might operate through the labor market in three ways. First, there is need to expand and improve primary education, which is still not universally available. Each year of schooling is on average associated with about 20 percent more income for both employees and employers. Gains appear to differ between levels, however, being higher at the primary level than at the university level. Primary education would, we feel, be privately beneficial to those who receive it, would promote a reduction in income inequality, and is warranted by considerations of basic social justice given Colombia's stage of development.[1]

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[1] Past researchers have used similar evidence to argue the need for increased expenditures on basic primary education. Their contention is that such expenditures would maximize social returns to education in a narrow productivity sense (Selowsky, 1968; Berry and Urrutia, 1976). Others hesitate to accept this rationale, the reason being that calculations of social rates of return to education are based on certain strict assumptions about the workings of labor markets (Fields, 1972) which may not hold in Colombia.

Second, it seems likely that improving job information throughout
the country, particularly for unskilled low income workers, could help
narrow the gaps in incomes among the various regional labor markets. A policy
of improved information might aid in the reallocation of the labor force to
areas of greatest need, thereby raising production and raising some individuals'
incomes and lowering that of others, probably reducing poverty and inequality.

Third, with the recently documented dramatic decline in fertility, the
rate of growth in the Colombian labor force will subside in the next two
decades. It should be possible to reestablish some degree of economic-demographic
balance between rural and urban areas in Colombia sooner than had been expected.
To accomplish this goal, investments in modernization of agriculture and in the
development of non-agricultural rural activities will be required. The
current Program for Integrated Rural Development now under way in Colombia
is a step in this direction.

A concerted affort in these three related areas would certainly reduce
current poverty and hasten the day when interregional variation in incomes
reflects to a greater degree only differences in the productive qualifications
of the labor force.

Areas for Future Research

The research reported in this paper may serve as the basis for further
analysis of the determinants of inequality and poverty Several areas
of further study would seem potentially rewarding.

Many accounts of economic development hold that migration is a critical
factor in allocating workers efficiently. Our findings for Colombia show
that inter-regional relative inequality is lowest at the highest educational level,
which suggests that migration comes closer to equilibrating labor markets

at the upper end of the skill and income distributions. One hypotheses is that highly-educated workers are better informed of alternative labor market opportunities and are more willing and financially able than uneducated workers to move in response to a given income differential. An alternative hypothesis is that a positive relationship between labor force mobility and education level arises because of educated workers' greater absolute income gain if they move, not because of the greater propensity or ability to move in response to a given dollar gain. Research by Fields in collaboration with Helena de Jaramillo is in the process of exploring these questions.

Education, age, and place of residence are important correlates of incomes throughout Colombia for all groups of workers: wage employees, self-employed, and employers. The simple linear model does somewhat better for wage employees, for the better-educated, and for prime age workers. Since a disproportionate number of the poor in Colombia are neither wage employees nor well-educated nor in the prime ages, additional considerations must be introduced to understand how the incomes of the poor are determined. In urban areas, the functioning of labor markets and the tendency toward labor market segmentation merit quantitative analysis. In rural areas, much of Colombia's poverty is to be found among the families with little or no land. Hence, the variation in the quantity and quality of land owned, the land tenure system under which land is worked, the ecological zone, and similiar dimensions of rural Colombia are probably key explanatory factors in determining income differentials in the rural population. By including such land-related variables in income-generating functions along with personal and regional characteristics such as those considered in this paper, the now-large unexplained component in the log variance of income could probably be reduced. This information, however, is not in the 1973 census.

From the findings that education and age account for a substantial share of income variation, it may be hypothesized that changes in the educational and age composition of the population and in the structure of rewards to education and experience would help to explain how Colombia's income distribution has changed. Unfortunately, we will probably have to wait for the availability of a comparable public use sample of microeconomic records from Colombia's next census or an interim national household survey to determine the predictive power of this framework in accounting for changes in the distribution of income over time.

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Table A-1

MALE AND FEMALE AVERAGE MONTHLY INCOMES BY AGE GROUPS
WITHIN DEPARTMENTS AND BY EDUCATION (in Pesos)

DEPARTMENT/	MALE Education				FEMALE Education			
AGE GROUP	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Antioquia								
10-19	511 (544)	505 (1598)	782 (351)	3133 (3)	361 (35)	530 (246)	990 (197)	-- --
20-24	585 (401)	748 (1561)	1398 (872)	3050 (79)	602 (21)	704 (309)	1421 (559)	2683 (55)
25-29	802 (374)	928 (1416)	2099 (724)	5918 (166)	388 (21)	739 (252)	1999 (378)	3692 (53)
30-34	691 (319)	1206 (1287)	2986 (471)	8292 (140)	408 (22)	794 (218)	2144 (197)	3677 (28)
35-44	775 (731)	1469 (2197)	4156 (626)	10783 (133)	528 (58)	960 (304)	2337 (181)	4031 (18)
45-54	833 (552)	1505 (1484)	5182 (331)	11943 (63)	575 (36)	882 (162)	2047 (96)	4750 (2)
55-64	736 (320)	1277 (711)	5058 (151)	10422 (36)	421 (19)	714 (57)	3005 (24)	-- --
65 and Over	625 (188)	1041 (288)	6084 (40)	8300 (9)	245 (11)	1277 (16)	2976 (5)	-- --
Atlantico								
10-19	476 (74)	654 (239)	986 (80)	1000 (1)	656 (18)	543 (81)	1019 (87)	1860 (5)
20-24	724 (71)	959 (405)	1416 (290)	2397 (39)	416 (7)	734 (145)	1204 (246)	1970 (35)
25-29	768 (70)	1099 (375)	2024 (261)	4330 (70)	513 (8)	647 (91)	1510 (124)	3030 (33)
30-34	619 (54)	1396 (322)	3387 (226)	7239 (65)	360 (12)	1136 (60)	2371 (72)	4000 (8)
35-44	864 (146)	1526 (539)	3590 (311)	10858 (61)	601 (18)	1042 (98)	2223 (100)	5019 (8)
45-54	1303 (79)	1856 (445)	3462 (162)	10016 (38)	852 (10)	1034 (62)	2285 (35)	3500 (2)
55-64	1028 (60)	1823 (180)	4343 (79)	8730 (20)	490 (7)	834 (23)	2471 (8)	1550 (2)
65 and Over	603 (46)	1654 (65)	3301 (25)	10000 (1)	513 (3)	793 (7)	2750 (2)	-- --
Bogotá, D.E.								
10-19	408 (84)	627 (1109)	938 (714)	1423 (14)	299 (43)	434 (544)	913 (436)	1712 (17)
20-24	775 (77)	938 (1268)	1532 (1316)	3812 (276)	346 (26)	675 (560)	1405 (1006)	2593 (160)
25-29	818 (70)	1168 (1295)	2264 (1081)	6153 (529)	465 (30)	753 (438)	1886 (656)	3672 (203)
30-34	925 (89)	1342 (1282)	3372 (764)	8407 (381)	511 (32)	875 (342)	2433 (368)	4682 (80)

Table A-1 (continued)

DEPARTMENT	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
35-44	1048 (226)	1694 (1964)	4330 (1071)	10593 (487)	669 (92)	979 (579)	2721 (454)	5014 (88)
45-54	1017 (155)	1824 (1198)	5514 (640)	13126 (249)	564 (64)	1012 (251)	2485 (206)	4076 (26)
55-64	1097 (86)	1789 (474)	5352 (260)	10395 (109)	729 (19)	1262 (88)	3196 (72)	4020 (5)
65 and Over	745 (28)	1398 (154)	4882 (64)	9086 (36)	983 (17)	804 (16)	2000 (7)	3213 (4)
Bolívar								
10-19	479 (143)	638 (189)	998 (38)	600 (2)	405 (22)	429 (51)	901 (26)	-- --
20-24	579 (130)	724 (254)	1589 (132)	4179 (12)	336 (12)	549 (49)	1314 (91)	2880 (5)
25-29	759 (123)	1054 (235)	1720 (125)	5483 (16)	483 (11)	684 (49)	1522 (71)	4121 (7)
30-34	864 (89)	1098 (177)	2490 (98)	6473 (19)	527 (18)	873 (33)	1615 (24)	3417 (6)
35-44	951 (202)	1356 (355)	2980 (137)	8478 (22)	400 (30)	709 (69)	1903 (40)	3153 (6)
45-54	781 (147)	1362 (234)	3778 (68)	11009 (11)	593 (16)	711 (35)	2156 (23)	3772 (3)
55-64	942 (89)	1416 (115)	2490 (31)	28300 (2)	823 (10)	691 (28)	1000 (1)	1805 (1)
65 and Over	586 (55)	919 (52)	2319 (18)	1475 (2)	223 (8)	708 (6)	300 (2)	-- --
Boyacá								
10-19	232 (109)	266 (492)	801 (40)	-- --	205 (12)	347 (80)	1030 (26)	365 (1)
20-24	322 (58)	403 (411)	1433 (96)	3348 (9)	134 (8)	303 (47)	1364 (75)	1500 (4)
25-29	382 (64)	679 (371)	1904 (96)	3591 (9)	204 (4)	390 (38)	1372 (44)	5340 (5)
30-34	473 (87)	722 (346)	2931 (71)	6759 (16)	75 (4)	695 (15)	2289 (35)	4384 (5)
35-44	362 (216)	873 (603)	3586 (93)	6166 (20)	370 (24)	606 (46)	1520 (29)	2843 (4)
45-54	364 (164)	955 (397)	3863 (52)	7586 (11)	290 (17)	1400 (19)	1679 (21)	5000 (1)
55-64	338 (133)	690 (218)	2626 (26)	5221 (7)	258 (17)	632 (6)	1525 (4)	-- --
65 and Over	244 (79)	671 (82)	3616 (10)	6645 (4)	62 (6)	150 (2)	883 (3)	-- --

Table A-1 (continued)

DEPARTMENT/	MALE Education				FEMALE Education			
AGE GROUP	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Caldas								
10-19	478 (94)	500 (485)	661 (72)	-- --	238 (4)	393 (60)	1003 (40)	-- --
20-24	633 (61)	691 (357)	1924 (131)	2689 (9)	150 (2)	678 (55)	1304 (110)	2757 (9)
25-29	634 (66)	899 (319)	1954 (119)	5517 (14)	500 (2)	584 (46)	1723 (71)	3957 (7)
30-34	648 (59)	967 (296)	2976 (82)	5355 (19)	406 (8)	535 (33)	1743 (21)	2207 (4)
35-44	716 (146)	1185 (537)	2879 (99)	9806 (27)	313 (8)	764 (64)	1781 (34)	3600 (2)
45-54	964 (124)	1328 (399)	4146 (53)	15425 (8)	736 (9)	676 (38)	1925 (19)	-- --
55-64	780 (73)	1251 (180)	5062 (20)	10000 (5)	193 (6)	682 (6)	2668 (6)	-- --
65 and Over	680 (42)	1266 (66)	5493 (9)	5000 (2)	193 (3)	450 (3)	-- --	-- --
Cauca								
10-19	276 (105)	300 (277)	675 (11)	-- --	126 (5)	394 (41)	911 (7)	-- --
20-24	417 (69)	497 (211)	1162 (51)	3725 (4)	374 (8)	449 (33)	1196 (44)	1807 (3)
25-29	388 (48)	558 (197)	2089 (51)	4359 (15)	333 (9)	614 (19)	1476 (34)	3900 (2)
30-34	537 (54)	692 (184)	2100 (43)	5244 (9)	258 (6)	524 (30)	1359 (23)	4200 (3)
35-44	474 (126)	794 (335)	2607 (40)	7000 (10)	314 (21)	646 (33)	2085 (18)	-- --
45-54	387 (86)	913 (205)	2160 (28)	10652 (6)	436 (16)	546 (24)	2545 (13)	-- --
55-64	421 (51)	701 (112)	1664 (8)	4302 (5)	309 (13)	356 (11)	1986 (2)	-- --
65 and Over	467 (34)	769 (43)	938 (4)	5000 (1)	246 (5)	133 (3)	1493 (2)	-- --
César								
10-19	832 (71)	643 (98)	1156 (9)	-- --	581 (9)	360 (25)	1356 (12)	-- --
20-24	818 (54)	958 (126)	1455 (43)	7500 (2)	300 (3)	955 (18)	1504 (34)	3500 (2)
25-29	1177 (44)	1060 (123)	1861 (49)	6538 (13)	248 (3)	633 (15)	1586 (12)	-- --
30-34	896 (43)	1265 (101)	4169 (30)	12429 (7)	624 (8)	724 (12)	3350 (4)	4620 (2)

Table A-1(continued)

DEPARTMENT	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
35-44	1086 (86)	1396 (158)	3627 (31)	9817 (3)	664 (11)	1047 (18)	2250 (7)	-- --
45-54	726 (70)	1393 (114)	3272 (25)	15000 (1)	500 (5)	600 (7)	3633 (4)	-- --
55-64	846 (39)	1992 (41)	2360 (5)	2600 (1)	550 (8)	839 (3)	1200 (2)	-- --
65 and Over	1103 (15)	633 (6)	738 (4)	3000 (1)	200 (1)	-- --	6000 (1)	-- --
Córdoba								
10-19	386 (201)	463 (256)	1029 (16)	-- --	149 (18)	359 (43)	1021 (20)	-- --
20-24	515 (191)	618 (271)	1169 (62)	1750 (4)	531 (16)	387 (35)	2486 (63)	3700 (1)
25-29	545 (121)	896 (198)	3147 (57)	8086 (5)	487 (9)	630 (24)	1566 (29)	2117 (3)
30-34	487 (133)	894 (175)	3059 (42)	6938 (8)	250 (8)	716 (23)	1756 (16)	-- --
35-44	611 (256)	1033 (275)	2783 (64)	8215 (12)	445 (31)	871 (21)	4588 (13)	2610 (2)
45-54	729 (186)	1213 (168)	4545 (30)	7660 (10)	290 (19)	1153 (14)	2210 (6)	3800 (1)
55-64	562 (118)	1168 (69)	5578 (17)	4850 (4)	563 (5)	1100 (3)	1954 (5)	-- --
65 and Over	1879 (62)	1167 (34)	2400 (6)	-- --	425 (6)	500 (1)	-- --	-- --
Cundinamarca								
10-19	332 (148)	375 (712)	940 (77)	-- --	228 (9)	360 (91)	782 (44)	-- --
20-24	448 (118)	529 (581)	1360 (137)	2760 (10)	167 (3)	497 (79)	1335 (119)	2580 (5)
25-29	536 (106)	797 (529)	1670 (120)	4565 ((26)	467 (6)	683 (46)	2200 (78)	2814 (7)
30-34	572 (111)	775 (504)	2179 (98)	3478 (23)	341 (9)	736 (35)	1938 (38)	1955 (7)
35-44	546 (286)	927 (890)	2855 (131)	8375 (18)	372 (29)	906 (68)	2128 (50)	-- --
45-54	523 (232)	929 (642)	3296 (78)	5899 (14)	771 (22)	931 (43)	1585 (30)	4200 (1)
55-64	611 (197)	1084 (344)	3084 (37)	5227 (9)	881 (10)	591 (15)	2061 (9)	-- --
65 and Over	516 (115)	878 (108)	2365 (17)	8767 (3)	262 (12)	616 (7)	2000 (2)	-- --

Table A-1 (continued)

DEPARTMENT/ AGE GROUP	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Choco								
10-19	94 (57)	332 (41)	1125 (4)	-- --	27 (30)	146 (8)	2 (2)	-- --
20-24	209 (29)	380 (48)	1257 (23)	-- --	245 (8)	25 (13)	1572 (19)	2040 (1)
25-29	280 (17)	593 (39)	1793 (22)	3819 (2)	77 (24)	301 (17)	1400 (15)	-- --
30-34	265 (21)	816 (43)	2409 (16)	10000 (1)	23 (19)	285 (9)	1128 (5)	8000 (1)
35-44	332 (63)	815 (76)	1942 (15)	7782 (8)	63 (49)	291 (14)	2219 (10)	-- --
45-54	284 (56)	808 (53)	2168 (9)	2900 (2)	112 (36)	661 (5)	1296 (4)	2500 (1)
55-64	266 (40)	963 (34)	1800 (1)	7000 (1)	194 (23)	300 (3)	2000 (3)	-- --
65 and Over	285 (24)	1156 (25)	1500 (1)	-- --	105 (18)	-- --	-- --	-- --
Huila								
10-19	326 (76)	385 (259)	975 (28)	-- --	176 (5)	388 (40)	805 (35)	-- --
20-24	762 (62)	579 (216)	1567 (67)	3443 (7)	583 (3)	549 (29)	1258 (65)	4375 (4)
25-29	498 (53)	750 (231)	2366 (65)	4911 (11)	243 (3)	538 (18)	1516 (37)	2867 (3)
30-34	647 (62)	835 (221)	2535 (36)	7258 (9)	264 (5)	413 (14)	1697 (23)	-- --
35-44	735 (156)	1095 (371)	4306 (45)	5664 (7)	451 (9)	1180 (36)	2108 (17)	1500 (1)
45-54	731 (128)	1250 (219)	3316 (28)	8285 (9)	951 (7)	1454 (18)	2011 (13)	-- --
55-64	1532 (85)	1234 (120)	2056 (9)	13080 (1)	594 (8)	531 (10)	1500 (10)	-- --
65 and Over	499 (42)	1053 (44)	3333 (3)	4150 (2)	117 (3)	500 (1)	825 (2)	-- --
La Guajira								
10-19	722 (9)	774 (44)	1260 (5)	-- --	230 (3)	445 (17)	933 (7)	-- --
20-24	686 (11)	859 (53)	2108 (26)	3000 (1)	300 (2)	475 (6)	1666 (24)	-- --
25-29	868 (11)	1595 (47)	2683 (32)	5333 (3)	670 (2)	859 (7)	2011 (10)	3500 (1)
30-34	976 (17)	1534 (33)	3024 (17)	5333 (3)	1150 (2)	1387 (11)	1759 (9)	-- --

Table A-1   (continued)

DEPARTMENT	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
35-44	795 (20)	2880 (70)	3375 (24)	12000 (1)	438 (2)	786 (7)	2108 (9)	-- --
45-54	585 (14)	1316 (33)	3600 (11)	15500 (2)	247 (3)	836 (5)	1982 (4)	-- --
55-64	1875 (12)	1207 (11)	3023 (4)	-- --	200 (2)	-- --	-- --	-- --
65 and Over	690 (5)	1567 (3)	3750 (2)	-- --	900 (2)	-- --	1500 (1)	-- --
Magdalena								
10-19	514 (149)	633 (111)	930 (21)	-- --	190 (5)	327 (23)	1100 (16)	-- --
20-24	605 (103)	784 (188)	1329 (71)	1700 (4)	601 (8)	453 (18)	1345 (61)	1800 (1)
25-29	714 (87)	864 (184)	1691 (58)	4480 (5)	313 (4)	1344 (12)	1711 (39)	4030 (2)
30-34	683 (95)	996 (141)	3196 (54)	6486 (7)	697 (6)	669 (16)	2173 (26)	5000 (1)
35-44	862 (168)	1411 (247)	3239 (84)	8260 (10)	473 (13)	1172 (32)	1691 (35)	3067 (3)
45-54	771 (105)	1351 (154)	3395 (46)	7156 (11)	440 (9)	895 (16)	2591 (7)	5500 (2)
55-64	749 (76)	1086 (64)	4193 (18)	6286 (7)	183 (4)	1775 (4)	2046 (1)	-- --
65 and Over	927 (33)	2424 (41)	2339 (10)	-- --	200 (1)	900 (6)	1700 (2)	-- --
Meta								
10-19	454 (34)	517 (146)	865 (30)	-- --	250 (2)	425 (22)	1120 (17)	-- --
20-24	602 (22)	810 (139)	1633 (52)	-- --	250 (2)	730 (23)	1466 (40)	1700 (1)
25-29	721 (34)	1013 (138)	2800 (55)	3900 (5)	483 (3)	593 (15)	1757 (19)	4400 (2)
30-34	530 (37)	1271 (123)	2960 (37)	9640 (10)	250 (1)	1030 (10)	2036 (11)	-- --
35-44	817 (75)	1216 (203)	2993 (42)	5507 (6)	1269 (7)	1002 (22)	1553 (10)	-- --
45-54	792 (53)	1591 (97)	7984 (16)	7000 (3)	267 (3)	2061 (11)	1860 (9)	5000 (1)
55-64	1124 (29)	1576 (47)	2629 (7)	-- --	360 (2)	-- --	-- --	5000 (1)
65 and Over	941 (23)	778 (13)	9000 (1)	4250 (2)	-- --	-- --	-- --	-- --

Table A-1 (continued)

DEPARTMENT/ AGE GROUP	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Nariño								
10-19	242 (129)	242 (517)	665 (27)	-- --	203 (18)	175 (131)	973 (21)	-- --
20-24	295 (97)	392 (422)	1158 (84)	1811 (9)	373 (15)	245 (89)	1389 (55)	3250 (2)
25-29	319 (108)	446 (384)	1531 (62)	4926 (18)	224 (9)	344 (66)	1502 (37)	3141 (8)
30-34	327 (103)	571 (319)	2392 (38)	6757 (13)	147 (16)	449 (54)	1935 (30)	3436 (7)
35-44	672 (208)	849 (550)	2595 (70)	6627 (9)	246 (39)	396 (100)	1842 (24)	4750 (2)
45-54	363 (141)	589 (367)	2337 (46)	8612 (7)	165 (36)	807 (79)	1245 (8)	3500 (1)
55-64	319 (82)	503 (237)	4287 (19)	6000 (3)	237 (17)	248 (32)	2488 (8)	-- --
65 and Over	285 (62)	402 (111)	1427 (3)	-- --	106 (23)	487 (10)	400 (1)	-- --
Norte de Santander								
10-19	413 (182)	353 (422)	701 (54)	-- --	250 (10)	429 (78)	793 (42)	-- --
20-24	413 (105)	657 (362)	1376 (103)	3557 (10)	243 (10)	552 (47)	1235 (88)	2186 (10)
25-29	545 (98)	821 (327)	1882 (93)	4860 (18)	250 (5)	588 (47)	1609 (57)	3033 (6)
30-34	507 (76)	864 (275)	3017 (72)	7332 (12)	292 (6)	493 (27)	1863 (27)	3801 (5)
35-44	605 (219)	1218 (468)	3866 (91)	8544 (18)	441 (15)	737 (53)	3222 (35)	5060 (1)
45-54	621 (147)	1354 (286)	2805 (41)	7771 (7)	487 (8)	723 (31)	1475 (16)	-- --
55-64	541 (108)	1156 (160)	4562 (22)	6190 (6)	252 (13)	2024 (7)	1500 (5)	-- --
65 and Over	464 (59)	767 (71)	2160 (5)	2458 (1)	183 (4)	410 (5)	2400 (2)	-- --
Quindío								
10-19	400 (26)	459 (235)	577 (44)	2000 (1)	213 (3)	360 (30)	626 (29)	1475 (1)
20-24	464 (24)	640 (173)	1302 (90)	1986 (10)	285 (2)	573 (32)	1171 (40)	2085 (6)
25-29	613 (32)	932 (140)	2095 (57)	3723 (14)	350 (5)	512 (23)	1562 (29)	2984 (7)
30-34	575 (28)	1271 (132)	2821 (42)	4700 (2)	350 (2)	526 (17)	2220 (19)	3650 (2)

DEPARTMENT	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
35-44	628 (65)	1325 (244)	3422 (65)	8718 (17)	248 (12)	519 (38)	1952 (18)	5750 (2)
45-54	1752 (58)	1729 (167)	3380 (50)	13000 (4)	594 (5)	606 (16)	3357 (3)	-- --
55-64	620 (30)	1349 (88)	3689 (18)	40000 (1)	483 (3)	542 (6)	850 (2)	-- --
65 and over	456 (21)	1324 (37)	950 (4)	-- --	400 (1)	-- --	-- --	-- --
Risaralda								
10-19	516 (48)	488 (312)	848 (65)	1200 (1)	412 (5)	552 (64)	962 (43)	-- --
20-24	641 (40)	727 (264)	1316 (103)	3500 (7)	325 (2)	668 (66)	1131 (81)	3992 (9)
25-29	676 (33)	1112 (224)	1944 (110)	6152 (18)	190 (2)	709 (63)	1136 (49)	3389 (9)
30-34	697 (53)	1173 (220)	3238 (59)	6323 (19)	423 (4)	1135 (35)	1696 (19)	4880 (5)
35-44	699 (93)	1429 (350)	4470 (94)	8515 (10)	593 (8)	810 (57)	1802 (25)	2950 (2)
45-54	764 (63)	1344 (271)	3584 (43)	9003 (9)	556 (9)	1424 (32)	1838 (11)	-- --
55-64	714 (45)	1536 (136)	2714 (21)	5500 (2)	-- --	1625 (10)	4000 (1)	-- --
65 and over	552 (21)	1069 (63)	6950 (10)	-- --	-- --	200 (2)	1800 (1)	-- --
Santander								
10-19	314 (186)	336 (751)	683 (91)	-- --	214 (21)	332 (172)	820 (105)	-- --
20-24	391 (131)	664 (624)	1509 (190)	3367 (28)	323 (17)	633 (114)	1211 (204)	2325 (15)
25-29	444 (159)	784 (540)	1957 (185)	4901 (34)	325 (18)	652 (95)	1491 (99)	3879 (18)
30-34	508 (138)	1080 (502)	3488 (125)	6832 (40)	341 (19)	794 (66)	2044 (68)	3630 (3)
35-44	532 (327)	1194 (891)	3973 (166)	8734 (37)	315 (51)	794 (106)	2087 (74)	5450 (4)
45-54	513 (313)	1533 (532)	4128 (77)	9189 (18)	344 (32)	726 (54)	1761 (21)	-- --
55-64	514 (211)	1084 (262)	4376 (45)	10000 (1)	294 (15)	1043 (22)	1955 (12)	5600 (1)
65 and over	456 (115)	981 (104)	7507 (12)	3500 (1)	133 (7)	1055 (14)	589 (2)	-- --

DEPARTMENT	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Sucre								
10-19	373 (116)	448 (97)	1425 (12)	-- --	393 (15)	436 (14)	1018 (14)	-- --
20-24	530 (95)	717 (93)	2098 (35)	2435 (2)	379 (7)	447 (22)	1330 (36)	3600 (1)
25-29	639 (59)	905 (84)	2752 (34)	3375 (6)	297 (9)	761 (14)	1575 (18)	2685 (2)
30-34	624 (69)	942 (68)	2963 (33)	7172 (6)	481 (10)	626 (16)	1733 (3)	4000 (1)
35-44	564 (114)	931 (127)	2682 (30)	7086 (7)	529 (9)	650 (7)	2574 (6)	-- --
45-54	649 (100)	2416 (83)	3138 (20)	2000 (1)	620 (10)	818 (5)	1900 (1)	-- --
55-64	622 (66)	1565 (44)	17490 (5)	-- --	417 (6)	750 (2)	-- --	-- --
65 and over	795 (35)	1268 (19)	5270 (6)	500 (1)	1050 (4)	900 (1)	-- --	-- --
Tolima								
10-19	384 (163)	431 (467)	837 (66)	-- --	348 (5)	339 (36)	797 (62)	-- --
20-24	483 (110)	608 (442)	1338 (122)	3011 (7)	414 (8)	479 (59)	1354 (129)	2867 (3)
25-29	629 (93)	850 (358)	2032 (102)	4778 (27)	397 (6)	675 (35)	1539 (73)	2025 (5)
30-34	615 (106)	1035 (364)	3580 (79)	5730 (22)	233 (6)	728 (35)	1707 (34)	2698 (2)
35-44	918 (251)	1208 (579)	3727 (115)	9797 (18)	339 (12)	828 (48)	2022 (39)	4133 (6)
45-54	856 (187)	1329 (393)	2901 (68)	23033 (9)	406 (18)	467 (18)	1738 (19)	-- --
55-64	991 (157)	1231 (209)	3890 (23)	5667 (3)	560 (12)	478 (14)	1648 (4)	-- --
65 and over	981 (76)	1895 (82)	4363 (4)	-- --	385 (6)	1575 (2)	-- --	-- --

Table A-1 (continued)

DEPARTMENT	MALE Education				FEMALE Education			
	NONE	PRIMARY	SECONDARY	HIGHER	NONE	PRIMARY	SECONDARY	HIGHER
Valle								
10-19	427 (263)	525 (1250)	890 (388)	1500 (3)	421 (31)	478 (261)	972 (244)	1986 (7)
20-24	637 (204)	868 (1183)	1360 (673)	3287 (66)	472 (13)	641 (290)	1295 (476)	2630 (52)
25-29	592 (139)	1042 (1168)	2192 (589)	5874 (126)	638 (24)	808 (231)	1899 (265)	3968 (44)
30-34	729 (181)	1174 (1097)	3171 (389)	8426 (120)	459 (26)	859 (204)	1963 (138)	4608 (16)
35-44	756 (365)	1449 (1892)	3990 (562)	11955 (121)	470 (55)	1035 (335)	2483 (177)	6952 (15)
45-54	787 (313)	1560 (1273)	4071 (281)	12215 (64)	524 (46)	1048 (141)	2748 (65)	3219 (5)
55-64	669 (173)	1495 (598)	4683 (104)	10243 (28)	350 (14)	1185 (47)	2594 (20)	-- --
65 and over	630 (117)	1261 (237)	3035 (26)	8592 (12)	312 (7)	1441 (21)	2450 (2)	-- --