PB-219 748

SOME EVIDENCE ON EDUCATIONAL RELATIONSHIPS IN CHILE

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November 1972

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SHEET	CI-37Ø.Ø983-G618	PB-219 748
"Some Evidence on Educational Relationships in Chile"		Nov 72
Marsha Goldfarb		
Yale University. Economic Growth Center New Haven, Conn. 06520		Proj. 931-17-995-511 AID/csd-2492
Department of State Agency for International Development Washington, D.C. 20523		Education Report 6/69 - 11/72

15. Supplementary Notes

16. Abstracts

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17. Key Words and Document Analysis. 17a. Descriptors

17b. Identifiers/Open-Ended Terms

*Educational development, ~~*Chile~~, (*Education, Socio-economic aspects,) ~~Chile~~)
*Wages, ~~Chile~~)

17c. COSATI Field/Group 370

18. Availability Statement	19. Security Class (This Report) ~~UNCLASSIFIED~~	21. No. of Pages 60
	20. Security Class (This Page) ~~UNCLASSIFIED~~	22. Price

Some Evidence on Educational Relationships in Chile*

by

Marsha Goldfarb

November 1972

Summary

Goldfarb's report presents the results of two empirical investigations involving education in Chile. The first study estimates the importance of school and non-school variables to dropout rate differences among schools. The second study evaluates the impact on worker earnings of formal education, on the job training, other personal characteristics of the worker, and characteristics of the firm at which the worker is employed. The workers studied reside in Santiago and are employed in manufacturing.

The report begins by discussing sources of the rapid growth in school enrollments observed in most countries in recent decades. This expansion can be attributed to:

1) A rising private demand for education spurred by the belief that education leads to better jobs.

2) An increased supply of school slots provided by government: governmental motivations include a belief that more education may be a prerequisite for fulfilling a development plan; that the education sector provides needed employment; that it generates valuable externalities.

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Yet these arguments have many loopholes, and raising educational levels in the face of mounting unemployment may divert resources from more productive uses. Educational planners ought, therefore, to have better notions of the costs, benefits, and production technologies of education before diverting more resources into its production.

The report's two studies provide exploratory analyses to improve knowledge of costs, benefits and production technology in education in Chile. In the first study we predict school dropout rates for schools in the private sector. It is assumed that dropout rates are functions of the quality of schooling (which includes both the quantity and quality of both physical facilities and teachers), the student's family income, direct costs of schooling to the student, opportunity costs of schooling, and other variables. The results for urban schools show that schools with better facilities have significantly lower dropout rates, and that family income measures are important. Differences in teacher quality, student-teacher ratios, scholarship availability, social class background of the students (except for upper class), and most other variables made little difference in dropout rates. For rural schools variables which are thought to be proxies for family income seem to have the largest impact on dropout rates, and opportunity cost variables are also important. While the data are too crude to use as a basis for making strong policy judgments, the study does suggest that the Educational Ministry's abilities to influence years of education may be stronger on the school facilities side than on the teacher resources side.

The second study uses hitherto unpublished data to compare the effects of years of education to the effects of a number of other human capital and other variables on worker earnings in Santiago. The sum of worker's basic earnings plus fringe benefits (both pecuniary and in kind) are regressed against years of formal education, diploma effects, educational tracking, whether the worker has had special training programs, age, years at the firm, union membership, migration, marital status, health, industry of employment, and size of firm variables. The sample of 2877 workers was stratified into subsamples of male white collar, male blue collar, female white collar, and female blue collar workers.

The results show that worker incomes are most reliably associated with worker experience, age, and years at the firm (seniority). Education variables have mixed effects: years of education have a major impact only on the earnings of male white collar workers, but diploma effects and educational shift variables measuring vocational tracks are occasionally statistically significant for the other three subsamples. The regressions confirm expectations about the effect of marital status and firm size on earnings, and indicate that special training programs often do and union membership does not work to raise workers' expected incomes. An important result is that, if education is used to statistically "explain" income without controlling for age, seniority and other differences, the return to education will seem considerably larger than it may in fact be. That is, simpler studies of the return to education may well overstate its income benefits.

Yet these implications are suspect for a wide variety of reasons:

1. Since education is very highly subsidized, the private educational costs to students (and their families) is only a fraction of the true cost to the country of providing education. Thus private rates of return may well be much higher than social rates of return.

2. Even if we argue that private rates of return approximate social rates of return, the calculation ignores the income distribution effects of subsidizing secondary and university education. Since a large percentage of the students going on to secondary and higher education are likely to be from the upper and upper-middle classes, government resources are being used to subsidize relatively well-off individuals.[2]

3. Rates of return to education may be overstated if the evaluator mis-specifies the income-estimating function by omitting important labor market variables with which education may be correlated. If high wage industries happen to have strong human and physical capital complementarities in production, omission of an industry or capital variable may overstate the apparent return to education. If access to income-enhancing skill training programs happens to be correlated with education, part of the effect of these programs will be attributed to formal education if the effect of these programs is not held constant.

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[2]Worse yet, suppose that richer individual's demand for higher education is relatively price-inelastic. Then cost subsidies to richer individuals do not increase very much the total educational output of the country. These subsidies are almost a pure income redistribution towards the rich.

4. On the other hand, rate of return calculations are allegedly biased too low because they ignore important benefits. For example, there may be a consumption component to education, and education may induce a sense of self-accomplishment. It may permit psychic returns from being able to pursue a more pleasant or prestigious occupation; and it may make an individual better able to face disaster and adversity, better able to protect himself from unscrupulour landlords or others, more aware of new developments from which he can profit, and less at the mercy of natural calamities, etc. But while there may be many advantages to education which rate of return calculations fail to capture, there is also the danger that education may lead to certain expectations (of jobs, of income levels, of personal happiness) which will be impossible to fulfill.

What are these expectations that increased education may be unable to fulfill? For one thing, the expected private rate of return calculated from today's data may not be the rate of return actually received tomorrow. A high rate of return today may result in a large increase in the number of persons getting more education today. This large increase in educated labor will in turn lower the marginal productivity of labor, hence its wage; thus actual rates of return will fall below expected rates. This can be avoided only if economic growth happens to be so rapid and labor-using that all the newly trained workers are absorbed at high wages. Historical experience in economies like India and Chile indicate that this is unlikely to be

the case. In particular, what we observe is that the rate of unemployment and underemployment among more educated workers is steadily rising.

5. Rate of return calculations are notorious for failing to adjust the return by the probability that a worker will be unemployed. Yet if educated manpower creation is outpacing job creation, then there will be some type of unemployment. Employer's are in a position to choose qualified workers from among many job seekers; if the employer derives a consumption benefit of his own from hiring a person high on the education ladder (even though the person, objectively, is overqualified) or (more plausibly) if he believes that the risk of his hiring a dumb, untrained, or lazy worker declines as the educational level of the new hire rises (because the new hire has "demonstrated" that he is trainable, intelligent, and industrious by obtaining an education), then the employer will hire better educated workers over less educated workers and educational standards for a given job will rise as the supply of educated labor rises.

Thus, if there is a job shortage, the best defense that a young adult has against losing out in the job lottery may be to "outqualify" his future competitors by getting more education. Suppose educational prerequisites for jobs are becoming inflated; if we could wave a magic wand and lower everyone's education by the percent by which they were overqualified for their present (and future) jobs, the country would lose no output, and wages determined by marginal productivity would be unchanged. That is, the country could have foregone the amount of education the wand took away, and used the real resources saved for other, more productive

purposes. This is true even though private rates of return as usually calculated are positive and high. Notice that this "job competition" world creates a high private demand for education. And, even though we are getting an increasingly overeducated labor force, the government's short run political survival may require it to meet this private demand rather than invest the education budget into projects (it knows are more socially productive.).

We stared out to give some reasons why educational enrollments have risen so rapidly. Thus far, we have discussed why private demand for education has been growing, and have questioned the social desirability of meeting that demand. Why then do governments generally expand their educational systems? Two explanations were suggested above: requirements of shortrun political necessity, and a failure to perceive the actual productivity of educational investment. In addition, there are three other reasons why governments might wish to expand enrollments.

B. Governments may sometimes justify expanding education as a crucial input into a development plan. This is, the use of resources for education is seen as essential to growth. Governments usually rationalize expansions of the educational sector on the grounds that it provides the skilled human resources which will be needed to meet the goals of the national development plan. Thus, assuming the development plan is feasible and likely to be met, and further assuming that the skills needed to fulfill this plan actually depend on formal education in the way manpower plans assume, increasing the educational levels of

the future work force becomes a vital input to growth. While there may be something to this, the usual arguments may be specious for several reasons. First of all, the lockstep between formal education and growth-generating skills has never been fully demonstrated. Some skills--medicine, civil engineering, etc.--are taught in schools, but many are not. Skills in the manufacturing-production sense are often learnable on-the-job. Furthermore, even for those skills learned in school, merely increasing the number of slots will not necessarily provide for much of an increase in skill-levels where they are needed; for example, raising the number of medical doctors trained may result in an increase in out-migration of doctors or an increased concentration of doctors in already "doctor-surplus" areas.[3] Other skills which may be growth-promoting might be more efficiently taught outside the school system altogether. Thus the development plan argument for expanding education is in no sense foolproof.

While the development plan justification has something in common with governmental belief that private demands are correlated with social productivities, these two arguments are conceptually distinct. Thus a government may believe that an increase in the present supply of educated labor will have little or no present social productivity, but will make it possible to achieve a faster rate of growth in the future. Because a development plan often promises a spurt in growth, having "too-educated"

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[3] In Chile, (and probably in many other countries also), nearly half the graduates of teacher training schools never enter teaching.

labor around may help to prevent bottlenecks in the achievement of the development plan's objectives.

C. A second reason why governments may expand school enrollment levels is to provide employment for graduates. Education is mostly a publicly provided service, and at its lower levels it has an exceedingly low capital-labor ratio. In the face of growing numbers of educated unemployed, it is certainly expedient in the short run to absord some of these people into teaching. Yet unless the government can expand overall employment opportunities, this policy will merely increase the supply of educated workers with high job expectations in the future.

D. A final justification for expanding educational opportunities is that education provides important external benefits to the citizenry. For fractionated, pluralistic, multilingual societies, schools may be a useful device for promoting a sense of unified nationhood, cultural homogeneity, and patriotism. Schools can be used to install ideals which promote political stability. Schools can also be a means for raising the nutritional and medical levels of the citizenry. Yet there are counter-arguments to the effect that education will promote regional or tribal loyalties, that students may come into contact with ideas antithetical to the ideals of their leaders, and that students will be both more demanding of what they expect from their education and better able to stir up trouble if their demands are not met. Finally, the more highly educated younger generation will begin to demand more and more of the political

action controlled by their less formally educated elders, implying a power struggle with an older generation not yet willing to give up power. Therefore, education can be distabilizing rather than stabilizing.[4]

We have argued that it is difficult to determine whether education is a socially productive investment. To even begin to meaningfully evaluate the contribution of education, however, we need a great deal more information about a variety of basic relationships than is presently available. One such crucial relationship is between costs and measurable outputs of education (reading scores, number of graduates per unit cost, etc.). For example, even if we knew that the real social marginal productivity of an additional graduate was X escudos, we would still need to know the real resource cost of producing this graduate before we could make the appropriate benefit-cost calculation. The information contained in private rate of return studies is only one of the elements needed in such a calculation.

Besides the link between real input cost and real output of graduates, second type of crucial relationship involves the causal tie between extra education and increased productivity. We have already expressed some skepcicism about the correctness of interpreting private returns as social returns. It is nonetheless true that better estimates of private returns can give us more insights into social returns than

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[4]David Abernethy and Trevor Coombe, "Education and Politics in Developing Countries", Harvard Educational Review, (35,3), Summer, 1965 pp. 287-302.

can worse estimates of private returns.[5] In particular, many of the existing studies fail to control for a number of factors which influence an individual's earnings and therefore these studies may overstate private returns to formal education.

We have singled out these two kinds of relationships for special mention because we are about to present the results of new analyses fitting into these two categories. Obviously there are other types of studies which would be extremely useful in providing the basic information needed to make better educational planning decisions. Carnoy and Levin,[6] have developed a four category framework which includes most of the information needs crucial for systemtic educational planning. Their categories embody information on:

1) Real societal costs of education. Private costs to households, opportunity costs to families and society, and various educational subsidies are all investigated here.
2) Monetary costs of education
3) Educational production relationships.
4) The social and economic value of educational outputs.

The two areas we look into fall into Carnoy's and Levin's categories 3 and 4.

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[5]For example, suppose that acursory study finds private returns are 20% but that a thorough study would show that private returns were 4%. Clearly, even if private returns overstate social returns, the second study has far different social investment implications than does the first.

[6]Martin Carnoy and Henry M. Levin, "A Systems Approach to Research for Educational Development in Venezuela", 25 November 1970, (mimeo).

II. A Study of the Dropout "Problem"

In order to link input costs of education to outputs of education, we need to know what factors affect the dropout rate. If $X of extra costs result in 10 new students per year, six of whom drop out, the relation between the $X of costs and graduates produced will be different than if only one person drops out.[7] Since many school systems in the LDC's have sizeable dropout and repeater rates, ignoring this link between inputs and outputs will lead to incomplete understanding of production processess. Moreover, if we can isolate the factors causing differential dropout behavior, we may be able to manipulate variables to reduce the

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[7] Similarly if there is a change in some factor to which dropout rates are very sensitive, the failure to recognize the impending change in school enrollment patterns may catch the education ministry unprepared to reallocate resources in appropriate directions. Consider the following simplistic example. Suppose that a new factory opens up in a particular area, greatly increasing employment. Several conflicting things could happen. (1) The new jobs created by the opening of the factory raise the opportunity cost of going to schoo, so students drop out in greater than usual numbers to take jobs. Teachers languish with too few students to teach. (2) Parents and older brothers and sisters take jobs in the factory, so family income rises. Now students can afford to stay in school longer, or pay a larger percentage of the true costs of their education. The dropout rate falls, class size swell, usage of school facilities and demands on libraries, textbooks, etc., increase to and beyond the full capacity point. The Ministry has to quickly expand the school's resource base. The point is that the Ministry of Education needs to have good information about which factors cause school-leaving if it is to respond quickly (efficiently) to large changing demands.

dropout rate.[8]

A complete study of the determinants of dropping out would have to look very closely at the microeconomic decisionmaking of individual household units. To begin with, assuming that there are school facilities available, the family must make a detailed calculation of the costs and potential benefits to the family from an additional year of education. To a family with restricted financial resources, there are many types of costs to consider: the family may have many children to educate, so that sending one child for "more" schooling perforce means that there is less money to pay for the schooling of other children. An "equitable" amount of schooling for all children may mean very little education for any one of them, implying poor job-acquiring power for each in the future. There are the costs of tuition, books, uniforms, and transportation to consider. There is the cost of foregone income; a child who might otherwise go to school might be needed as labor on the family farm or business. It seems

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[8] It is not always true that dropping out (usually called "Student wastage") is an unmitigated bad; students may drop out of one school in order to enroll at another school or they may drop out when job market conditions make it more beneficial in a long term sense to go to work than to go to school. While we cannot be completely successful in dealing with these possibilities given our data, our results are still useful. These results should show whether dropouts are sensitive to certain controllable school inputs. If individuals drop out solely for labor market considerations, our educational variables should show up as insignificant. On the other hand, if students drop out to enroll in schools with better facilities this should show up in our regressions and this will have implications for cost-effectiveness.

plausible that the costs of education to a family will decline--and hence the probability of dropping out at low grades should decline--a) the higher the family income, b) the larger the amount of tuition subsidized by the state, c) the lower are book, lunch, and clothes costs, d) the closer the proximity of the school,e) the fewer the number of children in the family, f) the more widely spaced the age distribution of children in the family, and g) the lower the opportunity cost to the family of providing that education.

There are many types of returns to education. There is the direct return in earnings associated with higher educational opportunities, and the greater choice of jobs yielding nonpecuniary satisfactions to the workers. For children of either sex, more education may enhance the child's (and hence the family's) pospects in the marriage market. In urban areas the job earnings which persons of different levels of education can expect will depend on the size and strength of the wage-income/education relationship and economic factors dictating the rate at which jobs are growing relative to the growth in the size of the labor force.

In rural areas, returns from education should be related to a) opportunities outside of farming itself which are profitable and for which education (or functional literacy) is a prerequisite, such as retailing, commerce, or money-lending, b) the availability of land, the availability of capital, and c) the structure of land tenure in the rural area. The demand for education ought to be higher if the student thinks that he will be able to get land of his own to farm. Finally, rural folk

always have the alternative of migrating to urban areas; school retention should rise if the student feels the need to tool up before trekking to the city. Alternately, dropout rates may be higher if the student intends to get more education in the urban area, where, after all, schools are not only likely to be better, but there are likely to be more of them.

There is some evidence for Chile on the degree to which migration depends on a desire to obtain better educational opportunities. Of a sample of 2877 workers in Santiago 1226 were migrants, but only 569 of these were below the age of twenty (which is a high upper limit to the age of the potential primary and secondary school population) when they arrived. Of these 569, 409 did not enter schools when they reached Santiago and of the remainder, about two dozen were below school entry age when they arrived. Another 10 or 15 came as graduates of secondary schools to enter the universities in Santiago directly. Therefore, most dropping out of school for migration to Santiago is clearly not done primarily to obtain better primary or seconcary schooling.

There may also be attitudes towards education correlated with the family's socio-cultural status, as distinct from its economic status. But the emphasis of the above discussion on dropout phenomena is on family decision variables and "economic opportunity" variables. In a cross section we might also expect the quality and the quantity of the school services available to affect the demand for education in that school because we expect the quality of schooling to influence future educational and income prospects.

The Dropout Model: Because the analysis must be based on data which is available, rather than on better data which is not, certain simplifications must be made. There are sins of omission--variables which must be included in a fully comprehensive model explaining dropout behavior but which must be deleted here because no measures exist--and sins of simplification--crude proxies must substitute for more precise or sophisticated but (also) unavailable measures. Thus, the model which we actually explore is of the form

$$d_j = d(S_j, T_j, A_j, F_j, E_j)$$

where d_j = the dropout rate for school j in the year 1966.

S_j = the vector of school characteristics which may have an effect on dropout rates. Examples of such variables include the availability of teaching supplies, textbooks, library books, maps, and the availability of science laboratories, studios, shops and office equipment, age of building, and quality and quantity of sanitary facilities. We might expect better facilities to indicate that a higher quality schooling is being offered, and thus that both the consumption benefits and the labor market benefits (better jobs, enhanced probabilities of getting into higher levels of formal schooling) would imply lower dropout rates.

T_j = the vector of teacher characteristics in school j which may have an effect on dropouts. Examples include the teacher-

student ratio, average teaching experience in years, distribution of teachers by age, sex or nationality, the educational qualifications of the teachers in the school, and the number of contact hours which teachers actually have with students in the school. We would expect better trained teachers and smaller class sizes to enhance the value of education and hence lower the dropout rate.

A_j = The vector of administrative and financial characteristics of the school. Since the sample comprises only private schools, these characteristics may vary considerably across schools. Two broad but distinct groups of variables are included:

1) background variables describing the school's religious affiliations, its nature (day school or boarding school) and type of ownership (profit-oriented, non-profit, run by a religious community, etc.), and its level (primary, secondary, academic, vocational).

2) budgeting information about the school. Unfortunately we do not have, for each school, either the size in escudos of its total budget or any breakdown of its cost structure by expenditure class (teacher salaries, rent, equipment, overhead). We do, however, know what percentage of its revenues come from tuition receipts, government subsidies, room and board payments, dona-

tions from Chileans, donations from abroad, and miscellaneous revenues. Thus we should be able to make at least some suggestive judgments, holding quality of facilities and teachers, and social class of students, constant; whether schools which depend heavily on student charges have higher dropout rates than similar schools which are heavily subsidized. Since dependence on tuition and other student charges implies higher direct costs to students, we would expect, other things equal, that dropout rates would rise as the direct costs to the student rise.

F_j = the vector of income and school cost characteristics of the student body. In this group we include three types of variables:

1) a categorical variable describing the socio-economic level of families whose children attend school j. This variable is to be regarded as a proxy variable for family income. We expect that the higher the social class, the less binding the income constraint, and hence the lower the dropout rate.

2) the number of full or partial scholarships and medical and nutritional services available to the students. These variables are expressed as percentages of enrollment. We would expect that for a given quality of

school services provided and a given distribution of school revenues from student charges and outside subsidies and gifts, the larger the percentage of students receiving scholarships to the school, the lower the private cost to needy but worthy students, and hence the lower the dropout rate.

3) We sometimes include the school repetition rate (the percentage of students who are in the same grade two consecutive years) as a private cost variable. A high probability of repeating a grade is a cost in that if the student fails and then returns he will have incurred a second year of direct and opportunity costs with little compensating gain in expected benefits from education.

Unfortunately, the repeater rate may be a very ambiguous variable for the following reason: dropouts may leave school for a variety of reasons, but one of these is surely that he foresees that he is going to fail the grade. If he then re-enrolls the next year, he will be counted as a repeater also (for the following year). Thus, a high dropout rate helps "cause" a high repeater rate. To the extent that this is happening, a high and positive correlation between repeaters and dropouts is hard to interpret casually. Thus, in the analysis to follow, we don't always include the repeater rate as a variable in the dropout rate regressions.

E_j = the vector of variables which attempt to depict the economic situation of the area in which the school is located. Examples include a standard of living index, the sizes of the manufacturing and agricultural labor forces, the degree to which the location of the school is urban or rural, and the rate of population growth.

The data, which pertain to the Chilean private school sector were collected in 1967 by the Centro de Investigación y Desarollo de la Educación (CIDE). The survey was undertaken in order to obtain detailed information about the physical and human resources available in the Chilean private schools. Apparently CIDE did not at that time foresee the potential usefulness of its survey for the kind of analysis reported here. Otherwise CIDE might have tried to gather additional useful information (if this information was in fact obtainable without a full-scale field study). For instance, data about family incomes or father's occupation, and estimate of the number of students dropping out because their families were moving out of the area would have been very useful.

The survey covered 1903 schools and the 11,111 teachers employed in those schools.[9]

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[9] About three-fifths of the schools are located in urban areas and two-thirds are affiliated with the Catholic Church. 28% are secular private schools; 4% are non-Catholic and non-secular. Approximately 10% are boarding schools. About two-thirds charge some tuition, nearly a quarter are free to the student and receive both subsidies and funds from other sources; 7% are financed wholly from private, non-student sources. About three-fifths are primary schools and another fifth are kindergartens. Half of the schools are regarded as serving a middle class student body, nearly half are regarded as serving a lower class student body, only three percent are regarded as upper class schools. Dropout rates range from zero percent to well over 40%, with the average of those reporting dropout rates being about 10%.

Unfortunately, the nonresponse rate was high on some questions, so that the number of schools for which a complete set of observations on all variables was available varied between 720 and 1136 schools, depending upon the particular data set being examined.

Regressions were run using small subsamples of the independent variables. Independent variables which were never significant in early runs were dropped from consideration in later, larger ones. In this way the independent variables data set was distilled from 153 variables to about 36 variables.

Linear regressions were run even though logarithmic forms are more "traditional" in equations with such a large educational production function component; logarithmic forms were avoided primarily because 52 of the independent variables were (1.0) dummy variables. A listing of the full set of variables from which the final variable set was deduced is provided in Appendix A.

Our use of the simple linear form has atleast one major drawback. The regression coefficients imply that the marginal productivity of more of the factor is constant throughout the range of the factor; i.e., there are neither increasing nor declining returns to factors of production.

Analysis of the Regressions:

The basic results of the regression analysis are reported in table 2.

Table 2

Results of Dropout Equations

	(ds) (Repeater Rate Excluded)		(Repeater Rate Included)	
	d_s Urban	Rural	Urban	Rural
Repeater rate			0.2734 (5.42)***	
Facilities:				
Lights	-2.5935 (-2.52)*		-3.0359 (-2.82)**	
Maps	-0.0922 (-1.81)			
Textbooks	-1.9907 (-2.93**)		-1.3761 (-1.89)	
Teacher variables				
Nationality	-2.4391 (-1.45)		-3.5162 (-2.07)*	
Quality "B"				1.4612 (1.20)
Teacher experience		-0.0716 (-1.33)		-0.0711 (-1.33)
Perc LT25	3.3636 (1.86)			
Enrollment variables				
Total enrollment	-0.0021 (-2.17)*			
Cost and revenue variables				
Finances from room or board payments	-0.0210 (-2.14)*		-0.0228 (-2.21)*	
Finances from tuition payments				0.0114 (1.08)
Ratio of tuition scholarships to enrollment	-3.7312 (-1.57)	22.9317 (3.25)**		26.6785 (3.91)*
Other School related variables				
High class	-4.2413 (-2.03)*		-3.4261 (41.56)	-9.7948 (-1.48)
Middle class		1.5451 (1.46)		
Secondary acad.		-8.8227 (-1.27)	2.7052 (2.37)*	4.8644 (1.19)
Vocational, Coeducational				6.1982 (1.80)
Other variables				
Percent LF Manufacturing		0.1734 (2.14)*		.0598 (2.46)*
Percent Urban			-0.0470 (-2.73)**	
Percent CF Agriculture	-0.0361 (-2.24)*			
Population growth rate		-.5783 (-1.61)		-.6869 (-1.72)
Constant	14.420	8.426	11.177	0.799
R^2	.136	.105	0.183	0.146
$f(3f_1, 3f_2)$	7.92***	3.87**	11.22***	3.27***

t-values are given in parentheses.

*** significant at 0.1% level.
** " " 1.0% "
* " " 5.0% "

The listed regressions have several important features. In the first place, overall R^2's are not high, although they are statistically significant. The low R^2's are not surprising for two reasons: first, cross-section data studies in education, even when the data is considerably better than ours, fail to achieve R^2's much above ours.[9] Second, we are forced in many cases to use some very weak proxies for the proper variables; family background variables and economic opportunity variables are especially weak. The information yield from better data might be quite high.

Even with these weaknessess, however, certain results are interesting and suggestive:

1) Facilities are significant in explaining urban dropout rates and teacher variables sometimes are. This is in marked contrast to studies for the U.S., which frequently show that facilities and most teacher variables bear no significant relationship to school outputs.[10]

2) The regressions are far less satisfactory for rural schools than they are for urban schools. This is not surprising, since

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[9]For example, our R^2's are not out of line with ones using "similar" variables reported by James T. Coleman in Equality of Educational Opportunity, U.S. Government Printing Office, 1966, Chapter 3, pp. 217-333.

[10]Coleman, Equality of Educational Opportunity, op. cit.; David J. Armor; School and Family Effects on Black and White Achievement: A Re-examination of the USOE Data and Marshall S. Smith, "Equality of Educational Opportunity: The Basic Finding Reconsidered", both in Frederick Mosteller and Daniel P. Moynihan, On Equality of Educational Opportunity, Random House, 1972.

migration effects are far more likely to greatly affect rural schools (since most migration is from rural to urban areas).

3) Financial variables (such as percent of the student body receiving tuition scholarships) are also significant, but often have the wrong sign. If these variables are reinterpreted as family income indices, however, the signs make good sense. Further studies with better controls for family incomes of students would allow us to see to what extent higher tuition subsidies or other "price" variables holding income constant would lower dropout rates. Since "costs to student" are an important manipulable policy variable, such studies would have a high social yield.

4) One striking result is that differences in the formal educational attainments of teachers never seem to have any relationship to dropout rates in this study. On the other hand, non-Chilean teachers are associated with lower dropout rates, and in both urban and rural areas, more teacher experience seems to be indicate lower dropout rates (although this second relationship is never statistically significant). We will discuss the implications of these results for teacher variables below.

Looking at the results in somewhat more detail, we see that there are a very large number of background and educational variables which appear

not to effect dropout rate distributions at all.

First of all, dropout rates appear to be totally unaffected by the nature of the ownership of the school: private, nonreligious, profit-making schools (whether owned by an individual or a corporation), schools run by local religious authorities or bodies, and schools run by international religious communities all seem to have similar dropout rates. Neither do various gross size of enrollment to population variables have any effect. Note also that both the level of the school (primary, vocational, liceo) and its composition (boy's school, girl's school, coeducational) have at most very minor implications for the dropout rate distribution.

Second, neither class size, teachers' sex, nor the educational qualifications of teachers appear to have any important effect on dropout rates. If this conclusion is valid, it has important implications both for teacher wage policy and hiring policy.

The first implication is that, to the extent that planning authorities weight the lowering of dropout rates heavily in their objectives, simply hiring either more or better educated teachers will not be an efficient way to lower these ratios. Put another way, were the Chilean government of a mind to expand the number of teachers as an employment creating mechanism, it could not use the argument that more teachers per pupil will lower dropoutism as a reason for the hirings.[11] The second implication is

[11] Most studies for the United States show similar class-size non-effects on achievement scores.

that, to the extent that teachers should be rewarded for lowering the wastage rate, pay scales based on formal education differentials would be a wasteful way of achieving that goal.

Some more positive implications do suggest themselves:

A) Urban Schools: Whether the repeater rate is excluded or not, both school facilities and teacher training and experience variables--especially facilities variables--are much more important in determining school outcomes than they would be in the U.S. Of course, strict comparisons are very hard to make. Unlike Chile, the U.S. has almost no dropout problem for enrollees below the 9th grade (except for isolated and tiny religious communities), so there can be no comparison for primary schools (and the junior high schools, too). For purposes of empirical studies educational outputs are achievement test scores. Yet the customary result is that achievement outputs are determined almost wholly by family variables. In this study family variables (which are wholly contained in the gross variablesocio-economic class) separate only the high class schools from the middle class and low class schools; not once are middle class and low class schools separated in the regressions.

Urban School Facilities: The best predictors of the school dropout rate are adequacy of teaching materials (measured by textbooks), availability of supplementary teaching materials (here measured by maps), and a measure of the school's basic moderness: whether or not it has electricity.

Urban School TEacher Variables: If repeater rates are not included, no teacher variable is statistically significant at the 5% level; however, a teacher experience measure (percentage of teachers in the school less than 25 years of age) is significant at the 6.4% level. This strongly suggests that teacher experience may lower dropout rates. Assumedly teachers who are above 25 have been teaching long enough to avoid the worst pedagogical mistakes. More importantly, this variable may also measure dedication. Those teachers who intend to work only until they are married or begin to raise children, or seek better-paying jobs outside of teaching, or discover that they have no patience for children or no ability as a teacher will have begun to leave teaching by the time they are in their mid-twenties, and have been teaching a few years. Wht is left should be the more capable and dedicated survivors of the first few teaching years.

When the repeater rate is included in the regression, dropout rates become more highly sensitive to the school's distribution of teachers by nationality. Schools staffed largely by non-Chileans have lower dropout rates. This may be due to a number of factors: a wealthier student body, a lower cost-to-student structure, more selective admissions procedures, and, perhaps, superior training.

Factors Affecting Urban Schools: That schools with a wealthy student body have lower dropout rates is not surprising; that dropout rates are significantly though negatively correlated with enrollments is a bit more puzzling. Larger schools are more capably run schools; they are also likely to be located in more densely populated areas, implying that the ease (cost) of getting to school is higher (lower), so there is more inducement not to drop out.

Cost considerations also seem to have a bearing on the dropout rate. The higher are direct costs to the student (measured as room plus food charges), the lower is the dropout rate. This relationship is statistically significant and counterintuitive; it must be acting as a proxy for a family wealth variable within the broad category "middle class."

The dropout rate in urban schools also seems to decline the larger the percentage of the labor force in agriculture. This seems pretty strange. The definition of "urban" is a locality (town, city, village) whose population is at least 2,000 persons. Rural schools are in localities of fewer than 2,000 persons. Labor force variables are defined for comunas (counties), which are of course collections of localities.

Therefore, for the range of towns from 2,000 to Santiago (2.5 million), the more likely that the locality is a town in

a primarily agricultural comuna, the lower its dropout rate is likely to be. This may be because there are very few other schools to attend (so that there is less dropping out to switch schools), or because only those students will enter school who are within easy commuting distance of the school.

The major impacts of putting the repeater rate into the regressions are that (1) the repeater rate is highly significant, lending support to the notion that students are responsive to the costs, whether financial or psychological, associated with high failure rates (2) moderately strong negative collinearities between repeater rates and both school facilities and the tuition scholarships variables lower the importance of the latter two groups of variables, although the selectivity variable retains its significance, (3) foreign teachers continue to retain their students better than Chilean teachers and, as mentioned above, the relationship becomes a statistically reliable one, (4) even high class students may drop out as apparent costs rise, (5) after standardizing for repeater rates, vocational schools have higher dropout rates than primary or academic secondary schools, reflecting either higher opportunity costs to vocational education or else a type of student body in these schools less anxious for formal education for other reasons.

Rural Schools: The results for rural schools aren't very good and don't bear much discussion. Statistically the most significant finding is that schools which provide relatively many scholarships have more dropouts! One sensible explanation is that the percent of the student body receiving scholarships is a proxy for family income--scholarships are made available to very poor students but enough other poor students do not receive them and a high percent of poor nonrecipients leave school. Facilities make absolutely no difference in dropout rates, although more experienced teachers do have a positive, if marginal, effect. Whether they admit boys or girls, sex-segregated schools (which may be more tightly run or have on average more well-to-do students) have lower dropout rates. Rural schools in more urbanized comunas have significantly higher dropout rates (which probably reflect the effects of migration, higher opportunity costs, or a combination of the two) and the dropout rate is larger (but not significantly so) the lower the rate of population growth, which, again, says that the lower the rate of population growth, the greater the probable rate of migration, hence the more students are leaving their rural schools. When the repeater rate is excluded, a higher percentage of the labor force employed in manufacturing in the comuna raises the dropout rate. One suspects this is also a combined migration--high opportunity cost proxy variable. Finally, repeater rates themselves appear to bear no significant relationship to rural

school dropout phenomena.

As we have indicated throughout the discussion, the study just described has a number of important data weaknessess. Even with these weaknesses; however, the results suggest that a more thorough study, with better family income and status, local economic conditions, and migration data, and with inclusion of public school sector data, could help to reveal important policy tradeoffs.

III. A Study of Manufacturing Workers in the Santiago Labor Market: What factors Affect Individual Incomes?

Economists studying LDC's have seldom been able to obtain data allowing thorough study of individual income determination. In particular, it has not been possible to separate out returns to formal education from returns to other human capital: experience, on-the-job training, and so forth. To the degree that education is correlated with --but does not "cause"--these other income-raising factors, the return to education may be overstated when these factors are omitted.

Formal education and other human capital variables are, of course, not the only ones of interest. The effects of firm size, skill groups, and other demographic characteristics on wages may also be revealing of the way the labor market works.

The present study utilizes a data set far richer than those usually available for LDC's; thus, the effects of many variables not usually can be measured. The data pertain to workers employed in manufacturing in Santiago in 1965. The Centro de Investigaciones Economicas at the

Catholic University of Chile interviewed around 2900 workers in 127 manufacturing firms; these data were made available to this writer by Sergio de Castro, under whose direction the original project was begun. No results have been published from this study, although de Castro's original conception has served as a guide for a Brookings Institution-sponsored study now underway of labor markets in several Latin American cities.

Treatment of the Data

(A) The Dependent Variable

The income measure recorded in the raw data is the sum of basic taxable income plus fringe benefits (both pecuniary and in kind) provided by the firm to the worker. The basic gross taxable yearly wage and salary figure was calculated from firm records by multiplying worker's salaries in February, May, August, and November 1965 by three. The yearly value of fringe benefits as calculated by the interviewers include all tips, bonuses, gifts and benefits in kind which are not deducted from wages and salaries. Lunches and snacks are valued at factor cost; lodging at market prices. This combined income figure is for the primary job only; second job income and employment is ignored.

(B) Independent Variables

The independent variables utilized in this study fall into a variety of categories: educational variables, experience and training variables, variables measuring each worker's sickness and involuntary unemployment, length of the work week, union membership, migration,

worker civil status and size of family, sex, occupational status, and labor market differences dictated by differences among firms of different size and within different subsectors of manufacturing.

1) Formal Education Variables: We expect a highly positive correlation between years of education and worker income. The present data allow us to get more refined measures of the relationship between income and formal education than are usually available.

The proper form of the relationship requires some discussion. Social scientists sometimes argue that there may be important non-linearities in the income-education relation. In particular, it is alleged that there exists a "diploma" effect, which implies that employer offer special bonuses to workers in the form of higher salaries if the worker has actually graduated from his terminal level of school. The rationale for rewarding graduation is that it proxies desirable employee traits--stick-to-itiveness and intelligence--which are thought to be productivity-enhancing. To the extent that graduation does measure steadiness and ability, employees can save labor screening costs by using "free" information about whether the potential employee is a graduate.[12]

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[12]Unfortunately, we cannot totally measure the diploma effect for vocational schools. These schools sometimes give intermediate licenses after, say, three years of study; the full program is much longer. We do not have data on these intermediate licenses.

We test for the diploma effect by including (0,1) dummy variables for degrees received, as well as a variable for years of education.

The data allows some other useful relations to be identified. By specifying the type of schooling last attended, we can see if some curriculum tracks are more income-enhancing than others, even when number of years of schooling are held constant. Holding years constant, we would expect, for example, that white collar workers have higher salaries if they attended commercial day schools (and perhaps secondary academic schools) than if they attended other vocational schools; we would expect the opposite relationship relationship for blue collar workers. With this data we are able to estimate, e.g., the explicit effect of attending commercial extension courses at night compared to having been a full-time commercial day student, and we are able to segregate the benefits of having had graduate training abroad from having "only" attended one of Chile's (5 year) universities. Besides the commercial day school vs. commercial night school distinction, vocational secondary education also includes an industrial track consisting of industrial arts schools and women's technical schools.

The data also permit us to measure whether it makes any difference in worker earnings if the student last attended a public or a private school. Since we are holding years of education and type of school attended (as well as the information about school "quality" implicit in the location of most recent

education variable) contant, our null hypothesis is that it should make no difference whether a person last attended a public or a private school.

2) Experience and training Variables: One important reason why this study is potentially more useful to educational policy-makers than previous, less thorough studies is our explicit inclusion of the effect of special training course data. To test if the fact of having once been enrolled in an accelerated skill training program enhances productivity, we have defined a dummy variable which takes the value 1 if the worker once participated in such a program and 0 otherwise. To test if the length of the skill program makes a difference, we have defined a second variable whose value is the length (in months and fractions of a month) of the program the worker participated in. If he or she participated in no programs, the value of this variable is, naturally, zero. We expect a positive correlation between duration of special training programs (implying a longer investment in worker capital period) and worker's income.

A set of other variables measures the experience-age-OJT relationship. The three variables, age of worker, years in labor force, and years in firm were handled in the following way:

A Gary Becker view of worker productivity is that the increasing familiarity with his job which the worker gets

just from doing it raises his productivity to the employer the more experience he has at his job. This is justification for wage differences based on seniority. However, this "pure" on-the-job training can be expected to be subject to diminishing returns, as additional equal investments of doing his job raise a worker's efficiency less and less. A variable of the form log (1+ years employed in the firm) captures both the experience (training) and diminshing returns effects properly.

A worker's age may also have a nonlinear relationship to his productivity and his earnings. Worker's earnings may rise as he advances toward his prime, and may decline as his strength, health, skills, and ambition decline past his prime. We handle this nonlinearity in the age-income relationship by using two variables, age and value of age squared. If incomes do in fact rise, level off, and then decline with age, age will dominate age-squared for younger workers, and the reverse will be true for older workers.

The treatment of seniority in log form and age in quadratic form allows the separation of the effects of these two variables. This technique was introduced in a recent pioneering study by Albert Rees and George Schultz of wage determination in manufacturing in the Chicago labor market.[13]

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[13] See Albert Reese and George Schultz, Workers and Wages in an Urban Labor Market, (University of Chicago Press, 1970). Rees and Schultz collected data on individual workers and their wages from 75 manufacturing firms. The workers are in selected occupations (that is, not all the occupations at all the firms were used). They ran regressions on worker and firm characteristics within each occupation to try to explain individual worker wages.

3) Unionism: The union membership variables are designed to capture the benefits to workers from (a) being a member of a union or (b) having access to benefits from collective bargaining. Our first union variable takes the value 1 if the worker belongs to a union; our second variable takes the value 1 if the worker is employed in an "open" shop,[14] but is not himself a union member. Since the function of a union is to raise members' incomes (and to improve work conditions and raise job security), we would expect both variables to be positive and significant, although the effect of the former variable (union membership) should be much stronger than the effect of the latter (open shop).

4) Migration: Data about migration is inferred from the variable "location of most recent education." Besides having had no schooling, there are five possibilities recorded: the person was most recently educated in (1) Santiago, (2) cities with a population of more than 20,000, (3) cities with a population of between 2,000 and 20,000, (4) a rural area, or (5) in a foreign country. Because the quality of education is expected to be poorest in rural areas, we expect otherwise similar workers

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[14] These are shops where there is a union, but the worker does not have to belong.

educated in rural schools to show lower incomes than those educated in rural schools to show lower incomes than those educated in more urban places. Since we do not know the composition of those educated abroad (highly educated refugees? Poorly educated manual laborers from poorer countries in Latin America?) we will be very agnostic about our expectations for this variable.

5) Personal Information about Each Worker: We know the number of dependents each worker supports and whether the worker is 1) married, 2) single, or 3) widowed or separated. Labor economists have long agreed that married workers are more stable workers. They have lower turnover rates, are more ambitious, etc. The major reason that productivity and marriage are complementary is probably that the personality characteristics most conducive to effective working are much the same as those which lead to a stable married life. A second reason is that marriage raises a person's "taste for income" both by increasing the worker's responsibility for others, and (for males) by making the psychic costs of not working very high in terms of "nagging wives."[15] Similarly the greater the number of persons the worker is responsible for, the greater his need to be the stable, efficient, reliable worker employers will reward with higher pay.

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[15]William G. Bowen and T. Aldrich Fingan, The Economics of Labor Force Participation, (Princeton Press, 1969), pp. 43-44.

The number of hours worked per week may have different effects for white and blue collar workers. The data do not specify whether workers received overtime pay or not; it may be reasonable to assume that long hours imply overtime premiums. Furthermore, blue collar workers are typically paid by the hour; hence, even in the absence of premium overtime pay, longer hours for this group would imply higher earnings.

We also include the sickness and unemployment rate (defined as UNEMSICK = 365- (days sick + days unemployed)). That is, UNEMSICK approaches 1.0 the 365 fewer the number of unemployed and sick days. Sick days do not include sick leave paid for by the firm. Nor were sick days or unemployed days counted by the interviewers if a payment was made by some social insurance institution. Obviously, we expect a positive relationship between the UNEMSICK variable as defined and earnings, if unemployment and illness actually happened during the 4 months for which firm wage payments to the worker were catalogued. The relationship will be weaker if illness or unemployment happened to be concentrated in the other eight months of 1965.

6) Industry and Skill Group Variables: The survey was collected at firms classified into 14 of the 20 subsectors comprising manufacturing. These 14 were merged into the following seven groups, and were incorporated into the analyses by using dummy variables:

(1) food, drink, and tobacco (20,21,22)

(2) textiles, (23, 24, but excludes shoe production)

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(3) wood products and furniture (25, 26)

(4) chemicals, coal and oil products (31,32)

(5) leather goods (29)

(6) non-metallic minerals (except coal and oil) (33)

(7) basic metals and non-electrical machinery (34, 35, 36)

There are no firms in this sample from classifications number 27 (paper and paper products), 28 (printing and publishing), 30 (rubber), 37 (electrical machinery and appliances), 38 (transportation equipment), or 39 (other manufacturing industries).

Some previous evidence on the relative wage characteristics of various industries is available. Peter Gregory[16] looked at interindustry wage differentials in manufacturing in Chile during the period 1960-early 1963 and provides us with rankings of daily total remunerations for each of the 3-1/3 years. Strict comparisions with our data are impossible, because (1) Gregory's sample of firms was different, (2) he looked at daily or monthly rather than yearly earnings, (3) his data do not adjust for labor force differences, such as differing sex or education distributions across subsectors, (4) he reports remunerations for each of the 20 subsectors separately, so that we have a weights-for-aggregation-into-our-seven-sectors problem. These problems notwithstanding, he finds, for example, that for manual workers in 1962 petroleum and coal products (32) were very high paying, but chemicals were very much an "average" wage-

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[16] Industrial Wages in Chile, Cornell International Industrial and Labor Relations Report Number 8, Ithaca, 1967.

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Table 3

Average Total Remunerations in Manufacturing, 1962

Industry	Manual Workers (Daily)	Rank	Office Workers (Monthly)	Rank
Meat and dairy products	3,277	8	128.46	18
Canning	2,050	23	127.85	19
Other good products	3,905	5	203.90	6
Beverages	2,768	14	179.78	9
Tobacco	3,698	6	210.63	5
Textiles-woven fabrics	2,696	15	143.25	16
Textiles-knitted fabrics	2,336	20	120.18	23
Shoes	2,635	17	168.40	12
Apparel	2,673	16	126.70	21
Wood products	1,797	24	124.19	22
Furniture	2,409	19	184.05	8
Paper and paper products	6,552	2	197.28	7
Printing and publishing	4,291	4	170.54	11
Leather	2,623	18	175.12	10
Rubber	3,115	11	233.09	3
Chemicals	3,155	10	161.09	13
Petrochemicals	8,097	1	310.83	1
Non-metallic minerals	3,642	7	213.00	4
Basic metals	6,379	3	298.15	2
Fabricated metal products	2,876	13	146.07	15
Non-electrical machinery	2,963	12	127.69	20
Electrical machinery	2,272	21	142.64	17
Transportation equipment	3,100	10	150.65	14
Miscellaneous industries	2,150	22	111.67	24
All Industries	3,184	-	178.24	-

Note: The Source of this table is Gregory, op. cit., page 109 (appendix Table A-2) and page 81 (Table 16). Data includes basic wage plus the value of fringe benefits.

Table 4

Results of the Regression Analysis

Dependent Variable:
Yearly earnings (including value of fringe benefits) in 1000's of 1965 escudos.

	Male White Collar	Male Blue Collar	Female White Collar	Female Blue Collar
Constant	-3.374	-3.191	0.918	-6.368
Education variables				
Years of education	0.6100(7.25)***	0.0436(1.78)	0.2083(1.86)	0.0388(1.39)
Primary diploma	-0.6518(-1.01)	-0.1079(-1.08)		-0.1253(-1.23)
Secondary diploma		-----a-----	-0.7169(-1.41)	0.7362(1.15)
Commercial diploma	1.2877(2.50)*	0.6138(1.50)		1.2491(1.40)
Industrial diploma	2.2810(1.79)	1.7006(1.18)	-----a-----	-----a-----
University diploma	2.3035(1.23)	-----a-----	5.4762(2.38)*	-----a-----
Public school	-0.5271(-1.40)	-0.3673(-3.56)***		
No schooling	-----b-----	-----b-----	-----b-----	-----b-----
Primary	1.3778(1.77)	0.4148(3.74)***		
Academic secondary				
Commercial day	1.1942(2.59)**			-0.1799(-0.70)
Commercial night		-----a-----	1.3675(1.56)	-----a-----
Industrial		0.2959(1.42)	-----a-----	1.4859(3.27)**
University		-----a-----	0.8572(0.76)	-----a-----
Foreign (graduate)		-----a-----	-----a-----	-----a-----
Special Programs				
Enrolled in program	0.6780(2.24)*	0.908(1.81)		
Duration of program		0.0070(0.95)	0.0282(3.07)**	0.0091(1.72)
Experience, Age, Seniority				
Years in Labor Force	0.0604(1.41)	-0.0231(-1.84)	0.1412(1.98)*	0.0235(1.42)
Log (1+Yrs. firm)	0.9840(4.90)***	0.4089(8.04)***	1.3047(4.57)***	0.3593(5.43)***
Age	0.3600(3.63)***	0.0725(3.35)***	0.1784(1.38)	
Age **2	-0.0048(-4.17)***	-0.0005(-2.36)*	-0.0038(-2.40)*	-0.003(-1.20)

Table 4 continued:

	Male White Collar	Male Blue Collar	Female White Collar	Female Blue Collar
Location of Last School				
Santiago	-----b-----	-----b-----	-----b-----	-----b-----
Urban A	0.8317(2.21)*			
Urban B	---	---	---	---
Rural	---	---	---	---
Foreign	4.4314(5.59)***	-----a-----	-1.8102(-0.057)	
Union Membership				
Union Member:	0.4161(1.07)			-0.1593(-1.32)
Open Shop	-----a-----	-0.2835(-1.25)	-2.1751(-1.10)	0.5421(0.88)
Hours worked weekly	-0.1830(-2.53)*	0.0812(3.96)***	-0.1024(-0.82)	0.1640(5.96)***
UNEM-SICK index (DS)	3.2483(1.08)	0.2107(1.48)		0.4410(0.95)
Civil Status Variables				
Married	0.5429(1.28)	-----b-----	0.5343(1.30)	0.2503(2.41)*
Single	-----b-----	-0.2474(-2.30)*	-----b-----	-----b-----
Widowed, etc.	-1.0630(-1.06)		---	
Number Dependents		0.0365(2.05)*		0.0633(2.00)**
Industry				
FDT		0.1836(1.74)	1.9601(2.82)*	-0.3851(-2.72)**
Textiles	1.5907(0.88)	-----a-----	-----a-----	-0.3362(-1.63)
Wood products	-0.5948(-1.39)	-1.3367(-12.68)***	0.6614(0.37)	-----a-----
Leather	-----b-----	-----b-----	-----b-----	-----b-----
Chemicals	-0.4597(-1.12)		1.2552(1.98)+	-0.2795(-2.09)*
Nonmetallic mins.		-0.4386(-3.66)***	3.9630(5.44)***	-0.3778(-2.17)*
Basic metals, etc.	-0.9636(-2.46)*	-0.4924(-4.58)***	1.6032(1.63)	-0.1248(-0.62)
Firm Size				
Less than 25 workers	-1.1519(-2.07)*	-0.6914(-7.07)***	-0.9576(-1.53)	-0.7806(-3.81)**
25-99 workers	0.8386(2.43)*		-0.3538(-0.85)	
100 or more workers	-----b-----	-----b-----	-----b-----	-----b-----
R^2	0.426	0.287	0.610	0.336
NOBS	485	1607	128	386
F Value	13.08(26,458)***	27.67(23,1583)***	7.91(21,106)***	8.35(22,363)***

-a- no observations in cell.
-b- in every regression at least one variable in each data set must all inclusive be excluded in order to avoid linear dependence among these independent variables.

Table 5

F Values

(DS)
(DS)

	Male White	Male Blue	Female White	Female Blue
(DS) Education (Years)	68.12***	1.32	10.59**	0.62
(DS) All Educ. vars.	9.58***	2.79**	2.36*	3.70**
(DS) Special Skill Progs.	1.96	6.01**	5.26**	1.42
(DS) Age, Experience, etc.	14.07***	62.68***	15.78***	34.03***
(DS) Last School Location	18.68***	0.12	0.83	1.68
(DS) Union Membership	8.31***	23.55***	1.13	4.81**
(DS) Hours, UNEMSICK	3.48*	13.29***	1.99	22.44***
(DS) Civil Status	3.81*	28.14***	1.11	7.35***
(DS) Industry	4.06***	38.17***	6.53***	9.33***
(DS) Firm Size	9.73***	44.25***	0.55	20.58***

payer; so that the amalgam of the two is a "higher than average" wage-paying pseudo-industry.

In the same way food, drink, and tobacco (FDT) is somewhat below average in the earnings rankings, textiles is well below average, wood products are the lowest paying, leather goods are below average, and non-metallic minerals are above average and may (depending on the weights attached to groups 35 and 36) be higher paying than basic metals industries (which are also high paying). Since within-industry wages are determined by constantly changing factors, and because wage structures may be influenced by factors contained in our data set, we will avoid apriori theorizing about the sign of the industrial sector dummy variables.

In discussing wage differences between white collar and blue collar workers, Gregory finds that inter-industry wage dispersion for office workers (the only subset of white collar workers for which he presents data), while substantial, is considerably less than that for manual workers. He attributes this to the legal minimum salary for white collar workers (the sueldo vital) being more effective for white collar workers than for industrial manual workers.[17,18]

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[17] Gregory, op. cit., p.80.

[18] Rees and Schultz implicitly provide a quite different type of possible explanation for lower white collar wage dispersion across industries. They find that wage regressions on personal variables for white collar occupations generally get higher R^2's than those for semi-skilled blue collar occupations. This can be attributed to the greater comparability of white collar occupations across firms, and the greater ease of judging productivity without lengthy on-the-job testing. Thus, a typist is a typist (and a good typist easier to spot) to a greater extent than a semiskilled machine operator is a semiskilled machine operator. That is, the variance in meaning and difficulty of semi-skilled industrial jobs is quite large across industries. The on-the-job training required to learn these semi-skilled jobs (as opposed to the generally-applicable-across-industries training required to be a typist) implies more wage dispersion in semi-skilled manufacturing jobs.

The relative total monthly remunerations office workers in 1962 by manufacturing subsector were not dissimilar to those observed for blue collar workers. Chemicals and nonmetallic minerals are high salary industries; basic metals is high but metal products and non-electrical machinery are low-paying, leaving the average in doubt. The leather industry pays about the manufacturing average; FDT is indeterminate; wood products is low; and textiles are very low paying.

Gregory does not present vary much evidence about the relation between daily earnings and size of firm. He does report that during the period April 1960--April 1963 larger firms tended to raise their wages more rapidly than smaller firms.[19] He also reports that larger firms were more likely than smaller firms to provide wage supplements.[20]

In this study we test for firm size effects by using three dummy variables: SIZESMAL takes the value 1 for firms employing fewer than 25 workers; SIZEMED equals 1 for firms whose payroll ranges from 25 to 99 workers; SIZELARG is set equal to one if the firm employes 100 or more workers. The null hypothesis is that firm size makes no difference after other factors are accounted for.

Results of the Regression Analysis

1. The R^2's are quite high compared to those frequently obtained in cross-section micro-data studies. Thus, the model seems to have

[19] Gregory, op. cit., p. 62.

[20] Gregory, op. cit., p. 23.

captured fairly well some of the determinants of income.

Several features of the overall results are instructive. The explanatory power is higher for the female equations than for the male ones (holding skill classification constant). In addition, explanatory power is higher for white collar workers than for blue collar workers. Possible reasons for the differences is explanatory power include (1) there are fewer observations for white collar workers and for females than for blue collar workers and for males. (2) there may be less heterogeneity in skills for white collar workers than for blue collar workers[21] and less heterogeneity in female-dominated occupations than in male-dominated occupations.

2. The dangers of overstating the return to education by not controlling for various other determinants are illustrated in the following comparison. When we run income of each of the four occupation-sex groups against education and age variables alone, the coefficients on education come out larger than when other factors are controlled, as the following array shows:

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[21]This is similar to the pattern of R^2's that Rees and Schultz observe. They predict wages in particular white collar occupations quite well, but do relatively poorly for semiskilled blue collar workers. See the discussion in footnote 18.

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Table 6

Differences in the Education Coefficient Assuming Differences in the Income Generating Function Specification

	Regression Coefficient On Years of Education			
	Male White Collar	Male Blue Collar	Female White Collar	Female Blue Collar
Regression with years of education and all noneducational variables in our set*	.5548***	.0538*	.2455*	.0435
Typical "simple" specification using education, age, and age squared	.5937***	.0814***	.3761***	.0512*

*To make the two sets of coefficients comparable we have omitted all education variables except years of education. Thus the coefficients here are different from those in table 4.

It is obvious from comparing the two lines of the table that earnings projections based on the type of simple specifications often used to generate rate of return estimates can lead to much larger apparent return to formal education than result from estimating more complex equations. The degree to which the two rates of return will be dissimilar will depend on the tuco regression coefficients and the relative value of

the difference in opportunity costs.[22]

3. Education does enhance the earnings of all sex-skill groups, but the variables seem to exert a stronger (more significant) influence for males than for females. Notice that years of education is significant only for male white collar workers; for male blue collar workers, having had some amount of primary schooling (which may be a proxy for basic literacy) shows up more strongly than years of education. One explanation for the stronger effects of education on male wages relative to female wages may involve the expected tenure of the worker at the firm; women tend to move into and out of the labor force more frequently than men, implying higher turnover rates for women. Thus, the anticipated length of payoff to an employer from hiring an educated male may be higher than the payoff to hiring an equally educated female, because the expected length of stay of the male is longer.[23] Discrimination against women by employers is another possible cause of lowered effect of the education variable.[24]

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[22]We are not arguing here that our specification is necessarily the correct one, but rather that it is important to try to fully specify the factors affecting earnings. Nor are we saying that all additional important factors are necessarily independent of education. If years of education helps determine union membership, (for example), then this relationship needs to be precisely specified; the effect of union membership on earnings cannot just be ignored, as most studies implicitly do. It is, of course possible that if (1) education affects earnings directly, and (a) union membership is both a function of past education and a determinant of income, then the correct estimate of the return to education--including both direct and indirect effects--could be close to the return estimated from the incorrect specification--which ignores unionism. But this needs to be demonstrated, not assumed.

[23]Obviously, this assumes that, in Becker terms, educated workers (1) receive specific training and (2) are easier (less costly) to train.

[24]The clustering hypothesis of Barbara Bergmann is relevant here. Employer discrimination may take the form of only hiring women for a limited number of occupations, and education does not raise productivity much in these occupations. See Barbara Bergmann, "The Effect on White Incomes of Discrimination of Employment", Journal of Political Economy, March-April 1971, pp. 294-313.

4. Diploma effects show up in several ways. Firms will pay a premium for fully licensed male accountants and possibly ohter white collar occupations employing males. University graduates, especially women, do "better", and so do male graduates of vocational (including fully time commercial)secondary schools. Perhaps male white collar vocational school graduates are primarily skilled workers employed as shop foremen (which may be a low-level management position), or in a few cases graduates of agricultural schools working in the food-processing industries. The negative results for the primary school diploma variable may be due to the tendency of people to report higher educational achievements (which is, after all, also a status good) than they have in fact attained.

5. Even when years of education are held constant, private school matriculants earn higher incomes than those who attended public schools. Private schools may offer a higher quality education or they may attract better applicants or they may utilize their power to be more selective in their admissions procedures, or all three. On the other hand, academic secondary schools seem to be high risk choice for the student who will not go on to college. Primary education for males and vocational (including commercial) education seem to be associated with significant earnings improvements.

6. Accelerated skill-training programs seem quite consistently to raise worker incomes. Since we have no information about the costs of these programs, we cannot calculate a rate of return to these programs.

Yet it seems that from the point of view of policy, such short and relatively flexible and job-specific programs deserve more careful study as an alternative to expansion of enrollments in traditional liberal arts curricula.

7. The cluster of variables measuring experience, age, and seniority make a large difference in the expected incomes of workers. The worker's seniority in the firm always--for all sex-skill groups --has a strong, positive effect on his earnings. Notice that this is a pure seniority effect, since we have controlled separately for age. Interestingly enough, this same seniority variable is the most significant explanatory variable in Rees' and Schultz's Chicago labor market study.[25]

8. The migration proxy, location of last school attended, has no effect on earnings except for white collar males. Notice that the strongest effect for this group results from the foreign eduated variable. Chile has a sizeable immigrant population of Germans and Eastern and Central European Jews, as well as affluent other European, Palestinian, Syrian, and possibly Cuban communities. This variable may be picking up members of thes groups who happen to be in the sample.

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[25] Notice that for white collar workers, the effect of seniority on women's earnings is about 30% higher than it is for men. A very tentative hypothesis is that, given employers' expectations that women will quit their jobs more frequently, individual women who demonstrate that they are not going to quit may be rewarded by having the gap between their earnings and male earnings narrowed somewhat.

9. Union membership appears to have no consistent impact on earnings. A possible explanation is suggested by Gregory.[26] He points out that there are very big differences in the effectiveness of unions for blue collar workers across types of firms. Both the probability of membership in unions and their organizational strength and aggressiveness are far greater in larger, newer, and more capital intensive firms than in smaller, older, and more labor-intensive firms. Frequently, unions may exist legally in smaller firms but no longer function as a trade union at all. Since unions are legal entities under Chilean law, they cease to exist only when certain legally prescribed dissolution procedures have been undertaken; since there is rarely a great rush to dissolve moribund unions, many workers could belong to unions which are legally alive and economically dead.

An implication of Gregory's point is that unions in large companies are active; unions in small companies are inactive; thus, the pure union effect may in fact show up in the size of firm variable. In such a case, we will observe larger companies offering higher worker incomes partially because they have more effective unions.

10. The results for our civil status variables confirm the Rees-Schultz-Bowen-Finegan view that employers perceive married workers to be more stable and productive than unmarried workers. Thus, blue collar workers who are married earn more than those who are single. More surprisingly, even among married blue collar workers, there is a positive

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[26] Gregory, op. cit., pages 66-70.

and significant relation between family size and income.[27]

11. The industry variables present a mixed bag of results. For males, the basic metals subsector and the nonmetallic minerals subsector (for blue collar workers) seem to exert very strong negative pulls on earnings. Since Gregory found these to be high wage industries in 1962, either labor's position in these sectors deteriorated very rapidly after 1962 or Gregory's results were fully accounted for by differences in human capital or other factors for which he was not able to standardize. On the other hand, we find wood products to be a very low paying industry, and this is completely consistent with Gregory's rankings.

For Women, the results seem peculiar. The leather goods industry (which was picked as the reference industry because it employes a lot of women) pays its white collar women very poorly, and pays its blue collar women, who may well be mostly highly skilled seamstresses, very well. The impact of the leather goods industry is so profound that it makes the earnings of women white collar workers appear higher and of blue collar women lower in every other industry group, although the reported coefficients are not always statistically significant.

There are also very strong firm size effects, especially for manual workers. Small firms do pay less, lending much support to Gregory's

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[27] This may be explained not only by the increased need for persons with large responsibilities to work harder, but also that employers may bend the wage-productivity lockstep by giving higher incomes to workers whose need for more income is demonstrably greater.

statement that unions are powerful forces in large firms and not in small ones.

By way of summary, then, it appears that models with a human capital orientation developed for predicting the earnings of workers in the labor markets of industrialized countries may be useful for looking at private income determination in the more modern industrial sectors of less developed countries. A variety of factors will affect these earnings: seniority, factors relating to firm size, sex, occupational characteristics, family characteristics, special vocational training, licensing, all may have an effect on private earnings. Educational policy makers who neglect these effects may misestimate the return to education itself, and may also overlook other, perhaps lower cost means of raising incomes and outputs.

Appendix A

Variables in School Dropout Study

1. School materials and physical plant:
   a. Teaching materials
      (1) Textbooks
      (2) Exercise books
      (3) Pencils
      (4) Laboratory materials
      (5) Manual education facilities
      (6) Home economics facilities

      Note: 1 = adequate; 0 = inadequate or none

   b. Supplementary materials
      (1) Number of books in library
      (2) Number of maps and charts

   c. Size and age of school
      (1) Capacity built before 1920
      (2) " " 1920-1940
      (3) " " 1940-1950
      (4) " " 1950-1960
      (5) " " since 1961

      Note: these variables are measured in student seating capacity units.

   d. Exceptional physical resources
      (1) Chemistry labs
      (2) Biology labs
      (3) Physics labs
      (4) Art studios
      (5) Manual arts shops
      (6) Home economics labs
      (7) Typing rooms

      Note: 1 = yrs; 0 = ns.

      (8) Chapel capacity
      (9) Auditorium capacity
      (10) Classroom capacity

(11) Dining hall capacity
(12) Gym capacity
(13) Number of dormitory beds
(14) Number of desks
(15) A set of variables detailing the number of workshops of various types.
(16) Variables measuring both the quantity and quality of four different types and hygiene facilities.

e. Utilities
(1) gas
(2) Electricity
(3) Running water
(4) Sewage Disposal

2. Teacher variables
a. Class size variables
(1) Pupil-teacher ratio, average per school
(2) Pupil-teacher ratio, adjusted for number of hours each teacher actually teaches, daily school average.
b. Teachers formal educational attainments
(1) Quality group A = university graduates or at least three years of university training
(2) Quality group B = graduates of secondary level teacher training schools academic secondary schools, or commercial schools; one or two years university
(3) Quality group C = at least three years and secondary education
(4) Quality group D = all others

Note: these variables are all expressed as percentages of the number of teachers in the school

c. Experience and age variables
(1) Average age of teachers
(2) Average years of teaching experience
(3) Percent of teachers in school who are more than 62 years old
(4) Percent of teachers in school who are less than 25 years old.

d. Percent of teachers in that school who are females
e. Percent of teachers in that school whose nationality is not Chilean
f. Miscellaneous teacher variables
(1) Percentage of teachers in school with "special" studies
(2) Percentage of teachers in school who have studied abroad
(3) Number of private school teaching jobs of those reporting, average for school
(4) Number of public school teaching jobs of those reporting, average for school
(5) Number of hours/day spent administrating, school average
(6) Number of hours/day spent teaching, school average

3. Administrative enrollment and financial variables
   a. Religious application
      (1) Secular
      (2) Catholic
      (3) Protestant or other

   b. Enrollment
      (1) Number of boarders
      (2) Number of commuters
      (3) Total boarders plus commuters

   c. Type of ownership
      (1) Private individual
      (2) Corporation
      (3) Other-profit foundation
      (4) Bishopric or parish school
      (5) Religious community (eg, Jesuit, Sacred Heart)

   d. School level
      (1) Kindergarten (omitted from analysis)
      (2) Primary
      (3) Academic secondary
      (4) Vocational

   e. Percent of budget received from
      (1) Tuition payments
      (2) Subsidies
      (3) Room and board charges
      (4) Donations from Chileans
      (5) Donations from abroad
      (6) Other income sources
      (7) Various combinations of (1) - (6)

   f. Does the school receive assistance from CARITAS?

4. Income and cost proxies
   a. Socio-economic class of the student body
      (1) High class
      (2) Middle class
      (3) Lower class

   b. Scholarship variables
      (1) Tuition
      (2) Board
      (3) Room
      (4) Other

      Note: There are separate variables for full or partial scholarships of each type, and other variables representing various combinations of the above variables.

c. Free medical, nutritional, and other services provided to students
   (1) Breakfast
   (2) Lunch
   (3) Clothes
   (4) School supplies
   (5) Dental care

d. The repetition rate for the school

e. Miscellaneous school controls variables
   (1) Urban or rural local
   (2) Sex of students attending--boys, girls, coeducational
   (3) Miscellaneous enrollment variables relating private school enrollments at each school level in province to public or total school enrollments; size of school enrollments related to size of population of province.

5. County level context variables
   a. Labor force variables
      (1) Percent labor force in manufacturing
      (2) Percent labor force in agriculture

   b. Population size variables
      (1) Population estimate for 1965
      (2) Population growth rate, 1952 to 1960
      (3) Percent of population in areas defined as urban

   c. Standard of living variable
      (1) Standard of living index

   d. Literacy rates
      (1) Male literacy rate
      (2) Female literacy rate

      Note: This group of variables all come from Mattelart's Atlas Social de las Comunas de Chile. The standard of living index is meant to be the equivalent of goods indices used in the post-Coleman educational production function studies; it is an average of the following percentages for each county: the percentage of houses with running water; installed electricity, and hygienic and sanitary facilities, and the degree to which adults and children each have access to medical services.

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