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## Intersectoral Wage Structure in Colombia

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CENTER DISCUSSION PAPER NO. 251

INTERSECTORAL WAGE STRUCTURE IN COLOMBIA

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## INTERSECTORAL WAGE STRUCTURE IN COLOMBIA

Gary S. Fields and Nohra de Marulanda

### I. Introduction

Critical areas of interest in current studies of economic development include the themes of income distribution, poverty, and employment generation. In the less developed countries, the majority of the economically active population obtain most or all of their incomes as fruits of their labor. For this reason, the structure and functioning of the labor market play a key role in determining the distribution of economic well-being.

A number of recent studies of LDC labor markets, including one by an author of this paper,<sup>1</sup> have dealt with income determination at the individual level. The reason for this emphasis is clear: if we wish to understand the incomes and poverty among individuals, we must study individuals. Microeconomic research has convincingly demonstrated the important role that an individual's education and labor market experience play in determining his income. The results of these studies have been used by many governments as the basis for policy formulation pertaining to the supply side of the labor market, particularly as regards development.

Without in any way downplaying the value of microeconomic studies of incomes, we would also observe that many government policies to alleviate poverty operate on the demand side of the labor market rather than the supply side. The question has been put to us in Colombia in the following

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<sup>1</sup>See Fields (1975).

way: given that the government has \$X which it wants to spend to stimulate employment growth by subsidizing certain sectors of the economy, where should the resources be allocated? We would not presume to attempt to dictate to policy-makers how public funds are best spent. Rather, our goal here is the more limited one of understanding the interindustry structure of wages and salaries in Colombia and determining the differentiating characteristics of high wage and low wage industries.<sup>1</sup> The other information needed to answer the policy question posed above --- i.e., sector-specific estimates of the employment elasticity of output --- must be left to other researchers. Still, if policy-makers know which are the relatively high wage sectors of the economy and what their characteristics are, they will have both a better basis for deciding which sectors might best be stimulated and some guidance on how to go about doing it.

Our study of Colombia is based on a particularly comprehensive body of data which has recently become available. In the late 1960s, the Colombian national statistical office (DANE) conducted industrial surveys in five major economic sectors (manufacturing, services, commerce, mining, and government). For each of 82 two-digit industries (leather goods manufacturing, for example) data are available on wages and other labor force remuneration. These sectors employ some 2 1/2 million people, or 40% of Colombia's labor force.<sup>2</sup> The most striking feature of the wage data is the considerable diversity in wages which one observes across the different

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<sup>1</sup>Our analysis is cross-sectional. For an in-depth analysis of the time series pattern of wages within sectors of Colombian manufacturing, see Sanjinés (1975).

<sup>2</sup>Banco de la Republica (1974, p. 24).

subsectors. Average annual remuneration per worker was Col. \$21,400.<sup>1</sup> Around this mean, remuneration per worker ranged between Col. \$5,000 in domestic services to Col. \$122,500 in coal mining,<sup>2</sup> with a standard deviation of Col. \$16,000. It is this diversity which we seek to account for in this paper.

The variables used to explain intersectoral wage patterns include a number of characteristics of the firms which comprise each two-digit subsector. These are: average productivity of workers in the industry, the capital-intensity of production methods, the size distribution of firms within the sector, the importance of foreign capital, and the occupational composition of the industry's labor force. Unfortunately, figures on unionism are not available, so we must account for unions' effects indirectly via other variables. Our empirical results show that higher average wages in a sector are associated with each of these sectoral characteristics and that these factors are capable of explaining a very substantial percentage of the variance in average remuneration across sectors.

The remainder of this study has six sections. Section II reviews the economic theory of wage differentials. In Section III, we state our hypotheses about intersectoral wage structure in Colombia and explain our reasons for each. The definitions of the variables and the empirical specification appear in Section IV. Sections V and VI present the results of simple correlations and multiple regressions respectively. The paper concludes with a policy discussion in Section VII. An appendix with the actual data follows the text.

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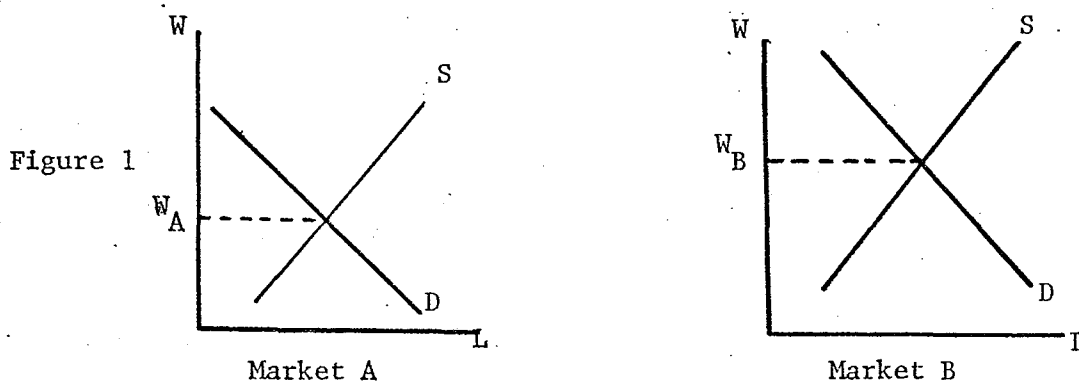
<sup>1</sup>All figures are expressed in 1967 Colombian pesos and include wages (salarios) and fringe benefits (prestaciones sociales).

<sup>2</sup>Owing to incomplete coverage and possible biases and errors in reporting, it is wise to regard the specific figures with caution. In coal mining, for example, it is probable that only the larger commercial mines appear in the sample whereas the small subsistence level mines are excluded.

## II. The Economic Theory of Wage Differentials

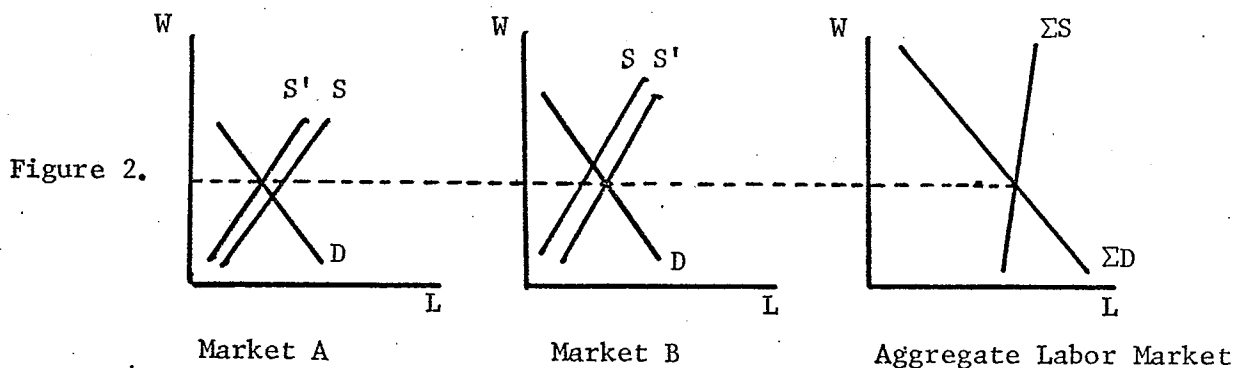
In seeking to explain the considerable diversity of average wages across the various subsectors of the Colombian economy, our research is based on the maintained hypothesis that average wages in the different subsectors are systematically-related to a number of attributes of the firms comprising the industry. In other words, we are explicitly assuming the existence of a certain degree of disequilibrium in the Colombian economy. This point of view has become quite accepted in the literature on labor in economic development. See, for example, Reynolds (1965, 1969), Berg (1966, 1969), Frank (1968, 1971), Turnham (1971), and many of the I.L.O. Mission Reports including that on Colombia (ILO (1970)).

The usual starting point for analysis of LDC wage structures is standard textbook level economic theory, in which it is suggested that a worker's production is greater the more complementary resources he has to work with. On the assumption that workers are paid the value of their marginal products, it is often argued that workers will be more highly-paid in more capital-intensive industries or in industries where the value added per worker is higher:



There is, unfortunately, a problem with this reasoning. Unless the difference between  $W_A$  and  $W_B$  is due to compensating differentials, the interindustry wage gap would not be expected to persist in the long run.<sup>1</sup> In the absence of compensating differentials, the situation in Figure 1 will be stable only if it is assumed that no mobility between the two labor markets takes place. However, it has been demonstrated in the less developed countries in general and Colombia in particular that workers move from relatively disadvantageous labor markets to those with better economic conditions.<sup>2</sup> Thus, an interindustry wage gap, as depicted by the difference between  $W_A$  and  $W_B$  in Figure 1, would tend to be eroded by market forces.

The market forces might work in either of two ways. Suppose that workers are mobile and that wages are flexible. Workers would move from market A to market B until the two markets paid the same wage, with the overall wage level being determined by aggregate labor supply and demand:



<sup>1</sup>This was recognized by Adam Smith. A penetrating essay on the process by which the labor force is allocated among alternative labor markets, including a review of classical writings, is that of Rottenberg (1956).

<sup>2</sup>For a review of this literature, see Todaro (1975). With particular reference to Colombia, see McGreevey (1968), the report of the ILO mission to Colombia (ILO (1970), Chapter 7 and Appendix 5), and the reference cited therein.

Thus, whatever wage differential might be observed would be only a short run disequilibrium phenomenon.

Market forces might also work but on a more limited basis. Suppose once again that workers are mobile but that wages in market B are inflexible downward. Perceiving that more could be earned in B, workers would move to B until the expected wage in B (actual wage adjusted for the probability of employment) were equal to the actual wage in A (see Harris and Todaro (1970)), but the wage differential among employed workers would still persist.

The point of this discussion is that the persistence of wage differentials in different economic sectors is inconsistent with the free operation of equilibrating forces as posited in the ordinary textbook-level competitive theory. To explain a persistently unequal wage structure, the standard competitive theory must be amended to allow for other market motivations of firms (such as paying higher wages in order to reduce labor turnover costs or improving worker efficiency) and to allow also for the influence on wages of institutional forces. In Section III, we draw on these market and institutional forces to formulate a number of hypotheses about the relationship between the characteristics of firms in an economic subsector and the average wages paid to that sector's workers.



III. Hypotheses on the Determinants of Intersectoral Wage Structure in Colombia

Hypothesis 1. Sectors with higher value added per worker pay higher wages ceteris paribus.

Hypothesis 2. More capital-intensive sectors pay higher wages ceteris paribus.

The available studies for Colombia have found a positive correlation between the level of wages and value added per worker (which, following custom, we shall call 'productivity') and the wage level and capital intensity.<sup>1</sup> There is no consensus as to why this is.

As we observed in the preceding section, textbook-level economic theory predicts the same wage for comparable workers provided the equilibrating forces in labor markets are freely-functioning. If all workers were identical, even if firms differed in 'productivity' the wages they pay would be equal, as determined by the labor market. Consider, for example, an industry in which two production technologies dominate all others.<sup>2</sup>

	<u>Technology A</u>	<u>Technology B</u>
Product	100 units	100 units
Labor utilization	200 workers	100 workers
Labor cost (wage = \$10)	\$2,000	\$1,000

- continued -

<sup>1</sup>See Urrutia (1968), Sanjinés (1975), and Heady (1976).

<sup>2</sup>The lack of a clearly-dominant technology is consistent with either (a) a limited number of available factor proportions (see Eckaus (1955)) or (b) indivisibility of capital.

	<u>Technology A</u>	<u>Technology B</u>
Capital utilization	1 machine	2 machine
Cost of capital (Price of machine = \$1,000)	\$1,000	\$2,000
Capital per worker	\$5	\$20
Value added	\$3,000	\$3,000
Value added per worker = 'productivity'	\$15	\$30

It is clear that the firms in the industry would be indifferent between A and B, since they obtain the same output for the same cost. Being indifferent, some would choose A while others choose B, the choice being made more or less arbitrarily. The two groups of firms would pay the same wage but would differ with respect to value added per worker ('productivity') and capital-intensity. In this case, 'productivity' and capital-intensity would have no significant relation with wage rates.

Since we do observe wage differentials and these differentials are associated with value added per worker and capital-intensity, the simple textbook theory cannot suffice. One reason may be that the equilibrating forces are not free to operate. A considerable amount of labor mobility might be impeded by restrictions on entry, lack of information, or costs of movement, for example. Wages may be prevented from falling due to institutional rigidities caused by labor unions, minimum wage legislation, government wage policy, and the like. The higher wage would induce firms to move up their labor demand curves and employ fewer workers. There would then arise a correlation between the wage in an economic sector and the value added per employed worker, which is what we are measuring by 'productivity'.

Another possibility is that the association between wages, productivity, and capital-intensity reflects other economic motivations of firms not captured in standard textbook-level theory. These lines of reasoning have been developed extensively by Stiglitz (1974a, 1974b). Stiglitz notes that firms receive a benefit by paying higher wages, either by reducing labor turnover costs or by raising worker efficiency. In the turnover argument, the higher is the firm's wage relative to the market wage, the larger is the pool of available job applicants and the lower is the quit rate among existing personnel, and thus the lower are the costs of hiring, training, and work disruptions. In the efficiency wage model, higher wages bring forth greater effort, for either motivational or nutritional reasons. In either case, Stiglitz posits that the firm weighs the costs of a high wage policy against the potential benefits and raises wages if the benefits exceed the costs.

Consider now the implications of these additional economic considerations for wage structure. Firms with relatively capital-intensive interdependent technologies might be expected to find high wage policies particularly advantageous for the reasons just mentioned. In the automobile assembly lines, for example, any damage to the machinery or underutilization of it due to absenteeism becomes extremely costly. To avoid these unfortunate events, automobile firms might raise their wages to assure themselves of a sufficient number of experienced workers. In this case, greater value added (per time period, not per worker, but the two are probably closely-related) and greater capital-intensity provide the economic rationale for higher wages.

A related argument has to do with labor unions. While very

little is known about the Colombian labor movement, it is clear that unions in some firms or industries are more powerful than in others.<sup>1</sup> It has been observed in the United States that unions possess greater negotiating power in highly-profitable industries, apparently because the cost of a strike is higher when more profits are foregone.<sup>2</sup> Insofar as profits are related to value added and capital-intensity (a not unreasonable assumption in Colombia), labor unions may be providing an additional impetus for higher wages to be paid in the high 'productivity', highly capital-intensive sectors.

It is important to note that all of the above arguments pertain to wage differentials among homogeneous workers. Of course, nobody would seriously argue that, as an empirical matter, labor is homogeneous. To the contrary, it is generally believed that certain groups of workers (the better-educated, for example) are inherently more productive than others. If competition in the labor market is at all prevalent, firms would be observed competing for the scarce pool of relatively able workers and would thereby bid their wages up. Gradually, a wage structure would evolve, with the more able members of the work force being rewarded by higher wages for their superior productivity.

Heterogeneity of the labor force poses a formidable problem for interpreting an association between average wages in an economic sector and value added and capital-intensity per worker. The difficulty is that these variables are denominated in non-standard units of 'labor,' and thus

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<sup>1</sup>The standard reference on labor unions in Colombia is Urrutia (1969).

<sup>2</sup>The theoretical arguments and empirical evidence are summarized in Levinson (1967).

are not very well-measured. We may illustrate the problem with reference to labor unions. As we have seen, one school of thought holds that the greater bargaining power of certain labor unions as compared with others originates in the presence of large profits in an industry or the absence of alternative production methods involving non-union labor. When a union raises wages, the higher wages serve to attract a larger pool of workers, and the employer can then choose the best workers from the available pool. On the other hand, it is also argued that those labor unions composed of inherently more productive workers enjoy greater negotiating power and are thus able to secure higher wages for their members. In the first explanation, we observe a causal relation running from higher wages to higher productivity, while in the second case, the causality is the reverse. Hence, higher 'productivity' in one sector as compared with another may be the consequence of higher wages achieved by unions and not the cause of the higher wages.<sup>1</sup> Therefore, while an association between wages, value added per worker, and capital per worker would be consistent with the view that workers in high productivity sectors are rewarded by higher wages, perhaps with their unions inducing the firms to

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<sup>1</sup>The absence of data for Colombia on union membership or power do not permit us to test among the alternatives mentioned. However, it is interesting to note that in the United States, where this type of information is available, Weiss (1966) and Ashenfelter and Johnson (1972) observed a wage differential due to unions of about 20%. They also found that unionized firms attract workers with more education and more experience. After adjusting the wage differential for these differences, Weiss found that unionized workers received wages similar to those received by comparable workers elsewhere and Ashenfelter and Johnson found that the union effect was not significantly different from zero. Thus, it may be concluded that one important effect of unions was to reallocate more productive workers to firms or industries which are forced by union pressure to pay higher wages.

share a part of their profits, it would also be consistent with the view that higher wages alter the skill mix but leave labor's share relatively unchanged.

In summary, we have isolated four reasons why firms with higher 'productivity' or greater capital-intensity might pay higher wages. These are: lack of equilibration in labor markets, firms' responses to a more complex set of economic forces than are usually considered, the impact of labor unions, and the lack of standardization for labor quality, particularly in capital-intensive processes. We reiterate that only some of these arguments apply to homogeneous labor. In others, there is nothing to indicate that groups of comparable workers receive higher wages if they work in sectors where value-added per worker and capital-intensity are high. To the contrary, it is precisely because those workers are better that their wages are higher.

Hypothesis 3. Sectors with proportionally more large firms pay higher wages ceteris paribus.

There is considerable evidence that large firms in Colombia pay higher wages.<sup>1</sup> We hypothesize that the effect of the variable "size of firm" remains even after controlling for the influence of other variables, in particular productivity and capital-intensity. There are three reasons for this hypothesis.

The first reason is the simple technological point that there tends to be greater interdependence among workers in large firms than in small firms. With this greater interdependence comes the need for a more

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<sup>1</sup>See, for example, Nelson, Schultz, and Slighton (1971), Chapter 5.

reliable work force, which is obtained through higher wages. The argument here is identical with that made earlier concerning the hypothesized relationship between capital-intensity and wages.

Secondly, there are other variables affecting wages for which size of firm is probably a proxy. Consider, for example, the effect of monopoly power in the product market.<sup>1</sup> In general, we would expect that firms which operate within monopolistic markets would be earning greater profits, and these firms would therefore have greater ability and incentive to pay higher wages. The monopolistic sectors would tend to be composed of relatively more large firms. Hence, in a cross section regression, we would find that economic sectors with more large firms would pay higher wages.

Finally, there is a connection between firm size and labor union activity. Colombian labor law prohibits the formation of unions in firms with fewer than 25 workers. Therefore, the more large firms there are in an economic sector, the more likely there are to be unions able to exert power to secure higher wages for their members. Data limitations prohibit the direct testing of unions' influence in large firms.

Hypothesis 4. Sectors which have proportionately more foreign investment or foreign capital pay higher wages ceteris paribus.

There is no reason inherent in the functioning of the labor market why higher wages would be paid in sectors with large concentrations of foreign investment or capital apart from the possibility that these firms may be more capital-intensive or have more large firms, which would

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<sup>1</sup>For an analysis of the role of product market considerations on wages in less developed countries with particular reference to Colombia, see Heady (1976)

presumably be reflected in the tests of Hypotheses 2 and 3. However, foreign firms in Colombia have been observed to pay higher wages<sup>1</sup> and various political or institutional reasons can be offered to explain this phenomenon. For example, one such reason is the desire of multinational firms in these sectors to maintain good public relations in the receiver country. Another reason is to avoid large wage differentials between foreign executives and nationals of the host country, and in turn, between nationals in executive positions and other personnel, also nationals. Also, it should be pointed out that foreign firms are probably on average more profitable than locals, and therefore possess greater capacity to pay higher wages due to pressures from unions or other sources. For all these reasons, we expect to find foreign firms paying higher wages. Once again, our hypothesis is multivariate, insofar as we hypothesize that the extent of foreign investment or capital contributes additional independent explanatory power even in the presence of productivity, capital-intensity, and size.

Hypothesis 5. Those sectors which have a higher proportion of white-collar workers (empleados) as compared with blue-collar workers (obreros) pay higher wages ceteris paribus.

Obreros are those who work directly with the industry's product while empleados do not; see the appendix for the precise definitions. In general, the category empleados includes higher-level occupations, such as professionals, managers, and office and clerical workers. Thus, we may regard the variable 'proportion white-collar' as a good approximation to the occupational composition of the sector in question. We

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<sup>1</sup>See Diaz-Alejandro (1974).



hypothesize that sectors with larger proportions of white-collar workers pay higher wages ceteris paribus, i. e., even after standardizing for productivity, capital-intensity, etc.

#### IV. Empirical Specification and Data

The sources of information are the sectoral surveys carried out by the national statistical office DANE (Departamento Administrativo Nacional de Estadística) between 1967 and 1970. The sectors in question are: industrial manufacturing, commerce, services, mining, and government. These five sectors are comprised of 82 subsectors and include 40% of Colombia's economically active population. In the appendix, we present a detailed description of the data and sources of information used in this study.

The variable to be explained is:

AVGREM. Average Remuneration.

AVGREM is equal to the sum of basic wages and salaries plus fringe benefits (prestaciones sociales) divided by the number of remunerated workers.

The definitions of the explanatory variables are:

PROD. Productivity.

PROD is value added per worker divided by the number of remunerated workers.

CAPINT. Capital Intensity.

This variable is defined differently in the sectors in which it appears due to lack of consistent data. In the industrial manufacturing sector, capital intensity is approximated by installed electrical capacity (measured in horse-power) per remunerated worker. In the mining sector, capital intensity is taken as electric usage (in kilowatt hours) per remunerated worker.

SIZE. Size of Firm.

Size of firm is equal to the proportion of establishments with more than 50 employees.

FOREIGN. Importance of Foreign Investment or Foreign Capital.

This variable is defined differently in the various sectors, which is because of lack of a consistent data series. In the manufacturing sector, FOREIGN is equal to the ratio of foreign investment to total investment. In the commerce and service sectors, it is the ratio of foreign capital to total capital.

WHTCOL. Importance of White Collar Employment.

WHTCOL is equal to the number of empleados (roughly, the number of white collar workers) as a percentage of the total remunerated labor force.

Our model therefore is:

$$\text{AVGREM} = \alpha + \beta_1 \text{PROD} + \beta_2 \text{CAPINT} + \beta_3 \text{SIZE} \\ + \beta_4 \text{FOREIGN} + \beta_5 \text{WHTCOL} + \epsilon$$

We hypothesize  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5 > 0$ .

Unfortunately, as is evident from the above descriptions, not all variables are available for all 82 subsectors. The availability of data is summarized in the following table:

	<u>Manufacturing</u>	<u>Commerce</u>	<u>Services</u>	<u>Mining</u>	<u>Government</u>
AVGREM	x	x	x	x	x
PROD	x			x	
CAPINT	x			x	
SIZE	x	x	x		
FOREIGN	x	x	x		
WHTCOL	x	x	x	x	*

x = Data available

\* = All government workers are classified as empleados;  
therefore, government workers are excluded from  
what follows.

We turn now to the empirical results. We present first the results of the simple correlations and then of the multiple regression.

## V. Results of Simple Tabulations and Correlations

Table 1 presents the average remuneration (AVGREM) in subsectors classified by the characteristics described in the preceding section. AVGREM appears to be positively-related, as hypothesized, to each of the following: value-added per worker (PROD), capital-intensity (CAPINT), percentage of establishments with more than 50 workers (SIZE), importance of foreign capital or investment (FOREIGN), and proportion white-collar (WHITCOL). Considering the basis in past empirical research for these hypothesis, the overall strength of these results is not particularly surprising.

To test the statistical significance of these patterns, we computed a set of simple correlation coefficients, which are presented in Table 2. Each of the variables shows a statistically significant positive correlation with AVGREM (.05 significance level, one-tail test). These results provide only partial confirmation of our hypotheses, however, since each of the hypotheses is formulated ceteris paribus and nothing has been standardized for in these tabulations and correlations. Hence, we must look at the multiple regression results, presented in Section VI.

TABLE 1. AVERAGE REMUNERATION IN COLOMBIA BY VARIOUS SECTOR CHARACTERISTICS

<u>Characteristic</u>	Average Remuneration	Number of Subsectors
	AVGREM	<u>n</u>
<u>Value-Added per Worker (Col. \$) (PROD)</u> <sup>a)</sup>		
< 25,000	\$10,500	2
25,000 - 50,000	28,700	12
over 50,000	30,300	14
<u>Capital Intensity (HP/L) (CAPINT)</u> <sup>b)</sup>		
0-5	\$18,300	13
> 5	23,300	7
<u>Percentage of Establishments with More than 50 Workers (SIZE)</u> <sup>c)</sup>		
< 10%	\$15,000	43
10-20%	20,600	10
> 20%	25,800	8
<u>Foreign Capital or Investment (FOREIGN)</u> <sup>c)</sup>		
< 5%	\$15,000	43
5-10%	19,000	6
> 10%	26,900	12
<u>Proportion White Collar (WHTCOL)</u> <sup>d)</sup>		
< 25%	\$18,200	34
25-50%	22,700	27
75%	29,700	8

a) Manufacturing, Mining

b) Manufacturing only

c) Manufacturing, Commerce, Services

d) Manufacturing, Commerce, Services, Mining

TABLE 2. SIMPLE CORRELATION COEFFICIENT WITH AVGREM, ALL AVAILABLE SECTORS

	Correlation Coefficient, <u>r</u>	Number of Subsectors, <u>n</u>	Critical Value <u>r<sub>n</sub></u>
PROD	+.83*	28 <sup>a)</sup>	+.35
CAPINT	+.64*	28 <sup>a)</sup>	+.35
SIZE	+.50*	61 <sup>b)</sup>	+.25
FOREIGN	+.56*	61 <sup>b)</sup>	+.25
WHICOL	+.34*	68 <sup>c)</sup>	+.24

a) Manufacturing, Mining

b) Manufacturing, Commerce, Services

c) Manufacturing, Mining, Commerce, Services

\* = Statistically significant correlation,  
.05 level, one-tail test

## VI. Multiple Regression Results

Our hypotheses of Section III and the model

$$\begin{aligned} \text{AVGREM} = & \alpha + \beta_1 \text{ PROD} + \beta_2 \text{ CAPINT} + \beta_3 \text{ SIZE} \\ & + \beta_4 \text{ FOREIGN} + \beta_5 \text{ WHTCOL} + \epsilon \end{aligned}$$

were formulated to test whether each of the explanatory variables has an independent effect on the dependent variable AVGREM. The multiple regression model lets us observe whether the influence of any of the independent variables is weakened by the presence of others, i.e., whether the relationship between the dependent variable and any particular independent variable are truly ceteris paribus. Consider, for example, the relationship between size of firm and capital-intensity. It is well-known that large firms in Colombia use more capital-intensive production techniques.<sup>1</sup> Are wages higher in these firms, because they are large or because they are capital-intensive, or does each factor provide additional explanatory power beyond that contributed by the other? An examination of multiple regression coefficients will give the answer.

The regression results are given in Table 3. The hypotheses of Section III receive substantial support. Three of the variables in question --- PROD, FOREIGN, AND WHTCOL --- are highly significant with positive signs each time they are encountered, thus confirming Hypotheses 1, 4 and 5. With respect to Hypotheses 2 and 3 (CAPINT and SIZE), the results vary from one sector to the next. The effect of capital intensity (CAPINT) is found to be statistically significant in manufacturing but not in mining. The poor result in mining may reflect poor quality data,<sup>2</sup> as

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<sup>1</sup>The simple correlation coefficient between SIZE and CAPINT in Colombian manufacturing is +0.42.

<sup>2</sup>Cf. footnote 2, page 3.



witnessed by the very large variation in the capital intensity variable reported in Table A.4. In the case of the large firm variable SIZE, its effect is significantly greater than zero in manufacturing, nearly so in commerce, and clearly insignificant in services.<sup>1</sup>

Overall, the regression results are quite good. The proportion of variance explained ranges from 83% in commerce and services to 95% in manufacturing. This is a strong finding and compares favorably with the explanatory power of other studies of Colombian wage structure.<sup>2</sup>

It might be objected that one possible reason for the high explanatory power is the close relationship between occupational composition, as measured by WHTCOL, and the average wage AVGREM. To gauge the importance of WHTCOL vis a vis the remaining explanatory variables, we re-ran each of the regressions with WHTCOL omitted. The results are reported in Table 4. As compared with those in Table 3, we note a decline in  $R^2$  ranging from four percentage points in manufacturing up to a 27 percentage point decline in services. Still, the overall explanatory power of the regressions remains high ( $R^2 = .91$  in manufacturing, .73 in mining, .64 in commerce, and .56 in services). Furthermore, and

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<sup>1</sup>It is interesting to note that it is the manufacturing sector in which the effects of CAPINT and SIZE are statistically significant, and that these effects are not significant in the other sectors in which they appear. One possible explanation is the fact that similar industrial surveys had been conducted previously in manufacturing, whereas the surveys in the other sectors were done for the first time. It is quite possible, therefore, that measurement errors are greater outside of manufacturing, which would tend to weaken the statistical results in those other sectors.

<sup>2</sup>See Sanjinés (1975) and Heady (1976).

equally important, each of the other independent variables retains its statistical significance (or lack thereof).

Based on these findings, we arrive at the following principal result:

Certain aspects of the industrial structure in Colombia are systematically associated with the wage structure. Higher wages are observed in those sectors characterized by higher value-added per worker, more foreign capital or investment, a higher percentage of large firms, greater capital-intensity, and more white-collar workers. Each of these factors has an additional influence beyond that contributed by the other variables.

While the effects of these variables are independent one from another in their influence on wage structure, we cannot be sure that they are independent of the omitted variables, in particular, those pertaining to the quality of the labor force. We have hypothesized, for example, that firms which are large and/or capital-intensive may require better-skilled workers due to the greater interdependence of their production methods, and so will pay higher wages in order to attract qualified workers. The regression coefficients on these variables would then reflect both the direct effect of size or capital-intensity on wages for workers in a given skill category and also the indirect effect of these characteristics in inducing firms to employ more highly-skilled workers. The task of distinguishing the direct from the indirect effects is left to future research.

In interpreting these results, we would infer that both market and institutional influences are at work in determining wage structure in

Colombia. While it is possible to offer market explanations for the observed relationships, we would hold that wage differentials of the observed magnitudes --- for example, 60% higher wages on average in the largest size category than in the smallest --- cannot be fully explained by assumed productivity considerations alone. It appears to us that an important independent influence is also exerted by labor unions, government pressures and legislation, and wage policies of large and/or multi-national corporations. This speculation cannot be verified with the available data. It would seem, though, that one would be hard-pressed to interpret the data as demonstrating that these institutional influences are absent.

TABLE 3

MULTIPLE REGRESSION RESULTS WITHIN SECTORS OF THE COLOMBIAN ECONOMY,  
ALL FIRM CHARACTERISTICS INCLUDED

	Manufacturing	Commerce	Services	Mining
PROD	0.06 (4.93)			0.12 (5.89)
CAPINT	216.51 (3.00)			0.09 (.56)
SIZE	123.60 (2.66)	266.31 (1.39)	56.19 (.63)	
FOREIGN	139.70 (1.98)	270.75 (2.99)	350.29 (5.90)	
WHFCOL	24,279.82 (3.38)	33,557.26 (4.30)	18,165.93 (5.06)	54,395.15 (3.77)
CONSTANT	7,232.59	2,562.03	6,122.15	5,402.30
R <sup>2</sup>	.95	.83	.83	.94
N (Number of Subsectors)	20	22	19	8

Note: t-statistics in parentheses

TABLE 4

MULTIPLE REGRESSION RESULTS WITHIN SECTORS OF THE COLOMBIAN ECONOMY,  
PROPORTION WHITE COLLAR EXCLUDED

	Manufacturing	Commerce	Services	Mining
PROD	0.07 (4.73)			0.13 (3.61)
CAPINT	233.03 (2.48)			-0.18 (.63)
SIZE	171.68 (2.98)	439.15 (1.69)	5.27 (.04)	
FOREIGN	187.07 (2.08)	458.63 (4.16)	388.52 (4.14)	
CONSTANT	10,327.13	12,507.79	11,361.99	24,146.71
R <sup>2</sup>	.91	.64	.56	.73
N (Number of Subsectors)	20	22	19	8

Note: t-statistics in parentheses

## VII. What We Have Learned and What Lies Ahead

The Colombian government has the objective of increasing the economic well-being of the poorest 50% of the population. Given that objective, and given the fact that most people receive most of their income from the work they do, the obvious need for public policy is to raise the rate of pay received by the poor. Toward this end, Colombian policy-makers are following a two-pronged strategy of enlarging the modern sector to absorb an increasing share of the economically active population in relatively remunerative activities while simultaneously seeking to provide those who remain in the traditional sector with more complementary resources. Planning for modern sector enlargement is typically done in sectoral terms, with the government trying to create more adequate-paying jobs by stimulating certain sectors of the economy or certain types of enterprises.

The main contribution of this paper has been to identify the high wage sectors and to describe their characteristics. We have found that five sectoral characteristics --- value added per worker, capital-intensity of production, degree of foreign capital or investment, importance of large firms, and occupational distribution --- have significant independent effects on wages.

Our results leave little doubt about the importance of these characteristics of the firms in an industry in explaining intersectoral, wage structure in Colombia. The role of the characteristics of the workers in an economic subsector has not been examined here. However, microeconomic studies have demonstrated convincingly that there is a systematic relationship between an individual's personal characteristics and his wage.

Together these results suggest that the Colombian wage structure is determined by a complex combination of institutional and market forces, the exact mechanisms of which are not yet fully understood.

A related question with substantial policy-relevance is the relative importance of individual as opposed to industrial characteristics in wage determination. At the industry level, this might be studied by including worker characteristics in interindustry regressions of the sort reported in this paper. Alternatively, at the microeconomic level, we might match up the individual with the distribution of firms in his subsector, classified according to size, degree of foreign ownership, capital-intensity, etc. and then regressing the individual's income on his characteristics and those of his industry. This might provide some useful input into decisions on such policy questions as whether the government should seek to encourage multinational firms which pay high wages or whether they should instead use their resources to subsidize education or vocational training. More generally, should government stimulate production and industrialization on the demand side of the labor market or should they instead work toward skill intensification on the supply side? This awaits additional research.

In the economy of an LDC like Colombia where budgetary resources are scarce, the government cannot act in all areas at once. Policy planners must evaluate the various possibilities in terms of their cost effectiveness, i. e., the number of jobs created per peso expended. This requires detailed knowledge of the employment-generation effects of alternative economic development policies, e. g., stimulus of large, foreign-owned firms which pay high wages versus small firms with intermediate technologies which

pay lower wages. Research on this question is notably lacking and badly-needed.

Finally, we are aware that our analysis has left out of consideration that part of the population which receives non-wage income, most importantly, the self-employed and small farmers who receive most of their income in kind rather than in cash. Agricultural incomes are undoubtedly determined by a quite different set of forces than incomes in other sectors of the economy. The enormous statistical difficulties of treating income in kind make the problem virtually intractable on a sectoral basis. Future investigations in these areas are essential if we are to really understand the determinants of incomes among Colombia's target group --- the poorer 50%.



## APPENDIX

### A. Data Sources

The sources used to obtain data for the five sectors (and sub-sectors thereof) of the Colombian economy are listed below.

#### Industrial Sector

Information on the industrial sector was obtained from the 1967 DANE Annual Manufacturing Survey (Encuesta Anual Manufacturera de 1967). This survey covers a wide spectrum of industries including establishments employing five or more persons and having a production volume of no less than 24,000 pesos.

The manufacturing sector is divided into the following 20 subsectors:

1. Foodstuffs
2. Beverages
3. Tobacco
4. Textiles
5. Clothing and footwear
6. Wood
7. Wooden furniture
8. Paper and its products
9. Printing
10. Leather
11. Rubber and its products
12. Chemicals
13. Petroleum derivatives
14. Non-metallic minerals
15. Basic metals

16. Metallic products
17. Non-electric machinery
18. Electric machinery
19. Transportation material
20. Diverse industries

Commerce and Services

For the commerce and service sectors, the data source was the 1970 DANE Census of Commerce and Services (Censo Grande de Comercio y Servicios de 1970).

The commerce sector is divided into 13 wholesale trade subsectors and 9 retail trade subsectors; the service sector consists of 19 subsectors:

Wholesale Trade

1. Non-processed agricultural products
2. Metallic minerals and fuels
3. Industrial chemical products
4. Sawed lumber and construction materials
5. Machinery and related materials
6. Vehicles, automobiles and accessories
7. Hardware and electrical products
8. Foodstuffs and beverages
9. Non-manufactured textile products
10. Clothing and accessories
11. Furniture and household accessories
12. Drugs and cosmetics
13. Other

Retail Trade

1. General merchandise
2. Grocery stores
3. Clothing and footwear
4. Pharmaceuticals
5. Furniture and household utensils
6. Porcelain and glass
7. Vehicles, motorcycles, bicycles
8. Fuel distributors
9. Non classified

Services

1. Restaurants, cafes and others
2. Hotels, boarding houses and others
3. Transportation services
4. Storage deposits
5. Real estate
6. Publicity services
7. Services rendered to businesses
8. Renting of machinery and equipment
9. Renting of non-specified machinery and equipment
10. Communal and social services
11. Footwear repairs and others
12. Electrical goods repair shops
13. Automobile repair shops
14. Watch and jewelry repair shops

15. Other repair services
16. Laundry services
17. Domestic services
18. Photographic studios
19. Non-specified personal services

### Mining Sector

Data for this sector were obtained from the 1969 DANE Census on Mines and Quarries (Censo de Minas y Canteras) which includes 203 of the most important establishments of this sector. The mining sector is divided into the following 8 types of activities:

1. Operation of coal mines
2. Metallic minerals excluding precious metals
3. Crude oil and natural gas
4. Operation of salt mines
5. Extraction of stone, clay and sand
6. Operation of emerald mines
7. Precious metals
8. Operation of other mines

### Government

Information for the government sector was obtained from the 1967 DANE Annual Report on Fiscal, Administrative and Financial Statistics (Informe Anual de Estadísticas Fiscales Administrativas y Financieras de 1967).

Only national employees were selected from this source since sex-specific data were not available for departmental and municipal employees. Figures refer to the following 13 administrative divisions:

1. Direction of public administration
2. Justice and interior order
3. International relations
4. Tax collection
5. National public services
6. National defense
7. Education and culture
8. Public assistance and hygiene
9. Labor and social security
10. Economic development
11. Control and fiscalization
12. Statistics
13. Miscellaneous services

B. Definitions of Variables

This section enumerates upon the variable definitions and, in some cases, explains the way they were modified for this study.

Average Remuneration

"Global salary" is used, which is defined as the basic salary expenditure plus fringe benefits divided by the number of remunerated workers in each sector and subsector. To make the figures comparable, remunerations in the trade, services and mining sectors are adjusted to 1967 pesos, using an average of the price indices for blue and white collar workers, which in 1969 and 1970 were 115.0 and 123.1 respectively.

Number of Remunerated Workers

Labor force figures are broken down by sex among both blue and white collar workers who received some type of remuneration (in money or in kind), omitting owners, partners and their families.

The difference between blue collar and white collar workers is that a blue collar worker (obrero) performs physical chores whereas a white collar worker (empleado) performs clerical and administrative duties.

Blue collar workers within the manufacturing sector include the workers and their apprentices; within the commerce sector blue collar include salespeople and service personnel; within the service sector, auxiliary personnel along with those rendering the service directly; and within mining both specialized and non-specialized laborers are included.

White collar workers in the manufacturing sector include administrative personnel and technicians; in the commerce and service sectors, national and foreign directors and office personnel; and in the mining sector, administrative employees. All workers in the government sector were classified as white collar.

Participation of Foreign Investment

This refers to the proportion of investment originating from foreign sources and was available for the subsectors of manufacturing. It is the ratio of foreign investment to net fixed investment. Net fixed investment includes expenditures during the year (purchases and/or own production) by industry and additions of new durable goods to their stocks of fixed assets, excluding sales of similar goods. Figures on foreign investment were transformed into 1967 pesos, using the annual

average of the official exchange rate, which was Col. \$14.73 per U.S. dollar.

#### Participation of Foreign Capital

This information was available in the commerce and service sectors. It is the ratio of foreign capital to total capital.

#### Average Productivity

Average productivity was defined as gross value added divided by the total number of paid workers. This variable was defined only for those sectors directly related to the process of production, namely the manufacturing and mining sectors. The value added of the latter sector was adjusted to 1967 prices using the same index by which remunerations were deflated.

#### Capital Intensity

In the manufacturing sector, capital intensity is approximated by installed electrical energy capacity in horsepower units divided by the number of remunerated workers. In the mining sector, the variable is electrical energy consumption in kilowatt hours divided by the number of remunerated workers. These two measures were used alternatively in the analyses of the respective sectors.

#### Size

For the manufacturing, services, and commerce sectors, for which data were available, establishment size was measured by the number of workers employed. The size variable used was the number of establishments with 50 or more employees in each sub-sector.

C. The Data

Tables A1-A5 give the data.



Table 1

Manufacturing Sector

1967

Sub Sector	Average Remuneration	Number of Remunerated Workers				Investment			Average Prod. (VA/L)	Capital Intensity (HP/L)	Number of Establishments by Size (No. of Workers)							
		Blue - Collar Men	Blue - Collar Women	White - Collar Men	White - Collar Women	Total (Thousands)	Foreign (Thousands)	F/T (%)			<5	5-9	10-19	20-49	50-74	75-99	100+	Tot.
0101	15.752	22.983	9.207	6.757	1.868	489.333	3.360	0.68	59.832	5.34	1.230	978	352	226	55	28	67	2.9
0102	28.293	8.798	1.062	4.731	656	117.807	133	0.19	135.923	4.63	53	45	29	24	13	10	46	2
0103	23.414	1.461	1.452	287	91	4.421	0	0	185.033	1.36	52	56	28	13	3	0	9	1
0104	20.120	25.057	14.216	5.323	1.502	212.973	13.396	6.28	43.435	3.35	100	83	65	92	31	10	61	4
0105	9.544	7.842	16.067	1.811	1.259	24.450	0	0	23.863	0.49	767	509	212	176	48	24	44	1.7
0106	11.390	4.934	305	605	143	20.541	0	0	25.107	5.44	134	135	83	34	5	1	14	4
0107	11.451	3.899	279	403	178	6.368	0	0	19.764	1.68	126	139	63	49	5	3	5	3
0108	25.341	3.404	1.165	1.219	304	108.835	313	0.28	64.430	11.35	6	15	27	36	8	7	11	1
0109	18.571	6.591	2.114	2.029	715	22.753	0	0	41.722	0.99	96	147	128	70	13	6	17	4
0110	14.611	2.775	710	461	119	10.922	0	0	41.225	3.73	138	63	36	15	2	3	10	2
0111	27.061	3.743	1.358	1.377	258	20.418	2.873	14.07	56.426	16.20	6	12	15	23	4	1	8	2
0112	25.016	9.402	4.939	6.586	2.553	579.297	39.815	6.87	87.240	4.52	105	104	104	91	29	16	49	5
0113	44.429	1.297	45	654	62	335.793	5.710	1.48	277.754	45.30	0	5	3	4	1	1	3	1
0114	17.189	18.896	1.679	2.598	699	88.286	15.892	18.00	35.567	6.83	333	297	148	116	24	16	43	9
0115	21.731	3.944	40	599	117	45.674	0	0	68.767	9.13	2	3	7	5	3	1	13	1
0116	16.037	14.070	1.872	2.863	823	76.563	5.812	7.59	35.627	2.83	109	182	163	145	37	20	38	6
0117	16.858	4.596	103	782	210	45.765	869	1.89	31.955	3.84	36	73	71	39	7	3	11	2
0118	21.748	5.847	1.180	1.778	523	25.052	6.138	24.50	52.776	4.03	35	61	54	42	15	11	19	2
0119	16.007	11.148	153	1.657	415	19.600	0	0	29.609	1.46	169	194	118	68	15	10	19	5
0120	16.652	4.771	2.616	1.372	568	59.719	0	0	44.168	1.96	55	76	57	70	23	13	20	3

Sources: DANE, Encuesta Anual Manufacturera and Boletín de Estadística No. 239, pp. 70-71

Table 2

## Commerce Sector

1967

Sub Sector	Average Remuneration	Number of Remunerated Workers				Capital			Number of Establishments by Size (No. of workers)							
		Blue - Collar		White - Collar		Total (Thousands)	Foreign (Thousands)	F/T (%)	<5	5-9	10-19	20-49	50-74	75-99	100+	Total
0201	13.185	441	58	121	57	22.286	0	0	1	13	6	6	0	1	2	29
0202	33.430	713	47	757	161	480.371	54.227	11.28	2	22	23	12	3	1	2	65
0203	42.999	661	86	707	412	132.848	58.332	43.90	2	14	17	11	4	0	6	54
0204	16.424	931	78	286	212	118.966	0	0	5	46	40	16	5	0	0	112
0205	29.411	961	109	923	439	169.861	18.959	11.16	4	27	25	33	6	1	3	99
0206	21.175	1.069	84	667	438	108.781	73.184	35.05	1	34	47	27	6	2	1	118
0207	18.575	1.434	99	624	424	194.506	0	0	6	57	59	34	5	1	1	163
0208	18.888	3.076	639	1.137	700	301.866	34.664	11.48	16	156	116	44	6	2	8	348
0209	19.874	1.629	647	728	706	233.402	0	0	1	42	110	58	5	1	0	217
0210	19.284	1.112	514	531	438	152.241	4.663	3.06	6	60	67	34	2	0	3	172
0211	30.344	755	281	594	292	89.217	22.716	25.46	4	26	23	8	0	0	4	65
0212	24.874	1.348	232	1.260	581	156.831	11.838	7.54	3	21	29	37	13	5	5	113
0213	24.132	2.159	370	1.346	689	303.839	59.569	19.60	13	92	75	38	5	1	7	231
0221	9.036	2.258	12.425	852	739	257.018	4.010	1.56	36	223	152	70	26	16	33	556
0222	11.566	3.753	2.591	1.219	768	314.663	2.067	0.65	74	254	104	60	8	3	14	517
0223	10.795	3.744	4.320	1.088	1.005	366.816	2.461	0.67	73	391	227	96	5	3	9	804
0224	9.816	2.334	896	565	378	163.579	0	0	43	206	98	33	2	4	2	388
0225	19.644	5.026	1.414	2.437	1.926	508.077	31.614	6.22	45	198	174	102	25	6	14	564
0226	12.064	3.228	384	913	708	271.181	480	0.17	45	262	155	44	7	1	0	514
0227	15.251	4.350	395	2.412	4.008	701.929	12.235	1.74	34	268	169	89	16	7	6	589
0228	11.326	4.588	118	871	401	189.569	5.999	3.16	12	173	164	57	4	1	4	435
0229	13.462	5.706	1.799	2.173	1.440	371.708	10.680	2.87	56	307	167	70	17	6	15	638

Source: DANE, Censo Grande de Comercio, 1970

Table 3  
Service Sector  
1970

Sub Sector	Average Remuneration (1967 pesos)	Number of Remunerated Workers				Capital			Number of Establishments by Size (No. of Workers)							
		Blue - Collar		White - Collar		Total	Foreign	F/T	<5	5-9	10-19	20-49	50-74	75-99	100+	Total
		Men	Women	Men	Women	(Thousands)	(Thousands)	(Thousands)								
0301	6.592	7.982	12.839	1846	498	315.925	784	0.24	165	1436	713	171	17	5	9	2516
0302	13.390	1.701	3.245	636	477	289.915	4.716	1.62	32	227	97	51	13	8	12	440
0303	16.750	642	152	419	204	52.651	56	0.10	3	34	19	13	1	0	2	72
0304	16.337	135	9	154	36	50.629	0	0	0	3	1	6	1	0	0	11
0305	19.304	210	91	585	451	50.867	2.000	3.93	11	50	32	13	1	1	2	110
0306	29.907	333	109	277	165	18.814	4.906	26.07	3	24	20	9	4	0	0	60
0307	9.782	101	66	62	20	2.193	0	0	0	3	4	4	1	0	0	12
0308	26.841	898	25	209	50	73.135	35.953	49.15	1	14	7	4	5	0	3	34
0309	13.216	94	11	29	16	14.678	405	2.75	3	1	6	3	0	0	0	13
0310	14.846	184	27	54	30	4.640	0	0	1	4	3	0	2	0	1	11
0311	8.402	77	26	12	2	664	0	0	2	13	4	1	0	0	0	20
0312	10.877	1.052	60	149	98	17.784	500	2.81	24	61	27	12	0	0	3	127
0313	10.978	6.072	100	605	405	102.273	2.575	2.51	143	472	183	75	7	2	0	882
0314	11.246	16	3	1	6	410	0	0	1	2	1	0	0	0	0	4
0315	10.175	739	33	57	52	13.628	80	0.58	21	54	23	8	2	0	0	108
0316	10.299	2.084	1.493	197	175	31.911	258	0.80	4	39	60	49	6	3	7	168
0317	4.947	326	243	19	18	461	0	0	3	4	0	2	0	0	2	11
0318	12.654	20	1	10	2	347	0	0	0	3	1	0	0	0	0	4
0319	8.542	17	8	7	3	461	40	8.67	1	4	1	0	0	0	0	6

Source: DANE, Censo de Servicios Grande, 1970.

Table 4

Mining Sector

1969

Sub-Sector	Average Remuneration (1967 pesos)	Number of Remunerated Workers				Average Productivity (VA/L)	Capital Intensity (KWH/L)
		Blue - Collar		White - Collar			
		Men	Women	Men	Women		
0401	122.475	4219	27	502	69	35.648	16.461
0402	55.814	3	0	10	3	28.372	0
0403	88.531	1902	141	802	186	522.345	39.789
0404	21.696	2093	15	253	45	57.041	54.100
0405	35.488	693	9	195	46	99.820	3.674
0406	21.057	124	12	45	23	93.410	1.035
0407	25.107	1772	74	351	62	52.708	37.963
0408	18.195	816	10	123	24	28.828	5.245

Source: DANE, Censo de Canteras y Minería, 1969

Table 5

Government Sector

1967

Subsector	Average Remuneration	Number of Remunerated Workers	
		Men	Women
0501	21.301	2.500	1.736
0502	13.483	50.343	3.842
0503	120.982	188	116
0504	20.714	2.976	1.799
0505	31.383	282	37
0506	9.714	6.048	1.436
0507	21.677	4.294	2.366
0508	23.639	243	224
0509	24.540	226	116
0510	30.933	1.466	282
0511	254.475	2.834	1.047
0512	16.151	847	372
0513	22.211	292	203

Source: DANE, Estadística Fiscal Administrativa y Financiera, 1966-67, pp. 495-498.

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