Review of Income and Wealth
Series 44, Number 2, June 1998

WAGE DIFFERENTIALS AND OCCUPATIONAL WAGE PREMIA: FIRM-LEVEL EVIDENCE FOR BRAZIL AND CHILE

BY ALEJANDRA MIZALA AND PILAR ROMAGUERA

Universidad de Chile

This paper examines wage differentials at the firm level in Chile and Brazil, using data for 1985 and 1991, and 1987 respectively. The high level of disaggregation in the data available for Chile enables us also to analyze the degree to which wage differentials between individual employers are similar across occupations.

The results of this study reaffirm those of previous research pointing to non-competitive explanations for wage differentials, specifically providing clear evidence that inter-firm wage premia are highly correlated across occupations.

I. INTRODUCTION

This paper examines wage differentials in Chile and Brazil using data at the firm level for 1985, 1991 and 1987 respectively. The high level of disaggregation in the data available for Chile enables us also to analyze the degree to which wage differentials between individual employers are similar across occupations. This type of analysis has not previously been carried out for developing countries, and indeed there are few studies using firm-level data even for developed economies.

Inter- and intra-industry wage dispersions have been analyzed extensively for developed countries, particularly the United States, but the evidence for LDCs is scantier. However, in recent years several papers have been published concerning inter-industry wage differentials in Latin American countries (e.g. Gatica, Mizala, and Romaguera, 1995; Castelar Pinheiro and Ramos, 1994; Abuhadba and Romaguera, 1993).

This study provides evidence on wage dispersion in two Latin American countries of similar development levels within an international spectrum, but of different characteristics in terms of size and degree of industrial development, thereby enabling us to confer greater generality on the conclusions. This research thus makes it possible to determine to what extent the patterns of wage differentials in developing countries are similar to those found in developed countries.

Chile is one of the most dynamic economies in Latin America, and has enjoyed high rates of GDP growth during the years analyzed (1985, 1991). Brazil is a highly industrialized country, of undeniable importance within Latin America owing to its size.

Wages in both economies have been influenced by government regulations, the most important of which has involved indexation to past inflation: a phenomenon typical of economies with high inflation levels.

Note: This research was conducted with the support of FONDECYT, Project No. 1255 91. We would like to thank an anonymous referee for helpful comments and suggestions, and we are indebted to Marcelo Henríquez for his research assistance. We are also grateful for comments received at the XIIth Latin American Meeting of the Econometric Society, Tucumán, Argentina, 1993.

In Chile, government-regulated wage-setting was phased out at the end of the 1970s and beginning of the 1980s, when mandatory readjustments and obligatory indexation for the private sector were eliminated. Thus, in the years under analysis (1985 and 1991), all private-sector wages were regulation-free, except for the minimum wage. In Brazil, mandatory wage indexation persisted throughout the entire period.

In the two economies the importance of collective bargaining has varied over time, partly due to changes in the political scenario. In Chile, collective bargaining covers less than 20 percent of the employed population, and trade union bargaining power was weak during the period under analysis: in 1985 the country was ruled by a military regime, and in 1991 only one year under democratic government had elapsed. In the Brazilian case, there was an increase in the importance of collective bargaining processes in the 1980s, due to a revival of trade-union activism following a long period of inactivity under military rule.

The Chilean data used in this study was provided by a leading firm of consultants in the field of private-sector wage surveys. The information for Brazil corresponds to the 1987 RAIS (Relação Anual de Informações Sociais—Annual Social Information Report). A detailed description of the information sources used for Brazil and Chile can be found in Section III of this paper, where it will be appreciated that the two data sources have different characteristics, thereby allowing us to stress different aspects of wage-differential issues.

II. Studies of Wage Differentials

The fact that apparently similar workers receive different wages has traditionally attracted research attention in labor economics.

The initial empirical research on this topic begin in the 1950s and 1960s, basically for developed countries, taking industry as the unit for analysis. Papers arising from this research dealt with the effects of several industry characteristics, such as level of profits, degree of concentration, degree of unionization, product, technology and size, on the average wage.[1]

However, new theoretical developments and access to better information sources later changed the research emphasis, and it was against this background that wage dispersion, which traditionally had been explained basically by demand factors (industry characteristics), in the 1970s began to be accounted for in terms of labor supply features (human-capital models).

Subsequently, in the 1980s a new generation of studies appeared emphasizing firm or industry characteristics as explanatory factors for wage dispersion, but at the same time controlling for supply-side factors (worker characteristics). These new studies use more disaggregated data at the firm or worker level, with workers' human capital endowment being acknowledged as a central factor in wage dispersion, even though wage differences between "comparable" workers are highlighted. In other words, attention is focused on the hypothesis that workers with identical human capital endowments receive different remunerations, depending on where they work.

[1]See, for instance, the classic papers by Dunlop (1957), Slichter (1950) and Master (1969).

More recently, there has been a renewed interest in the topic of wage dispersion, associated with studies by Krueger and Summers (1987, 1988), Dickens and Katz (1987a, b) and Groshen (1986, 1991a), among others. The major contribution of these papers has been to relate empirical evidence to new theoretical developments. Previously, most of the studies that analyzed the influence of firm or industry characteristics on wage determination were based on relatively *ad-hoc* hypotheses about the influence of trade unions, market concentration, etc., without being able to generate a theory to explain the regularities observed.

The work of Krueger and Summers—and the other authors cited—relates the existence of wage differentials to efficiency-wage hypotheses. Although efficiency-wage models were developed initially as a neo-Keynesian justification for unemployment, they also furnish arguments to account for wage dispersion between "equivalent" workers.[2] These models and the ensuing discussion as to whether the labor market is competitive or not, have generated new interest in wage dispersion, not only as a distributive problem, but also for what it can tell us about the workings of the labor market.[3]

The literature on wage differentials has blossomed in recent years, and although most of it relates to the U.S.A., studies for other developed countries are also available: Edin and Zetterberg (1992) for Sweden; Elliott and White (1993) for United Kingdom; Gera and Grenier (1994) for Canada and Moll (1993) for South Africa, among others.

In Latin America, research on wage-setting has been concerned mainly with the estimation of human-capital models and the analysis of labor-market segmentation, but recently inter-industry wage differentials have been analyzed for Brazil, Chile, Uruguay and Venezuela.[4] The results of these studies are similar to those reported for developed economies: substantial wage differentials persist, even after controlling for worker characteristics, and they are stable over time. The differentials are also correlated across occupations and, to a lesser extent, across establishment sizes. Moreover, it is also found that both the low-paying and the high-paying industries are the same across the development spectrum: industries such as textiles and apparel tend to pay low wages across different countries, whereas heavier industries, such as transport or chemicals, always tend to pay higher wages (Gatica, Mizala, and Romaguera, 1995). These results strengthen the role of technology as a factor underlying wage differentials and, conversely, militate against country-specific factors—such as market regulations or degree of unionization. The main divergences from developed-country studies are larger inter-industry wage dispersions and a much bigger drop in wage differentials when labor quality controls are introduced into the estimation.[5]

[2]For further information on efficiency-wage models, see Shapiro and Stiglitz (1984), Katz (1986, 1988), Akerlof and Yellen (1986), and Solow (1980).

[3]Further background information on the issue of labor market competitiveness and its relationship to wage dispersion can be found in Murphy and Topel (1987, 1990) and Gibbons and Katz (1992). With respect to policy implications, see Bulow and Summers (1986) and Katz and Summers (1989).

[4]In Gatica, Mizala, and Romaguera (1995), as well as in Castelar Pinheiro and Ramos (1994), inter-industry wage differentials are analyzed for Brazil. In Abuhadba and Romaguera (1993) results on inter-industry wage differentials, reported for Chile, Uruguay and Venezuela, are summarized.

[5]This difference may be explained by a higher educational variance across industrial sectors and a higher return to human capital in LDCs than in developed countries.

Each of the studies mentioned, with the exception of Groshen (1986, 1991a), addresses the issue of inter-industry wage dispersion, i.e. their unit of analysis is the industry, and they implicitly assume a standard representative firm for each one. The reason why an industry may be made up of a heterogeneous set of firms is an issue that is not explicitly tackled in these studies. However, given that efficiency-wage models take the firm as the unit of analysis, studies at the firm level are especially suitable for examining some of these models. Sociological models, for example, stress that workers are concerned about their relative wages, so there ought to be some positive correlation between the wages within a firm.

A selection of empirical studies on wage differentials among firms and between plants is summarized in Groshen (1991b). Many of these are case studies centered on a single labor market, and they provide strong evidence not only that employer differentials within occupations do exist, but they are associated with measurable employer-attributes, such as firm- or plant-size. Groshen (1986, 1991a), in particular, provides an exhaustive investigation of intra-industry wage differentials among U.S. manufacturers. She finds that within a detailed occupational category and industry, (i) a random switch in employer is associated with an expected wage differential of 10–15 percent, and (ii) that the wage level is associated with employer size, industrial sector and the gender composition of the firm.

There are also studies arguing that the firm is a poor predictor of wages and that the greater wage dispersion is accounted for by worker characteristics. This is the conclusion reached by Knight and Sabot (1983), for instance, in a study carried out in Tanzania. However, their result may be due to methodological differences, especially in the occupational variances of the samples of workers used.

The present study attempts to analyze wage differentials at a more disaggregated level, mainly using data at the firm level, together with a detailed occupational classification in the Chilean case.

III. Empirical Results

In this study, wage differentials at the firm level are analyzed by testing the statistical significance of dummy variables representing the firm in a wage equation that controls for human capital.[6] This technique captures the entire firm-effect, but it does not identify correlated characteristics and may overstate the firm effect if firms are ranked by unmeasured human capital.

The relationship between wages and firm characteristics is analyzed by regressing the coefficients of the firm dummies (which constitute a ranking of firms on the basis of the wages they pay to workers with identical personal characteristics) on firms' characteristics. This approach has the advantage of allowing

[6]To do so, the first step is to perform a regression of the logarithm of wages as a function of human capital variables. Then the dummy variables representing the firm in which each worker works are added to this equation. The difference between the R^2 of each equation determines the marginal contribution of firms to the explanation of variations in wages. The statistical significance of these dummy variables is analyzed by resorting to likelihood-ratio and F-tests.

a clear separation between variables representing workers' personal attributes and those of the firm.[7]

It is important to point out that in both data sets—Chile and Brazil—there is a small number of firms in each industry, so it may be difficult to distinguish industry-effects from firm-effects.

Another way of testing whether the firm or the industry has a significant effect on wages is through a correlation analysis of wages across groups of workers belonging to the same firm. If all wages are positively correlated within the firm, a wage-differential effect exists because it is unlikely that unmeasured human capital would be correlated across occupations. An in-depth examination of this issue requires highly disaggregated data at the occupational level, which is available in the case of Chile.

III.1. Brazil: Wage Differentials at the Firm Level

This section presents the results of the analysis of wage differentials in Brazilian manufacturing industry. The information source used is the 1987 RAIS, an annual census of establishments carried out by the Ministry of Labor, containing individual information on workers and firms in the major Brazilian cities. The study is based on a representative sample of 12,580 workers in 172 firms selected at random from São Paulo manufacturing industry.[8] The earnings variables used were individual wages.

Two regressions were estimated, one covering all workers (from managers to unskilled workers) and a second one limited to 8,071 workers on the production staff (industrial production workers, machine operators, drivers, etc.), so as to analyze whether the results are sensitive to the occupational variance of the worker sample.

Table 1 presents a summary of the regressions of the logarithm of wages as a function of human-capital variables and firm-dummy variables.[9] The dummy variables, as a whole, are statistically significant, indicating the importance of the place of work in wage differentials. These results are obtained for the whole sample, as well as for the regression run with the reduced occupational variance. In other words, there is empirical evidence confirming that the firm an individual works in is a good predictor of the wage he or she is paid. By including the firm dummy, the explanatory power of the regression is raised by 6.7 percentage points for the whole sample (the adjusted R^2 increases from 63.5 to 70.2), and by 9.2 percentage points for the regression covering occupations only among the production staff. Furthermore, by adding the firm-dummy variables the standard deviation of log. wages is reduced.

[7]As an alternative to this technique, one can run a regression of wages as a function of human capital variables and the firms' characteristics. However, the statistical significance of firm-characteristics may be overestimated, as the latter are included several times in the same regression. The results obtained by including firm-characteristics along with human capital, or occupation, in wage regressions are available under request.

[8]Individuals working in manufacturing industry in São Paulo represent 28.6 percent of all Brazilian industrial workers.

[9]The human capital variables used were: age, seniority, gender (dummy), 9 educational dummies, 7 occupational dummies and gender-age interaction.

This approach is similar to that of Dickens and Katz (1987a) where the contribution of covariates to wage variation is measured with and without the firm effect. For the sample as a whole we obtain the same result as Dickens and Katz (1987a, Table 3-1); i.e. the adjusted R^2 increases by 6.7 percentage points when including the firm dummies in our case, or the industry dummies in their case.

TABLE 1
SUMMARY OF REGRESSIONS FOR BRAZIL

Regression Results					
	Adjusted R^2	F-Test Firm Dummies	Likelihood Ratio Test	Standard Deviation	N
All occupations					
Covariates	63.5			0.395	12,580
Covariates + firm dummies	70.2	17.56**	1186.64**	0.357	12,580
Occupations in the production staff					
Covariates	53.8			0.376	8,071
Covariates + firm dummies	63.0	12.61**	850.32**	0.337	8,071

Range of Firm Wage Differentials[b]				
	Minimum	Maximum	Standard Deviation	N
All occupations	−0.82	0.52	0.20	172
Occupations in the production staff	−0.99	0.83	0.23	172

** Significant at 1%.

[a] The independent variable in the regression is the logarithm of the individual wage, and the covariates are: age, seniority, gender (dummy), 9 educational dummies, 7 occupational dummies, and gender-age interaction.

[b] Based on firm dummy coefficients, obtained from regression results, explained in note *a*.

It is important to draw attention to the magnitude of the wage differentials, and Table 1 shows the range of estimated differentials along with their standard deviations. In São Paulo manufacturing industry, workers in the same occupation and with similar characteristics may earn 82 percent less, or 52 percent more, than the average wage, with a standard deviation of 0.20. These differentials become more pronounced when only production staff occupations are considered, the range fluctuating between 99 percent less and 83 percent more than the average wage, with a standard deviation of 0.23. This range of wage differentials is extremely high, especially when one considers that the estimation not only controls for occupation, but also for gender, age, education and seniority in the company.[10] The standard deviation of wage differentials obtained at the firm level is higher than the standard deviation obtained in other studies at the industry level—0.13

[10] In the case of Brazil, the range of differentials can also be computed by weighting by employment in each firm. Wage differentials fluctuate between 86 percent less and 49 percent more than the weighted-average salary in the case of all occupations, with a standard deviation of 0.22, and between 90 percent less and 77 percent more than the weighted average in the case of production staff occupations only, with a standard deviation of 0.25.

in the case of Brazil, and between 0.108 and 0.177 in the case of U.S.A.[11] Furthermore, the standard deviations of wage differentials obtained in this study are higher than those reported by Groshen (1991a) in a study using firm-level data for the U.S.A., where the figures vary between 0.09 and 0.18, with a mean of 0.14. However, these estimates are not wholly comparable as Groshen calculates the standard deviation of establishment wage differentials for each of the six industries she works with rather than as a whole set. Moreover, since she examines six fairly narrowly defined industries, with a significant number of establishments in each, she is able to analyze each industry separately and can therefore be confident that true firm-effects are being picked up.

The results obtained for Brazil, using a large sample and controlling for human capital variables, thus show that there are significant differentials among workers' wages. As expected, the effect of the firm on wage differentials is higher when the occupational variance is lower; this is shown both by the increase in the adjusted R^2 when including the firm-dummy variables, and by the greater range of wage differentials.

We also examine the influence of firm size on wage differentials, by estimating a regression of wage differentials as a function of the firm's industrial sector and size—measured by the number of workers.[12] This regression, presented in Table A1 in the Appendix, has been corrected for heteroskedasticity.[13] The relevance of firm size in explaining wages has been proven in many studies and is reaffirmed in this research.[14]

III.2. Chile

The research on Chile is based on data from wage surveys carried out by a private consultancy firm for 1985 and 1991. This is a non-random sample, made up of large and technically advanced corporations which are leaders in their respective areas. The corporations in the sample represent 42 percent of total assets and 44 percent of sales revenues earned by all corporations in the country.[15] The data for 1985 comes from two surveys: one conducted in March involving managerial and administrative staff (MAS), covering 86 firms, 75 occupations and 2,288 observations, and another carried out in June (75 firms, 59 occupations and 2,102 observations) covering production and administrative staff (PAS). The 1991 sample comprises 86 firms, 81 occupations and 3,006 observations drawn from production and administrative staff (PAS). The MAS sample covers the entire range of occupations (from managers to unskilled workers), excluding

[11]See Gatica, Mizala, and Romaguera (1995) and Krueger and Summers (1988) for Brazil and U.S.A. respectively.

[12]Ideally, other firm characteristics should be included, such as ownership, technology and gender composition. However, in the Brazilian case this information is not available.

[13]In an alternative approach, a wage regression including firm characteristics as well as human capital and occupational variables was estimated, and the results confirm the importance of firm size in explaining wage premia. Our results are therefore robust to the methodology used to investigate the influence of firm size on wages. These results are available under request.

[14]See, for instance, Davis and Haltiwanger (1991), Brown *et al.* (1990), and Morissette (1993).

[15]There could be a selection bias in the sample of companies, since they themselves buy this service from the private consultancy firms, which indicates they are companies which are interested in or concerned with the issue of wages.

TABLE 2

SUMMARY OF THE REGRESSIONS FOR CHILE

	Adjusted R^2	*F*-test Firm Dummies	Likelihood Ratio Test	Standard Deviation	*N*
Regression Results[a]					
Year 1985					
Managers and Administrative Staff (MAS)					
Covariates	87.03			0.305	2,288
Covariates + firm dummies	92.70	21.61**	597.17**	0.228	2,288
Production and Administrative Staff (PAS)					
Covariates	63.90			0.318	2,102
Covariates + firm dummies	82.00	28.81**	561.42**	0.225	2,102
Year 1991					
Production and Administrative Staff (PAS)					
Covariates	78.54			0.312	3,006
Covariates + firm dummies	88.77	90.69**	884.8**	0.226	3,006

Range of Firm Wage Differentials[b]

	Minimum	Maximum	Standard Deviation	N
Year 1985				
Managers and Administrative Staff (MAS)	−0.61	0.52	0.23	86
Productive and Administrative Staff (PAS)	−0.59	0.69	0.24	75
Year 1991				
Production and Administrative Staff (PAS)	−0.41	0.59	0.22	86

** Statistically significant at 1%.

[a] The independent variable in the regression is the logarithm of the average wage earned by an occupation in a specific firm (firm cell), the covariates are the occupational dummies.

[b] Based on firm dummy coefficients, obtained from regression results, explained in note *a*.

production jobs. The PAS sample covers occupations from the middle to bottom of the range (from department heads to unskilled workers) including production workers.

The earnings variable used is the average wage for all individuals in a specific occupation; therefore, for each firm we have as many observations as it has occupations.

(a) Wage Differentials at the Firm Level

Table 2 presents a summary of the results obtained from a regression of the logarithm of wages as a function of occupational and firm dummies.[16]

[16]Unfortunately, the information available for Chile does not make it possible to control for human capital variables, it is only possible to include occupation as a control variable, and we use 75 occupational dummies. Also, since our sample sizes are small, the industry controls are broad; therefore, firm wage differentials could include differentials normally counted as part of industry wage differentials.

The firm-dummy variables, as a whole, are statistically significant at 1 percent in all regressions, thereby verifying the relevance of where a person works in the determination of his/her wage.

After incorporating the firm-dummy variables, the explanatory power of the regression using the 1985 MAS sample is raised by 6 percentage points (the adjusted R^2 goes up from 87.03 to 92.70), and by 18 percentage points for the regression using the 1985 PAS sample. For 1991, the explanatory power of the regression is increased by 10 percentage points. In addition, the standard deviation of log. wages is reduced by at least 25 percent after adding the firm dummy-variables to the wage equation. Here again, the results for the 1985 MAS sample are similar to those reported by Dickens and Katz (1987a, Table 3-1), whereas the results for the 1985 PAS sample are higher than those reported for the U.S.A., probably due to the lower occupational variance of the PAS sample.

As in the case of Brazil, the increase in explanatory power gained by adding firm dummies is greater in the regression using a sample restricted to specific occupations (mainly production workers). This can be explained by two factors: (i) the lower occupational variance of the production workers' sample will raise the firm-specific portion of the total variance, as the variance due to other factors falls; (ii) if inter-firm wage differentials are larger among production workers than among others, the increase in explanatory power obtained by adding firm dummies will be greater for this group than for workers as a whole. Both effects appear to be present in our estimations, and they may account for the different results found in the studies discussed in Section II.

The relevance of the employer in wage determination can also be seen by analyzing the range of dispersion among wage differentials. The last part of Table 2 shows the maximum and minimum differentials with respect to the average wage and their standard deviation. In the 1985 MAS sample, workers in the same occupation may earn anything from 61 percent below, to 52 percent above the average wage, with a standard deviation of 0.23, depending on where they work. For the 1985 PAS sample this range fluctuates between 59 percent less, and 69 percent more than the average wage, with a standard deviation of 0.24. The 1991 data present wage differentials varying between 41 percent less and 59 percent more than the average wage, with a standard deviation of 0.22. In this case, the standard deviations of wage differentials are greater than those estimated for Chile in studies undertaken at the industry level, where values range between 0.11 and 0.15 depending on the year under consideration (Abuhadba and Romaguera, 1993).[17]

In summary, the results show that where a person works does have a significant effect on the wage paid, and that this is a phenomenon that is maintained over time and manifests itself even in a sample covering large and technically-advanced companies only.

It can be argued that the wage differentials might not only be explained by efficiency-wage considerations but also by human capital, since we are not controlling for such variables in the Chilean sample. For example, if significant wage differentials in the same occupation exist across firms, one would expect to find

[17]In the Chilean case the standard deviations of wage differentials were not compared with those of Groshen (1991a), because we have only been able to control for occupation.

adverse selection, with high-paying firms obtaining better-qualified workers. Therefore, part of what shows up as a firm-effect in our results could be attributable to a potentially observable human-capital effect.

However, the size of the wage differentials obtained and the Brazilian results (which *do* control for human capital), argue in favor of wage differentials that go beyond observable or unobservable human-capital explanations. For example, in the case of the PAS sample for Chile, which comprise well defined middle- to low-level occupations, it is hard to attribute the observed differentials (ranging from −0.59 to 0.69) to human-capital type variables alone, especially when one considers that the return to an additional year of education in Chile is approximately 5 percent (Butelmann and Romaguera, 1993).

We also examine the extent to which these wage differentials are related to firm-characteristics, by running a regression of the firm-dummy coefficients as a function of firms' characteristics. This regression, as in the case of Brazil, is corrected for heteroskedasticity and presented in Table A2 in the Appendix.

The data from the March 1985 survey make it possible to include among firms' characteristics the form of ownership, the sector the firm belongs to, the number of employees and sales volume. Firm size and sector have been included because these are variables that previous studies have traditionally considered when analyzing the relation between wage differentials and firm characteristics (see Section II). In this study we also include ownership, as this is a relevant variable in developing countries where a firm may behave differently according to whether it belongs to a multinational corporation, the State or the private sector.

Variables such as form of ownership and sales volume are, indeed, important determinants of wage differentials. However, industry variables have little explanatory power, which may be due to our inability to distinguish industry effects from firm effects, with the result that firm dummies are picking up the industry effects in the first-stage regression.

The widespread perception that foreign firms pay higher wages is confirmed by the data for Chile. Even though the available information does not enable us to determine which factors differentiate foreign firms from local ones, the literature on multinational companies stresses that these firms are especially concerned for their reputation, and one way of making a reputation is by paying high wages.

We tested two different specifications for size: number of employees and volume of sales, but only the latter variable was statistically significant. This might be due to the fact that the sample used mainly includes middle- and large-sized companies; hence sales volume, a variable which is associated more with the firm's market power, is the variable that best discriminates between them.

(b) Wage Correlations across Occupations

One of the most persistent results in recent research on wage differentials is the high correlation between wages paid by firms across different occupations.[18]

[18]A detailed analysis of correlations across different occupations at the industry level is carried out by Dickens and Katz (1987b). They find that wages are highly correlated across 12 occupational groups. From a total of 66 correlations, only 5 showed values under 0.5, and the average correlation was of 0.78.

However, most of the hypotheses that have been put forward to explain wage differentials do not account for the existence of such correlations. In the first place, if wage differentials are associated with measurement errors relating to human capital or unmeasured abilities, the question arises as to why industries or firms requiring highly qualified managers also need drivers with special abilities. It is difficult to imagine technologies calling for a high degree of interdependence among the abilities of all occupations, rather than just among those that are interrelated in the productive process. On the other hand, theories emphasizing labor turnover costs, monitoring problems and adverse selection predict that firms should pay higher wages only in occupations where the costs associated with such problems are especially high. Only sociological and rent-sharing models provide explanations for the high correlation between wages across all occupations. According to these models, firms tend to be consistent in their wage levels, paying either high or low wages to all workers alike. This could be explained by the existence of social norms and considerations of loyalty and justice, which might exert an influence on the workers' labor effort (Akerlof 1982, 1984); alternatively it could be explained by the existence of firm rents and employee bargaining power (Dickens, 1986).

Most of the empirical studies of this topic are highly aggregated, so it is interesting to carry out an analysis with greater occupational disaggregation, and this is done extensively in the present section by making use of the detailed occupational classification provided in the Chilean sample. It is important to bear in mind that the samples are small and that the number of observations across occupations varies. These two aspects may have an influence on the results obtained; the results are consistent nonetheless.

Tables 3 and 4 show correlations across aggregate occupational groups from the 1985 MAS and PAS samples. Tables A.3 and A.4 in the Appendix give the correlation coefficients across selected occupations for the (PAS) surveys (1985 y 1991).

TABLE 3

CHILE: WAGE CORRELATIONS ACROSS AGGREGATE OCCUPATIONS, MAS SAMPLE, MARCH 1985

	1	2	3	4	5
1. Managers	1.000 (81)				
2. Department heads	0.448 (85)	1.000 (86)			
3. Clericals	0.300 (79)	0.627 (80)	1.000 (80)		
4. Secretaries	0.360 (84)	0.699 (85)	0.717 (79)	1.000 (85)	
5. Semi- and unskilled workers	0.219 (83)	0.565 (84)	0.696 (78)	0.662 (83)	1.000 (84)

Note: The number of observations is given in brackets. All the correlations are statistically significant at 1%, except three that are significant at 5%.

TABLE 4

CHILE: WAGE CORRELATIONS ACROSS AGGREGATE OCCUPATIONS, PAS SAMPLE, JUNE 1985

	1	2	3	4	5	6	7	8	9	10	11
1. Department head 1	1.000 (65)										
2. Department head 2	0.707 (51)	1.000 (57)									
3. Foreman	0.592 (57)	0.676 (50)	1.000 (62)								
4. Professionals	0.479 (60)	0.518 (52)	0.526 (56)	1.000 (65)							
5. Productive skilled	0.422 (64)	0.560 (56)	0.792 (61)	0.576 (65)	1.000 (73)						
6. Productive semi-skilled	0.246 (46)	0.204 (40)	0.431 (44)	0.410 (44)	0.733 (49)	1.000 (50)					
7. Productive non-skilled	0.439 (61)	0.484 (53)	0.496 (59)	0.544 (59)	0.738 (66)	0.723 (49)	1.000 (67)				
8. Clerical	0.499 (65)	0.583 (56)	0.670 (62)	0.665 (64)	0.765 (72)	0.702 (50)	0.726 (67)	1.000 (74)			
9. Secretaries	0.454 (63)	0.349 (55)	0.520 (60)	0.540 (62)	0.638 (70)	0.571 (49)	0.627 (65)	0.711 (72)	1.000 (72)		
10. Non-productive semi-skilled	0.457 (62)	0.455 (55)	0.582 (61)	0.624 (62)	0.770 (70)	0.748 (50)	0.817 (65)	0.821 (70)	0.696 (68)	1.000 (71)	
11. Non-productive unskilled	0.670 (60)	0.602 (54)	0.649 (58)	0.632 (60)	0.782 (68)	0.547 (48)	0.725 (63)	0.767 (69)	0.638 (67)	0.769 (66)	1.000 (65)

Note: The number of observations is given in brackets. All the correlations are statistically significant at 1%, except two that are significant at 10%.

Occupations which have some degree of interrelationship in production are highly correlated. For instance, the wages of top-level supervisory positions are more highly correlated with wages at second level supervisory positions than with other occupational categories. However, there is also a high correlation between occupations where this type of interrelationship would seem not to exist: for instance, between wages in supervisory positions and those earned by unskilled administrative workers (Table 4).

The wages of skilled workers, such as electricians and mechanics, are highly correlated (see Tables A.3 and A.4), where again we see that related occupations show high correlations. However, there are correlations that cannot be explained by interrelationships in the productive process: for instance, wages of production workers are correlated with those of drivers and those of employees in the accounts department.

The existence of high wage-correlations across occupational groups is consistent with the competitive explanation of unmeasured abilities, as high correlations would be due to the existence of interrelationships in the productive process. Such correlations could also be explained by increased productivity arising from reduced monitoring or shirking costs, or lower turnover. However these arguments cannot explain why there are high correlations across almost all occupational groups within a firm. In particular, in this study the wages of non-professional workers are highly correlated, regardless of the specific function they perform in the firm.

The correlation results reported in this study, therefore, offer evidence in support of sociological or rent-sharing models that provide an explanation for a uniform pattern of wage correlations across all occupations within a firm. As Katz (1988) suggests, firms may have to pay efficiency wages for monitoring or turnover reasons in some job categories and then face horizontal equity constraints that lead them to pay high wages in occupations where these considerations are not relevant. According to the rent-sharing model there are three reasons why firms may pay a similar wage premium across occupations: (i) workers' bargaining power may be consistent across occupations; (ii) workers may need to form large groups in order to exert bargaining power; and (iii) managerial altruism may extend uniformly across occupations (Groshen, 1991b).

IV. Conclusions

This study shows that where a worker is employed does have a significant effect on his or her wages, and this phenomenon persists over time and is perceived even in samples including mainly middle-sized and large modern companies. The conclusion holds not only for Chile, but also for Brazil, a country for which there was a sample that enabled us to control for worker characteristics rather than occupation alone. Estimated wage differentials are statistically significant at 1 percent, indicating that workers with similar personal characteristics, in the same occupation, receive different wages depending on where they work. Furthermore, employer wage differentials are systematically associated with certain firm characteristics, principally size.

The existence of wage differentials when controlling for human capital, and particularly when comparing between narrowly defined occupations, shows that firms have a uniform internal pattern of remunerations. In this sense, our paper confirms, with data at the firm level, one of the more remarkable facts about the inter-industry wage pattern: its stability across occupations (Katz and Summers, 1989; Thaler, 1989).

An important conclusion of this study is that wages in most occupations within firms are highly correlated. These occupations are not related by technology, but rather by the fact that the workers share the same physical location, interact with each other and have a similar status. In other words, the high correlations reported in this study offer evidence in favor of sociological models which predict that workers care about their relative wages; such models stress the importance of social norms in wage determination. The results are also consistent with the outcome of rent-sharing models where workers appropriate a portion of the firm's rents. This is not to deny the influence of technological factors in wage differentials, but it does suggest that they do not explain the uniformity seen in the pattern of remunerations inside the firm. In fact, firms may be forced to pay efficiency wages for supervision or turnover reasons in certain job categories and then, for reasons of equity, have to pay high wages in occupations where such considerations are not relevant (Katz, 1988).

The results of this study reaffirm those of previous papers which favor non-competitive explanations for wage differentials: specifically they provide clear evidence that inter-firm wage premia are highly correlated across occupations.

Appendix

TABLE A1

Brazil, Wages and Firm-Characteristics (Dependent Variable: Coefficient of Firm Dummy Variables)

Variables	Coefficient	*t*-Test
Constant	−1.035	−1.35
Industrial Sector		
Non-metallic mineral products	−0.067	−0.61
Metal industries	0.108	1.28
Mechanical industries	0.196	2.19*
Electrical materials	0.023	0.27
Transport materials	0.147	1.69
Lumber	0.017	0.08
Paper	0.194	2.00*
Rubber	0.203	1.97*
Chemical	0.224	2.36*
Pharmaceutical products	0.052	0.44
Oil refining	−0.036	−0.27
Textile	0.050	0.57
Apparel	0.010	0.07
Foodstuffs	0.044	0.43
Beverages	0.169	1.07
Publishing and graphics	0.037	0.35
Others	0.126	1.04
Number of workers	0.15×10^{-4}	2.03*
R^2	0.22	
Adjusted R^2	0.13	
F-test[a]	2.36**	
N	171	

** Significant at 1%; * Significant at 5%.

[a] F-test for overall statistical significance of the independent variables.

TABLE A2

CHILE: WAGES AND FIRM-CHARACTERISTICS, MARCH 1985. (MAS SAMPLE)
(DEPENDENT VARIABLE: COEFFICIENT OF FIRM DUMMY VARIABLES)

Variables	Coefficient	*t*-Test
Constant	−5.260	−4.86**
Ownership[a]		
Domestic Private	0.053	0.89
Multinational	0.233	3.66**
Sector		
Mining	0.121	1.88
Foodstuffs	−0.047	−0.78
Pharmaceutical	−0.047	−0.66
Metallurgical and mechanical	−0.033	−0.50
Commerce	−0.075	−1.27
Services: AFPs[b]	0.063	0.81
Insurance	−0.020	−0.26
Other services	−0.048	−0.76
Sales (million)		
US$ 3.4–US$ 7.5	0.300	4.70**
US$ 7.5–US$ 18.7	0.349	5.82**
US$ 18.7–US$ 34.2	0.342	5.07**
US$ 34.2 and more	0.509	8.15**
R^2	0.65	
Adjusted R^2	0.58	
F-Test[c]	9.28**	
N	85	

** Significant at 1%.

[a] The three alternative ownership statuses are represented by two dummy variables, with the third (domestic public firms) implicit.

[b] Administradoras de Fondos de Pensiones, private-sector pension fund managers.

[c] *F*-test for overall statistical significance of the independent variables.

TABLE A3

Chile: Wage Correlations Across Occupations: PAS Sample, 1985

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1. Local Purchasing Manager	1.000																	
	(28)																	
2. International Purchasing Manager	0.874	1.000																
	(18)	(31)																
3. Head Quality Control	0.796	0.727	1.000															
	(22)	(24)	(43)															
4. Foreman	0.371	−0.011	0.310	1.000														
	(14)	(16)	(23)	(33)														
5. Electrical Maintenance Head	0.639	0.276	0.633	0.616	1.000													
	(16)	(19)	(20)	(18)	(29)													
6. Electrician	0.283	0.378	0.257	0.673	0.637	1.000												
	(14)	(14)	(21)	(24)	(18)	(32)												
7. Mechanic, 1st Class	0.606	0.763	0.608	0.542	0.416	0.923	1.000											
	(23)	(24)	(33)	(23)	(25)	(24)	(55)											
8. Mechanic, 2nd Class	0.655	0.745	0.635	0.630	0.487	0.920	0.934	1.000										
	(17)	(18)	(22)	(27)	(20)	(29)	(33)	(43)										
9. Lathe Operator	0.612	0.457	0.375	0.552	0.509	0.790	0.596	0.846	1.000									
	(12)	(13)	(17)	(18)	(16)	(16)	(26)	(24)	(31)									
10. Welder	0.532	0.363	0.243	0.770	0.527	0.838	0.642	0.683	0.609	1.000								
	(12)	(14)	(16)	(18)	(17)	(20)	(23)	(24)	(22)	(27)								
11. Warehouse Machine Operator	0.330	0.415	0.397	0.488	0.500	0.919	0.74	0.885	0.658	0.610	1.000							
	(15)	(19)	(28)	(23)	(21)	(24)	(37)	(27)	(22)	(21)	(44)							
12. Warehouse Worker	0.559	0.538	0.425	0.420	0.247	0.78	0.531	0.753	0.478	0.600	0.746	1.000						
	(23)	(25)	(35)	(29)	(24)	(29)	(45)	(38)	(29)	(26)	(35)	(61)						
13. Cashier	0.495	0.598	0.583	0.393	0.375	0.623	0.608	0.712	0.440	0.340	0.603	0.625	1.000					
	(26)	(27)	(36)	(28)	(26)	(26)	(48)	(37)	(29)	(23)	(37)	(52)	(62)					
14. Accounts Clerk	0.341	0.369	0.555	0.490	0.472	0.66	0.487	0.772	0.619	0.645	0.562	0.608	0.546	1.000				
	(23)	(26)	(33)	(27)	(25)	(27)	(41)	(34)	(22)	(22)	(37)	(48)	(48)	(57)				
15. Departmental Secretary	0.268	0.250	0.438	0.551	0.371	0.582	0.388	0.570	0.449	0.449	0.561	0.487	0.438	0.459	1.000			
	(23)	(26)	(30)	(24)	(23)	(22)	(41)	(29)	(23)	(18)	(29)	(41)	(45)	(39)	(50)			
16. Receptionist	0.101	0.091	0.478	0.101	0.516	0.680	0.419	0.490	0.322	0.282	0.836	0.542	0.516	0.455	0.422	1.000		
	(16)	(19)	(29)	(16)	(19)	(21)	(39)	(28)	(22)	(18)	(31)	(44)	(45)	(42)	(35)	(53)		
17. Driver	0.494	0.553	0.498	0.619	0.309	0.626	0.850	0.795	0.532	0.665	0.775	0.652	0.705	0.468	0.331	0.552	1.000	
	(19)	(23)	(31)	(25)	(24)	(25)	(34)	(31)	(22)	(21)	(28)	(42)	(41)	(35)	(34)	(29)	(47)	
18. Messenger	0.223	0.235	0.468	0.373	0.362	0.850	0.683	0.669	0.209	0.559	0.650	0.414	0.429	0.627	0.429	0.495	0.429	1.000
	(19)	(23)	(31)	(21)	(20)	(20)	(39)	(28)	(19)	(14)	(30)	(44)	(35)	(42)	(35)	(41)	(35)	(56)

Note: The number of observations is given in brackets. 164 correlations are statistically significant at 1%, 34 are significant at 5%, 11 at 10% and 28 are not statistically significant at these levels.

TABLE A4

WAGE CORRELATIONS ACROSS OCCUPATIONS. PAS SAMPLE 1991

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Local Purchasing	1.000													
	(44)													
2. Senior Auditor	0.526	1.000												
	(16)	(32)												
3. Head of Personnel	0.568	0.591	1.000											
	(28)	(21)	(53)											
4. Technical Draughtsman	0.431	0.335	0.696	1.000										
	(22)	(12)	(28)	(40)										
5. Computer Operator	0.465	0.408	0.358	0.825	1.000									
	(27)	(17)	(27)	(24)	(47)									
6. Electrician	0.244	−0.047	0.415	0.835	0.632	1.000								
	(31)	(18)	(38)	(33)	(28)	(55)								
7. Mechanic, 1st Class	0.141	0.213	0.428	0.780	0.582	0.933	1.000							
	(35)	(20)	(39)	(33)	(34)	(48)	(59)							
8. Mechanic, 2nd Class	0.479	0.498	0.682	0.840	0.704	0.796	0.805	1.000						
	(27)	(16)	(33)	(30)	(28)	(42)	(47)	(50)						
9. Warehouse Worker	0.415	0.424	0.636	0.788	0.563	0.593	0.463	0.664	1.000					
	(29)	(18)	(28)	(23)	(27)	(37)	(38)	(32)	(49)					
10. Sales Administration Clerk	0.524	0.228	0.384	0.467	0.715	0.677	0.533	0.596	0.519	1.000				
	(22)	(17)	(25)	(14)	(26)	(24)	(28)	(20)	(29)	(41)				
11. Cashier	0.383	0.369	0.552	0.709	0.671	0.679	0.716	0.75	0.658	0.657	1.000			
	(35)	(25)	(43)	(32)	(35)	(43)	(46)	(38)	(36)	(33)	(64)			
12. Accounts Clerk	0.332	0.169	0.515	0.752	0.617	0.63	0.613	0.791	0.642	0.596	0.715	1.000		
	(37)	(29)	(45)	(34)	(41)	(46)	(49)	(42)	(44)	(37)	(54)	(72)		
13. Departmental Secretary	0.589	0.449	0.515	0.803	0.727	0.587	0.575	0.831	0.645	0.645	0.663	0.724	1.000	
	(39)	(29)	(48)	(34)	(41)	(48)	(50)	(40)	(45)	(37)	(53)	(61)	(74)	
14. Messenger	0.210	0.156	0.285	0.639	0.658	0.53	0.559	0.466	0.630	0.538	0.568	0.429	0.717	1.000
	(36)	(27)	(42)	(32)	(42)	(43)	(47)	(39)	(40)	(33)	(55)	(60)	(62)	(72)

Note: The number of observations is given in brackets. 72 correlations are statistically significant at 1%. 10 are significant at 5%, one at 10% and only 8 are not statistically significant.

REFERENCES

Abuhadba, M. and P. Romaguera, Inter-Industrial Wage Differentials: Evidence from Latin American Countries, *Journal of Development Studies*, Vol. 30, 190 205, October 1993.

Akerlof, G., Labor Contracts as Partial Gift Exchange, *Quarterly Journal of Economics*, Vol. 97, 543 69, November 1982.

———, Gift Exchange and Efficiency Wage Theory: Four Views, *American Economic Review*, Vol. 74, 79 83, 1984.

——— and J. Yellen, *Efficiency Wage Models of the Labor Market*, Cambridge University Press, New York, 1986.

Brown, C., J. Hamilton, and J. Medoff, *Employers Large and Small*, Harvard University Press, Cambridge, MA, 1990.

Bulow, J. and L. Summers, A Theory of Dual Labor Markets with Application to Industrial Policy, Discrimination, and Keynesian Unemployment, *Journal of Labor Economics*, Vol. 4, 376–414, July 1986.

Butelmann, A. and P. Romaguera, Educación Media General vs. Técnica: Retorno Económico y Deserción, *Colección Estudios Cieplan*, No. 38, 5–26, 1993.

Castelar Pinheiro, A. and L. Ramos, Inter-Industry Wage Differentials and Earnings Inequality in Brazil, *Estudios de Economía*, Vol. 21, 79 111, November 1994.

Davis, S. and J. Haltiwanger, Wage Dispersion between and within U.S. Manufacturing Plants, 1963-86, *Brookings Papers on Economic Activity (Microeconomics)*, 115–99, 1991.

Dickens, W. Wages, Employment and the Threat of Collective Action by Workers, *Working Paper 1856 NBER*, 1986.

——— and L. Katz, Inter-industry Wage Differences and Industry Characteristics, in Lang, K. and J. Leonard (eds.), *Unemployment and the Structure of Labor Markets*, Basil Blackwell, 48–89, 1987a.

———, Industry Wage Differences and Theories of Wage Determinations, *Working Paper 2271 NBER*, 1987b.

Dunlop, J., The Task of Contemporary Wage Theory, in Dunlop, J. (ed.), *The Theory of Wage Determination*, St. Martin's Press, New York, 1957.

Edin, P. and L. Zetterberg, Interindustry Wage Differentials: Evidence from Sweden and a Comparison with the United States, *American Economic Review*, Vol. 82, 1341–49, 1992.

Elliott, R. F. and M. J. White, Recent Developments in the Industrial Wage Structure of the U.K., *Cambridge Journal of Economics*, Vol. 17, 109–29, 1993.

Gatica, J., A. Mizala, and P. Romaguera, Inter-Industry Wage Differentials in Brazil, *Economic Development and Cultural Change*, Vol. 43, 315 31, 1995.

Gera, S. and G. Grenier, Interindustry Wage Differentials and Efficiency Wages: Some Canadian Evidence, *Canadian Journal of Economics*, Vol. 27, 81–100, 1994.

Gibbons, R. and L. Katz, Does Unmeasured Ability Explain Inter-Industry Wage Differentials? *Review of Economic Studies*, Vol. 59, 515–35, 1992.

Groshen, E., *Sources of Wage Dispersion: Does it Matter Where You Work?* Ph.D. dissertation, Harvard University, Cambridge, MA, 1986.

———, Sources of Intra-Industry Wage Dispersion: How Much Do Employers Matter? *Quarterly Journal of Economics*, Vol. 106, 869 84, 1991a.

———, Five Reasons Why Wages Vary Among Employers, *Industrial Relations*, Vol. 30, 350–81, 1991b.

Katz, L., Efficiency Wage Theories: a Partial Evaluation, in Fisher, S. (ed.), *Macroeconomics Annual* NBER, 235–75, MIT Press, Cambridge, MA, 1986.

———, Some Recent Developments in Labor Economics and Their Implications for Macroeconomics, *Journal of Money, Credit and Banking*, 507–30, 1988.

——— and L. Summers, Can Interindustry Wage Differentials Justify Strategic Trade Policy? in Feenstra, R. (ed.), *Trade Policies for International Competitiveness*, 85–116, University of Chicago Press, Chicago 1989.

———, Industry Rents: Evidence and Implications, *Brookings Papers on Economic Activity*, Microeconomics, 209 75, 1989.

Knight, J. B. and R. H. Sabot, The Role of the Firm in Wage Determinations: an African Case Study, *Oxford Economic Papers*, Vol. 35, 45–66, 1983.

Krueger, A. and L. Summers, Reflections on the Inter-Industry Wage Structure, in Lang, K. and J. Leonard (eds.), op. cit., 17 47, 1987.

———, Efficiency Wages and the Inter-Industry Wage Structure, *Econometrica*, Vol. 56, No. 2 (March), 259–93, 1988.

Master, S. H., Wages and Plant Size: An Interindustry Analysis, *Review of Economics and Statistics*, Vol. 51, 341 45, 1969.

Moll, P. G., Industry Wage Differentials and Efficiency Wages: a Dissenting View with South African Evidence, *Journal of Development Economics*, Vol. 41, 213 46, 1993.
Morissette, R., Canadian Jobs and Firm Sizes: Do Smaller Firms Pay Less? *Canadian Journal of Economics*, Vol. 26, No. 1, 159-74, 1993.
Murphy, K. and R. Topel, Unemployment, Risk, and Earnings: Testing for Equalizing Wage Differences in the Labor Market, in Lang, K. and J. Leonard (eds.), op.cit., 1987.
——, Efficiency Wages Reconsidered: Theory and Evidence, in Weiss, Y. and G. Fishelson (eds.), *Advances in the Theory and Measurement of Unemployment*, 204 40, Macmillan, London, 1990.
Shapiro, C. and J. Stiglitz, Equilibrium Unemployment as a Worker Discipline Device, *American Economic Review*, Vol. 74, 433-44, 1984.
Slichter, S., Notes on the Structure of Wages, *Review of Economics and Statistics*, Vol. 32, 80 91, 1950.
Solow, R., On Theories of Unemployment, *American Economic Review*, Vol. 70, 1-11, 1980.
Thaler, R., Anomalies: Interindustry Wage Differentials, *Journal of Economic Perspectives*, Vol. 3, 181 93, 1989.