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WAGE DIFFERENTIALS AND EFFICIENCY WAGE MODELS: EVIDENCE FROM THE CHILEAN ECONOMY

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To a large extent this paper summarizes and reviews parts of her thesis. It was written during her stay at the Kellogg Institute and she would like to gratefully acknowledge the hospitality of the institution.

ABSTRACT

This paper conducts an empirical investigation of wage differentials and theories of wage determination for the Chilean economy. Competitive and efficiency wage theories of the labor market are examined and their implications for the existence of wage differentials are discussed. The investigation reveals the existence of statistically significant interindustrial wage differentials, and shows the consistency of their patterns across time, occupations, and firm size. It is not only the existence of wage differentials but also the regularities of their patterns that are particularly difficult to reconcile with a competitive explanation. Wages inside a firm are highly correlated across occupations, lending support to the hypothesis that equity considerations matter in wage determination. In agreement with other studies on wage differentials, the paper finds that high paying industries comprise large, capital-intensive firms, which are highly concentrated and earn above average profits. The extent to which this relation between wage differentials and firm characteristics supports efficiency wage models is discussed. In short, the behavior of the Chilean labor market poses a number of questions for the competitive hypothesis. The results of this research are consistent with the predictions of efficiency wage models.

RESUMEN

Este estudio realiza una investigación empírica sobre el tema de diferenciales de salario y teorías de determinación de salarios, analizando el caso específico de la economía chilena durante el período 1937-1987. El estudio examina tanto teorías competitivas, como teorías de salarios de eficiencia, y discute la relevancia de ambas en la explicación de los diferenciales de salarios. La investigación revela la existencia de diferenciales de salario estadísticamente significativos, y demuestra la consistencia del patrón de dichos diferenciales a través del tiempo, entre ocupaciones y firmas de distinto tamaño. Tanto la existencia de diferenciales de salario, como sus regularidades, son difíciles de reconciliar con explicaciones competitivas de determinación de los salarios. En particular, los salarios al interior de las empresas muestran ser altamente correlacionados, evidencia que apoya la hipótesis de que consideraciones de equidad son importantes en el proceso de determinación de las remuneraciones. En forma similar a otros estudios, encontramos que las industrias con elevados salarios relativos se caracterizan por estar compuestas por firmas de gran tamaño, intensivas en capital, con alto grado de concentración y utilidades superiores al promedio industrial. El estudio discute hasta que punto esta relación entre diferenciales de salario y características de la firma, apoya las hipótesis de los modelos de salarios de eficiencia. En resumen nuestro estudio demuestra que el comportamiento del mercado laboral chileno, en el período analizado, cuestiona la hipótesis de un comportamiento competitivo de dicho mercado. Por el contrario, los resultados de la investigación apoyan las predicciones de los modelos de salarios de eficiencia.

INTRODUCTION

This investigation relates to the question of why workers with apparently identical characteristics receive different wages across firms and industries. As we will see this is a question that has a long tradition in economics and has received greater attention lately, especially in developed countries. Our concern is with the behavior of LDCs' economies, and in particular with the Chilean labor market.

The paper examines the existence of interindustrial wage differentials, their pattern across occupations and time, and inquires into the factors determining such differentials. The objective is to bring new insights to bear on the pattern of the Chilean wage structure and the factors that could explain such behavior. In particular, the investigation confronts competitive vs. efficiency theories of wage determination. An investigation of the determinants of wage differentials has implications that reach beyond the traditional concern with income distribution policies. The debate between competitive and efficiency wage models (EWMs) points to different interpretations of the relationship between wages and unemployment and implications for the role of macroeconomic and industrial policies.

The plan of this paper is as follows:

Sections I and II set the theoretical background for our analysis. Section I presents an overview of the wage differentials literature, both for developed economies and for Latin American countries. After the evolution of the literature has been addressed do we turn to the theoretical explanations. The reason is that in spite of the fact that empirical wage differential estimations have a long tradition in economics, only recently has an effort been made to provide more formal theoretical explanations for such behavior. Therefore, section II presents a review of recent theories of wage determination explaining the existence of wage differentials, giving special emphasis to efficiency wage models.

The following two sections deal with the empirical results of our investigation. Section III presents the estimation of interindustrial wage differentials and the examination of their pattern across time, firm sizes, and occupations. In Section IV we relate the wage structure to the industrial characteristics that seem to explain wage differentials. Finally, section V addresses the main conclusions of this research.

I. STUDIES OF INTERINDUSTRIAL WAGE DIFFERENTIALS

This section reviews studies dealing with interindustrial wage differential estimations. Given that most of the empirical research has been conducted for the US economy, the first section, which addresses the most important literature about the subject, largely refers to this country. In section I.2 we discuss the state of the research on wage differentials for Latin American economies.

1. A Review of the Basic Literature

The dispersion of wages across industries for workers in apparently identical occupations is by now a well documented fact. The existence of interindustrial wage differentials was first emphasized in the early fifties in the work of Dunlop, Slichter, Lester, and other institutional economists. One early reference indicating the existence of wage dispersion was provided by Dunlop (1957), showing large variance of average wages for truck drivers, ranging from a maximum of $2.25 to a minimum of $1.20 across industries.

These early investigations not only showed the existence of high earnings dispersion but also provided initial insights into the existence of a pattern of wage differentials. In a study that is now a classic reference, Slichter (1950) found high correlations across occupations and stable wage differentials over time for the US economy. The stability of the wage structure for the US economy was further advanced by a study carried out by Cullen (1956). These early studies on wage differentials emphasized the demand side of the labor market, focusing on industrial characteristics influencing the wage structure.

The studies on wage differentials carried out during the sixties and early seventies followed the same line of research. The studies by Rapping (1967), Masters (1969), and Kumar (1972), among others, focused on estimating the effects on the average industrial wage dispersion of several industrial characteristics, such as profits, degree of concentration, union density, and the size of the firm.

During the seventies, the development of the human capital model changed labor research emphasis toward supply aspects. A countless number of studies analyzed the importance of an individual's occupation, experience, and other human capital variables in income determination. This type of research was also conducted extensively in LDCs.

The development of the human capital model and access to better data sources made possible the rise of a new generation of wage differentials studies during the seventies and eighties. These studies used individual earnings as the dependent variable and tested the

significance of industrial variables in wage equations that include controls for differences in worker characteristics. For example, Dalton and Ford (1977) and Long and Link (1983) found that market power—measured by concentration variables—had a positive significant relation with wages. Freeman and Medoff (1981) found that industry average firm size raised wages of both union and nonunion workers. Dunn (1986) also asserted a positive relation between firm size and wages, one that was not explained by compensating wage differentials only.

However, research focusing on the relation between wage dispersion and industry characteristics lacked a formal model for explaining such facts. A number of studies, especially those related to *market power* and *ability to pay*, loosely based their hypotheses on some sort of bargaining model where high wages were driven by a combination of a firm's market power and trade union pressure. Nevertheless, this is restrictive and not a general model, given that wage differentials persisted for both union and nonunion workers.

In spite of the lack of a full-fledged model, several theoretical insights were provided by the studies that correlated wages with industrial characteristics. For example, the relation between monitoring cost, firm size, and wage differentials was advanced by Lester (1967), and Stigler (1962) suggested the hypothesis that the process of selecting workers was most costly in large firms. As we will see many of these ideas were later integrated into efficiency wage models.

In short, these studies showed that in the US economy workers in large firms received higher wages, that a firm's ability to pay had a positive influence on wage differentials across industries, and that industry union density was positively correlated to the earnings of union and nonunion workers.[1] Also, in some studies capital-labor ratios had a positive relationship with wages. However, these investigations are subject to the critique that most results are highly sensitive to the wage equation specification chosen by the researcher, a fact that considerably limits the generalization of their conclusions.[2]

New interest in the topic of wage differentials sprang up again in recent years, with the studies by Krueger and Summers (1987, 1988), Dickens and Katz (1987a, 1987b), and Groshen (1986). What is distinctive about the recent generation of empirical studies is both their methodology and theoretical background. In terms of methodology they provide new tests for the existence of interindustrial and establishment wage differentials and for the regularities of their patterns, using improved econometric techniques and extensive controls for worker and job characteristics. On the other hand, they use as theoretical background the efficiency models of wage determination, models that provide a new rationale for the existence of wage differentials.

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1 Dickens and Katz (1987a) and Groshen (1986) present excellent reviews of the wage differentials literature that correlates wage dispersion with firm and industrial characteristics.

2 See Dickens and Katz (1987a).

As we will discuss extensively later on, efficiency wage models (EWMs) predict the existence of wage differentials as an equilibrium solution in models where firms and workers optimize their behavior; those models do not rest on the assumptions that firms are oligopolist and wages are subject to collective bargaining.

The existence of wage differentials is confirmed by the Krueger and Summers, Dickens and Katz, and Groshen studies, that found workers with identical characteristics receiving different wages across industries. However, it is not only the existence of wage dispersion but also the regularities of their patterns that provide support for the EWMs. In fact, the studies mentioned found that wage differentials are stable across time and countries, and highly correlated across occupations and firm sizes.

In short, the recent empirical research on wage differentials in the US is seen as an attempt to confront competitive vs. efficiency models of wage determination, a fact that has broadened the implications of wage differentials studies, given the different policy implications of the underlying theories. In other words, the new studies address the extent to which the existence of wage differentials challenges the hypothesis of a competitive labor market.

2. Studies of Wage Differentials for Latin American Economies

This section presents a review of selected investigations that deal with the issue of wage differentials for Latin America. There are two type of studies that one should distinguish. First the ones that analyze the relation between development and the wage structure, and secondly case studies of wage differentials for particular countries.

The following are some of the predominant hypotheses concerning the relation between wage structure and development:

a. "Wage dispersion tends to reach a maximum sometime during the early stages of industrialization, and to diminish gradually after that point" (Reynolds and Taft, 1956).

b. There are "smaller interindustry differentials in a country with a lower level of industrialization than in a highly industrialized one, due to differences in the degree of skill and product market differentiation between the two type of countries" (Dunlop, 1957, pp. 25-6). In the same sense, Krueger and Summers, (1987) have pointed out that LDCs' economies may have a lower dispersion of wages than more developed countries, because their labor force presents a lower level of human capital.

c. The pattern of wage differentials is very similar across developed countries. However, the interindustry wage structure patterns of LDCs tend to differ from the developed ones, and also tend to differ among themselves (Papola and Bharadwaj, 1970). Krueger and Summers (1987) conjecture that as countries become more developed their industrial wage structures tend to converge.

With respect to the country studies, it must be noticed that there are in fact few investigations dealing directly with the issue of wage differentials; most of them cover the general subject of the determinants of worker earnings. Also, the relation between industrial characteristics and wage differentials often arises only as an extension in studies that focus on estimating the human capital model.

The fact that research on wage differentials in LDCs is more dispersed and more difficult to track down makes a review of the available literature particularly useful. Table 1 presents a summary of selected studies that deal—in a general sense—with wage differentials in Latin American economies.

One of the investigations that more directly address the topic of wage differentials in Latin America, is Ferreira da Silva's (1987) study for Brazil. He found that the main determinants of earnings were the individual worker's characteristics, but that firm, industry, and regional characteristics were also significant, after controlling for human capital variables. Fields and Marulanda (1976) found that for the Colombian manufacturing sector higher (average) wages were associated with more capital-intensive sectors, with high foreign investment, and larger firms. Macedo (1985) investigates a special aspect of the wage relation, i.e., wage differentials between private and public firms in Brazil. His results show that higher wages are paid in the public sector, even after controlling for worker characteristics. However, the general applicability of his conclusion is not very strong, since the results with human capital controls refer only to a comparison between two firms.

Other studies examine the influence of industrial attributes on wages, but mainly as extensions (control-variables) in human capital type models. In Castello Branco (1979) the degree of concentration has a positive effect on the average industrial wage for Brazil. Salazar Carrillo (1982) finds a nonsignificant effect for size of firm on individual earnings; however, these results must be affected by the small sample size variance.

In general, most of the studies for Latin America emphasize the importance of the human capital variables. The correlation coefficient (R^2) from standard human capital estimates ranged between 40% to 50%, far higher than for the US economy. This is a well-documented result for

LDCs, related to their higher schooling variance. The fact that human capital variables are a main determinant of worker earnings is seen in some of these studies as a confirmation of the predominance of the neoclassical-competitive model. However, we could argue that this is not the right test. The importance of human capital variables is an unquestionable fact in any model of the labor market, however it is not a market clearing test.

In contrast to human capital theory based studies, other researchers focused on the segmentation hypothesis. They test this hypothesis through comparisons of earning equations across labor market segments and industrial sectors. Souza and Tokman (1978), in an analysis of three Latin American countries, found that workers in the formal sector earn 40% more than workers with similar characteristics in the informal sector, and that the size of establishment has a positive effect on individual wages. Uthoff (1983), in an analysis of the Chilean labor market, classified the individuals in two labor market segments, formal and informal, and estimated human capital type equations.[3] His results indicate that the wage determination process differs between sectors.

In what concerns us most, there are studies that have tested segmentation across industrial sectors for the Chilean economy, in fact testing for wage differentials. Corbo and Stelcner (1983) found that the human capital model had a high explanatory power for individual wages dispersion and no differences in earning equations across industrial sectors (Chow test). They concluded that there was no evidence of segmentation and that their results validated the hypothesis of the competitiveness of the Chilean labor market. Their results have been criticized on the basis that their sample data biased the results against the segmentation hypothesis (Uthoff, 1981). An investigation carried out by Riveros (1983) corroborated Corbo and Stelcner's conclusions, in the sense of obtaining equivalent statistical results. His results have also been under debate on the basis that alternative tests—with the same data—lend support to opposite conclusions (Romaguera, 1986).

Edwards and Edwards (1987) refer to another type of segmentation in the Chilean labor market, i.e., between protected, covered by the minimum wage law, and unprotected sectors. The earning equation differs across the three segments, for the period 1974-80. They attribute the wage differentials to the influence of unions (prior to 1973), differentials that were later perpetuated by the indexation mechanism.

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[3] The criteria for being informal were: self-employed workers with less than 13 years of education, temporary workers, employers, and family workers in firms with less than 5 employees, and domestic service. In the formal sector all other classifications were included, covering all the blue and white collar workers, since his data base did not identify size of firm.

Finally, there are studies that deal with the issue of wage differentials from other perspectives. For example, Reyes Heroles (1984) examines the effect of modernization on the wage structure.

Summarizing, the studies dealing with development and the wage structure hypothesize that LDCs should have a lower wage dispersion than developed economies and a less similar wage structure. The case studies have found similar evidence to the earlier investigation for the US economy, in the sense that high paying industries are large and capital intensive. However a greater role is assigned in some of these studies to human capital explanations of wage dispersion.

In general, there has been little concern in the Latin American literature with examining the pattern of wage dispersion and the implications of wage differentials for nonclearing interpretations of the labor market. The exceptions are studies that are currently being conducted for Venezuela and Uruguay.[4] The present research—together with the above mentioned studies—constitutes an attempt to fill this gap and bring new insights on the determinants of wages in Latin American economies.

II. THEORIES OF WAGE DETERMINATION: WHY DO WAGE DIFFERENTIALS EXIST?

In the previous section we briefly reviewed empirical studies of wage differentials. As we stated in that section, the research that has been conducted lately, both for developed and less developed countries, is concerned with the extent to which the existence of wage differentials discriminates between competitive and noncompetitive theories of the labor market.

In this section we review competitive and noncompetitive theories of wage determination that attempt to explain the existence of wage differentials, giving special emphasis to efficiency wage models. A basic difference between both groups of theories rests on the hypothesis that wages do, or fail to, adjust in order to clear the labor market.

1. The Competitive Model

The neoclassical interpretation of wage differentials emphasizes two aspects of wage behavior. Since labor demand is determined by the value of the marginal product, wage differentials must correspond to productivity differentials. A second argument refers to the competitive hypothesis: free market forces will ensure that labor of the same quality will be paid the same wage.

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4 See Márquez (1988) and Abuhadba (1988).

However, a number of studies have found a pattern of persistent and stable wage differentials. The crucial question is then, what explains these wage differentials?

There are basically three types of consideration under which wage differentials remain consistent with a competitive interpretation of the labor market: transitory differences, compensating differentials, and unmeasured labor quality. The last two are related to measurement problems.

In the first place, changes in labor demand could produce transitory wage differentials for equally productive workers, differentials that will tend to narrow over time as the labor market returns to equilibrium. A second explanation focuses on compensating differentials that arise as higher wages are needed to compensate workers for job attributes of the industry. In this case wage differentials are essentially a measurement error, since the comparison does not take into account differences in nonpecuniary costs of worker employment. Finally, wage differentials may reflect the existence of unmeasured labor characteristics. These differentials could arise because different industries employ different technologies, which in turn are sensitive to worker ability in different degrees. The differential ability is known by the worker and the firm but is unobserved by the econometrician.

An alternative explanation is that the competitive model is prevented from prevailing, owing to external imposed rigidities. This is the view of some Chilean economists who perceive wage differentials as arising from the role of unions and government regulations, such as minimum wages and wage indexation (see previous section).

2. Efficiency Wage Models[5]

a) The Basic Model

The essential feature of efficiency wage models (EWMs) is the hypothesis that worker productivity is a positive function of wages, at least over some relevant range. Therefore, firms may be reluctant to reduce wages in the face of excess supply, since the associated decrease in productivity may result in an increase in labor costs. There are different hypotheses to explain the link between wages and productivity which give rise to alternative efficiency models.

A crucial assumption in all the models is the dual role played by the wage rate. In the neoclassical model wages perform only an allocative job, i.e., equating supply and demand for labor. In all the EWMs wages play an additional role, which varies depending on the model's assumptions. Wages affect worker behavior by affecting physical productivity in the nutritional

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5 There are a number of excellent reviews of the efficiency wage theories, and this section is partially based on them. See Katz (1986), Yellen (1984), Stiglitz (1986), Carmichel (1987), and Lang and Kahn (1988).

model, by affecting work effort in the shirking model, or by affecting morale in the normative models. Wages also determine the quality of the labor hiring pool in the adverse selection model, or the probability of acceptance of a firm's employment offer in the recruitment model. The dual role played by the wage rate is at the core of the nonclearing results obtained by these models.

In its simplest form, the efficiency wage hypothesis can be summarized by a production function of the form:

$$Q = f(e(w)\,L), \qquad e'(w) > 0 \qquad [1]$$

where L is the number of workers, w is the real wage and e is the effort per worker, or more general, worker productivity.

EWMs have been mostly developed as explanations of involuntary unemployment, but they also provide a justification for wage dispersion. If the effort function differs across firms then firms' optimal wages will also differ, and in equilibrium wage differentials will arise.

b) Alternative Efficiency Wage Models

There are different types of EWMs: the nutritional model; models that involve what in the literature has been called a "malfeasance," such as shirking, turnover, adverse selection, and recruiting models; and the sociological models. The nutritional model originated in the development literature, applied to LDCs, and can be considered a pioneer efficiency wages model. The models that involve a "malfeasance" are the ones that have been most developed in the literature and some of them express in a more formal setup hypotheses previously advanced in the institutional literature on wage differentials. Finally, the sociological or normative models bring into the analysis social considerations about workers behavior. A brief discussion of these models follows.

i) Nutritional Model

The earliest efficiency wage model was originated in the development literature by Leibenstein (1957). He advanced the idea that under certain circumstances it will benefit the landowner to pay a wage above the competitive level. The reason is the existence of a neglected relationship between wages and productivity, i.e., the amount of workers' effort depends positively on their wage. The linkage between higher wages and greater effort is related to health and nutrition under the hypothesis that in poor economies wages determine workers consumption levels.

The focus of the nutritional model on rural sectors and on the relation between wages and consumption seemed more adequate for rural poor countries, thus reducing the generalization of

the model. However, in many Latin American countries very low wage levels in some sectors of the economy are found, e.g., wages that are below poverty line estimations.

There are a number of studies that attempted to test the nutritional model in LDCs. The results of such investigations vary from rather inconclusive results, such as those of Inmink and Viteri (1981), to weak support, as in Bliss and Stern (1978), to strong support for the model, as in Rodgers (1975) and Audibert (1986).

ii) Shirking Model

The shirking model is the one that has been most extensively developed in the literature. See Shapiro and Stiglitz (1984), Calvo (1985), Sparks (1986), and Bulow and Summers (1986), among others. The model assumes that workers have some discretion concerning their work performance and that there are costs associated with monitoring, or that monitoring is imperfect. In order to induce workers' good behavior and discourage shirking, a firm needs to pay above the market clearing wage, to a point where the wage premium raises the cost of being laid off. The shirking model adds new variables to equation [1]; now the firm's effort function depends on the average wage, the aggregate unemployment and the unemployment benefit.

The shirking model predicts that firms that pay high wages are those with high monitoring costs, significant possibilities for workers to vary their effort inputs, and high costs from shirking, such as expensive broken machinery (Shapiro and Stiglitz, 1984). Another hypothesis derived from this model is that a firm should pay a higher "premium" to occupations in which poor worker performance can cause larger damage to the firm.

The shirking model has been criticized because the same results (deterred shirking) could be obtained by means other than firms paying high wages, e.g. workers posting performance bonds which are forfeited if the worker is caught shirking. The existence of imperfect capital markets, the possibility that firms will falsely claim the bond, and worker risk aversion are some of the reasons that could deter the existence of bonding schemes.

iii) Turnover Model

The labor turnover model assumes that turnover is costly to firms and therefore their wage policy is used to economize on such costs (Salop, 1979, and Stiglitz, 1974, 1986). The costs could be direct expenditures, such as orientation programs, or indirect costs such as lower worker productivity during an adjustment process, which are at least partially paid for by the firm. This model has a formal structure that is very similar to the shirking model. In this case, a higher wage than the market clearing level plays the role of reducing costly labor turnover. Workers will be more reluctant to quit the higher their relative wage (compared to the market wage) and the higher the cost of being unemployed.

The bonding critique referred to in the shirking model also applies to the turnover model. Salop (1979) assumes that there are restrictions to charging a fee to new applicants (which is an alternative to wage policy), restrictions that arise from imperfect capital markets, worker risk aversion or moral hazard problems.

Stiglitz (1974) has explained rural-urban wage differentials for LDCs in terms of a labor turnover model. The assumption is that turnover, hiring and training costs are higher in the urban than in the rural sector, and that turnover is a function of wages. Thus, a firm can reduce its turnover rate by paying urban workers higher wages than those that prevail in rural areas.

iv) Adverse Selection Model

The adverse selection model is based on four assumptions: first, workers are heterogeneous in ability; second, job performance depends on worker ability; third, the firm has imperfect information on worker characteristics (ability); and last, ability and worker reservation wages are positively correlated. The model is set up under the assumption that better workers have better alternative offers, where a relevant option is self-employment (Weiss, 1980).

The firm that offers higher wages attracts a better pool of applicants, and the quality mix of those who quit their jobs is a function of relative wages. Thus, firms that pay higher wages will be able to achieve higher levels of productivity. Similar adverse selection models to the one described in Weiss (1980) are tested in Garen (1985) and Weiss and Landau (1984).

v) Recruiting Model

In the recruiting model firms are concerned with the probability that their employment offer will be accepted by the worker (Lang, 1988 and Montgomery, 1988).

The assumptions of the model are that workers may hold more than one job offer simultaneously, that there is a delay between a firm's offer and the time workers show up to work, and that the firm does not know the alternative options available to workers. In this situation it is

costly for the firm if its wage offer is turned down by the worker for three reasons: first, the position remains vacant longer and there are costs of forgone production; second, the firm may lose other qualified applicants; and finally, there are new costs of evaluating further applicants. Therefore, firms that find vacancies more costly will offer higher wages. Firms should choose a "strategy of scale," where high capital firms pay high wages and vice versa (Lang, 1988).

vi) Sociological or Normative Models

While the previous EWMs were neoclassical in their assumption of individual maximization by all agents, the sociological models, by contrast, emphasize social conventions that are not completely individualistic (Solow, 1979 and 1980; Akerlof, 1982 and 1984; and Akerlof and Yellen, 1988).

In Akerlof's partial gift exchange model (Akerlof, 1984) the firm raises worker effort by paying the worker a wage above the going wage (giving a gift) and in reciprocity workers will work harder than the minimum standard (a reciprocal gift). Workers have a perception about their fair wage that Akerlof models as a function of previous period wages, wages paid to other workers who belong to the individual's reference group, unemployment levels, and the individual's work rules. They make a similar argument to predict the positive correlation between wages and profits. The hypothesis is that worker morale, and therefore work effort, will be negatively affected by "unfair" disparities between worker and firm earnings.[6]

There are two main implicit hypothesis in the sociological model that we would like to highlight.

A first implicit assumption is the notion that in most occupations workers have some discretional power over their work. As a consequence firms' output does not depend only on the number of workers employed but also on workers' level of effort. As has been stated by Akerlof (1982) this could be also interpreted as a distinction between labor and labor power.

A second implicit notion is that the economic man is a social category (Solow, 1980). The recognition of the importance of social conventions and fairness considerations determines that the effort function depends not only on workers' own wages, but also on workers' relative wages (across workers) and workers' past wages. A worker's perception of being unfairly treated with respect to his/her coworkers influences his/her productivity.

vii) Union Threat Model

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6 The importance of "fairness" considerations in economic decision has also been addressed by Kahneman, Knetsch, and Thaler (1986). They survey evidence indicating that there are "community standards of fairness" that influence the behavior of firms and workers.

Finally, let us note that the union threat model developed by Dickens (1986) led to outcomes similar to EWMs. The threat of collective action provides workers with bargaining power that allows them to appropriate part of the firm's rents. In the case of a monopoly, rents are derived from the firm's market power (monopoly profits); in the case of a competitive firm, Dickens assumes that in the short run workers will share the return from any firm's fixed assets. The model predicts that unemployed workers will be unable to bid down the firm's wages and that higher wages are expected in sectors with low organization costs and high potential gains from unionization.

c) Implications for Wage Differentials Analysis

As was stated before, one of the most important predictions of EWMs is the existence of wage dispersion. However, it must be noted that neither the competitive model nor most of the EWMs can explain the fact that firms employing different technologies coexist in the same industry. In this sense, EWMs are able to explain only the existence of interindustrial wage differentials, but not intraindustry wage dispersion.[7] Therefore, some external assumption is needed in order to generate intraindustry dispersion. A solution used in the literature to obtain heterogeneity among firms has been to assume that one factor of production has a flexible supply to the industry but a fixed supply to the firm.[8] Additionally, we may consider that there are empirical problems that generate intraindustrial heterogeneity, i.e., we will observe some product differentiation even if we are very careful in our empirical assessment of the industry.

EWMs also predict an association between wage premium and firm characteristics, where the link between both sets of variables varies depending on the models. In this sense, EWMs provide a formalization for arguments found earlier in the literature about the influence of industrial characteristics on wage dispersion. Consider for example Lester's monitoring hypothesis and Stigler's screening hypothesis, mentioned in Section 1. In the rest of this section we will focus on these links between EWMs and firm characteristics and the predictions of EWMs in terms of firm's wage behavior.

The nutritional model predicts that the efficiency wage for workers who are in excess supply should be stable, that different wage agreements should exist for workers employed under long- vs. short-term contracts, and finally that we should observe a predominance of stable long-term employment agreements (Rodgers, 1975 and Bliss and Stern, 1978).

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7 An exception is the recruiting model (Lang, 1988), where a vector of capital and wage combinations exists in equilibrium.

8 Oi (1983) demonstrates that, under the assumption that entrepreneurial ability is the specific scarce input, an industry will contain heterogeneous firms that will differ in size and in their organization of production.

The shirking model predicts higher wages in firms where monitoring costs are high and/or where the cost of worker malfeasance is high. Similarly the turnover model predicts higher wages in firms where turnover is more costly. In turn, there are different hypotheses that link these efficiency wage costs with firm characteristics that can be measured.

Shirking/monitoring costs have been assumed to be higher in large firms. Given that the production process is more interdependent in large firms, any breakdown, slowdown, or industrial accident will be more costly. Additionally, higher wages play the role of saving monitoring-entrepreneurial time, which has a higher opportunity cost in large firms.

In addition, shirking may also be associated with the capital endowment, in the sense that it will be costly for firms that use expensive capital equipment (in the extreme shirking could be associated with smashing the machines or stealing inputs or products).

Turnover costs have also been related to the size of the firm. The hypothesis is that recruiting and training costs are higher in large firms, owing to their more prescribed production methods. In this case, if firms share at least part of such costs they will have an incentive to reduce turnover.

Screening costs are also higher in large firms. Weiss and Landau (1984) formulate a screening model in which wages determine the productivity of a firm's best employees and the number of applicants. In this set up, they show that wages and firm size are positively correlated, a result that is driven by the fact that large firms need more workers. In Garen's (1985) model large firms have a higher cost of acquiring information about workers. Those differences in the screening process between large and small firms generate a positive relationship between firm size and wages. Both models seem to be supported by the author's estimates.

The recruiting models predict a relationship amongst capital, profits, and wages. This relation could be extended to other EWMs under the canonical form of equation [5]. The intuition is that any malfeasance that involves underutilization of capital and forgone production, such as a higher rate of quitting and shirking, or lower recruiting, will be more costly in firms with high capital-labor ratios, higher profits and a large labor force (Lang, 1988, p. 3).

In most EWMs workers are concerned with their own wage and their opportunity cost, measured by an average wage and the unemployment rate. Under the sociological model, workers are also concerned with their relative wages inside the firm and their own past wages, since these relative wages affect their perception of being fairly treated.

Both the union threat model and the sociological model predict higher wage premia in sectors with high rents which, as in Dickens (1986), we can assume represent monopoly rents or returns to fixed investments. However, while in the first model worker pressure arises from the threat of unionization, in the sociological model worker pressure arises from a morale effect that influences productivity.

Some caveats need to be made to the previous arguments. In particular, large and capital intensive firms should choose a technology that prevents the damage from shirking or that makes monitoring easy. However, considering the sum of arguments just discussed, we conclude that EWMs create a presumption that higher wages should be expected in large firms with high capital investments and high profits. Additionally, the sociological model predicts that firms will tend to pay high or low wages to all occupations.

3. A Comment on Segmentation

Segmentation is a topic closely related to wage differentials, because one of the main arguments of the segmented labor market (SLM) school is that the neoclassical model does not provide an adequate explanation of the dispersion of wages and income. SLM theory asserts that differences in wages can be explained by the adscription of the labor force to different segments of the labor market.

Moreover, most of the empirical tests on segmentation have attempted to prove the hypothesis that wagesetting mechanisms differ across labor market segments, and there is rationing of primary or formal sector jobs. Therefore, the existence of wage differentials across labor market segments has been one of the empirical tests for segmentation. However, in order to relate segmentation to interindustrial wage differentials, we should argue that some industries belong to the primary (or formal) sector while others belong to the secondary (or informal).

EWMs have tried to provide a rationalization for the existence of dual labor markets of the type postulated by Doeringer and Piore (1971). The hypothesis is that the primary sector is composed of efficiency wage firms while the wage-productivity relation is weak or non-existent for secondary sector firms.[9]

In the LDCs' case, it also has been argued that a key difference between formal and informal sectors is the existence in the former of a wage efficiency relationship. However this is a more controversial assertion, given the predominance of self-employed inside the informal sector.[10]

The analysis of the segmentation hypothesis goes far beyond the purpose of this paper. Also data limitations prevents us from a further discussion of this point, since most of our data excludes informal activities and we basically focus the analysis on the wage differences among employees. However large wage differentials prevail in the Chilean economy even after excluding informal sector workers from the analysis.

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9 See Bulow and Summers (1986).

10 See Mazumdar (1981).

III. THE EXISTENCE OF WAGE DIFFERENTIALS AND THEIR PATTERN ACROSS TIME, FIRM SIZES, AND OCCUPATIONS

In the following pages we test the statistical significance of wage differentials across industries in the Chilean economy and examine their pattern across time, firm size, and occupations.

We rely on three sources of data on workers' industrial wages: (i) manufacturing censuses; (ii) employment household surveys; (iii) occupational wage surveys for selected large firms.

The manufacturing censuses are conducted by the Instituto Nacional de Estadísticas (INE). They have the advantage of providing historical data, dating from 1937; however, their information refers only to workers' average wage and industry average characteristics. Therefore it does not allow us to control in the estimations for differences among individual workers characteristics. The censuses have been conducted for 1937, 1957, 1967, and 1979.

The household survey of the Universidad de Chile presents information both on workers' individual earnings and personal characteristics, such as age, education, etc. The disadvantages are related to the small sample size (near 3,000 observations) and the fact that it refers only to Santiago. We have information for 1969, 1978, and 1987.

Finally, we also have information for a sample of 86 "modern" and large firms. They report their wages along occupations and some characteristics of the firm. This sample does not present information on individual characteristics; however the very detailed occupational classification (more than one hundred occupations) allows comparisons between workers performing very similar jobs.

The three samples present useful information, despite the fact that none of them is an "ideal" data source. However in conjunction, they provide useful information for testing the EWMs and reaching a better understanding of the Chilean labor market.

1. The Existence of Wage Differentials[11]

The importance of industry affiliation on worker's wages is examined by testing wage differentials across industries, taking into account differences in workers' personal characteristics. Wage differentials are estimated from a standard cross section wage equation that includes controls for worker education, age, sex, and occupation. The estimated wage equation has the form:

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11 This methodology follows closely Krueger and Summers (1988).

$$\ln W = X\,\boldsymbol{a} + Y\,\boldsymbol{ß} + \mu \qquad [2]$$

where:

X is a matrix of worker characteristics

Y is a vector of industrial dummies.[12]

In order to get a more intuitive measure of the impact of industry affiliation on wages, the estimated **ß** coefficients are normalized around the weighted mean, as follows:

$$\hat{\beta}_i^r = \hat{\beta}_i - \sum_{i=1}^{s-1} \hat{\beta}_i * \frac{n_i}{N} \qquad [3.1]$$

Wage differentials are represented by the vector $\boldsymbol{ß}_i^r$ and they indicate the proportional difference in wages between the average worker in an industry and the weighted average of all industries, controlling for differences in worker characteristics.

The standard deviation of $\boldsymbol{ß}_i^r$ represents a measure of wage dispersion and needs to be adjusted to take into account the effect of sampling errors, given that estimated coefficients are by definition:

$$\hat{\beta}_i = \beta_i + \hat{\varepsilon}_i \qquad [4.5]$$

then,

$$\sigma = SD(\beta) \quad \sqrt{\text{var}(\hat{\beta})} - \frac{1}{N}\sum_{i=1}^{s} n_i\,\hat{\sigma}_i^2 + \frac{1}{\sum n_i\,n_j}\sum_{i\,j} n_i n_j\,\sigma_{i\,j} \qquad [4.6]$$

where the variance is weighted by employment shares and σ is the standard error of $\boldsymbol{ß}_i$.

Table 2 reports the estimated interindustrial wage differentials, for 1967, 1978, and 1987. The statistical test (test F) indicates that interindustrial wage differentials are statistically significant, after controlling for workers' characteristics, i.e., all the estimations report statistically significant jointly industrial dummies. (The complete regression results are presented in the Appendix.)

TABLE 2

Industrial Wage Differentials: Santiago, Chile, 1969, 1978, and 1987[a]

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12 Some of the coefficients are individually statistically significant also. However the small sample size is a limitation for the industry individual analysis.

	1969	1978	1987
Food, Drinks, and Tobacco	-0.042	0.006	0.045
Textiles, Apparel, and Leather	-0.006	0.079	0.051
Wood and Furniture	-0.139	0.095	0.052
Paper and Printing	0.207	0.161	0.150
Chemical Products	-0.099	0.193	0.097
Non-Iron Metals and Basic Metallics	0.091	-0.032	0.043
Fabricated Metals and Machinery	0.024	0.032	0.118
Construction	0.013	0.104	0.118
Wholesale Trade	0.202	0.209	0.108
Retail Trade	-0.238	-0.264	-0.170
Restaurants and Hotels	-0.114	-0.038	-0.136
Public Administration	0.249	-0.284	-0.266
Financial Service and Insurance	0.236	0.293	0.493
Repair Service	-0.063	-0.019	-0.025
Laundries	0.179	0.028	-0.117
Domestic Services	-0.370	-0.059	-0.009
Educational Services	0.034	-0.116	-0.083
Health Services	-0.114	-0.107	-0.167
Other Services	0.051	0.070	-0.049
Transport and Storage	0.021	0.137	0.090
Public Utility Services	0.091	-0.050	0.257
Sample Size	2,667	2,708	2,598
Standard Deviations[b]	0.114	0.141	0.154

[a] The sample includes white and blue collar workers from the private and public sectors.

[b] Standard deviations are weighted by employment shares; adjusted for sampling error.

Additionally, the results indicate that industry affiliation has a large impact on wages. For example, in 1987 financial service institutions workers earned 49% above the mean, while workers in retail trade earned 17% below the average wage, after controlling for individual characteristics (see Table 2).

For the three years under analysis we find, among the high paying industries, workers belonging to financial services and wholesale trade. The lowest paying industries are retail trade and restaurants and hotels.

The wage dispersion, as measured by the standard deviation ranges from 0.114 to 0.154 (see Table 2). These results do not differ too much from the ones obtained for the US, opposing the view that wage dispersion in LDCs should be lower. Krueger and Summers' (1988) report standard deviations of interindustrial wage differentials in the range 0.11 to 0.14 for different years. Moreover, the dispersion of the simple average wage (without human capital controls) seems larger in Chile. The standard deviation of the average wage (no-controls) across industries

is 0.29, 0.26 and 0.35 for the years 1969, 1978, and 1987. The corresponding figure is 0.24 for the US economy.[13]

The previous comparison implies that adding workers' characteristics to the wage equation produces a larger drop in interindustry wage dispersion in the estimates for the Chilean economy, a result that could be driven by the higher educational variance across industrial sectors and the higher return to human capital that are generally present in LDCs.

2. The Pattern of Wage Differentials across Time

After testing for the existence of significant wage differentials, we analyze the stability of the wage structure through time.

Table 3 presents the correlations through time of the wage differentials estimated in the previous section.

The results indicate a low correlation between the years 1969 and 1978, however a high correlation between 1978 and 1987. In order to further check this results we performed similar estimations for a sample of private workers only. In this case we obtained high correlations for both periods. Therefore the changes in the wage structure that we observe between 1969 and 1978 are mainly due to changes in the relative wages of public sector workers. In the previous table (table 2) it was possible to observe the drastic change in public servant wages.

TABLE 3

Intertemporal Correlation of Industry Wage Differentials: 1969-87 (Correlation Coefficients)

	Public and Private Sectors			Private Sector		
	1969	**1978**	**1987**	**1969**	**1978**	**1987**
1969	1.000*			1.000*		
1978	0.348	1.000*		0.915	1.000*	
1987	0.376	0.959	1.000*	0.874	0.989	1.000*

* The correlations are weighted by employment shares and adjusted for the sampling error. This adjustment causes some correlations to be greater than 1.

The public sector wage differential falls from 25% above the mean to 29% below the mean between 1969 and 1987. A similar but less dramatic change is also observed in educational

[13] See Krueger and Summers (1987), Table 2.1. They report standard deviations of 0.146 and 0.24 for the industrial wage differentials, with and without labor quality controls, respectively.

services, which fall from 0.03% to -12%. These results are associated with the decrease in the government budget expenditure that took place during these years and the existence of public emergency employment programs at very low wages.

The wage structure seems very similar the years 1978 and 1987. The major difference for the last period is the increase in wages in the financial service sector. This sector, which is always one of the highest paid, goes from 24% in 1969 to 29% in 1978 to 49% above the mean in 1987 (see table 2).

In order to perform a long-term comparison of the wage structure, we have to rely on data from the manufacturing census. In this case wage differentials simply represent the difference between the average wage in an industry and the total weighted average wage. Table 4 presents the correlations of the average wage between 1937, 1957, 1967, and 1979.

The correlations for the last three years (1957, 1967, and 1979) ranged between 0.92 and 0.89. Going back in time lowers the correlation to 0.60 between 1979 and 1937. The results indicate a stable wage structure, especially during the last two decades, an impressive fact given the very different economic policies that were implemented during that period. On the other hand, the results seems to indicate that the wage structure was more affected by the process of development than by changes in economic policies. Let us remember that much of the industrial development in Chile took place after the '40s. The correlation between 1937 and 1957 is 0.72 while the correlation between 1957 and 1979 is 0.92.[14]

TABLE 4

Industry Wage Structure through Time: Comparisons of Log Earnings in the Manufacturing Sector, 1937-79 (Standard Deviation and Correlation Coefficients)

	Standard Deviation of Log Average Wage		Weighted Correlations with 1979		
Year	Original Classification	Homogeneous Classification	84 Industries	50 Industries	30 Industries
1979	0.398	0.393	1.000	1.000	1.000
	(84)	(30)	(84)	(50)	(30)
1967	0.398	0.359	0.865	0.884	0.915
	(84)	(30)	(84)	(50)	(30)
1957	0.356	0.318	-	0.871	0.917
	(57)	(30)	-	(50)	(30)
1937	0.335	0.256	-	-	0.604

[14] These correlations are lower than the ones obtained for the US for similar periods of time; however the data present different levels of aggregation.

(95)	(30)	-	-	(30)

Note: The number of observations are in parentheses.
The correlations are weighted by 1979 employment shares.

It must also be pointed out that the correlations with 1937 are subject to a downward bias owing to the fact that the data is not strictly comparable, since the census of 1937 includes establishments with fewer than five workers.

The analysis of the wage structure over time indicates a very stable pattern of relative wages for the Chilean economy, an impressive result given the changes that this economy has experienced during the period under examination.

Overall, the magnitude of the policy effects on wages seems very small. The results indicate that only very dramatic changes in policy—such as those in the Chilean public sector case—have important impacts on the wage structure. The fact that the interindustry wage structure seems very stable across time implies that competitive explanations of wage differentials based on the short-run immobility of labor or transitory labor demand shocks have a minor role, or no role at all, in explaining such differentials.

The data on table 4 also indicate a high dispersion of wages in the manufacturing sector, with standard deviations in the range of 0.34 to 0.40. Similar results have been obtained for Venezuela and Uruguay. Data from the Uruguay manufacturing census indicates that the weighted standard deviations range from 0.308 in 1982 to 0.353 in 1986 (Abuhadba, 1988). In the case of the manufacturing sector in Venezuela, the wage dispersion was 0.34 in 1985 (Márquez, 1988).

The dispersion of wage differentials seems high, compared with the international data presented by Krueger and Summers (1987). As in the previous section, our results tend to contradict their hypothesis that developed countries have greater wage dispersion than LDCs, owing to their higher level of human capital.

3. The Pattern of Wage Differentials across Firm Sizes

Size seems to have a more significant effect on wages in Chile. Comparisons of interindustry average wages in the manufacturing census indicate that the pattern of correlation differs across size. In the case of Chile, the wage correlation between large and medium size firms is 0.656; however there is no correlation between large and small firms, 0.084.[15]

[15] The census firm strata are: small, 5-9 workers; medium, 10-49 workers; large, 50 and more workers.

By contrast, in the US economy the industry wage structure is shown as highly correlated across firm size, a correlation of 0.78 between small and large firms (Krueger and Summers, 1987).

We interpret these results as an indication of the greater intraindustrial heterogeneity of LDCs.

4. The Pattern of Wage Differentials across Occupations

One of the most interesting hypothesis to test is the stability of the pattern of wage differentials across occupations, given the different predictions of different models of wage determination in respect to this pattern.

In the first place, if wage differentials arise owing to unmeasured worker ability, then why do industries that require highly skilled managers also require janitors with special abilities? It is difficult to argue in favor of a technology that requires such strong ability complementarities across all occupations. According to the competitive model, we should expect high correlations only between occupations that are complementary in the firm's production function.

Secondly, shirking, turnover, and screening theories predict that firms should pay high wages only to those occupations where such costs are especially high. A uniform correlations pattern is to some extent also a challenge for these models.

A unique prediction of the sociological models is that firms will pay evenly high or low relative wages to all their workers because norms, loyalty feelings, and fairness considerations influence worker productivity.

In the Chilean case, the correlation of wage differentials between white and blue collar workers across industries is 0.652, according to the data from the household survey of 1987.

The data from the manufacturing census indicate a growing correlation between white and blue collar workers. The correlation between blue and white collar workers was 0.128 in 1937; 0.523 in 1957; and 0.757 in 1967 and 1979. One reason behind this tendency could be the relative decline in the proportion of blue collar workers in the work force.[16] The increase in white collar workers has been accompanied by a change in their composition, increasing the number of clerical and productive white collar workers compared to managerial positions. Nevertheless, the observed correlations indicate that the new white collar entrants were paid according to the relative wage level of existing employees.

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16 It should be noticed that data from 1937 are less compatible with the surveys performed thereafter.

Overall, the results indicate that the wage structure is fairly uniform among blue and white collar workers in the Chilean manufacturing sector, indicating a pattern of high- vs. low-paying industries.

However, the data analyzed so far provide us only with highly aggregated occupational categories. In order to advance in the testing of the EWMs, we have to rely on a new set of data: wage surveys for selected Chilean large firms. There are two wage surveys: an Administrative Survey and a Productive Workers Survey, for March and October 1985 respectively.

The first thing worth noticing is that wages in this sample are much higher than the average wage in the economy, even for the lowest skilled occupations. For example, during 1985 the minimum wage was 6,667 pesos while the average wage of this sample of unskilled workers was 22,775 pesos monthly. More recent data (from the same survey) indicate that in January 1989 the average wage for unskilled blue collar (in production) was 45,000 pesos and the lowest wage in the sample was 22,500 pesos. These figures are much higher than the minimum wage (about 15,000). It must also be noticed that the poverty line wage is estimated around 28,000 pesos.

The magnitude of the differentials between the legal minimum wage and the wage of low skilled occupations in modern firms makes very difficult an explanation of these wage differentials based on any "malfeasance." On the contrary, it makes more sense to hypothesize that "modern" firms that require a stable, motivated, and productive labor force need to pay their workers a wage that at least provides for their basic needs. What is detrimental to this nutritional "basic needs" argument is the high dispersion of wages in the lower ranked occupations. The data show us that even inside the modern sector wage dispersion across occupations is high; the standard deviation ranges from 0.15 to 0.47.

Additionally, contrary to what is expected in a competitive model, we do not find higher wage dispersion in the top ranked positions than in lower ones. If wage differentials were due to differential abilities, we should expect higher dispersion in occupations where differences in ability or other personal characteristics have a greater impact on productivity. In this sense we should expect high dispersion in occupations such as managers and chiefs of departments, for example. However, performing a simple correlation test we found that the wage dispersion is negatively correlated with the absolute wage level in the Administrative Survey and has no correlation at all in the Productive Survey.[17] An explanation could be that firms set wages at the bottom of the occupational ladder more imprecisely when there are few workers in such occupations.

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[17] The correlation coefficient between the standard deviation of wages and the average wage for each occupation are -0.4 for the Administrative Survey and 0.0 for the Productive Survey.

Tables 5 and 6 present the correlations for aggregated groups of Administrative Office occupations and Productive Plant occupations, respectively. We need to have in mind that the sample size is small and that the number of observations across occupations varies, issues that may influence the results. However, we assert that the results are highly consistent even under this limitation, and they provide a good estimation of the tendencies in the pattern of wage-occupation correlations.

Occupations that are likely to be complementary in production are highly correlated. For example, managers are more correlated with secretaries than with blue collar workers. Chiefs of departments are more correlated with professionals than with other categories. But we also find high wage correlations in occupations where such complementarity is hard to justify, for example among blue collar workers, clerical workers, and secretaries (see table 5).

TABLE 5

Correlations across Occupations: Administrative Survey (Coefficient of Correlation)

	Managers	Chiefs of Depart.	Professional	Clericals	Secretaries	Semi- and Unskilled
Managers	1.000 (80)					
Chiefs of Department	0.480 (77)	1.000 (84)				
Professionals	0.289 (59)	0.761 (64)	1.000 (64)			
Clericals	0.308 (62)	0.488 (66)	0.440 (52)	1.000 (68)		
Secretaries	0.385 (78)	0.648 (83)	0.641 (63)	0.721 (66)	1.000 (85)	
Semi- and Unskilled workers	0.220 (61)	0.518 (67)	0.396 (54)	0.627 (54)	0.625 (67)	1.000 (68)

Note: The number of observations is in parenthesis.

Similar evidence is provided in Table 6 for the sample of productive workers. Overall this matrix presents higher correlation coefficients than the Administrative Office sample. The pattern of high correlations between 'likely' complementary occupations is also observed in this sample. For example first level chiefs are highly correlated with second level chiefs. However, we also find high correlations between occupations that are not related in production. It is hard to see why a firm that needs above average qualified clerical workers (the accounting department) also needs above average productive workers.

A comparison among individual occupations yields similar results (see Romaguera, 1989).

Summarizing, the correlation analysis indicates that, as predicted by the unmeasured ability-competitive model, one explanation for the high wage correlations across occupations is that such occupations are complementary in production. However, this is only a partial explanation. The results indicate that most of the occupations in a firm are highly correlated among themselves. In particular all of the nonprofessional positions are highly correlated, independently of the specific function that they perform in the firm. These occupations are not related by technology but by the fact that workers share a physical location, establish contacts among themselves, and have a more similar status. In sum, the correlation results provide strong

support for sociological models that predict that workers care about their relative wages; models that emphasize the importance of norms in wage determination.

The fact that wages are highly correlated among occupations inside a firm also implies that wages tend to move together across time, imposing some stickiness into the wage structure.

An examination of the wages of these large firms over the 1975-86 period helps us to elucidate this point. The fact that wages evolved similarly across firms occupations is made clear from observing that unskilled workers followed the wage evolution of their managers much more closely than the evolution of the minimum wage during the 1976-86 period (see graph 1). The wage correlations are 0.98 and 0.20 respectively.

IV. WAGE DIFFERENTIALS AND INDUSTRY CHARACTERISTICS

The existence of significant wage differentials in the Chilean economy and the examination of their patterns across time and occupations was the subject of the previous section. A pattern of high vs. low industries emerged from that analysis, where high (or low) industries are the same for both blue and white collar workers and tend to remain stable over time. The purpose of this section is to continue this line of inquiry by examining the industrial characteristics associated with high vs. low paying industries.

This section presents estimations of industry wage correlates for the Chilean manufacturing sector. The dependent variable is the average (log) wage in the industry. As independent variables we have data on five types of industry characteristics. First, there is limited information on average worker characteristics, such as male-female and blue-white collar proportions, and average hours of work. Second, there are several measures of capital intensity. Information on capital has the limitation that it refers to the book value of plant and equipment and exists only for 1957 and 1967. We have added measures of physical capital, such as hp and kwh and fuel consumption. Third, we have a single measure of growth, represented by new investment per firm. Fourth, there are two measures of size, given by the number of workers and the volume of sales. Finally, measures of market power are given by two measures of profits: profits per worker, and the ratio of profits to sales. Profit is traditionally a difficult variable to measure and our variable definition—value added minus wages—is only an approximation. We have also included a measure of concentration for 1967.

The industrial characteristics show a high correlation among themselves. The problem that the high multicolinearity of industry attributes poses for studies of wage differentials was referred to before, in the literature review in Section I. The sensitivity of the results to a particular specification—a problem raised by Dickens and Katz—induces us to base our conclusions on the

entire set of possible regressions. Therefore, we followed their approach of testing different specifications.

We tested several specifications of the wage equation as a way to partially cope with the multicolinearity that exists between industry characteristics. The difference between each specification relates to the variable chosen to represent a specific industrial characteristic, i.e., how size, capital intensity, etc. are measured. Thus, the equation includes a measure of size (workers per firm or sales per firm), a measure of profitability (profits per worker or profits/sales), and a measure of capital intensity (capital/labor, or hp per worker, or kwh per worker, or fuel per worker). The growth variable (investment per firm) was included as an alternative to measures of capital intensity. The equations also include controls for female/male composition, hours of work, and blue/white collar ratio. This gives us a total of 20 specifications for 1957 and 1967 and 12 specifications for 1979.[18] We estimated the regressions separately for the whole sample of workers, for blue and white collar workers, and for the three years under analysis. This gives a total of 156 regressions. Additionally we use information from an independent study on concentration for 1967.[19] In this case we regress again the 20 alternative specifications, now adding the concentration variable. This raises the total number of estimated equations to 216.

A summary of the complete set of regression results is presented in Table 7, which describes the number of times the variable was positive or negative, and the number of times the variable was statistically significant at 5%. Some selected specifications are also presented in full in Table 8.

The results are very consistent. Most of the variables have the right sign and only one variable with the wrong sign was significant.

However, the results seem sensitive to the particular manner of measuring the variables. The better measure of firm size is the number of workers, while sales per firm has weaker and less consistent results. In terms of the measures of profitability, profits per worker is generally significant, while the ratio profits/sales shows inconsistent results and even negative (nonsignificant) signs. We have employed four alternative measures of capital intensity. Hp per worker and kwh per worker are the variables that show a higher predictive power, performing better than the alternative measure of physical capital (consumption of fuel per worker) and better than the capital/labor ratio that reflects the monetary value of installed capital.

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18 We do not have information on capital/labor ratio and HP per worker for this last year.

19 The information was obtained from Meller and Swinburn (1973) and provides information on 59 industries, which represent 70% of our sample.

On the other hand we note that the results are also sensitive to time period and differences appear in the wage equation of white vs. blue collar workers. For example, in 1957 the workers per firm variable is significant in 7 out of 10 specifications in the case of blue collar workers, but it is not significant for white collar workers. In 1967 the results for size and capital intensity measures are similar between white and blue collar workers, while profitability is more significant for white collar workers. In 1967 we also included a measure of concentration, which was highly significant only for blue collar workers. The results for 1979 indicate that the variables representing size and capital are more relevant for blue collar workers, while profitability has a high influence on both groups of workers.

In sum, the results show that high paying industries have higher capital intensity, are more profitable, have experienced greater growth in terms of capital investment, and have a higher average size of firm. Additionally, in spite of having data for only one year, concentration seems to strongly affect the wages of blue collar workers. These results are in line with the predictions of EWMs, which—as discussed in Section II—make the presumption that higher wages should be paid in large firms that employ expensive capital equipment and have high levels of profitability.

CONCLUSIONS

The implications of our results can be considered from two perspectives. First, in terms of the support or rejection that our analysis provides for different theories of wage differentials, and in particular for the debate between competitive vs. efficiency wage theories. Second, in terms of what we have learned about the wage structure of LDCs, and in particular that of the Chilean economy.

The basic prediction of efficiency wage models is the existence of wage differentials; in this sense our results support such models. However, the empirical analysis always has limitations and ours is no exception. The examination of the pattern of wage differentials provides additional information for responding to the question of whether such differentials represent merely a statistical phenomenon.

The research on the pattern of wage differentials reveals that they are relatively stable across time and occupations. Moreover, wage differentials are significantly correlated with the characteristics of firms and industries. The results show that high paying industries have higher capital intensity, are more profitable, have experienced greater growth in terms of capital investment, and have larger average size of firms. Additionally, concentration seems to strongly affect the wages of blue collar workers.

A number of these results pose serious difficulties for a competitive hypothesis. Interindustrial wage differentials are stable across time, including periods that involved important

changes in economic policies. Therefore, competitive explanations based on the short-run immobility of labor or transitory demand shocks should have a minor role or no role at all in explaining such differentials. The high correlation of wage differentials across occupations is an argument against the unmeasured ability explanation, since it is unlikely that workers in different occupations within a firm or industry have similar quantities of unmeasured ability.

In terms of the correlates of industrial wage differentials, the results also fit better with the prediction of the EWMs, but do not necessarily rule out the competitive hypothesis. A significant correlation between wages and capital intensity should be observed if high-ability technologies are capital intensive and if the estimation did not adequately control for worker ability. The significance of profits suggest the existence of rent-sharing processes that are more difficult to reconcile with a competitive explanation

One of the results that poses more questions for a competitive hypothesis is the behavior of modern firms during the 1975-86 period. The results show that modern firms pay wages substantially higher that what seems to be the opportunity cost of workers. The dispersion of wages is not only high in the high-skilled occupations (where unmeasured ability should be greater) but also in the semi- and unskilled occupations. Wages are highly correlated between occupations that are not complementary in production, and wages for different occupations show a similar evolution across time.

The addition of this evidence makes very implausible the argument that the wage differentials observed in the Chilean economy respond to the effect of unmeasured worker variables. The results suggest, on the contrary, that industries and firms do in fact pay different wages to similar workers.

There are still other arguments that can explain the existence of “real” wage differentials without challenging the competitive hypothesis: the existence of imperfections or rigidities that prevent the adjustment of the labor market. In the Chilean case the arguments have been based on the existence of unions and the existence of indexation. Our research indicates that it is difficult to attribute to such factors the persistent pattern of wage differentials that we observe for the whole period 1937-87. In the previous sections we have suggested several arguments for why this is so; here let us only remember that the influence of unions and the policies of indexation have changed greatly during the period covered by our analysis, yet the wage differentials have remained stable.

In short, the existence of wage differentials and the stability of their pattern is more consistent with EWMs that predict such behavior. The examination of the pattern of wage differentials also provides a test for the predictions of different EWMs. However it is difficult to discriminate among different EWMs.

The importance of size and capital intensity in wage determination are factors that are consistent with shirking and turnover models. The problem with these findings is that alternative explanations can also be provided. In particular, the argument that unmeasured ability is correlated with technology makes it very difficult to discriminate among alternative hypotheses.

The high correlation across occupations poses a challenge to shirking or monitoring models because firms should pay high wages only to the occupations where such costs are particularly high.

The most consistent results are obtained for normative or sociological models that predict a pattern of high correlations across all occupations inside a firm. The evidence of rent-sharing processes even when union power is weak is also consistent with this model. Also, rent-sharing arguments could be combined with other EWMs. Overall, the Chilean evidence on wage differentials seems better explained by a combination of models that include both economic and sociological arguments in order to explain the persistent pattern of such differentials. In this sense, our results confirm the conclusions that have been obtained for the US economy: firms tend to pay higher wages to some occupations, owing to turnover, effort elicitation, recruitment or other reasons, but at the same time they also face equity constraints that lead them to pay high wages to all the other occupations.[20]

One of the main predictions of the EWMs is that wages will tend to be sticky. Therefore, if efficiency wage considerations are applicable to the Chilean economy—as this investigation has attempted to prove—a pattern of sticky wages in the Chilean economy should also be predicted. The behavior of wages in modern firms during the 1975-1986 period support such hypothesis.

Finally, with respect to LDCs' wage structures, contrary to what was assumed by other researchers, we found a higher dispersion of interindustrial wages in Chile compared with the US manufacturing sector. Nor is there a pattern of decrease of these differentials with higher levels of development. We interpret several of our results as a reflection of a more heterogeneous industrial structure in LDCs than in developed countries.

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20 See Katz (1988).

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TABLE 1

Review of Selected Wage Differentials—Wage Determination Studies in Latin America

Author and Country	Data	Relevant Conclusions
Ferreira da Silva (1987) Brasil	Relacao Anual de Informacoes Sociais (RAIS), 1977 and Imposto de Renda de Pessoas Juridicas (IRPJ), 1978. Sample of 46,531 workers in manufacturing industries. Dependent variable is monthly individual wage (linear and log).	The study analyzes the influence on wage differentials of four groups of variables: individual, firm, industrial, and regional. Firm size, profits, concentration, union power, and minimum regional wage, almost always have a positive and significant effect on wages. The results for profits and concentration depend on the specification. Worker characteristics explain the bulk of individual wage variation: 80%-86% of the sum of the beta coefficients.
Macedo, Roberto (1985) Brazil	Sample from RAIS, Relacao Anual de Informacoes Sociais, (RAIS) 1981. The initial sample includes 335,000 workers. One private and one public enterprise are selected from that sample for further analysis (n= 1204).	The study shows that wages in state firms exceed those paid by private firms. The results hold even when controls for worker characteristics are included. Public-private wage differential is decomposed.between a portion attributable to worker characteristics and a surplus. The wage differentials attributed to surplus ranged from 26% to 83%, depending on the wage structure selected as the norm (public or private).
Reyes Heroles (1984) Mexico	Household Survey, 1977 and Industrial Census, 1975. Dependent variable is the monthly average wage in 23 manufacturing industries, and moments from the earning distribution.	The study asserts that the modernization of Mexican industry changed the industry distribution of earnings: average earnings are higher and the variance of interindustry earnings was reduced. Modernization is measured through variables related to technology: as capital per worker, average size of establishment, and specialization ratio on production.
Corbo and Stelcner (1983) Chile.	Employment and Unemployment Survey, Universidad de Chile, 1978. Dependent variable is log of individual earnings. Sample size = 1788.	This study tests the competitiveness of the labor market and the relevance of the H-C model in explaining individual variations in earnings. They test for structural differences in the earnings functions of 9 industrial sectors (Chow test), finding no evidence of segmentation and concluding that their results are a validation of the H-C approach.

TABLE 1 (Cont.)

Author and Country	Data	Relevant Conclusions
Salazar-Carrillo (1982) 11 Latin American countries	ECIEL specially designed survey. It covered 9 manufacturing industries. In each industry between 9-3 firms were surveyed, and for each firm approximately 20 occupations were selected. They surveyed 361 firms. The dependent variable is individual worker earnings.	Estimate wage equations using as independent variables: education, experience and degree of responsibility. The study estimates wage rankings across countries, normalize for differences in H-C. They observe wide wage and interskill differences within the region. The study found no strong firm size effect on wage differentials.
Castello Branco (1979) Brazil	Data from the Labor Ministry : 1969 and 1973. The sample size is 70,000 for the estimation of a standard H-C model and the dependent variable is the log of individual wages. The study also estimates wage equations with industrial characteristics as explanatory variables. The dependent variable is the log of the average wage for 18 industrial sectors.	The main purpose of the study is to estimate H-C models.They obtain an R^2 around 40% and important differences in H-C return are observed across industries. Equations with the industrial average wage as dependent variable are also estimated. An index of machine imports and the degree of concentration has positive and significant effect on wages, while output increase is positive but not significant and tariff protection is negative and not significant. Concentration, output and technology explained 31% of changes in average wage (1969-73).
Souza and Tokman (1978) Dominican Republic, Paraguay and Salvador.	Data from Household Surveys from Dominican Republic, Paraguay and Salvador.	They study the existence of segmentation in the labor market. Using a two-step regression, they regress the residuals of an earning equation against occupation, industrial sector and size of firm variables. They found that these variables explain nearly 25% of residual wages after controlling for H-C factors. Workers with similar characteristics earn 40% more in the formal than in the informal sector.
Fields and Marulanda (1976)—Colombia.	Data for five manufacturing industries (2 digit - SIC), 1967. Dependent variable is the average industrial wage.	They found higher wages in sectors with higher value added per worker, more capital intensity, with larger firms, high foreign investment and a high proportion of white collar workers.