Unions, wage gaps and wage distribution

Study cases of Bolivia and Chile

by

Fernando Rios Avila*

Abstract

Most of the empirical literature on the effects of unions in developed countries agrees on two results: unions increase wages of union members, and they typically reduce wage dispersion among their members. These results, however, are arguably tied to the strong institutional, legal and economic background characteristic of developed countries. In this paper, I analyze the effect of unions in terms of wage gaps and wage dispersion, controlling for the same methodology, for two neighboring countries, Bolivia and Chile, who are at different stages of economic development. My results indicate that, in average, unions have similar effects on wages, in terms of wages gaps and wage dispersion, in both countries, corroborating the findings of the traditional literature on unions.

This draft is preliminary and incomplete. Please do not cite or circulate

without the permission of the author.

October 2011

* Phd Canditate at Georgia State University (friosavila1@gsu.edu). I thank my committee advisors and readers for its helpful comments and direction.

Introduction

Most of the empirical literature on the effects of unions on wage determination and wage distribution in developed countries agree on two basic results. First, unions increase wages of union members, creating a wage differential with otherwise similar non-union workers. Second, unions typically can reduce wage dispersion among their members, both within and across unionized establishments as compared to their nonunionized counterparts.

The union wage literature tends explain these economic effects of unions, focusing on the role unions have as the "monopoly" bargaining unit in a given market. Under this role, unions are able to create a wage gap by generating a monopoly rent if they have enough coverage of the work force (monopoly face of unions). A second potential channel, identified by Freeman and Medoff (1984), is the so called collective voice/institutional response. In this framework, unions affect wages, as well as other workplace outcomes, by redirecting their monopoly power to affect different aspects of the firm organization and decision process.

Although the literature on this topic is large, it is concentrated on developed economies, which arguably possess strong institutions with similar economic backgrounds. It is possible that because of these underlying conditions, some conclusions found in the literature could change when those conditions change. Aspects such as legal frameworks, size of informal economies, inequality and economic development could have different impacts on the role of unions, from the freedom workers may have to establish this kind of organizations, to the rights and powers union have to intervene for the wellbeing of their members.

In this framework, because developing countries are typically characterized by high levels of poverty, high inequality, large informal sector and less competitive markets, it is possible that effects previously seen in the need not be applicable for these economies. In fact, some of the incipient literature that has focused on the analysis of unions in developing countries

has found results that greatly differ from those found in the traditional literature , while others have corroborated the traditional findings{Arbache, 1999 #564; Cassoni, 2005 #617; Schultz, 1998 #506}. Because these analyses differ not only on nature of the countries analyzed, but also on the methodology and type of information they use, it is possible that differences in the obtained results are capturing methodological differences, and not reflecting the differences caused by their economic and legal backgrounds.

In this sense, this paper aims to provide evidence on this issue by analyzing the effect of unions on wage gaps and wage distributions, using a consistent and comparable methodology for two neighboring countries: Bolivia and Chile. These two countries are characterized for having historically strong union organizations (Alexander & Parker, 2005; Ulloa, 2003), but at the same time have contrasting characteristics in terms of poverty, inequality, informality and economic development.

Although both countries shared a similar economic history background, Chile has a larger economy, has achieved a considerably higher level of development, lower inequality, smaller informal sector, with better institutions and relatively great success applying a free market model. Bolivia, in contrast, is one of the countries with the highest level of poverty and inequality in South America, with a much larger informal sectors compare to Chile. From a legal point of view, although the freedom of association and collective bargain is allowed in both countries, there are more restrictions on the creations of labor associations in Bolivia than in Chile, which could further affect the bargaining role of unions in each country.[1]

To analyze these effects, first, I use ordinary least squares and Oaxaca type of decompositions to examine the magnitude of the wage differentials, and to what extend the

[1] According to the report presented in OECD (1996) while in countries like Chile, there are some restrictions, it is relatively easy to establish independent workers' organizations and union confederations, whereas in Bolivia they indicate the restrictions are significant, particularly due to the requirements for registration and political interference.

observed wages gaps can be explained by worker characteristics, as well as by returns to their endowments. Furthermore, considering the extent of union coverage in the public and private sector, separate analysis is provided for in each case. Second, in order to analyze the effects of unions on wage distribution and dispersion, I start by applying a quantile regressions approach to test the hypothesis if unions have differentiated effects across wage's distribution, to use them as a first approach to determine how they can affect wage inequality. As a second approach, I apply a variance decomposition analysis to directly test the hypothesis that the lower union wage inequality can be explained by differences in wage structures and not only by higher homogeneity across union workers.

Contrary to my original expectations, once workers and job characteristics and methodology are being controlled for, the results indicate that the average union wage gap in both countries is rather similar, with an estimate of around 10-12%. The separate analysis show that for the union wage gap in the private sector is fairly similar, albeit slightly higher in Bolivia (17%) compare to that in Chile (14%). For the public sector, in contrast, I find that union wage gaps is at least half as big as those of the private sector, and further that the wage gap in Bolivia (7%) is almost twice as large as the observed in Chile (4%).

The results from the quintile regression are consistent with most of the previous findings. In terms of the effects across the distribution, the results indicate that unions have a rather constant effect across the wage distribution, with an estimated union wage gap between 10% to 12%, and only around 4% for the particular case of public unions in Chile, thus providing little evidence on the increasing or decreasing inequality effects of unions. For the particular case of the public sector in Bolivia, however, we find that the union's wage gap decreases strongly across for the upper section of the distribution, with even negative wage gaps for around the 90^{th} quantile. The direct variance analysis indicates that unions are indeed able to reduce wage

inequality among their members in about 5 to 12% compared to nonunion workers, although such estimations are not statistically significant for all cases. The results, however, are insufficient to identify a single mechanism through which unions are able to reduce dispersion, being the alternatives reducing residual dispersion or generating flatter returns to characteristics.

The rest of the chapter is structure as follows. First, I present arguments on the mechanisms through which unions affect wages. Second, I present a brief description of the background, characteristics and legal framework of Bolivia and Chile. In the third section, I provide a review of the literature on the effect of unions on wages. In the fourth and fifth section, I present the methodological strategy and data used for this paper. The results are presented in the sixth section, and the seventh section concludes.

1. How do unions affect wages?

Unions are associations of employees whose main goal is to improve the well-being of their members. They can be conceive as agents that maximize an implicit objective function reflecting a tradeoff between wages (compensations) W and employment (or membership) E. To do so, unions participate in the labor market as the representative agent in a collective bargaining process with employers, where they can use their bargaining power to negotiate collective contracts in behalf of their members. This bargaining power develops as a function of the threat of a strike and other restrictions unions can apply on labor supply. As a result of this process, unions can cause wage and nonwage benefits to diverge from nonunion outcomes.[2]

Introduced by Freeman and Medoff (1984), there are two approaches commonly used to explain the mechanisms through which unions affect wages in the market. The traditional view among economists is to consider unions as maximizing monopoly agents, who are able to distort

[2] It is also possible that due to this process, nonunion outcomes are also affected because non-union workers can also benefit from the union contracts. These effects are typically more difficult to measure.

outcomes away from otherwise competitive nonunion outcomes. A contrasting point of view, with roots in the industrial relations literature, is to consider unions as agents capable of improving communication between workers and employers, which can improve management, productivity, and provide higher wages without a loss in efficiency.

Unions are typically granted by law monopoly bargain rights within covered establishments. These rights allow them to organize their members and be their only representative for negotiations with their employer. According to the monopoly model, a union uses those rights to obtain market power by controlling the supply of labor, in the extreme doing so through the form of a strike or strike threat. They can use this market power to maximize their utility function, raising wages and benefits above competitive levels as a trade off for lower employment, since they lead firms to employ less or substitute labor, in particular if bargaining outcomes are on a labor demand curve. Because the new set of equilibrium created by the presence of unions reduces employment due to the higher wage, production cost per unit of a good will increase, and, in absence of a productivity increases, profit would decrease even after considering the labor-capital substitution.

This monopoly face of unions has additional effects in the labor market. Although workers will queue for high wage union jobs, employment at those levels will be lower, thus increasing the supply of labor in nonunion jobs (the so-called “spillover” effect). This reduces wages of non-unionized workers, increasing the union wage gap (relative to the wage gain). Working in the opposite direction are “threat” effects. In industries or markets where there is substantial threat of unionization, nonunion firms will pay higher wages to deter union organizing. If these threat effects dominate spillover effects, then unions increase nonunion as well as union wages and lead to lower union wage gaps (relative to wage gains).

Although it is convenient to model a union as a monopolistic agent that can select its place along the labor demand based on its preferences (tradeoff between wages and membership/employment), real world outcomes are determined through collective bargaining and reflect the interaction between unions and employers. This means that outcomes depend on the relative bargaining power of the parties, and that contracts will not necessarily be on the labor demand curve, nor one would observe tradeoffs.

An additional issue is that any outcome with lower profits for union firms, at least for profits below opportunity costs, is that they are not sustainable over the long run. In a competitive market, unions cannot indefinitely maintain wages above competitive levels and survive absent offsetting positive effects on productivity (Hirsch, 2008). Unions, however, can survive if they operate throughout an industry or in industries with heterogeneity in their cost structure. Nevertheless, this implies that union wage gains cannot be too large, since they would be unsustainable.

The traditional monopoly approach to analyzing unions can be complemented by the alternative collective voice/institutional response (CV/IR) approach. In contrast to unions' monopoly face, their CV/IR face emphasizes the potential for unions and collective bargaining to mitigate market imperfections and frictions at the establishment level. First, markets are not composed by perfectly rational agents, instead agents are better represented by models of bounded rationality.[3] This implies that working contracts do not consider all the possible working conditions (incomplete contracts), but that are rather specified on constrained information that could allow for potential costs rising from opportunistic behavior from employers or employees. As an alternative, the "voice" provided by unions can improve

[3] Initially developed by Simons (1997), it implies that agents do take rational decisions but not based on all the information available, mainly due to the incapacity of agents to process all that information.

communication between agents, which can help to avoid some transactions costs and improve working contracts that are beneficial for both employers and employees.

Second, some working conditions can be considered as public goods that cannot be directly provided in the absence of labor organizations and/or unions, because workers themselves are not willing to risk their jobs, making requests for better conditions. In Freeman and Medoff interpretation, unions can improve the worker-employer relationship because they provide voice to workers that allow the median worker to communicate and reveal their preferences to the employers. With better communication and information, costs derived from alternative responses to problems in the job, such as turnover or exit, will decline, and better contracts and conditions can be achieved. Let's turn now to the effects on wage dispersions.

Unions affect wage dispersion (inequality) in, at least, three distinct ways (Freeman, 1980; Lewis, 1963). First, even if unions increase wages by the same proportion (say 15%) for all workers covered, this can either increase or decrease dispersion (i.e., inequality) depending on where union workers are in the distribution. If union workers tend to have lower than average wages, their wages are pushed toward the mean (or median) and wage dispersion decreases. If affected workers are primarily in the top half of the distribution, then dispersion would increase as union wages move further from average.

The second channel through which unions affect wage dispersion is related to the contractual nature of union wages. Due to union's ability to bargain collective contracts, these contracts can standardize wages among workers by reducing management discretion with respect to ad hoc compensations. These contracts can also reduce dispersions by reducing returns (flatter β's) of observed characteristics, such as education, experience or tenure, implying that workers with lower levels skill will obtain the largest union wage gap, while those with highest levels of skill will show lowest ones, thus compressing wages from top to bottom.

The third channel through which unions might reduce wage dispersion is by a composition effect. This channel does not properly reduce wage dispersion, but explain why unions might show lower wage inequality because of the more homogeneous nature of their members. The result of a more homogenous worker pool can be explained by the selection process based on observed and unobserved characteristics. The selection based on observed characteristics happens because unions form in specific type of occupations and industries that requires certain kind of formation and characteristics from the workers, generating a pool of highly homogenous workers. The selection on unobserved characteristics indicates that because workers with the highest skill level are less likely to seek a union job, due to low union premium, and also that unions and employers will try to avoid workers at the lower end of the skill distribution, the pool of union workers would be concentrated around those with medium skill levels, with their wages reflecting that concentration.(Card, 1996; Hirsch & Schumacher, 1998)

2. Unions in Bolivia and Chile: Background

Bolivia and Chile are neighboring countries located in the South American continent. Being both countries once Spanish colonies, they share much common history and background, yet both have followed different paths of economic development (Quiroga, 2010). These countries inherited from their colonial past an extractive and agricultural economy, which marked the early development of their economies and their labor organizations. They both suffered periods of dictatorship and debt crisis that affected their economic development from the 1970s through the early 1990s, during which unions played a crucial role representing, organizing and defending the working class against the dictatorship.

After the debt crisis in 1980s, both countries tried to promote the development of their economies following policies of industrialization, import substitution and open market economies. Only Chile was relatively successful in supporting a stronger industrial sector and

creating better institutions that facilitated transition to a largely free market economy. Bolivia, in contrast, was less successful in establishing an environment supporting the transition to a free market economy and in creating an industrialized economy.

In terms of economy size alone, according to the information from the World Development Bank, Chile has one of the largest economies in the region, with a GDP in 2009 of $us6,077, which is almost six times the GDP per capita in Bolivia ($us1,203) who is ranked among the poorest. With respect to poverty, while only 15% of the population in Chile is below the poverty line, more than 60% of the population in Bolivia is under that condition. In terms of inequality, although both still show relatively high levels of inequality, it is still a mayor problem in Bolivia, with a Gini index of 57, whereas in Chile the corresponding statistics is slightly lower at 52. The biggest difference in terms of economic structure is size of their informal sectors. According to Gasparini and Tornaroli (2009), where an informal worker is define as such if (s)he is an unskilled, self-employed, salaried worker in a small private firm or a zero-income worker, estimates that about 65.5% of the workforce in Bolivia is informal, whereas only 37.5% of the workforce in Chile can be consider informal. To comprehend the role that unions have had in the political and economic process in these countries, it is necessary to first understand part the history of this institution in their respective country.

2.1. Unions History

Bolivia

According to Hudson and Hanratty (1991) and Carriere, Haworth and Roddick (1989), unions in Bolivia can be considered one of the most powerful and politically active in Latin America. Most of its power came from the organized labor in the mining sector, given its importance to the economy. This power become represented in the figure of the Central Obrera Boliviana (COB), which was originally founded in 1952 by the in Movimiento Nacionalista

Revolutionario (MNR) as a subordinate group which group different unions including the organized mining sector.

Due to the growing power of the COB as a unions representative and coordinator, reinforced by the recognition of unions in different productive and non-productive sectors, it became an autonomous institution that challenged the Bolivian stated in every step (Hudson & Hanratty, 1991; Mansilla, 1993). During the years of dictatorship, 1971-1981, the COB and other union leaders were persecuted and their institutions sent into clandestinity. This, however, did little to stop their fight to reestablish essential rights, defending the welfare not only their members, but of all the working class.

The power withheld by the labor unions, represented by the COB, reached its maximum during the 1982-1985. This period was marked as one with the greatest number of strikes, stoppages and diminished productivity, consequence of the inability of the government to face the unreal petitions of higher wages and more control on the public and private firms for the organized labor. At the same time, this period also marked one of the worst crises in Bolivian history. Although this period showed the power unions had to influence governments, it also marked their downfall, slowly losing the support of the public while the economy kept getting worse. In 1985, the new government, led by Victor Paz Estenssoro, was able to impose the New Economic Policy (NPE), that helped to end the period of economic crisis. Among other points, this new model promoted the restructuration and decentralization of the nationalized mining sector. The weaken COB tried to stop this process, but lacking of public support they were unable to prevent the massive layoff in this sector, marking their worst defeat and the loss of one of their strongest members. Subsequent attempts from the government to restructure and decentralize the health care and education sector were successfully stopped, thanks to the COB

and the organize labor in these sectors. Despite their diminished power, the organized labor still remains a formidable force in the creation of economic policies in the country.

Chile

The Chilean labor movement is one of the oldest in Latin America, being perhaps the first to organize nationwide and to obtain legal concessions from the state (Carrière, et al., 1989). According to Ulloa (2003), the unionism process observed in Chile started in the early 1900s around the mining sector, perhaps the most important sector in the economy. These institutions organized protest in pro of better wages, labor conditions and social security. During the transition period of 1920s, a process of selective repression against unions started, with the formation of parallel union organizations that support the government and the repression of all other union leaders. With this, the development of the labor unions and workers remain delayed in front of their new role to influence the countries policies. By the end of this period, the Confederacion de Trabajadores Chilenos (CTCH) is created. They would become the most important representative for the unions and the organized labor, and also a key ally for the left parties that governed the period until 1946. The ideological conflict within created two Confederations: one aligned to the government interests, and one illegal and closer to the workers claims. Six years later, a new entity would be created in order ease the communication between the government and the labor organizations, the Central Unica de Trabajadores (CUT).

This new entity would become the most important representation of the labor movement in Chile. Although they would constantly dialog with the Government in pro of social protection, wages, dwelling, health services, work condition and right of organization, relations between the union movement and the Government were primarily political. In 1971, the CUT was legally recognized by the government of Salvador Allende, with whom he would sign an agreement of mutual cooperation. With this movement, more than ever, the CUT was in the position to

transform the claims from the social base into political pressure to transform the economic model.

The military coup of 1973 marked the destruction and restructuration of the labor unions. Showing the weaknesses of the previous unions government alliance, they eradicate the presence of unions, eliminating the rights of association and persecuting all their leaders, leaving little if no space for the formation of new labor organizations. The Plan Laboral dictated in 1979 became one of the most important steps in the transformation of the new face of labor organizations and unions in Chile. With this plan, they would re-estate the rights of association and re-introduced the bargain rights, forbidding association by industry of productive branch, but allowing the formation of unions by firms, establishments, among independent workers and transitory workers. At the same time, the military imposed a number of political and economic principles establishing the market as the mechanism of resources allocation, ordering the opening of the economy to foreign trade, restricting the public expenditure, and the generation of incentives to promote productivity and investment. This adaptation of the new economic model, market driven, seemed promising until the crisis in the 1980s. Thanks to the reaction of the anti-dictatorship organizations, together with the labor organizations, Chile was able to return to democracy in 1990. By this time, a new representation for the organized labor was created, the *Central Unitaria de Trabajadores*, who constitutes the main representative and organization of the unions until today. Nevertheless, after the 1990s, it seems that the affiliation to unions has decreased, in favor to a higher number, but smaller, unions. This indicates a new trend in the relationship between unions and firms and the state, although the *Central Unitaria de Trabajadores*, stills plays an important role organizing claims against the state.

2.2. Legal framework

As of today, Bolivia and Chile have both ratified the conventions 87 –Freedom of association and protection of right to Organize– and 98 –Right to organize and Collective Bargain. The first convention guarantees all workers the right to form unions from their own choice and for employers to form employers' organizations. The second convention provides the right to unions to negotiate work conditions in behalf of workers, protecting them against acts of anti-union discrimination. Whereas Bolivia ratified this conventions in the 1965 (c87) and 1973 (c98), Chile has just ratified them in 1999. Although both countries have ratified these standard conventions, there are differences in the extent these standards are guaranteed in Bolivia and Chile. According to the inform OECD (1996), although there are some restrictions to the formation of unions, it is relatively easy to establish independent union organizations in Chile. They do not have noticeable restrictions on strikes and have an adequate protection system for anti-union discrimination and collective bargain. For Bolivia, the restrictions of association and union formation are more significant and usually suffer from political interference. General strikes and solidary strikes are considered illegal, and even though anti-union discrimination is prohibited, protection is inadequate and slow. Following, some legal aspects on the nature of the collective contracts and formation of unions in these countries are described

According to the Labor Law in Bolivia collective contracts constitutes an agreement between the employer/employers and a union, or unions, in order to determine general work conditions. These contracts are binding for any future workers who become members of the union. To be recognized, however, these contracts must be negotiated by unions that are recognized and approved by the *Ministerio de Trabajo* (Department of Labor). In Chile, collective bargaining and contracts are also recognized. Such contracts, however, can be negotiated with union/unions and also by a group of workers who decide to do so. Collective bargain, however, is prohibited in public institutions where more than 50% of the budget is

financed by the state. Excluded from these rule are all educational institutes and public enterprises (case by case decision). These contracts can negotiate on any working conditions, as long as it does not limit employers' abilities to organize, direct and manage the establishment or firm.

Respect to the recognition of unions, the Bolivian law recognizes the rights of association to unions in different levels: workers or employers in the same firm, or in the same profession or occupation, or within different firms or occupations that are similar or interconnected. If a member remains unemployed for more than 6 months, he/she losses its affiliation to its union. Public officials are not allowed to organize into unions, regardless of their condition. Respect to the requirements, a union can be formed with at least 20 workers in case of professional or occupation unions, or at least 50% of the labor force in case of unions in a firm. As mentioned before, for a union to be officially recognized, they need to submit a request and be approved by the Department of Labor, who has the last word to accredit the legal existence of the union. Unions are also allowed to form federations or confederations in benefit of common interest, but must also be approved by the Department of Labor to be legally recognized.

In Chile, the Law recognizes that all workers in the private sector and public firms have the right of free association in unions. To be recognized, these unions do not need any previous authorization, as long as they follow the statements dictated by law. Unions are also free to affiliate or disaffiliate to federations or confederations either national or international. The law also defines and recognizes four types of unions: Firm unions, inter-firm unions, unions for independent workers, and unions for casual and eventual workers. For a firm union to be constituted, if the firm has 50 or more workers, it is required a minimum of 25 workers or 10% of their workers to form a union. However, the process for a union formation can start with a minimum of 8 workers with a calendar year to achieve the minimum required. In smaller firms,

only 8 workers are needed to form a union. For all other types of unions, one can be form with at least 25 workers willing to do so.

3. Literature Review: Empirical Evidence on Unions and Wages

Despite the growing information quality and improvements on the econometric techniques, there is a strong consensus in the US literature that the average union wage gap is on the order of 10-20% (Fuchs, Krueger, & Poterba, 1998; Jarrell & Stanley, 1990; Lewis, 1963, 1986). There is, however, discrepancy on the interpretation of these magnitudes, particularly on how selection bias and other omitted variables (unobserved heterogeneity) affect union premiums, and on how the quality of the information affects the estimations of the wage gaps.

The work of Lewis (1963, 1986) and the research that followed him presents reasonable evidence showing an average union wage gap of about 15%. The meta-analysis of Jarrell and Stanley (1990), using the studies covered by Lewis (1986), indicates that the gaps falls between 9-12 percent. Classic studies such as Freeman and Medoff (1984) and Hirsch and Addison (1986) report that the estimated wage gaps can also differ depending on the method of estimation. They report that when using cross-sectional estimates union wage gap estimates tend to be higher (15%-25%) than when longitudinal information is used (10%-16%). Although estimates using longitudinal information have the advantage that they control for worker fixed effects, they also have the strong disadvantage of severe attenuation of estimates due to reporting errors on the change in union status (Freeman(1984), among others). Recent studies such as Blanchflower and Bryson (2004) and Hirsch (2004) have found that, despite declining union density, the union wage gap has remained fairly steady, declining only modestly over time. Further, Hirsch (2004) also shows that because of the inclusion of imputed earners in most estimates of the union wage gap, past estimates have substantially understated the level of union wage gaps.

Turning to wage dispersion, evidence is also clear that unionization is associated with lower inequality (Freeman, 1980, 1982). Unions, however, would not only reduce wage dispersion, but also create a two-sided selection that compresses labor quality, with positive selection in the lower tail of the ability distribution (firms need not and do not hire lower quality workers) and negative selection in the upper tail (highly able workers are less likely to sort into union jobs). In short, union coverage and wage inequality are simultaneously determined (Card, 1996; Hirsch, 1982; Hirsch & Schumacher, 1998). Recent literature on rising earnings inequality has focused on the decline in unionization as one of several explanations. Card (2001) and Card et al. (2003) present evidence for United States, United Kingdom and Canada, find that unions reduce wage inequality, and further that the decline in unionization rations in the 1980s and 1990s constituted one of the main reasons for the increasing inequality in United States.

The evidence on union wage gaps outside the US is limited, and most of the available research is focused for developed countries such as Canada, United Kingdom, and Japan, among others, which arguably have similar economic conditions to those in the US. In general, these studies find conclusions similar in direction and magnitude to those observed for the US (Card et al. (2003). Kuhn (1998) Hirsch and Addison (1986).

In developing countries, the literature is also limited, and although some results seem to reasonably fall within the standards of the US literature, some other results provide rather different conclusions. Shultz and Mwabu (1998), analyzing survey data for South Africa in 1993, uses a quantile regression approach to estimate the heterogeneity on the wage gaps and reports that union workers could earn between 145% to 19% more than comparable nonunion workers. Fairris (2005) and Fairris (2003) reports that for Mexico unions are strongly associated to reductions in wage dispersion, and provides estimates on the union wage gap ranging from 21%-

15%. In both cases, they also mention that both wage gap and dispersion reduction effect of unions has decline together with the fall in union density in Mexico.

Arbache (1999) and Arbache and Carneiro (1999) study the impact on wages and wage dispersion in Brazil. Using information from for the early 1990s, they find that union workers earn a wage premium in the range of 6.7%-11.3%. However, in terms of dispersion, they find that unions in Brazil, specifically in manufacturing, are positively correlated with higher wage dispersion. On Cassoni et al (Cassoni, Labadie, & Fachola, 2005), evidence for manufacturing sector in Uruguay is presented. Using establishment level survey information and applying a simultaneous equation model characterizing wage and employment determination, and report that total unionization could increase wages in 4.8%.

From what can be seen in the literature for developing countries, some of the findings differ from those found in the US literature. In some cases, significantly higher and lower union wage gaps are reported, compared to the standard 10-15% gap reported for the US. In others, the conventional wisdom that unions reduce wage dispersion among their members seems not to hold true. Unfortunately, this information is not enough to determine if such results are a consequence of the institutional and economic differences of these countries respect to the US, or a consequence of the methodology and information used in each particular case.

This paper will contribute to the literature in two aspects. First, it will provide new evidence on two aspects of the effects of unions on wages, namely union wage gap and wage distribution effects, for two developing countries, Bolivia and Chile. To the best of my knowledge, there is no formal analysis that has been done for this topic in any of these countries. Second, it will provide evidence on the role of institutional and economic differences on the effect of unions on wage differentials and dispersion. This will be done by using the same

methodology and similar information for both countries, in order to reduce the effect that methodological differences could have on the estimation of union effects.

4. Empirical strategy

4.1. Union wage gap

In an ideal world, the appropriate way to estimate the impact of unions on union and non-union wages (i.e., in the terminology of Lewis, wage "gains") would be if we could observe wages in absence of unions in the economy, and compare them with those in the presence of unions. Because such wages cannot be observed, most of the literature has tended to focus to on union wage gaps, rather than wage gains, since it acknowledges that both union and non-union wages can be affected by unions. As such, the union wage gap can be defined as:

$$D_i = \frac{W_{iu} - W_{in}}{W_{in}}, \text{ or in means } \overline{D} = \frac{\overline{W_u} - \overline{W_n}}{\overline{W_n}}$$

Where the subscripts *u* and *n* indicate the union and non-union status, and $\overline{D}$ representing the average proportional union wage differential. This measurement is typically estimated using a log wage differential $\bar{d} = \overline{\ln W_u} - \overline{\ln W_n}$, where $\bar{d}$ represents the union wage gap, typically estimated conditional on the observed worker's, job's, and location characteristics (one can similarly measure a "raw" or unconditional wage gap).

4.1.1. OLS

A direct and simple approach to estimate union wage gaps is to use a Mincerian (semi-logarithmic) wage equation to control for different worker, job, and location characteristics that reflect human capital and other relevant wage determinants.[4] Here, in addition to the demographic and labor market characteristics, it includes the union status as the characteristic of interest:

[4] This model can be derived from a simple semi-log human capital model following Mincer (1974) , which has shown to be superior to other specifications based on a Box-Cox test (Heckman & Polachek, 1974).

$$\ln W_i = X_i\beta + dU_i + \varepsilon_i \qquad (1)$$

Where U=1 if the worker is identified as a union member and 0 if is not (a separate literature attempts to distinguish the effects of union membership from union coverage).

For this specification to provide consistent and unbiased estimations of the union wage gap "d", two assumptions are needed: no endogeneity and homogeneity between the union and non-union wage structures. The first assumption requires that there are no endogeneity problems with respect to workers' union status on this specification, such that the union status and those unmeasured characteristics are uncorrelated. In the case of positive correlation, estimations on the union wage gap are likely to bias upward, and vice-versa.

The literature suggests that this might not be the case, and that union status not an exogenous decision (Lewis, 1986). Furthermore, as Card (1996) and Hirsch and Schumacher (1998) indicate, the process of selection into union jobs is better characterized by a two sided selection, where workers select themselves to seek for union jobs, but are firms who finally choose to hire workers among those candidates. In practice, as Card (1996) reports, workers with low skill have positive selection, while workers with higher skill are negative selected. This characteristic of the double section suggests that estimation of *"d"* using specification of equation (1) might still be a good candidate for the estimation of the average union wage gap.

A second assumption to estimate the union wage gap using equation (1) requires that both union and non-union jobs have the same returns to the endowments and characteristics of the workers (wage structures). In consequence, it implies that for the union wage gain to be correctly identified, such premium should be reflected by a parallel shift of all wage profiles. This assumption, however, might not be correct. As the literature on union wage differentials states, one reason why unions are able to compress wages (more on this on section 3.2.2) is because they have different wage structures which are expected to show flatter returns (flatter β's) to the

worker characteristics. Although failing this assumption wouldn't be a problem if union and non-union workers would have similar observed characteristics, when such characteristics differ, using this methodology could overestimate or underestimate the true union wage gap.

4.1.2. Oaxaca-Blinder Decomposition

An alternative methodology, which complies with the assumption of differentiated wage structures, is to estimate the wage gap based on separate wage equation for union and non-union jobs, allowing all coefficients to differ between sectors (Bloch & Kuskin, 1978). Assuming both sectors can be model using the standard Mincerean wage equations, it requires the estimation of a two equation model such that:

$$\ln W_{i,u} = X_{i,u}\beta_u + \varepsilon_{i,u} \qquad if\ U = 1 \qquad (2)$$

$$\ln W_{i,n} = X_{i,n}\beta_n + \varepsilon_{i,n} \qquad if\ U = 0 \qquad (3)$$

Where the subscript *u* indicates that the information corresponds to union workers and *n* if the information corresponds to non-union ones.

Once equations (2) and (3) are estimated, following a standard Oaxaca-Blinder methodology (Blinder, 1973; R. Oaxaca, 1973), we can decompose the raw union wage gap into a portion explained by differences in workers characteristics (endowments) and a portion explained by differences in the coefficients (returns to characteristics), which corresponds to the union wage gap. This estimation can be obtained as follows:

$$\overline{\ln W_u} - \overline{\ln W_n} = \overline{X_u}\beta_u - \overline{X_n}\beta_n \pm \overline{X_n}\beta_u$$

$$\underbrace{\overline{\ln W_u} - \overline{\ln W_n}}_{Raw\ Differential} = \underbrace{(\overline{X_u} - \overline{X_n})\beta_u}_{Due\ endowments} + \underbrace{\overline{X_n}(\beta_u - \beta_n)}_{Union\ wage\ gap} \qquad (4)$$

One must notice that that the decomposition proposed in equation (4) is not unique, and that the union wage gap could be as well estimated using a different reference group or a weighted average of those possibilities. As discussed in the literature, how these weights are

defined is rather arbitrary. For the implementation in this paper, however, the share of union workers ($\overline{U}$) will be used as weights for the decomposition: [5]

$$\underbrace{\overline{\ln W_u} - \overline{\ln W_n}}_{Raw\ Differential} = \underbrace{(\overline{X_u} - \overline{X_n})[(1-\overline{U})\beta_u + \overline{U}\beta_{nu}]}_{Due\ endowments} + \underbrace{[\overline{U}\,\overline{X_u} + (1-\overline{U})\overline{X_n}](\beta_u - \beta_n)}_{Union\ wage\ gap} \quad (5)$$

An additional advantage of this methodology over the OLS approach is that one can obtain a detailed decomposition of wage gap. This decomposition can be used to analyze the contribution of different worker characteristics on the union wage gap. Such detailed decomposition, however, has some disadvantages. According to Oaxaca and Ransom (1999), among others[6], there exist an identification problem when trying to estimate the detailed contributions of sets of dummy variables to the unexplained component (here union wage gap) of the wage differentials, since those contributions are not invariant to the choice of excluded dummy category. They also explain that a similar problem is present in case of continuous variables, although at a lesser extent.[7]

A solution for this potential problem was suggested by Yun(2005). This solution involves the normalization of the coefficients for all sets of dummy variables such that the sum of the coefficients of all dummy variables equal to zero. In practice, this means that the base category is the average, and the dummies are deviations from that average. For the purpose of this paper, this methodology will be implemented when detailed analysis is presented.

4.2. Impact of unions on wage dispersion

The methodologies presented in the previous section are useful to analyze the average impact of unions on wage differentials in the labor market. Although they can also provide some

[5] One must notice that using the share of union workers for the weighted average of union and non-union worker characteristics the expression $\overline{UX_u} + (1-\overline{U})\overline{X_n}$ is equivalent to using the average characteristics of the whole data. For further discussion on the topic see Reimers (1983) and Cotton (1988).

[6] Insert reference for other papers discussing this problem

[7] The problem presented by Oaxaca and Ransom (1999) implies that when one applies affine transformations of continuous variables, it will usually cause variations on the effect of the contribution that this variable has on the unexplained component of the wage decomposition.

intuition on the expected effect on wage distribution and dispersion, more precise methodology is needed to assess the impact of unions on aspects is needed. In this section, two methodologies that analyze the impact of unions on wage dispersion are discussed: a quantile regression and a variance analysis framework.

4.2.1. Quantile regression approach

Quantile regression analysis provides an alternative methodology to examine wage variation across union status, and test whether or not the effect on wages is heterogeneous. Applying this methodology has two advantages. First, it provides a less restrictive description of how the different covariates, unions in specific, affect the entire distribution of wages. Second, is that it is less sensitive to outliers in the distribution, providing more consistent estimators than the standard OLS approach (Cameron & Trivedi, 2005), thus can be used as a robustness for the union wage gaps estimated using the previous methodologies.

Following the same standard Mincerian approach presented in equation (1), one is interested in finding the parameters of model:

$$\ln W_i = X_i\beta_\theta + d_\theta U_i + \varepsilon_{\theta,i}, \quad (6a)$$

such that:

$$Quant_\theta(\ln W\,|X,U) = X_i\beta_\theta + d_\theta U_i \;\; and \;\; Quant_\theta\left(\varepsilon_{\theta,i}|X,U\right) = 0 \quad (6b)$$

Where X_i represents the worker's demographics and job characteristics, *U* is a dummy variable indicating union status of the workers, and the sub index θ indicates the parameters and errors corresponding to the θth quantile.

As described in Koenker and Basset (1982), given the quantile of interest $\theta\epsilon(0,1)$, the parameters of the model described by (6a) and (6b) can be estimated by minimizing the following equation:

$$Min\ Q(\beta_\theta, d_\theta) = \sum_{I=0} \theta\ |lnW_i - X_i\beta_\theta - d_\theta U_i| + \sum_{I=1}(1-\theta)|lnW_i - X_i\beta_\theta - d_\theta U_i| \quad (7),$$

Where:

$$I = 0\ if\ lnW_i \geq X_i\beta_\theta + d_\theta U_i \text{ and } I = 1\ if\ lnW_i < X_i\beta_\theta + d_\theta U_i$$

Once these parameters are estimated for all the quantiles of the distributions, the parameters d_θ can be considered as the estimated union wage gap that is relevant within the θ quantile, after other variables (X) are being controlled for. A disadvantage of this methodology is that, similar to the analysis using OLS, inferences on the wage gap estimates are subject to the assumption that there union status is exogenous, and that, except for the intercept, both union and non-union jobs share the same wage structures (across the wage distribution).

It should also be considered that the effects found here cannot be directly interpreted as effects on the wage distribution. The reason for this is that parameters found as union wage gap are only valid within the defined quantile, but does not consider the between effect on the quintile. Nevertheless, these results can be used to test the hypothesis of heterogeneous union wage gaps, and provide some intuition on the direction of the effects on inequality.

4.2.2. Variance analysis approach

For the variance decomposition approach, the question to be asked is different from the one pursued using the quantile regression. Instead of analyzing if unions have heterogeneous effects across the wage's distribution, this methodology concentrates on directly analyzing the effects on wage's dispersion, using the variance of logarithm of wages as indicator of interest.

This methodology is similar to that used by Freeman(Freeman, 1980, 1982)and is described in Fortin, Lemieux, Firpo (2010).

Similar to Bloch and Kuskin (1978), the methodology starts by assuming that union and non-union jobs have two different wage structures that can be represented as a linear function of the worker and job characteristics:

$$\ln W_k = X_k\beta_k + \varepsilon_k \qquad for\ k = u, n$$

Where sub index *k* indicates if the wage structure corresponds to that of a union worker *u* or a non-union worker *nu*, $\ln W_k$ refers to the log wages, $X_k\beta_k$ is the observed characteristics and returns in the regime *k*, and ε_k is a well behaved error that is assumed to follow a normal distribution with mean zero and standard deviation σ_k, which for now can be assumed to be constant (homoscedasticity). For this model, we should also assume that the unionization decision is exogenous, and there is no selection issues, such that $cov\ (X_k, \varepsilon_k) = 0$ for all explanatory variables.

If the assumptions are correct, using the law of total variance, one can write the unconditional variance of $\ln W_k$ as:

$$Var(\ln W_k) = \beta'_k Var(X_k)\beta_k + \sigma_k^2 \qquad for\ k = u, n \quad (8)$$

Where the first component is the between group component, also called regression variance. It represents the wage variance that is explained by the variation on workers characteristics given returns to skills. The second component represents is the within-group component also known residual variance, which represents the variation that is not explained by observable characteristics. Using this expression, the differences in variance across both groups can be written as follows:

$$\Delta v = Var(\ln W_n) - Var(\ln W_u) \qquad (9)$$

Where Δv is the unconditional variance difference between wages in the union and non-union sector. According to the literature on unions and wage dispersion, one would expect $\Delta v > 0$, intuitively indicating that there is higher wage dispersion among non-unionized jobs. The question however is to understand whether the source of the higher wage dispersion is due to a higher heterogeneity on the characteristics of non-unionized workers, due to higher compression on the wage structure system in the unionized sector, or due to a higher level of unexplained dispersion. Replacing equation (8) in (9), the differences in variances can be written

$$\Delta v = \beta_n' Var(X_n)\beta_n - \beta_u' Var(X_u)\beta_u + \sigma_n^2 - \sigma_u^2 \quad (10)$$

Using a strategy similar to the one used in Oaxaca-Blinder decomposition, we can rewrite equation (10) using the following identity:

$$\Delta v = \beta_n' Var(X_n)\beta_n - \beta_u' Var(X_u)\beta_u + \sigma_n^2 - \sigma_u^2 \pm \beta_u' Var(X_n)\beta_u$$

Rearranging the terms on this identity, the variance difference can finally be decomposed in three different components:

$$\Delta v = [\beta_u' V(X_n)\beta_u - \beta_u' V(X_u)\beta_u] + [\beta_n' V(X_n)\beta_n - \beta_u' V(X_n)\beta_u] + [\sigma_n^2 - \sigma_u^2], or$$

$$\Delta v = \underbrace{\left[\beta_u'\left(V(X_n) - V(X_u)\right)\beta_u\right]}_{c1} + \underbrace{[(\beta_n' - \beta_u')V(X_n)(\beta_n - \beta_u)]}_{c2} + \underbrace{[\sigma_n^2 - \sigma_u^2]}_{c3} \; or (11)$$

Where the first component represents how much of the dispersion differences between wages can be explained by the differences on the dispersion of workers' characteristics (composition effect), the second component represents how much dispersion is explained by the differences in the returns to characteristics (differences in β's). Finally, the third component represents the dispersion due to unmeasured characteristics, or differences on the residual variance. This decomposition corresponds to the one described in Fortin et al. (2010), under the

assumption of homoscedasticity.[8] Using their approach, the second and third components are considered part of the wage structure effect.

Similar to the issues described for the Oaxaca methodology, the decomposition shown in (11) is not unique. One can as well chose a different reference group and find an alternative decomposition. To reduce ambiguity, a similar procedure as the one described in (5) is applied here. Let's considered the following alternative decomposition:

$$\Delta v = \underbrace{\left[\beta_n'\left(V(X_{nu}) - V(X_u)\right)\beta_n\right]}_{c5} + \underbrace{\left[(\beta_{nu}' - \beta_u')V(X_u)(\beta_{nu} - \beta_u)\right]}_{c6} + \underbrace{\left[\sigma_{nu}^2 - \sigma_u^2\right]}_{c7} \quad (12)$$

Using equations (11) and (12), and the sample share of union workers ($\overline{U}$), one can combine the statistics to obtain the weighted averages of the proposed statistics:

$$X_{var} = [(1-\overline{U})\beta_u + \overline{U}\beta_{nu}]'\left(V(X_n) - V(X_u)\right)[(1-\overline{U})\beta_u + \overline{U}\beta_{nu}]$$

$$\beta_{var} = \left(\beta_{nu}^{'} - \beta_u^{'}\right)[V(X_n) - V(X_u)]\left(\beta_{nu} - \beta_u\right) + (\sigma_{nu}^2 - \sigma_u^2) \qquad (13)$$

Where β_{var} is the share of the log wage variance explained by differences in returns and residual variance (wage structure effect) and X_{var} is the share explained by differences in the variation of endowments and work characteristics (composition effect).

There exist some caveats using this methodology. The first one is related to the homoscedasticity assumption of the errors. As described by Firpo et al.(2010), in the framework of their decomposition, in presence of heteroscedasticity one might spuriously assign all of the unexplained variation as part of the wage structure effect. To reduce the impact of this problem on the interpretation of the decomposition, my analysis will separate both components of the wage structure effect to identify the contribution of each component to the wage structure effect.

Although relaxing the assumption of homoscedasticity is an alternative, it implies finding a correct functional form to model the variance of the errors. Unfortunately, there is no standard

[8] For a more generalized expression of the variance decomposition relaxing the assumption of homoscedasticity refer to Firpo et al.(2010) p 12.

functional form to model heteroscedasticity, and misspecification of the functional form might create other inconsistencies on the interpretation of the decomposition. An additional caveat of this methodology is the difficulty of estimating a detailed decomposition of the variance, even under homoscedasticity, since the variance becomes a quadratic form of the parameters involved. Due to this problem, I will present only the aggregate effects as proposed in equation (13).

5. Data

For the purpose of this paper, two information sources are used. For Bolivia, household surveys for the years 2000 through 2007 are used.[9] These surveys are annually collected by the National Institute of Statistics and are publicly available at their homepage. They collect detailed individual information for all members in selected households. These surveys collected are representative at the national level, but each cross-sectional survey is not statistically independent from year to year. For Chile, the information used corresponds to the Social Protection Surveys for the years 2002, 2004, 2006 and 2009.[10] These surveys only collect basic information for all members of the selected households, detailed job characteristics and job's history information is only available for one person in each household. Although the survey for 2002 was originally structured to represent workers who were once affiliated to the pension system (representation), starting with the 2004 survey, they included a sample representing the labor force outside of the pension system. Nevertheless, this information is still representative at the national level.

[9] These surveys were collected through the *Program for the Improvement of Surveys and the Measurement of Living Conditions in Latin America and the Caribbean (MECOVI* in Spanish) with the cooperation of the World Bank until 2004, after wards it is independently carried out by the national statistical office (INE). This initiative promotes the collection of adequate and high quality information about the living conditions of people in the region.

[10] These surveys were collected to obtain information of the labor market and the social protection system in Chile using longitudinal information. They were collected by the Universidad de Chile, and kindly provided by the Subsecretaría de Previsión Social in Chile.

For each country, the household and worker/job survey information are pooled to provide more information for the analysis. This, however, may have some minor consequences on the estimations. Because the surveys from Bolivia are not independent from year to year, and the ones from Chile have a panel component, pooling information together and using the year by year weights might cause the standard errors to be artificially smaller, increasing the statistical significance of the estimations. Nevertheless, one might expect that the point estimates are still unbiased, representing the pooled averaged population.

The sample is restricted to provide an appropriate analysis of the labor force in the following way. First, the analysis includes employed adults between 18 and 65 years old. Second, the sample is restricted to workers whose occupation can be classified as salaried workers, the segment of the labor force who can potentially work under a union bargaining system. All other classifications such as self-employed, family workers and employers are excluded from the analysis. Workers in the agricultural sector are also excluded because work in this sector is concentrated in rural areas and typically present very different employment arrangements (e.g., season employment, piece rates and other non-wage forms of compensation, and types of works very different from those in the wage and salary sectors). Extraterritorial organizations and bodies workers as well as workers from the army force are also excluded from the analysis, due to small number of observations and identification.

For the identification of the presence of unions in the labor market, workers are identified as union members if they answer positively to the following questions, respectively, for Bolivia and Chile.

Bolivia: Are you affiliated with any union, guild or labor organization?/ ¿Está usted afiliado a algún gremio, sindicato o asociación laboral?

Chile: Are you affiliated with any union?/¿Se encuentra usted afiliado a algún sindicato?

This self identification does not necessary imply that workers who declare to be part of a union are covered by collective contracts. However, based on the characteristics of the legal framework in Bolivia and Chile, the underlying assumption is that all workers who declare to be members of a union are also covered by some kind of collective contract.

Using this self-identification as the main variable of interest, summary statistics by union status is presented in Table 1. For the selected sample of workers, the unionization rate (i.e., union density) is 23.6% in Bolivia, somewhat higher than the 17.0% density found in Chile. In terms of trends (Figure 1), one can see that there is no defined trend of the union density in Bolivia (Survey information only) in the last decade. In the case of Chile, the official report on union density shows that it has remained rather stable with a slight increase in 2009.[11]

In terms of demographic characteristics, both countries display similar patterns between union and nonunion workers. For instance, union workers are older, with more years of education and more potential experience. These differences, however, are more pronounced in Bolivia than in Chile, showing a larger heterogeneity among the workforce in Bolivia. In terms of age, Bolivian union workers are almost 6 years older than nonunionized workers, versus a 4 year-difference in Chile. There is also a more than 2 year union-nonunion education difference in Bolivia compared to only a half year in Chile. With respect to potential experience, the union-nonunion differential is similar between both countries. Such differences between union-nonunion workers' endowments are relatively unexpected, since most of the literature usually shows that union workers are the typical average worker, whereas here union workers seem to be better prepared than the average worker.

Table 1 Descriptive Statistics

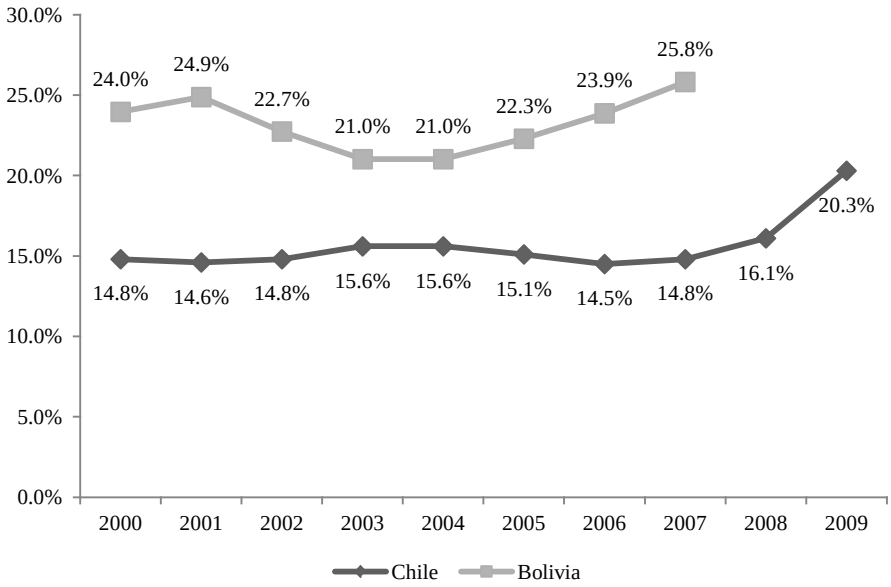
	Bolivia	Chile

[11] Survey estimations on Union density are very close to the official reports in Chile.

Variable		Union	Non-union	Union density		Union	Non-union	Union density
Union=1	23.6%				17.0%			
	(0.42)				(0.38)			
ln(wage/hr)	1.65	2.05	1.53		7.24	7.45	7.20	
	(0.88)	(0.82)	(0.86)		(0.64)	(0.61)	(0.64)	
Wage/hr	8.03	10.89	7.14		1765.25	2094.35	1697.79	
	(10.40)	(11.09)	(10.01)		(1486.58)	(1503.10)	(1474.16)	
Male	68.1%	64.6%	69.2%	22.4%	61.5%	63.3%	61.1%	17.5%
	(0.47)	(0.48)	(0.46)		(0.49)	(0.48)	(0.49)	
Female	31.9%	35.4%	30.8%	26.2%	38.5%	36.7%	38.9%	16.2%
	(0.47)	(0.48)	(0.46)		(0.49)	(0.48)	(0.49)	
Indigenous	21.3%	24.6%	20.4%	27.2%				
	(0.41)	(0.43)	(0.40)					
Non-Indigenous	78.7%	75.4%	79.6%	22.6%				
	(0.41)	(0.43)	(0.40)					
Yrs schooling	11.40	13.13	10.86		11.89	12.33	11.80	
	(4.58)	(4.34)	(4.52)		(3.15)	(2.84)	(3.20)	
Age	34.37	38.81	33.00		36.30	39.60	35.62	
	(10.97)	(10.34)	(10.79)		(11.29)	(11.40)	(11.14)	
Exp (Age-yrs-6)	16.98	19.67	16.14		18.41	21.27	17.82	
	(12.06)	(11.08)	(12.23)		(12.41)	(12.19)	(12.38)	
Married	65.4%	75.4%	62.3%	27.2%	55.1%	62.7%	53.6%	19.3%
	(0.48)	(0.43)	(0.48)		(0.50)	(0.48)	(0.50)	
Single and other	34.6%	24.6%	37.7%	16.8%	44.9%	37.3%	46.4%	14.1%
	(0.48)	(0.43)	(0.48)		(0.50)	(0.48)	(0.50)	
Head of household	56.6%	65.3%	53.9%	27.2%	54.9%	62.8%	53.2%	19.5%
	(0.50)	(0.48)	(0.50)		(0.50)	(0.48)	(0.50)	
Other HH members	43.4%	34.7%	46.1%	18.9%	45.1%	37.2%	46.8%	14.0%
	(0.50)	(0.48)	(0.50)		(0.50)	(0.48)	(0.50)	
Public Sector	27.9%	60.3%	17.9%	51.0%	14.4%	31.2%	11.0%	36.8%
	(0.45)	(0.49)	(0.38)		(0.35)	(0.46)	(0.31)	
Private sector	72.1%	39.7%	82.1%	13.0%	85.6%	68.8%	89.0%	13.7%
	(0.45)	(0.45)	(0.45)		(0.35)	(0.46)	(0.31)	
Nr Obs	15,533	4,275	11,258		21,183	3,958	17,225	

Note: Standard deviations are shown in parenthesis. Statistics shown in this table were calculated using the corresponding sample weights. Detailed information on unionization rates and market structure with respect to industry and occupation can be found in the appendix 1.

Figure 1 Trends on union density



Source: Bolivia: Own estimations from House Hold Survey's information; Chile: Direccion Nacional del Trabajo

These Union-nonunion differences in endowments are reflected in the raw (unadjusted) union wage gaps.[12] In Bolivia, the unadjusted arithmetic wage gap is 52% (w_u/w_n-1) while the log wage gap is 0.52 log points, almost twice as large as the wage gap for Chile, with a 23% arithmetic gap and a 0.25 log point gap.[13] This initially suggest that unions in Bolivia are producing larger wage premiums compared to unions in Chile, although it needs to be further tested when other once controls for other worker and job characteristics. In terms of wage dispersion, the statistics shown in table 1 also provide preliminary evidence than unions are able to reduce wage inequality both in Bolivia and Chile, even though this is a reduction of only 0.03 points on the log variance.

Looking at other demographic characteristics, some additional difference can be seen. Union density is higher among women than men in Bolivia, while basically the same for men

[12] Wages are measured in local currency and are adjusted by inflation. The hourly wages presented here are measured as monthly labor earnings divided by average hours worked in a month. This measurement of wages corresponds to the self-report wages, and accounts for the gross (before taxes) earnings of the primary job. It does not include other incomes sources such as tips, commissions or overtimes.

[13] In general the exponentiated log gap will overstate the arithmetic percentage gap if the union wages are relatively less dispersed than are nonunion wages. An example of such effect is presented in Hirsch and Schumacher (2010).

and women in Chile. Similarly, indigenous workers have higher union density than do non-indigenous workers (Bolivia only). Finally, it can also be seen that, for both Bolivia and Chile, the share of union workers is hire among married workers and among workers who are considered head of their households.

Perhaps even more interesting is the fact that both Bolivia and Chile present similar union densities when observing only at the private sector (13% and 13.7% respectively), whereas the union density in the public sector is much higher in Bolivia (51.0%) respect to Chile (36.9%). This can be explained because of size of health and education sectors in Bolivia, historically two of the largest organized sectors in the country.

6. Results

Wage gap effect: OLS estimations

Table 2 presents the results of the OLS regressions, using different specifications of equation (1). All specifications include a set of region fixed effects[14] and year fixed effects to allow for some specific shocks across time and regions. In all specifications, estimated coefficients have the expected sign and magnitude. Column 1 provides an estimate of the raw union wage gaps, after controlling for year and region fixed effects. These wage gaps are similar to those previously shown in the summary statistics, being the raw log wage difference in Bolivia (0.55 log points) twice as large as that of found in Chile (0.24 log points). As stated previously, the large differences in these largely raw gaps are likely to reflect, at least in part, differences between union-nonunion endowments. After demographic characteristics are included (column 2), the union gap estimate for Bolivia fall sharply to 0.18 log points (a 65% reduction), whereas in Chile, the wage gap falls to 0.11 log points (a 55% reduction). If we consider that this

[14] In Bolivia, the 9 departments are used to create the region fixed effects, while in Chile it includes the 12 regions plus the metropolitan region.

demographic characteristics capture, to some extent, the level of skill and motivation of the workers, it is not surprising that once we control for this characteristics, a large share of wage differentials attributed to union workers is rather a retribution to observed skill characteristics. The only difference between the specifications in both countries is the inclusion of ethnicity (indigenous) in the Bolivian case. The reason is that the Chilean survey does not provide any information on ethnicity. In addition, according to the official statistics, less than 5% of their population can be considered indigenous. Although the exclusion of this variable (not shown here) does not seem to have any effect on the union wage gap estimation, it is kept in the specification because indigenous discrimination is an important aspect of the wage determination in Bolivia.

Since not all skill factors can be captured by demographic variables like education and potential experience, one approach to reduce potential bias is to include variables that identify job characteristics as proxy for worker skills and working conditions (Hirsch, 2004; Hirsch & Schumacher, 1998). Under this consideration, broad occupation dummies are included to the specification and presented in column 3 for a better characterization of unmeasured skill.[15] After these fixed effects are included, the union wage gap in Bolivia falls further (almost 0.10 log points smaller), whereas in Chile, the wage gap remains almost unchanged. This can be explained because Bolivia has much more wage heterogeneity across occupation compared to Chile, which can be also translated in terms of higher skill heterogeneity. In addition, this wage heterogeneity is also correlated to the union density on those specific occupations. It is the combination of both characteristics what explains the changes on the wage premium.

[15] For both Bolivia and Chile, “managers of administration” is used as the base category for occupation.

Table 2 OLS estimations for hourly wages, different specifications

Dependent var:	Bolivia					Chile				
ln(wage/hr)	(1)	(2)	(3)	(4)	(5)	(1)	(2)	(3)	(4)	(5)
Union(=1)	0.55	0.18	0.08	0.09	0.07	0.24	0.11	0.12	0.11	0.06
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Sex (1=male)		0.09	0.14	0.10	0.09		0.18	0.19	0.17	0.16
		(0.02)	(0.02)	(0.02)	(0.02)		(0.01)	(0.01)	(0.01)	(0.01)
Indigenous(=1)		-0.06	-0.08	-0.10	-0.08					
		(0.02)	(0.02)	(0.02)	(0.02)					
Yrs of education		0.11	0.07	0.06	0.06		0.13	0.07	0.07	0.07
		(0.002)	(0.003)	(0.003)	(0.00)		(0.002)	(0.003)	(0.003)	(0.003)
Potential		0.04	0.03	0.03	0.03		0.01	0.01	0.01	0.01
Experience		(0.002)	(0.002)	(0.002)	(0.00)		(0.002)	(0.002)	(0.002)	(0.002)
Exp^2/100		-0.04	-0.04	-0.04	-0.04		-0.0004	-0.01	-0.01	-0.01
		(0.005)	(0.004)	(0.004)	(0.00)		(0.003)	(0.003)	(0.003)	(0.003)
Married		0.08	0.07	0.06	0.05		0.08	0.07	0.07	0.06
		(0.02)	(0.02)	(0.02)	(0.02)		(0.01)	(0.01)	(0.01)	(0.01)
Head household		0.05	0.06	0.06	0.06		0.09	0.07	0.07	0.06
		(0.02)	(0.02)	(0.02)	(0.02)		(0.01)	(0.01)	(0.01)	(0.01)
Year	x	x	x	x	x	x	x	x	x	x
Region	x	x	x	x	x	x	x	x	x	x
Occupation			x	x	x			x	x	x
Industry				x	x				x	x
Firm size					x					x
N	15533	15533	15533	15533	15533	21183	21183	21183	21183	21183
r2	0.107	0.400	0.468	0.4849	0.4990	0.0441	0.358	0.4674	0.4803	0.4985

Note: All shown coefficients are significant at 1%. In parenthesis the robust standard errors are shown.

In the same line, on column 4, broad industry and a public sector dummies are included, for better characterizations of the job conditions and activities required in the specific sectors.[16] Although there is substantial difference across the union density across industries, particularly for Bolivia, contrary to what was expected, including industry fixed effects to the previous specification has little effect on the average union wage gap for Bolivia and Chile.[17] This seems to indicate that the union wage gap is uncorrelated to the union density in each sector. Using this specification as the preferred model, the estimation shows that, despite to the underlying differences between both countries, the average union wage differential is relatively similar in both countries of around 10% (0.09 log points in Bolivia and 0.11 log points in Chile).

[16] For Bolivia, 12 industry-dummies are included in the model, whereas for Chile, 7 industry-dummies are used. In both countries mining sector is used as base category. The difference on the number of sectors between countries is explained because Bolivia uses the classification established in ISIC rev3, whereas the information in Chile is industries are classified using ISIC rev2.

[17] See appendix 1 for reference on union density and market structure across industries.

An additional issue is to explore whether or not one should include firm size as a control in the specification.[18] According to and Oi and Idson (1999) and Brown and Medoff (Brown & Medoff, 1989) there is strong evidence suggesting that firm size is an important determinant of wages. As they state, larger firms are able to pay higher wages because they hire higher quality workers with better observed endowments, are more productive thus able to pay higher wages, and tend to pay higher wages to reduce risk of shirking. On the other hand, as discussed in Hirsch (2004), firm size is usually excluded from this kind of analysis because larger firms are also more likely to be unionized. Whether or not including this variable is good for the model specification is not clear. If employer-employees matching would be mainly driven by skill factors, including this variable in the specification would be appropriate, since it would be taking into account unobserved skill characteristics. If this is not the case, including firm size into the model would generate a downward bias on the estimates of the union gap.

Although there is no evidence, for Bolivia or Chile, supporting the assumption that employer-employees matching is driven by skill factors, firm size dummies are still included in the model to analyze the effects on union wage gaps. These estimations are shown in column 5. As it was expected, once firm size dummies are included, the estimation on the union wage gap decreases in both countries. Nevertheless, the estimates of the union wage gap alone (0.07 log points for Bolivia and 0.06 log points for Chile) are still highly significant and of considerable magnitude, which can be considered as a lower bound estimates for the union wage gap.

Including interactions of firm size and unionization to the model can provide information on the consistency of the firm wage policy and the specific union effect at each firm size. As expected, there is evidence for an increasing firm size premium, which is particularly stronger

[18] For both surveys, information on firm size is directly provided by the workers. Each worker is asked how many people works in the establishment they are currently working. Details on the classification and groups of firms respect to number of workers can be found in appendix 1.

and more significant for Chile than for Bolivia. These effects could be explained because Chilean entrepreneur tradition has more experience than Bolivian one, thus making Chilean firms more likely to offer competitive wages as it happens in more industrialized countries (Brown & Medoff, 1989), explaining why firm-size premium is stronger in Chile.

Table 3 OLS estimations, firm and firm-union interactions

	Bolivia		**Chile**	
	(1)	(2)	(1)	(2)
Union(=1)	0.067***	0.031	0.061***	0.172**
	(0.019)	(0.075)	(0.012)	(0.059)
Firm Size				
1 to 9 wrks	-0.179***	-0.191***	-0.079*	-0.066
	(0.039)	(0.044)	(0.035)	(0.039)
10 to 19 wrks	-0.060	-0.061	0.029	0.044
	(0.040)	(0.047)	(0.036)	(0.041)
20 to 49 wrks	0.020	0.028	0.083*	0.105*
	(0.040)	(0.047)	(0.036)	(0.041)
50 to 99 wrks	0.028	0.006	0.108**	0.126**
	(0.045)	(0.052)	(0.035)	(0.041)
100 wrkrs or more	0.151***	0.138**	0.169***	0.187***
	(0.040)	(0.048)	(0.034)	(0.040)
Firm Size * union interaction				
1 to 9 wrks		0.066		-0.014
		(0.080)		(0.075)
10 to 19 wrks		0.006		-0.099
		(0.081)		(0.075)
20 to 49 wrks		-0.018		-0.159*
		(0.082)		(0.070)
50 to 99 wrks		0.099		-0.124
		(0.095)		(0.067)
100 wrkrs or more		0.049		-0.119*
		(0.081)		(0.060)
Nr Obs	15533	15533	21183	21183
R2	0.4990	0.4993	0.4985	0.4989

Note: Only selected variables are displayed. The corresponding regressions follow same specification as in table 1 columns 5. Base category for Firm size is when workers ignore the number of workers in the firm.

In the case of the interaction terms, one should expect negative signs for all interactions, probably decreasing further for larger firms, since workers could be getting a premium from working in larger firms, and from being unionized workers, but not both. The results here are less evident. For Bolivia, all interactions have positive sign, with no visible down sloping trend and non significant, whereas for Chile there are signs of a decreasing trend on union wage effects. The fact that Chilean unions are more used to bargain contracts with decentralized units

whereas Bolivian unions tend to bargain to the centralized level, might explain why differentiated effect of unions across firm size in Chile are observed, while the union-firm size interactions seem to have no significant effect in Bolivia.

In view of the results under the different specifications, I consider that the best specification corresponds to that which includes occupation and industry effects only, since using these variables accounts for unobserved skills factors and job characteristics. Although there is some gain on the explanation power of the models when including firm size fixed effects, because such gain is negligible and there is no evidence supporting the firm size-skill matching hypothesis. Furthermore, considering that the inclusion of these variables can create a downward bias on the union wage gap estimation, I consider that those variables should be excluded in favor of a more parsimonious model.

Wage gap effect: Oaxaca-Blinder Decomposition

As explained before, one of the limitations of the OLS approach is that it assumes union and non-union wage structures differed only by the changes in the constant, meaning that all other variables and endowments are believed to have the same returns in both situations. The alternative used there to relax this assumption is to use an Oaxaca-Blinder type of decomposition to separate the wage differentials due to endowments from those coming from coefficients (union wage gap). In table 4, Oaxaca type of decompositions, following the decomposition shown in equation (5), is presented. For comparison and robustness with the OLS estimations vs Oaxaca decomposition, specifications similar to those presented in columns to 2-5 in table 2 are estimated and presented in columns (1). Although different decompositions are possible using this methodology, depending on the weights one can assign to either group (union-nonunion). As described before, the union density in each country is used to weight the average wage gaps.

Table 4 Oaxaca estimations: Full Sample

	Bolivia	Chile
ln(wage|union)	2.047	7.450
ln(wage|non union)	1.526	7.202
Raw wage differential	0.520	0.248
Model 1: Demographics		
Composition effect	0.332	0.133
	(0.012)	(0.007)
Wage structure effect	0.188	0.115
	(0.014)	(0.010)
Model 2: Demographics+Occupation		
Composition effect	0.395	0.127
	(0.014)	(0.008)
Wage structure effect	0.125	0.121
	(0.014)	(0.009)
Model 3: Demographics+Occupation+Industry		
Composition effect	0.400	0.127
	(0.016)	(0.009)
Wage structure effect	0.120	0.121
	(0.016)	(0.009)
Model 4: Demographics+Occupation+Industry+Firm Size		
Composition effect	0.428	0.169
	(0.016)	(0.011)
Wage structure effect	0.092	0.079
	(0.016)	(0.011)

Note: The Specifications of Models 1-4 follow similar specifications as columns 2-5 in table 2. All models include year and region fixed effects.

In general, the wage gap estimations from both methodologies follow the same trend with rather similar wage gap estimations, although the ones using Oaxaca decomposition are relatively higher than those estimated using OLS. Looking at the decomposition itself, once we include demographic characteristics of workers, they explain a relatively large portion of the raw wage differential (64% and 54% for Bolivia and Chile respectively). As mentioned before, this is an indication that union workers in these two countries have, in quantitative terms, better observed characteristics than the average worker. Furthermore, it is also reflecting that, particularly in Bolivia, endowment distribution is one of the main factors explaining wage inequalities.

Similar to the OLS estimations, including additional controls to the specification, such as occupation and industry fixed effects, has little to none effects on the union wage gap for Chile, but reduces further the wage gap estimation in Bolivia. More interesting perhaps is that when one compares the estimated union wage gaps for the preferred models (model 3 table 4), they show that Bolivia and Chile have almost the same union wage gap, of about 0.12 log points. Including firm size fixed effects to the specification also reduces the union wage gap estimation, and as mentioned before they could be considered lower bound estimates of the union wage gap.

Based on the results obtained from the preferred model, whereas 51% (0.121/0.248) of the wage gap is explained by endowments and job characteristics in Chile, the same factors explain almost a 77% (0.400/0.5200) of the wage gap in Bolivia. These results reinforce the idea that even though the union wage gaps are, in average, similar for both countries, the heterogeneity between both countries is considerably large that it is worth to analyze in more detailed the role of the workers and job characteristics on the wage gap estimations.

Perhaps one of the most natural ways start a more detailed analysis of the union wage gap is by making a separate analysis for public and private sector workers in both countries. As shown in Table 1, the size and unionization ratio of the public sector is considerably different in both countries. Whereas 28% of the salaried workforce in Bolivia works for the public sector, only 14% of salaried workers in Chile do so, showing the importance of the public sector as a creator of jobs. Furthermore, in terms of unionization, more little more than half of public workers in the Bolivia are unionized compared to 37% of unionization in Chile. I suspect that the main reason for this difference in the unionization rates in both countries is the relatively larger education and health sectors in Bolivia, which are also known for being one of the traditionally largest labor organized sectors. Unfortunately, this cannot be tested because there is not enough disaggregation of industry information for Chile. In the case of the private sector alone,

surprisingly, the presence of union in both countries is quite similar, with a unionization rate of 13% in Bolivia and 13.7% in Chile.

Under this considerations, columns 1 and 2 in table 5 presents the corresponding results of the Oaxaca decomposition for the private and public sector in Bolivia and Chile, using only our preferred specification.[19] Just looking at the raw wage gaps, we can see that there are some important differences between and within each country. In Bolivia, it seems that a significant portion of the raw union wage differential was coming because wages in the public sector, in average, are higher than those in the private sector, which was previously being captured as a union-nonunion gap. Once both sectors are separated, the raw wage gap decreases to similar wage gaps for both sectors in the order of 0.35 log points (public sector) and 0.30 log points (private sector). In Chile, the results also show some important changes. While the average wage in the public sector is also higher than that of the private one, this does not seem to be explaining the overall raw wage differentials, based on the raw wage differentials of each sector. When observing to the private sector only, the raw wage differential is similar to that of the entire sample (0.24 log points), however, in the case of the public sector it is only about 0.07 log points.

[19] Results using all alternative specifications are shown in appendix 2

Table 5 Oaxaca estimations: Public and Private sample for preferred model

	Bolivia		Chile	
	(1)	(2)	(1)	(2)
	Public	Private	Public	Private
ln(wage|union)	2.241	1.751	7.542	7.408
ln(wage|non union)	1.888	1.447	7.474	7.169
Raw wage differential	0.353	0.303	0.068	0.240
Composition effect	0.278	0.136	0.031	0.102
	(0.019)	(0.023)	(0.018)	(0.010)
Wage structure effect	0.075	0.168	0.037	0.137
	(0.020)	(0.025)	(0.017)	(0.011)

Note: the preferred model includes demographic characteristics, occupation, industry, year and region fixed effects. Standard deviations are shown in parenthesis.

After controlling for demographic characteristics, occupation and industry fixed effects the estimations for Bolivia indicate that almost 79% of the raw wage gap in the public sector can be explained by differences in endowments, showing an estimated union wage gap of almost 0.08 log points. In the private sector, controlling for these variables only explains 45% of the raw wage gap, indicating that the union wage gap in the private sector is about 0.17 log points. In Chile, controlling for the same variables explain 46% of the raw wage gap in the public sector, which reduces the already low union wage differential to just 0.04 log points. Similarly, this control factors explain 43% of the raw wage differential in the private sector, indicating a union wage gap of 0.14 log points. From these results, two general conclusions can be obtained. First, similar to the conclusion for the overall sample, when only the private sector is under consideration, the evidence indicates that the magnitudes of the union wage gap are similar in both countries, though slightly higher for Bolivia. Second, although we find small union wage gaps for the public sector, in both Bolivia and Chile, Bolivia's public sector raw wage gaps are considerably large, which might imply that also in the public sector, there are considerable endowment differences between union and non union workers, which doesn't seem to be the case for Chile, where union and non-union public workers display similar characteristics. Nevertheless, in relative terms, the union wage gap in Bolivia is twice as large, which could be

indicating that unions in the public sector are relatively stronger than in Chile, considering the observed differences in the unionization ratios.

Based on the results found for the entire sample and the private/public subsample, it seems evident that, in contrast to the literature, union-workers seem to have better observed characteristics and work in better paid occupations and industries. Similar patterns are found in Arbache and Carneiro (Arbache & Carneiro, 1999)and Fairris(Fairris, 2003). The only situation for which this does not seem to be the case is for union-non union workers in the public sector in Chile, since there is little variation on the estimated union wage gap across different specifications, which implies that there is little difference between endowments within workers in the public sector.[20] Although detailed sources of the explained portion of the raw wage gap can be directly explained by looking at the summary statistics, very few can be said about the portion explained by differences on coefficients (union wage gap), without incurring into a detailed Oaxaca decomposition. To avoid some of the identification problems discussed in Oaxaca and Ransom (1999), the normalization strategy suggested by Yun (Yun, 2008) is implemented to obtained detailed decomposition in the presence of grouped dummies. Even though these results are also subject to its own normalization assumption, I believe some general conclusion can be obtained from these results.

In table 6, detailed decompositions using the preferred model for Bolivia and Chile are presented. The contribution of years, region, occupation and industry fixed effects are shown only in aggregate. Just as in previous estimations, the decompositions are calculated using the union density as weights. Only the decomposition for the portion explained by differences in coefficients is shown (wage structure effect). Detailed results on the decomposition can be found in appendix 3 and 4.

[20] See appendix 2

Table 6 Oaxaca Decomposition: Detail contribution to wage structure effect

	Bolivia			Chile		
	Entire sample	Public Sector	Private Sector	Entire sample	Public Sector	Private Sector
Ln(wage|union=1)	2.047***	2.241***	1.751***	7.450***	7.542***	7.408***
Ln(wage|union=0)	1.526***	1.888***	1.447***	7.202***	7.474***	7.168***
Raw wage differential	0.520***	0.353***	0.303***	0.248***	0.068***	0.240***
Composition effect	0.400***	0.278***	0.136***	0.127***	0.031*	0.102***
Wage structure effect	0.120***	0.075***	0.168***	0.121***	0.037**	0.137***
Male	-0.033***	0.005	-0.040*	0.002	0.003	-0.001
Female	0.016***	-0.004	0.015*	-0.001	-0.004	0.001
Indigenous	-0.004	0.005	-0.003			
Non-Indigenous	0.014	-0.017	0.011			
Yrs schooling	0.155***	0.156	0.028	0.050	-0.017	0.040
Exp (Age-yrs-6)	-0.218***	-0.147	-0.300***	-0.116**	-0.260**	-0.094*
Exp^2	0.141***	0.072	0.175***	0.091***	0.128*	0.079***
Married	0.007	0.003	0.018	-0.006	-0.015	-0.001
Single and other	-0.004	-0.001	-0.01	0.005	0.011	0.001
Head of household	-0.011	-0.007	-0.003	-0.005	0.01	-0.008
Other HH members	0.009	0.005	0.002	0.004	-0.008	0.007
Occupation	0.02	-0.037	0.097*	0.043***	-0.05	0.046*
Industry	-0.042***	-0.177***	-0.01	-0.004	0.017	-0.005
Region	-0.01	0.007	-0.026	-0.050***	-0.044**	-0.029*
Year	0.007***	0.007**	0.003	-0.001	0.001	-0.001
Constant	0.073	0.205*	0.210*	0.108*	0.265*	0.103
Nr Observations	15533	5093	10440	21183	3638	17545

Note: * p<0.1 ** p<0.05 *** p<0.01

All coefficients shown here correspond to the detailed decomposition of the wage structure effect: $\bar{X}^{*} * (\beta_{u} - \beta_{n})$, where $\bar{X}^{*}$ is the overall sample average of the kth variable. Estimations were estimated using Yun(Yun, 2005, 2008) solution.

In general, it seems that the differentiated wage structure between union and non-union jobs is relatively more important in Bolivia than in Chile, judging only on the magnitude and significance of the coefficients. Most of the changes are observed respect to variables of gender, education and potential experience. Other demographic variables such as ethnicity, marriage status and household head status do not seem to have any significant contribution to the wage structure effect.

The contribution of the variables sex and years of education are only statistically significant in Bolivia, although they also have important magnitudes in Chile as well. Looking only at the differences respect gender, it seems that in Bolivia, males are relatively penalized (women rewarded) among union jobs, which can be interpreted as a smaller gender wage gap

among union jobs. Using the private and public samples, it reveals that such effect on the gender gap is not important in the public sample, but only in the private one. Chile also shows signs of a similar pattern (smaller gender wage gap among union jobs) although it only happens for the private sector with the coefficients being insignificant. Although this results support the idea that unions are able to equalize wages among their members, thus reduce gender wage gaps (perhaps reducing discrimination), it is still puzzling that such effects are not observed for the public data alone. It also is possible that these results are reflecting some issues analyzing gender wage gaps, which are beyond the scope of this paper.

Education and (potential) experience are by far the most important components of the wage structure effect for both countries, although their magnitudes are more pronounced in Bolivia. Considering the magnitude and sign of this component, the return an average bolivian worker would receive for all his years of education would be 0.16log points higher in a union job compared to a non union job, whereas an analogous situation only brings only a 0.05log points higher return in Chile, a contribution that is not statistically significant. Such results were unexpected. As it was stated in section 2, one of the roles of unions is equalize wages within their members, mainly due to collective bargaining and standardized contracts. Based on this premise, one would smaller returns to endowments such as education among union workers, which translate in negative coefficients on the detailed decomposition.

For Bolivia, the specific sample analysis shows that increasing returns on education are observed only for the public sample, but not for the private one. In neither case the estimated contributions to their respective wage structures effects is significant anymore. Nevertheless, the observed increasing returns to education in the public sector can be conceived as a positive signal to attract better workers, particularly for jobs in health and education. This hypothesis,

however, only has some support for Bolivia, since there is no evidence of higher or lower education returns in Chile.

The contribution of potential experience on the union wage differential shows consistent effects across countries and subsamples, although they also indicate the presence of linearities on the returns to experience. For instance, for the average Bolivian worker with about 17 years of potential experience,[21] everything else assumed constant, he will receive a return to experience 0.08log points (=0.141-0.218) lower in a union job compare to a non-union one(similar for the public and private sample). For Chile, the return difference is much lower, with only a -0.02 log point return to experience difference between union and non union jobs for the full sample, although such difference is higher for the public sector alone. Based on these results, it seems that unions are indeed able to equalize wages respect experience, by reducing the returns of experience for the average worker. However, because of the observed non linearities, workers with the lowest levels of potential experience will be the most affected by the lower returns, although that effect diminishes with higher levels of potential experience.

The variables identifying occupation, industry, year and region fixed effects present mixed results respect to their contribution to the union wage gap. The coefficients reported in table 6 can be interpreted as a weighted average of return differentials among all the coefficients in a particular category. Having this said, it seems that in Bolivia and Chile, in average, there seems to be a positive union wage gap for most of occupations, contributing to the observed union wage gap, an effect particularly strong for the private sector in Bolivia, but still significant for the private and entire sample in Chile. The combined effects of occupation fixed effects in the public sector, albeit negative, are not significant in either country. With respect to industry, it seems that there are some industries in Bolivia for which unions have a negative wage gap, and

[21] And an average squared experience of E[exp^2/100]=4.3.

that is large enough to show a negative contribution to the union wage gap, although only for the case of the public sector and entire sample. This information, however, could be misleading since the public sector is heavily driven by the health and education sectors, which, after controlling for the other observed characteristics, seem to be having lower premiums for union workers, but do not necessary provide lower wages to workers. Again, no significant effect can be observed for the contribution of these variables in the Chilean case.

The region fixed effects seem to have no significant contribution to the union wage gap in Bolivia. In Chile, on the other hand, the estimations show that it contributes to lower the union wage gap, although it is mainly driven because of the lower estimated union premium in the metropolitan region, which concentrates a little more than half of the observations in the sample. It is worth to mention that the most important component of the union wage gap (wage structure effect) is driven by differences on the constant, which could be indication of two things. They could be indicating that unions increase wages in the same amount for all their members, and that return differentials on other worker characteristics play a small role on the wage structure at the mean. However, they can also be a signal that there are other unobserved factors that are not being account for, that are driving the union wage gap.

The results presented here, both for the OLS and the Oaxaca-Blinder decomposition analysis, provide some consistent evidence that the union wage gap found for this countries is around 10% (OLS estimation) and 12% (OB estimation). One argument with respect to this result, however, is that they could be driven by the nature of the definition of wages per hour used in the analysis. As described before, since actual wages per hour is not available in either survey, they were estimated by dividing the monthly wage by average number of hours worked in a month. If, for example, union workers tend to work fewer hours than their counterparts, even if their monthly wage is fixed, one would still observe positive union wage premium, causing a

possible overestimation. To test this hypothesis, using only our preferred specification, additional models are estimated using the log(Worked monthly hours) as dependent variable.[22] According to these estimations, in Bolivia, there is no statistical difference on the number of hours worked between union and nonunion workers, supporting that the estimates on the union wage gap is similar for the hourly and monthly wage. For Chile, on the other hand, the models indicate that union workers, particularly those in the public sector, work for longer hours (2.5%-6% more) than their counter parts. This implies that previous estimations could be understating the union wage gap for the Chilean case, and that the total monthly wage gap is higher than for the hourly wage case. Nevertheless, since the main concern to this paper is the analysis of the actual compensation workers receive for their labor, under the assumption that working hours are measure without systematic error, previous estimations can still be hold as the true union wage gap, or at least considered as lower bounds of the true union wage gaps.

Distribution effect of unions: Quantile regression

As stated before, the literature suggests that unions reduce wage inequality among union workers ((Freeman, 1980)), mostly by reducing skill differentials across workers or reduce wage gains associated with observed characteristics. The first alternative is to estimate the net effect of union status dummy across the different quintiles following equation (6a), under the assumption that the relative wage structure between union and non-union jobs is the same across the distribution. The results of the union wage differential (d_θ) are shown in Table 7 and illustrated in Figure 2, for the full sample and the private and public sample. The raw wage differentials, which control only for year and region fixed effects, are also shown to illustrate the share of the wage gap which is explained by observed characteristics.

[22] These results can be found in Appendix 5.

The results shown in table 7 are important not only to test the hypothesis of heterogeneity across the wage distribution, but also because they can be used as a robustness to be compared with the OLS and Oaxaca-Blinder decomposition approach. Comparing the results of the coefficients on union status of the 50th quintile (median) with those shown in table 2 (OLS) and table 4 (OB), one can finds that these methodology corroborates some of the previous results, indicating that in average, union wage gap is around 10 and 12%, with small differences across countries. Considering the private and public sectors individually, although no major differences are found for Chile, some estimations for Bolivia show different results than those previously found. Specifically, while one would expect the quantile wage gaps estimates to be slightly larger than those using the Oaxaca decomposition approach, the median union wage gap estimate in the public sector shows to be almost twice as large (0.11 log diff) as that using the OB approach (0.06 log diff) (see table 8). This difference seems to be explained because the Oaxaca decomposition is being driven by the negative union wage gaps at the upper tale of the wage distribution.

Table 7 Union Wage Gap, Selected quantiles

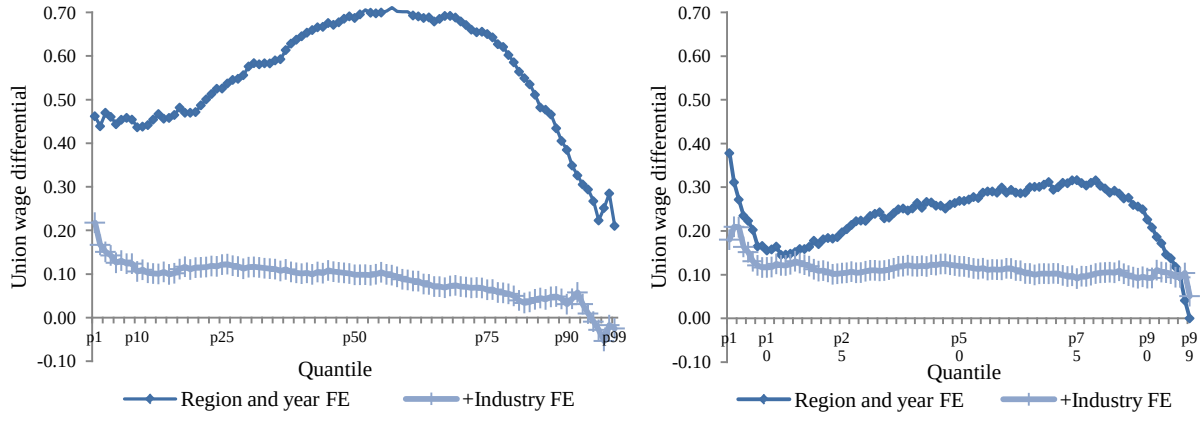
	Bolivia				
	P5	P10	P50	P90	P95
Full Sample					
Raw Diff	0.444***	0.442***	0.689***	0.386***	0.267***
	(0.038)	(0.027)	(0.024)	(0.040)	(0.053)
Preferred model	0.130***	0.110***	0.098***	0.034	-0.015
	(0.034)	(0.026)	(0.016)	(0.025)	(0.052)
	Chile				
	P5	P10	P50	P90	P95
Full Sample					
Raw Diff	0.223***	0.158***	0.269***	0.226***	0.137***
	(0.014)	(0.012)	(0.009)	(0.036)	(0.033)
Preferred model	0.152***	0.118***	0.119***	0.092***	0.102***
	(0.022)	(0.011)	(0.011)	(0.015)	(0.024)

Note: * p<0.1 ** p<0.05 *** p<0.01
Standard deviations are shown in parenthesis. Only union dummy coefficients are shown (d_θ).
Raw wage differentials are estimated using only years and region fixed effect. Preferred model considers demographics variables and occupation, industry, region and year fixed effects.

Looking at the raw wage differential across the distribution, both countries show an inverse "u" form on the within union wage gap (Figure 2). For Bolivia, it seems to be the highest between the 50th and 60th quintiles (0.70 log diff) whereas in Chile the highest differences are present around the 75th quintile (0.32 log diff). After controlling for demographic and job characteristics, the union wage gap estimation in Bolivia shows a stable but monotonically decreasing union wage gap from a significant 0.11 log wage diff (P10) to a non significant 0.034 log diff (P90). In Chile, on the other hand, the estimations show that, except for upper 95th and lower 5th percentile, unions have a relatively constant effect on wages (0.10 log points) across distribution.

From a theoretical point, because the union wage gap shows a monotonically decreasing effect on wages in Bolivia, one might expect unions to decrease wage inequality within union members and across all workers wage distribution. For Chile, on the other hand, because unions seem to have a more equalized effect across the wage distribution (union wage gap around 10 percent), no answer can be given on whether unions are contributing to reduce or increase within, nor across, wage dispersion.

Figure 2 Entire Sample, Union wage gap across quantiles



Based on previous results, we know that one of the reasons explaining the large raw union wage differentials is the underlying inequality of distribution of endowments across

workers. The results shown here not only confirm this hypothesis, but also show that those workers in around the middle (Bolivia) and upper middle (Chile) section of distribution are the ones that present the largest differences in terms of endowments. This is particularly important in Bolivia, where at least 0.30 log points of the raw wage differential can be explained by differences on observables characteristics.[23] Although this is also an important characteristic for Chile, as it was also observed before, the endowment differences are less severe. In fact, for workers at the higher end (95th or higher) and lower end (10th or lower) of the distribution, the differences on endowments is negligible, and union status alone is the most relevant factor to explain the within wage differentials.

Table 8 Quantile regression, selected quantiles

	Bolivia				
	P5	P10	P50	P90	P95
Public Sector					
Raw Diff	0.332***	0.386***	0.459***	0.049	-0.039
	(0.064)	(0.054)	(0.031)	(0.043)	(0.076)
Preferred model	0.135*	0.077**	0.135***	-0.048	-0.203***
	(0.055)	(0.030)	(0.018)	(0.039)	(0.048)
Private Sector					
Raw Diff	0.377***	0.346***	0.349***	0.404***	0.354***
	(0.055)	(0.041)	(0.029)	(0.076)	(0.093)
Preferred model	0.126**	0.140***	0.107***	0.152***	0.161**
	(0.041)	(0.032)	(0.022)	(0.034)	(0.054)
	Chile				
	P5	P10	P50	P90	P95
Public Sector					
Raw Diff	0.131***	0.085**	0.061	0.021	-0.031
	(0.038)	(0.026)	(0.038)	(0.040)	(0.036)
Preferred model	0.019	0.042***	0.029*	0.049**	0.014
	(0.035)	(0.009)	(0.014)	(0.016)	(0.035)
Private Sector					
Raw Diff	0.223***	0.160***	0.228***	0.230***	0.163**
	(0.019)	(0.018)	(0.000)	(0.045)	(0.052)
Preferred model	0.156***	0.145***	0.141***	0.107***	0.099**
	(0.020)	(0.016)	(0.011)	(0.015)	(0.030)

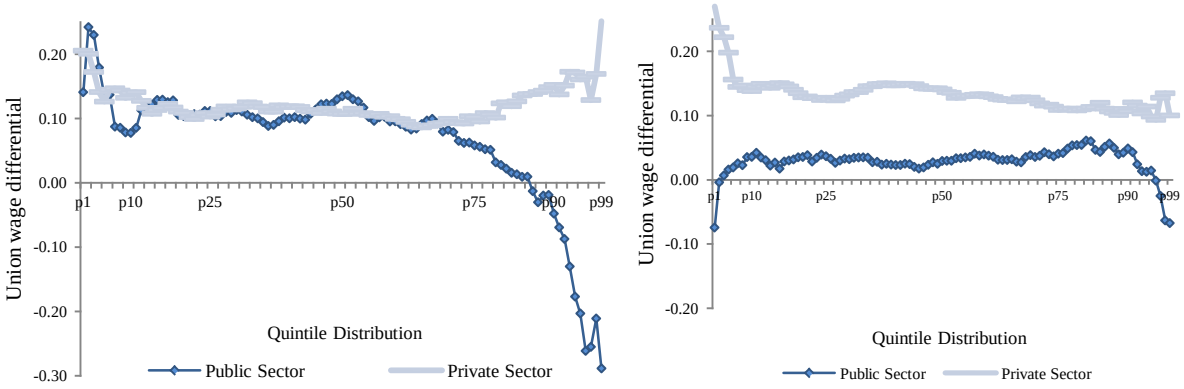
Note: * p<0.1 ** p<0.05 *** p<0.01
Standard deviations are shown in parenthesis. Only union dummy coefficients are shown (d_θ).

[23] This result is an approximation to the composition effect (endowment effect) obtained using Oaxaca-Blinder type of decompositions. It assumes that the difference between the raw wage differential, which controls only for year and region fixed effects, and the union wage gap, based on the preferred model, is explained by those additional controls.

Raw wage differentials are estimated using only years and region fixed effect. Preferred model considers demographics variables and occupation, industry, region and year fixed effects.

Figure 3 Public and Private Sample, preferred models:

Union wage gap across wage distribution



A separate analysis for the public and private sector (Figure 3 and Table 8) reveals that when looking at the private sector only, the estimations of the union wage gap seem constant across the wage distribution for both countries. Although there is some systematic variation on these estimates, with increasing union wage gap for the lower and upper tail in Bolivia, and showing a small but negative trend on the wage gap for Chile. In both cases there is not enough evidence to conclude whether or not unions are increasing or decreasing the wage dispersion among union members, or across the whole population.

In the case of the public sector alone, as it was highlighted before, the estimated union wage gap Bolivia using quantile regression is considerably larger than that using the OB approach. Whereas for the first half of the distribution, the union wage gap seem to be constant, after the 50th quantile the union wage gap starts to show progressive decline, showing a negative gap after the 90th quintile. It is also interesting to notice that for most of the wage distribution, the union wage gap in the public and private sector are roughly of the same magnitude. For Chile, the results show a different trend. Although the union wage gaps are as small as those presented before, it seems that it is slightly higher for some portion of the upper section of the

distribution. This evidence strongly suggest that, in Bolivia, unions might be able to reduce wage inequality, specifically compressing wages at the upper section of the wage distribution, although this might not be enough to reduce wage dispersion overall, since the wage gap is almost constant for the rest of quantiles. In Chile, on the other hand, the results suggest that either union have an uncertain effect on wage distribution, or that it might increase the inequality around the upper tail of the wage distribution, although the magnitude of such effect is expected to be small.

Distribution effect of unions: Variance decomposition analysis

A direct approach to analyze the effect of unions on wage dispersion is to measure to what extent wage structures and workers characteristics explain the observed differences on wage dispersion, here measured as the variance of the log wages. Based on equations (12) and (13), and using bootstrapping to calculate the standard deviations, the results of the wage decomposition are shown in table 9.[24]

An overview of the statistics indicates that, in general terms, wage inequality is a much severe problem in Bolivia (0.737) than in Chile (0.414), a reflection of the development differences between these countries. These differences on the raw wage distribution must be kept in mind, since even if unions have the same potential to reduce inequality, the absolute impact on the wage dispersion might be lower in Chile than in Bolivia. A simple comparison between union and non-union dispersion indicates that in for the full sample, wage inequality among union workers is around 10% lower compared to their counterparts. This average impact, however, does not necessarily represent the wage dispersion differences within the public-private sample.

[24] The results shown correspond to the preferred specification only. Results using alternative specifications are shown in Appendix 6.

For the private sector only, the estimates indicate that the reduction on wage dispersion seems to be lower than that observed for the public sector. For Bolivia, there is no statistical difference between union and non union wage dispersion in the private sector, whereas there is a 0.20 points lower wage dispersion (27% lower) among union workers in the Public sector. In the case of Chile, although the wage dispersion difference in the private sector is similar to that found for the full sample, it is only half as big as the inequality difference in the public sample.

Although the difference on the log wage variance is useful to indicate some simple patterns on the effects on unions on wage dispersion, it does not provide enough evidence to arrive to any conclusions, since it aggregates both composition and wage structure effects, which could be affecting wage dispersion in the same or opposite directions. In the case of Bolivia, it seems that the composition effect has contributed to increase wage inequality among union workers for the whole sample and private sample in particular. Combined with the previous findings on the wage gap, this implies that union's workers are not only characterized having in average a quantitative advantage respect to their endowments, but also that there is higher worker's heterogeneity among union workers. This is not true for the public sector. From the previous paragraph we stated that the Public sector in Bolivia is the one that showed the largest differences in wage inequality. The decomposition results, however, show that almost 75% of this lower wage dispersion can be explained because there is much more homogeneity across workers, which is not a surprise. Considering that most of union workers in the public sector are concentrated in specific occupations and industries (education and health), a more homogenous set of workers is expected, once we control for dummies for these particular sectors. In the Chilean case, the estimations indicate that for all cases, full sample and private-public sample, there is less heterogeneity among union workers, in particular for the public sample. Although such differences are relatively small for the full and private samples, they are still significant at

10% of confidence, indicating that the composition of workers in the union sector decreases the wage inequality in the sector.

Table 9 Variance decomposition for preferred models

	Bolivia			Chile		
	Full Sample	Private	Public	Full Sample	Private	Public
Non Union: Total Variance	0.737	0.697	0.763	0.414	0.394	0.488
Union: Total Variance	0.676	0.711	0.557	0.371	0.349	0.408
Total Var Difference Var(NU)-Var(U)	0.062*** (0.024)	-0.014 (0.036)	0.205*** (0.039)	0.043*** (0.014)	0.045*** (0.016)	0.080*** (0.024)
Composition effect	-0.028** (0.013)	-0.066*** (0.019)	0.143*** (0.018)	0.011* (0.006)	0.013* (0.007)	0.054*** (0.014)
Wage Structure effect	0.089*** (0.024)	0.052 (0.032)	0.063 (0.040)	0.032** (0.014)	0.032** (0.016)	0.026 (0.024)
Variance Diff due β's	0.032 (0.021)	0.059** (0.024)	-0.045 (0.030)	0.015 (0.009)	0.003 (0.012)	0.034* (0.019)
Residual difference	0.058*** (0.015)	-0.007 (0.022)	0.108*** (0.022)	0.018* (0.010)	0.029*** (0.011)	-0.008 (0.013)

Note: * p<0.1 ** p<0.05 *** p<0.01
Standard errors are shown in parenthesis. They are calculated using Bootstrapping.

The second component of the variance decomposition (wage structure effect) identifies the impact that unions would have had on wage dispersion, under the assumption that union and nonunion workers have the same distribution of observed and unobserved characteristics. This is also decomposed by two terms, one that reflects the direct impact of the different returns (β's) on observables, and the second that considers only the differences on the within wage distribution (residual variation).

In absolute and relative terms, unions are better at reducing wage inequality in Bolivia than in Chile, although this can be simply because inequality is already low in Chile. For instance, they are able to reduce the log wage variance between 7-12% in Bolivia and around 5-8% in Chile, with respect to the observed variance among non-union workers. One should also notice that, nevertheless, such reductions on the wage dispersion are not statistically significant for the separate private-public sample in Bolivia, nor for the public sample in Chile.

When looking at portion of explained by differences in returns on observables (β's), based on the theoretical model, one should expect this term to contribute to lower wage dispersion. The results corroborate such effect for most of the cases, with some exceptions. In Bolivia, the reduction on dispersion due to flatter returns is positive but not significant for the full sample. A separate analysis shows that the lower dispersion effect can only be seen among private workers. For the public sector, the results indicate that returns differences are increasing rather than decreasing wage dispersion, although this estimate is not statistically significant. Considering the results of the detailed Oaxaca decomposition (table 6), this effect was not expected, since most of the returns differentials were smaller than those found for the public case, except for differences on the return of education and industry, which seem to be driving this increasing effect on dispersion. In Chile, the results show that, in contrast with that found in Bolivia, differences on returns have a significant effect reducing wage dispersion only for the public sector. For the private one, albeit positive, the contribution to reduce dispersion is marginal and not statistically significant. In this case, relying on the results from the Oaxaca decomposition, it is possible the low impact of on wage dispersion for the private sector is due higher returns to education and higher premiums to some specific among union workers.

For the second component of the wage structure effect, the residual variance difference, one must remember that it can only be entirely considered as part the wage structure effect under the assumption of homoscedasticity. From the results shown in table 9, it seems this component has a positive impact reducing wage dispersions in both countries, although the effect is almost zero for the private sector in Bolivia and the public sector in Chile. Combined with the direct effects of the differences in returns (β's), it indicates that unions operate differently when reducing wage inequality, although there is no information to explain why such differences are observed.

The lower residuals dispersions, which can reduce wage dispersion between 7 to 14% with respect to non-union workers, can be interpreted in two ways. If we consider that the residual variance is capturing the dispersion of skill level among workers, and further that unobserved skill level is uncorrelated to the observed characteristics, it could be interpreted as if unions are able to compress skills level among its workers, through the selection process, following the hypothesis of Card (Card, 1996) and Hirsch and Schumaher(Hirsch & Schumacher, 1998). If this were true, however, it would imply that the residual difference should not be considered part of the union's potential to reduce inequality, since the innate distribution of skill cannot be affected by the presence of unions.

A second interpretation of this component is directly related to the wage structure and wage policy effects. Under the assumption that the unexplained residual is a reflection of truly unexplained wage differentials, i.e. ad hoc wage premiums, the estimations might indicate that unions are able to reduce wage dispersion by constraining, to some extent, the ability of employers to assign ad hoc wages to their employees. This hypothesis is consistent with the fact that unions usually encourage to create collective contracts that establish standardized wage levels for their members. It is still uncertain why this effect is relevant only for the Bolivian public sector and Chilean public one.

7. Discussion and Conclusion

Considering that the legal structure and economic environment in Chile is relatively more adequate for the creation and organization unions compared to those in Bolivia; that the history of this institution showed that unions in Chile country went to an earlier adjustment to the changes that the neoliberalism brought to Latin America after the Debt Crisis of the 1980s; that all unions in Chile early experienced to deal with a more decentralized process of negotiation, compared to an still centralized version that remain the cannon for the broader sectors in Bolivia,

leaving smaller unions in uncertainty; and that evidence from other developing countries have shown results that greatly differ from the standard findings in the literature, my original expectations was to observe that unions having a differentiated impact respect to wage gaps and wage dispersion in both countries, possibly having the stronger impacts in Chile.

The evidence presented here, however, indicates a different story. Once observable characteristics and methodology differences are being controlled, I find that in average the union wage gap is rather similar between both countries, with an estimate around 10 to 12%. An estimate that is considerably close to the wage gaps reported for US. In an analysis for the private sector only, where the density of unions is fairly similar for both countries, the results also indicate that the wage gaps are rather similar and in the neighbor of the typical findings, although slightly higher for Bolivia (17%) compare to Chile (14%). In relative terms, I find that the difference in wage gaps in the public sector is more important, with a wage gap in Bolivia (7.5%) almost twice as large as the one in Chile (3.7%).

This result, however, is not completely unexpected. For the private sector, if the wage premiums were smaller, the premium of being affiliated to a union would be too low, and there would be little incentives for people to participate in unions. If it is too high, it would make union establishments unprofitable and unsustainable, and such high union wage gaps would not be observed in the long run. In case of being observed, the incentive to be part of a union would be so large, that all workers would be willing to be a union member, which could only be stopped with tighter restrictions of affiliation or hiring process.

In the public sector, however, the wage gaps seem to be, at least for Chile, so small that that it would not be a large enough to create incentives and attract workers to form unions. One should consider, however, that unions in the public sector in both countries operate differently than in the private sector. For instance, the largest unions, who are concentrated in the health and

education sector, have been form by tradition, and membership to those, though considered as voluntary, is basically a mandatory right for teachers and physicians who enter to work in the public sector, and could not carry the strength that a traditional union in the private sector might have. The observed differences on the wage gap can also be related to the considerably larger union density in Bolivia (51%) compare to Chile (37%), reflecting the difference in union's strength in both countries.

The analysis on the unions wage gaps across the wage distribution indicates that, except for the public sector in Bolivia, those wage gaps are mostly constant across the wage distribution, with an estimated union wage gap between 10% to 12%, and only around 4% for the particular case of public unions in Chile. For the public sector in Bolivia, although the estimated wage gap seems invariant for almost three quarters of the wage distribution, it presents a decreasing trend for the upper section of the distribution, even showing negative wage gaps for the top 10 percent of the distribution. Except for these last results, it seems that the hypothesis of heterogeneous union wage effects cannot be sustained, at least for the particular cases of Bolivia and Chile. These results provide little if no information on the implications on wage distribution.

When analyzing the direct impact of unions on wage dispersion, I find that for both countries, unions reduce wage dispersion among their members because of their differentiated wage structure. I also find that in absolute terms, this effect is stronger for Bolivia (reduction between 0.05-0.09 points) than for Chile (around 0.03). However, when considering the underlying inequality differences between both countries, which for our sample seem much larger than the Gini index show, the relative inequality reduction is fairly similar between both countries. Although there is no standard measure to compare these results, I believe that these magnitudes are important, although most of them become statistically insignificant when the public and private samples are analyzed separately. Although I am able to identify to what extent

the components of the wage structure effect (flatter returns or lower residual variance) contributes to the reduction of wage dispersion, the information is insufficient to identify if unions use the same mechanism to reduce wage dispersion in both countries. This, however, may be indicating that the mechanism unions use to reduce wage dispersion is unique to each country, and also that more detailed analysis might be needed to identify any patterns on the mechanisms.

The evidence provided here shows that in average, once observed characteristics and methodological differences are being controlled, the impact of unions on wages gaps and wage dispersions is fairly similar to those found in the traditional union literature. This, however, does not imply that that legal frameworks, institutions and economic backgrounds play no role on the way unions behave, interact and affect the labor market. It is possible that because this paper analyses the labor market in each country as a whole, important characteristics that are unique to each sector are not being considered. Further, it is possible that if this type of analysis is elaborated within more detailed sectors, similar contradictions to the traditional literature can be found. I leave such analysis for future research .

References

Alexander, R. J., & Parker, E. M. (2005). *A history of organized labor in Bolivia*: Praeger Pub Text.

Arbache, J. S. (1999). Do unions always decrease wage dispersion? The case of Brazilian manufacturing. *Journal of Labor Research, 20*(3), 425-436.

Arbache, J. S., & Carneiro, F. G. (1999). Unions and interindustry wage differentials. *World Development, 27*(10), 1875.

Blanchflower, D. G., & Bryson, A. (2004). What effect do unions have on wages now and would Freeman and Medoff be surprised? *Journal of Labor Research, 25*(3), 383-414.

Blinder, A. S. (1973). Wage Discrimination: Reduced Form and Structural Estimates. *The Journal of Human Resources, 8*(4), 436-455.

Bloch, F., & Kuskin, M. (1978). Wage determination in the union and nonunion sectors. *Industrial and Labor Relations Review, 31*(2), 183-192.

Brown, C., & Medoff, J. (1989). The Employer Size-Wage Effect. *The Journal of Political Economy, 97*(5), 1027-1059.

Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: methods and applications*.

Card, D. (1996). The effect of unions on the structure of wages: A longitudinal analysis. *Econometrica: Journal of the Econometric Society, 64*(4), 957-979.

Card, D. (2001). The effect of unions on wage inequality in the US labor market. *Industrial and Labor Relations Review, 54*(2), 296-315.

Card, D., Lemieux, T., & Riddell, W. C. (2003). Unionization and Wage Inequality: A Comparative Study of the U.S, the U.K., and Canada. *National Bureau of Economic Research Working Paper Series, No. 9473*(published as Card, David, Thomas Lemieux and W. Craig Riddell. "Unions and Wage Inequality." Journal of Labor Research 25 (Fall 2004).).

Carrière, J., Haworth, N., & Roddick, J. (1989). *The State, industrial relations and the labour movement in Latin America*: Macmillan.

Cassoni, A., Labadie, G. J., & Fachola, G. (2005). The economic effects of unions in Latin America: Their impact on wages and the economic performance in Uruguay. In P. Kuhn & G. Márquez (Eds.), *What Difference Do Unions Make? Their Impact on Productivity and Wages in Latin America*: Inter-American Development Bank.

Fairris, D. (2003). Unions and Wage Inequality in Mexico. *Industrial and Labor Relations Review, 56*(3), 481-497.

Fairris, D. (2005). What do unions do in Mexico? *University of California Riverside*.

Fortin, N., Lemieux, T., Firpo, S., Orley, A., & Card, D. (2010). Chapter 1 - Decomposition Methods in Economics *Handbook of labor economics* (Vol. Volume 4, Part A, pp. 1-102): Elsevier.

Freeman, R. B. (1980). Unionism and the Dispersion of Wages. *Industrial and Labor Relations Review, 34*(1), 3-23.

Freeman, R. B. (1982). Union wage practices and wage dispersion within establishments. *Industrial and Labor Relations Review, 36*(1), 3-21.

Freeman, R. B. (1984). Longitudinal Analyses of the Effects of Trade Unions. *Journal of Labor Economics, 2*(1), 1-26.

Freeman, R. B., & Medoff, J. L. (1984). *What do unions do?* (Vol. 23): Basic Books New York.

Fuchs, V. R., Krueger, A. B., & Poterba, J. M. (1998). Economists' Views about Parameters, Values, and Policies: Survey Results in Labor and Public Economics. *Journal of Economic Literature, 36*(3), 1387-1425.

Gasparini, L. C., & Tornaroli, L. (2009). Labor Informality in Latin America and the Caribbean: Patterns and Trends from Household Survey Microdata. *REVISTA DESARROLLO Y SOCIEDAD*.

Heckman, J., & Polachek, S. (1974). Empirical Evidence on the Functional Form of the Earnings-Schooling Relationship. *Journal of the American Statistical Association, 69*(346), 350-354.

Hirsch, B. T. (1982). The Interindustry Structure of Unionism, Earnings, and Earnings Dispersion. *Industrial and Labor Relations Review, 36*(1), 22-39.

Hirsch, B. T. (2004). Reconsidering union wage effects: Surveying new evidence on an old topic. *Journal of Labor Research, 25*(2), 233-266.

Hirsch, B. T. (2008). Sluggish Institutions in a Dynamic World: Can Unions and Industrial Competition Coexist? *Journal of Economic Perspectives, 22*(1), 153-176. doi: doi: 10.1257/jep.22.1.153

Hirsch, B. T., & Addison, J. T. (1986). *The economic analysis of unions: new approaches and evidence*: Allen & Unwin.

Hirsch, B. T., & Schumacher, Edward J. (1998). Unions, wages, and skills. *Journal of Human Resources, 33*(1), 201-219.

Hirsch, B. T., & Schumacher, Edward J. (2010). Underpaid or Overpaid? Wage Analysis for Nurses Using Job and Worker Attributes.

Hudson, R. A., & Hanratty, D. M. (1991). *Bolivia: a country study*: United States Government Printing.

Jarrell, S. B., & Stanley, T. D. (1990). A meta-analysis of the union-nonunion wage gap. *Industrial and Labor Relations Review, 44*(1), 54-67.

Koenker, R., & Bassett, G., Jr. (1982). Robust Tests for Heteroscedasticity Based on Regression Quantiles. *Econometrica, 50*(1), 43-61.

Kuhn, P. (1998). Unions and the Economy: What We Know; What We Should Know. *The Canadian Journal of Economics / Revue canadienne d'Economique, 31*(5), 1033-1056.

Lewis, H. G. (1963). *Unionism and relative wages in the United States: an empirical inquiry*: University of Chicago Press.

Lewis, H. G. (1986). Union relative wage effects. *Handbook of labor economics, 2*, 1139-1181.

Mansilla, H. C. F. (1993). Apogeo y declinacion del Movimiento Sindical Boliviano. *Revista de Estudios Politicos*(79), 227-245.

Mincer, J. (1974). Schooling, Experience, and Earnings. *New York: National Bureau of Economic Research*.

Oaxaca, R. (1973). Male-Female Wage Differentials in Urban Labor Markets. *International Economic Review, 14*(3), 693-709.

Oaxaca, R. L., & Ransom, M. R. (1999). Identification in Detailed Wage Decompositions. *Review of Economics and Statistics, 81*(1), 154-157. doi: doi:10.1162/003465399767923908

OECD. (1996). Trade, Employment and Labour Standards: A Study of Core Workers' Rights and International Trade.

Oi, W. Y., & Idson, T. L. (1999). Chapter 33 Firm size and wages. In C. A. Orley & C. David (Eds.), *Handbook of labor economics* (Vol. Volume 3, Part 2, pp. 2165-2214): Elsevier.

Quiroga, P. A. B. (2010). Convergence Patterns in Latin America. *Economics Working Papers*.

Schultz, T. P., & Mwabu, G. (1998). Labor unions and the distribution of wages and employment in South Africa. *Industrial and Labor Relations Review, 51*(4), 680-703.

Simon, H. A. (1997). *Models of bounded rationality: Empirically grounded economic reason* (Vol. 3): MIT Press.

Ulloa, V. (2003). *El movimiento sindical chileno del siglo XX hasta nuestros días*: OIT, Oficina Internacional del Trabajo.

Yun, M.-S. (2005). A Simple Solution to the Identification Problem in Detailed Wage Decompositions. *Economic Inquiry, 43*(4), 766-772. doi: 10.1093/ei/cbi053

Yun, M.-S. (2008). Identification problem and detailed Oaxaca decomposition: A general solution and inference. *Journal of Economic and Social Measurement, 33*(1), 27-38.

Appendix 1: Union Density and market structure by Industry and Occupation

	Bolivia			Chile	
	Market Structure	Union Density		Market Structure	Union Density
Industry					
Mining	2.67	34.0	Mining and Quarrying	2.3	47.4
Manufacture	17.07	10.9	Manufacturing	15.3	18.4
Electricity, gas and water	1.23	30.9	Electricity, Gas and Water	0.9	32.4
Construction	12.95	7.6	Construction	11.2	7.9
Repair of motor vehicles and motorcycles	10.77	4.4	Wholesale, Retail and Accommodation	22.0	11.8
Accommodation and foodservices	3.68	3.4	Transport, Storage and Communication	9.3	18.8
Transportation and warehousing	9.85	31.8	Financing, Insurance, Real Estate	11.8	12.7
Finance and Insurance	1.74	16.9	Community, Social and Personal Services	27.3	22.7
Real estate and rental and leasing	5.26	8.2			
Public administration and defense	8.53	27.5			
Educational Services	15.86	63.0			
Health care and social assistance	5.29	37.5			
Communitarian, social and personal services	5.1	15.1			
Occupation					
Management	3.7	31.1	Management	1.09	10.3
Professionals and scientist	15.2	55.6	Professionals and scientist	10.01	20.2
Technicians and support	14.5	30.5	Technicians and support	11.31	20.5
Office workers	9.9	15.2	Office workers	17.83	18.0
Service and retail sellers	11.2	10.1	Service and retail sellers	18.16	14.7
Farmers	0.4	18.6	Farmers	0.71	13.7
Mine and construction workers	24.7	7.8	Mine and construction workers	16.04	13.5
Machinery operators	10.7	32.5	Machinery operators	11.44	23.5
Unqualified workers	9.7	15.6	Unqualified workers	13.4	12.9
Firm size by number of workers			**Firm size by number of workers**		
Doesn't know	2.1	24.2	Doesn't know	5.2	14.7
1 to 9	41.0	13.1	1 to 9	18.9	3.3
10 to 19	14.9	27.9	10 to 19	9.3	6.8
20 to 49	16.5	32.8	20 to 49	14.1	10.6
50 to 99	7.3	23.0	50 to 99	10.3	15.5
100 or more	18.2	35.5	100 or more	42.3	28.2

Notes: Union densities are estimated using weights for the full selected sample

Appendix 2 Oaxaca Estimations for Private and Public sector

	Bolivia		Chile	
	(1) Public	(2) Private	(1) Public	(2) Private
Union	2.241	1.751	7.542	7.408
Non union	1.888	1.447	7.474	7.169
Raw log wage gap	0.353	0.303	0.068	0.240
Model 1: Demographics				
Explained	0.261	0.121	0.043	0.107
	(0.016)	(0.021)	(0.015)	(0.008)
Unexplained	0.092	0.183	0.024	0.133
	(0.019)	(0.024)	(0.018)	(0.011)
Model 2: Demographics+Occupation				
Explained	0.296	0.136	0.007	0.100
	(0.018)	(0.023)	(0.017)	(0.009)
Unexplained	0.057	0.168	0.061	0.140
	(0.019)	(0.025)	(0.017)	(0.011)
Model 3: Demographics+Occupation+Industry				
Explained	0.278	0.136	0.031	0.102
	(0.019)	(0.023)	(0.018)	(0.010)
Unexplained	0.075	0.168	0.037	0.137
	(0.020)	(0.025)	(0.017)	(0.011)
Model 4: Demographics+Occupation+Industry+Firm				
Explained	0.277	0.180	0.043	0.155
	(0.019)	(0.024)	(0.018)	(0.014)
Unexplained	0.076	0.123	0.025	0.085
	(0.020)	(0.025)	(0.017)	(0.014)

Note: The Specifications of Models 1-4 follow similar specifications as columns 2-5 in table 2. All models include year and region fixed effects.

Appendix 3 Detailed Oaxaca decomposition for preferred model: Bolivia

3a National Sample

National Sample	βu	βnu	Xu	Xnu	Wage Structure X*(Bu-Bnu)	Composition B*(Xu-Xnu)
Total effect					**0.120**	**0.400**
Male	0.015	0.064	0.646	0.692	-0.033	-0.001
Female	-0.015	-0.064	0.354	0.308	0.016	-0.001
Indigenous	-0.056	-0.039	0.246	0.204	-0.004	-0.002
Non-Indigenous	0.056	0.039	0.754	0.796	0.014	-0.002
Yrs schooling	0.075	0.062	13.133	10.860	0.155	0.164
Exp (Age-yrs-6)	0.019	0.032	19.673	16.144	-0.218	0.077
Exp^2	-0.010	-0.043	5.099	4.102	0.141	-0.018
Married	0.040	0.028	0.754	0.623	0.007	0.005
Single and other	-0.040	-0.028	0.246	0.377	-0.004	0.005
Head of household	0.014	0.034	0.653	0.539	-0.011	0.002
Other HH members	-0.014	-0.034	0.347	0.461	0.009	0.002
Occupation					0.020	0.212
Industry					-0.042	-0.019
Region					0.007	0.005
Year					-0.010	-0.029
Constant	0.633	0.560	1.000	1.000	0.073	

3b Private Sector

Private Sector	βu	βnu	Xu	Xnu	Wage Structure X*(Bu-Bnu)	Composition B*(Xu-Xnu)
Total effect					**0.168**	**0.136**
Male	0.029	0.084	0.834	0.719	-0.040	0.004
Female	-0.029	-0.084	0.166	0.281	0.015	0.004
Indigenous	-0.043	-0.028	0.258	0.204	-0.003	-0.002
Non-Indigenous	0.043	0.028	0.742	0.796	0.011	-0.002
Yrs schooling	0.060	0.058	10.867	10.445	0.028	0.025
Exp (Age-yrs-6)	0.014	0.032	19.638	15.709	-0.300	0.064
Exp^2	-0.003	-0.046	5.208	3.945	0.175	-0.011
Married	0.058	0.029	0.764	0.614	0.018	0.008
Single and other	-0.058	-0.029	0.236	0.386	-0.010	0.008
Head of household	0.031	0.037	0.728	0.539	-0.003	0.006
Other HH members	-0.031	-0.037	0.272	0.461	0.002	0.006
Occupation					0.097	0.055
Industry					-0.010	0.003
Region					0.003	0.007
Year					-0.026	-0.039
Constant	0.854	0.644	1.000	1.000	0.210	

3c Private Sector

Public Sample	βu	βnu	Xu	Xnu	Wage Structure X*(Bu-Bnu)	Composition B*(Xu-Xnu)
Total effect					**0.075**	**0.278**
Male	0.015	0.005	0.523	0.565	0.005	0.000
Female	-0.015	-0.005	0.477	0.435	-0.004	0.000
Indigenous	-0.061	-0.083	0.238	0.202	0.005	-0.003
Non-Indigenous	0.061	0.083	0.762	0.798	-0.017	-0.003
Yrs schooling	0.099	0.087	14.623	12.767	0.156	0.172
Exp (Age-yrs-6)	0.017	0.025	19.696	18.142	-0.147	0.033
Exp^2	-0.005	-0.020	5.027	4.822	0.072	-0.003
Married	0.031	0.026	0.748	0.667	0.003	0.002
Single and other	-0.031	-0.026	0.252	0.333	-0.001	0.002
Head of household	0.003	0.016	0.604	0.542	-0.007	0.001
Other HH members	-0.003	-0.016	0.396	0.458	0.005	0.001
Occupation					-0.037	0.119
Industry					-0.177	-0.037
Region					0.007	0.010
Year					0.007	-0.017
Constant	0.418	0.213	1.000	1.000	0.205	0.000

Appendix 4 Detailed Oaxaca decomposition for preferred model: Chile

4a National Sample

National Sample	βu	βnu	Xu	Xnu	Wage Structure X*(Bu-Bnu)	Composition B*(Xu-Xnu)
Total effect					0.121	0.127
Male	0.087	0.083	0.633	0.611	0.002	0.002
Female	-0.087	-0.083	0.367	0.389	-0.001	0.002
Yrs schooling	0.076	0.072	12.331	11.805	0.050	0.040
Exp (Age-yrs-6)	0.008	0.014	21.268	17.820	-0.116	0.031
Exp^2	0.004	-0.014	6.008	4.708	0.091	0.001
Married	0.026	0.036	0.627	0.536	-0.006	0.002
Single and other	-0.026	-0.036	0.373	0.464	0.005	0.002
Head of household	0.025	0.035	0.628	0.532	-0.005	0.003
Other HH members	-0.025	-0.035	0.372	0.468	0.004	0.003
Occupation					0.043	0.027
Industry					-0.004	0.006
Region					-0.001	0.005
Year					-0.050	0.003
Constant	6.403	6.295	1.000	1.000	0.108	0.000

4b Private Sector

Private Sector	βu	βnu	Xu	Xnu	Wage Structure X*(Bu-Bnu)	Composition B*(Xu-Xnu)
Total effect					0.137	0.102
Male	0.079	0.081	0.706	0.634	-0.001	0.006
Female	-0.079	-0.081	0.294	0.366	0.001	0.006
Yrs schooling	0.074	0.070	11.967	11.602	0.040	0.027
Exp (Age-yrs-6)	0.009	0.014	19.692	17.613	-0.094	0.020
Exp^2	0.001	-0.015	5.310	4.627	0.079	-0.001
Married	0.034	0.035	0.622	0.535	-0.001	0.003
Single and other	-0.034	-0.035	0.378	0.465	0.001	0.003
Head of household	0.025	0.040	0.627	0.535	-0.008	0.003
Other HH members	-0.025	-0.040	0.373	0.465	0.007	0.003
Occupation					0.046	0.006
Industry					-0.005	0.015
Region					-0.001	0.005
Year					-0.029	0.007
Constant	6.390	6.287	1.000	1.000	0.103	0.000

4c Private Sector

Public Sector	βu	βnu	Xu	Xnu	Wage Structure X*(Bu-Bnu)	Composition B*(Xu-Xnu)
Total effect					0.037	0.031
Male	0.102	0.095	0.472	0.426	0.003	0.005
Female	-0.102	-0.095	0.528	0.574	-0.004	0.005
Yrs schooling	0.080	0.081	13.134	13.441	-0.017	-0.025
Exp (Age-yrs-6)	-0.002	0.010	24.740	19.496	-0.260	0.015
Exp^2	0.022	0.001	7.547	5.359	0.128	0.031
Married	0.004	0.031	0.639	0.543	-0.015	0.001
Single and other	-0.004	-0.031	0.361	0.457	0.011	0.001
Head of household	0.013	-0.005	0.630	0.510	0.010	0.001
Other HH members	-0.013	0.005	0.370	0.490	-0.008	0.001
Occupation					-0.050	-0.046
Industry					0.017	0.032
Region					0.001	0.007
Year					-0.044	0.004
Constant	6.504	6.239	1.000	1.000	0.265	0.000

Appendix 5 OLS estimations for the monthly hours, preferred specifications

Dependent variable: Log(monthly hrs)	Bolivia Entire Sample	Bolivia Public Sector	Bolivia Private Sector	Chile Entire Sample	Chile Public Sector	Chile Private Sector
Union(=1)	0.009	0.008	0.010	0.025	0.057	0.012
	(0.012)	(0.019)	(0.016)	(0.009)	(0.014)	(0.010)
Sex (1=male)	0.113	0.057	0.130	0.046	0.015	0.051
	(0.014)	(0.023)	(0.018)	(0.011)	(0.026)	(0.012)
Indigenous(=1)	-0.035	0.021	-0.050			
	(0.013)	(0.023)	(0.016)			
Yrs of education	-0.004	0.004	-0.007	0.002	0.013	0.000
	(0.002)	(0.003)	(0.002)	(0.002)	(0.005)	(0.002)
Experience	0.009	0.008	0.009	0.009	0.010	0.009
	(0.002)	(0.003)	(0.002)	(0.002)	(0.005)	(0.002)
EXP^2	-0.020	-0.015	-0.021	-0.018	-0.016	-0.018
	(0.003)	(0.007)	(0.004)	(0.003)	(0.008)	(0.003)
Married	0.019	0.017	0.019	0.021	0.062	0.014
	(0.012)	(0.023)	(0.014)	(0.009)	(0.015)	(0.009)
Head household	0.062	0.076	0.058	0.021	0.029	0.023
	(0.012)	(0.020)	(0.015)	(0.010)	(0.023)	(0.010)
N	15533	5093	10440	21183	3638	17545
r2	0.2441	0.3767	0.1306	0.0931	0.1112	0.0912

Note: The models include occupation, industry, region and year fixed effects, although they are not shown here.

Appendix 6 Variance decomposition using different specifications

Bolivia	**National Sample**				**Public Sample**				**Private Sample**			
Specification	**Md1**	**Md2**	**Md3**	**Md4**	**Md1**	**Md2**	**Md3**	**Md4**	**Md1**	**Md2**	**Md3**	**Md4**
Nonunion Variance	0.737	0.737	0.737	0.737	0.697	0.697	0.697	0.697	0.763	0.763	0.763	0.763
Union Variance	0.676	0.676	0.676	0.676	0.711	0.711	0.711	0.711	0.557	0.557	0.557	0.557
Total Variance difference	0.062	0.062	0.062	0.062	-0.014	-0.014	-0.014	-0.014	0.206	0.206	0.206	0.206
	(0.024)	(0.024)	(0.024)	(0.024)	(0.036)	(0.036)	(0.036)	(0.036)	(0.037)	(0.037)	(0.037)	(0.037)
Composition effect	-0.014	-0.047	-0.028	-0.001	-0.037	-0.067	-0.066	-0.058	0.116	0.120	0.143	0.159
	(0.009)	(0.011)	(0.013)	(0.014)	(0.009)	(0.015)	(0.019)	(0.019)	(0.015)	(0.017)	(0.018)	(0.019)
Wage Structure effect	0.076	0.109	0.089	0.063	0.023	0.053	0.052	0.044	0.090	0.086	0.063	0.046
Variance Diff due β's	-0.012	0.051	0.032	0.006	0.019	0.071	0.059	0.046	-0.029	-0.029	-0.045	-0.061
	(0.017)	(0.018)	(0.021)	(0.021)	(0.022)	(0.022)	(0.024)	(0.025)	(0.026)	(0.027)	(0.028)	(0.029)
Residual difference	0.087	0.058	0.058	0.058	0.004	-0.018	-0.007	-0.001	0.118	0.115	0.108	0.108
	(0.016)	(0.015)	(0.015)	(0.014)	(0.025)	(0.023)	(0.022)	(0.022)	(0.025)	(0.024)	(0. 023)	(0.022)

Chile	**National Sample**				**Public Sample**				**Private Sample**			
Specification	**Md1**	**Md2**	**Md3**	**Md4**	**Md1**	**Md2**	**Md3**	**Md4**	**Md1**	**Md2**	**Md3**	**Md4**
Nonunion Variance	0.414	0.414	0.414	0.414	0.394	0.394	0.394	0.394	0.488	0.488	0.488	0.488
Union Variance	0.371	0.371	0.371	0.371	0.349	0.349	0.349	0.349	0.408	0.408	0.408	0.408
Total Variance difference	0.043	0.043	0.043	0.043	0.045	0.045	0.045	0.045	0.081	0.081	0.081	0.081
	(0.014)	(0.014)	(0.014)	(0.014)	(0.017)	(0.017)	(0.017)	(0.017)	(0.024)	(0.024)	(0.024)	(0.024)
Composition effect	0.022	0.017	0.011	0.019	0.017	0.022	0.013	0.021	0.061	0.063	0.054	0.056
	(0.005)	(0.005)	(0.006)	(0.007)	(0.005)	(0.007)	(0.007)	(0.008)	(0.012)	(0.012)	(0.014)	(0.014)
Wage Structure effect	0.021	0.026	0.032	0.024	0.029	0.024	0.032	0.024	0.020	0.018	0.026	0.024
Variance Diff due β's	-0.0002	0.017	0.015	0.013	-0.003	0.001	0.003	0.002	0.026	0.038	0.034	0.033
	(0.009)	(0.009)	(0.009)	(0.010)	(0.012)	(0.012)	(0.012)	(0.014)	(0.020)	(0.019)	(0.019)	(0.019)
Residual difference	0.021	0.009	0.018	0.011	0.032	0.023	0.029	0.023	-0.006	-0.020	-0.008	-0.009
	(0.011)	(0.010)	(0.010)	(0.009)	(0.012)	(0.012)	(0.011)	(0.010)	(0.017)	(0.014)	(0.013)	(0.013)

Note: All models include region and year fixed effects. The controls in each model are detailed as follows: Md1. demographics;

Md2. Md1+occupation; Md3. Md2+industry; Md4. Md2+Firm Size