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**On the Determinants of Changes in Wage  
Inequality in Bolivia**

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# **On the Determinants of Changes in Wage Inequality in Bolivia\***

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## **Abstract**

In recent years, Bolivia has experienced a series of economic and political transformations that have directly affected the labor markets, particularly the salaried urban sector. Real wages have shown strong increases across the distribution, while also presenting a decrease in inequality. Using an intertemporal decomposition approach, we find evidence that changes in demographic and labor market characteristics can explain only a small portion of the observed inequality decline. Instead, the results indicate that the decline in wage inequality was driven by the faster wage growth of usually low-paid jobs, and wage stagnation of jobs that require higher education or are in traditionally highly paid fields. While the evidence shows that the reduction in inequality is significant, we suggest that such an improvement might not be sustainable in the long run, since structural factors associated with productivity, such as workers' level of education, explain only a small portion of these wage changes.

**Keywords:** Bolivia, Decomposition, Wage Inequality

**JEL Classifications:** D63, I31, J31

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## 1. INTRODUCTION

Over the past decade, inequality in Bolivia has declined sharply, which was reflected in a Gini index fall from 0.62 (2000) to 0.47 (2012)<sup>1</sup>. This trend is not unique in the region, as many countries exhibited similar declines in inequality over the same period, especially after the second part of the decade (Lustig, Lopez-Calva, and Ortiz-Juarez, 2013; Gasparini and Lustig, 2011).

The existing literature suggests three explanations of these trends in inequality, which are also close to the Bolivian experience: improvements in the macroeconomic environment for developing countries, establishment of larger and better conditional cash transfer programs, changes in the structure of the labor market, and reduction in gender and race wage gaps (see Jiménez, 2012; Gray-Molina and Yañez, 2009). It is undeniable that labor markets play a key role in determining the evolution of inequality in Bolivia. In fact, there is compelling evidence from several countries that shows changes in labor income inequality are the most important determinants of the recent reduction in income inequality<sup>2</sup>, especially considering that labor income accounts for around 80 percent of total household incomes.

This paper aims to analyze which factors are driving the strong declines in labor income inequality experienced in Bolivia since 2000. Using household survey data from 2000 to 2012, we have analyzed trends in wage levels and distribution among salary workers in Bolivia. A generalization of the Oaxaca-Blinder decomposition proposed by Firpo, Fortin, and Lemieux (2007) is used to analyze how different factors may explain the changes observed in wage distribution over the past twelve years. Four lessons can be drawn from our results. First, we have found evidence suggesting that changes in demographic and labor market characteristics explain only a small (and insignificant) portion of the observed inequality decline. Second, most of the wage inequality decline can be explained by faster wage growth in the lower segment of the wage distribution compared to the higher segment. Third, upon closer look, the wage structure decomposition indicates that the fall in the returns on education and changes in the occupational/industry structure of the labor market have been the main contributors to the decline in wage inequality. Finally, there is a large portion of this decline that remains unexplained, which could potentially be linked to the rising minimum wage in Bolivia and other unaccounted factors. To the extent that the changes

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<sup>1</sup> UDAPE (2014) “Séptimo Informe de Progreso de los Objetivos de Desarrollo del Milenio en Bolivia.” Accessed January 15, 2015. <http://goo.gl/sjkBgD>

<sup>2</sup> For further evidence, see Azevedo, Inchauste, and Sanfelice (2013) and Gasparini and Lustig (2011).

in the returns to characteristics, particularly education and occupation, are driven by short term economic policies, these results suggest that improvements in inequality might not be sustainable in the long run.

Different explanations for the decline in wage inequality in Latin America have been offered. Lustig et al. (2013), Fortun-Vargas (2012), and Gasparini and Lustig (2011) suggest that the trends in wage inequality have been mainly driven by declining returns on education. Others, like Borraz and Pampillón (2011) and Bosch and Manacorda (2010), have attributed most of the decline in wage inequality to changes in the real minimum wage and to the strengthening of labor unions. Others, like Gray-Molina and Yañez (2009), have suggested that demographic changes, greater labor force participation, and (partially) educational improvements have significantly contributed to the decline in wage inequality. Finally, authors such as Snower (1998) and Chen, Snower, and Zoega (2003) have attributed the decline in wage inequality to a structural shift in occupations and industries caused by macroeconomic shocks.

We argue that changes in the labor market are key when examining wage inequality in Bolivia for a number of reasons: First, an increase in the size of the government has led to high levels of public job creation in the country despite a shortage of jobs in the formal private sector. This has contributed to a decline in Bolivia's unemployment rate along with a small reduction in the size of the informal economy. Second, Bolivia, one of the largest exporters of gas in the region, benefited from the increase in commodity prices, which has resulted in higher income and higher economic growth for the country. Third, the Bolivian government has implemented aggressive economic policies aiming to increase wages at the bottom of the wage distribution, mainly driven by increases in the minimum wage.

The Bolivian case is unique for a number of reasons. On one hand, Bolivia has undergone a number of significant political and economic changes<sup>3</sup> that began in 2006 with the election of Evo Morales Ayma, Bolivia's first indigenous and socialist president. The main characteristics of this government are an expansion of the public sector and the establishment of a more comprehensive social assistance system in the form of conditional cash transfers for the poor, particularly children, as well as direct transfers for certain demographic groups (e.g., the elderly and the indigenous) (Fundación Milenio, 2014; Durana, 2012). In addition, the significant increase in commodity prices (gas in particular) experienced over the past ten years has led to an increase in

<sup>3</sup>In 2009 Bolivia changed its name from Republica de Bolivia to Estado Plurinacional de Bolivia. To avoid confusion we are using the name Bolivia across the document.

disposable income in the country, which is reflected in better macroeconomic conditions as well as a sharp decline in poverty levels (see CEDLAS, 2009). Some empirical evidence (see Jiménez, 2012) argues that these changes have had a direct effect on labor market structure through a general equilibrium process that has led to reductions in wage inequality, especially in the formal market.

There is no conclusive evidence regarding the decline in wage inequality. However, some research, such as that conducted by Jiménez (2012), argues that the macroeconomic shocks that affected Bolivia have been the main explanation for the decline in wage inequality. Other evidence presented by Hernani-Limarino and Eid (2014) as well as Landa (2002) provides a similar explanation suggesting that the decline in education returns accounts for most of the wage inequality decline. These explanations are also supported by the evidence presented in this paper.

The rest of the paper is structured as follows: Section 2 briefly presents the trends in wage inequality in Bolivia. Section 3 introduces the data and methods used in the paper. Section 4 summarizes the main results, and Section 5 presents the conclusions and provides some policy recommendations.

## **2. A DECADE OF WAGE INEQUALITY**

Labor income, also referred to as wages, is one of the most important sources of household income. On average, they represent 87 percent of the average Bolivian household's income. Therefore, changes in the distribution of wages have a large impact on welfare across the population. As argued by CEDLAS (2009), changes in the labor income distribution have been the main contributor to the increase (1990s) and decline (early 2000s) in income inequality in the country.

Between 1995 and 2012, Bolivia went through many political and economic changes that led to changes in the labor market conditions and macroeconomic stability of the country.<sup>4</sup> During the period 1995 to 1999, Bolivia went through a series of privatization reforms (so-called “second-generation” reforms) in an attempt to follow the regional trend of increasing foreign private investment. The aim of these reforms was to increase the efficiency of newly privatized companies as well as to create jobs. At the end of the 1990s and the beginning of the next decade, Bolivia was affected by international crises such those in Asia, Mexico (at the end of the 1990s), and especially Brazil and Argentina (between 1999 and 2002), yet the economy did not fall into a

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<sup>4</sup>For a more comprehensive review of the labor market reforms in Bolivia, see Muriel and Jemio (2009).

deep recession during this uncertain period. While several studies have shown the limited positive effects of privatization in Bolivia, most of them concede that the reforms were effective in attracting foreign direct investment as well as increasing exports, but their results were limited in terms of job creation and inequality reduction.

With the election of President Morales in 2006, the new government decided to completely change the economic set up through several policies that aimed to directly affect formal labor markets. Initially, the government implemented a process of nationalization of strategic companies, which were previously privatized in the mid-1990s.<sup>5</sup> The government also increased the minimum monthly wage from 440 Bolivianos (US\$ 55) in 2005 to 1440 Bolivianos (US\$ 206) in 2014 as a strategy to increase people's wellbeing. In addition, higher taxes were implemented in the hydrocarbons sector to increase government revenues; there was a large increase in public sector spending; and an antidiscrimination law was implemented to reduce labor market discrimination towards indigenous populations.

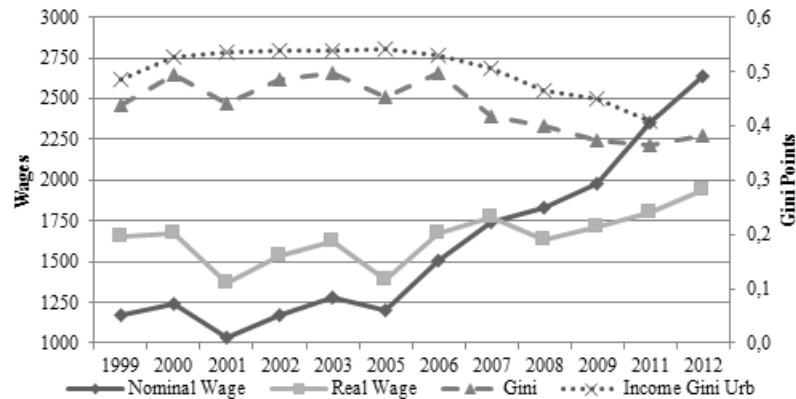
Under these circumstances, it is useful to understand the main trends in the labor markets in Bolivia. The delicate economic environment of the first half of the past decade (2000–05) had a profound impact on labor markets. Between 2000 and 2005, average nominal wages remained stagnant, but thanks to a fairly low rate of inflation, real wages did not deteriorate (Figure 1). Starting in 2006, rapid economic growth was observed, mostly spurred by the rise in commodity prices (mainly gas and minerals). Between 2005 and 2012, average nominal wages increased by nearly 120 percent, which, despite increasing inflation, provided positive growth of nearly 40 percent in average real wages since 2005.

This period of fast wage growth coincided with a sharp reduction in wage inequality. Before 2005, the wage Gini coefficient for salaried workers in the urban sector had hovered around 0.5. After 2005, following the rapid increase in the minimum wage as well as the implementation of other labor market reforms, the Gini coefficient fell to below 0.37 in 2009, remaining low during 2011 and 2012 (Figure 1). The decline in wage inequality can also be observed when looking at the income Gini coefficient for the total population in urban areas. While the income Gini shows a higher degree of inequality compared to the wage Gini, it also presents a similar trend, with substantial declines in inequality starting in 2007.

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<sup>5</sup>Many state-owned companies went through a capitalization process during the government of Gonzalo Sanchez de Lozada (1993 to 1997). This process transfer the ownership of 50 percent of many state companies to private parties.

Figure 1: Nominal and Real Wage Trends

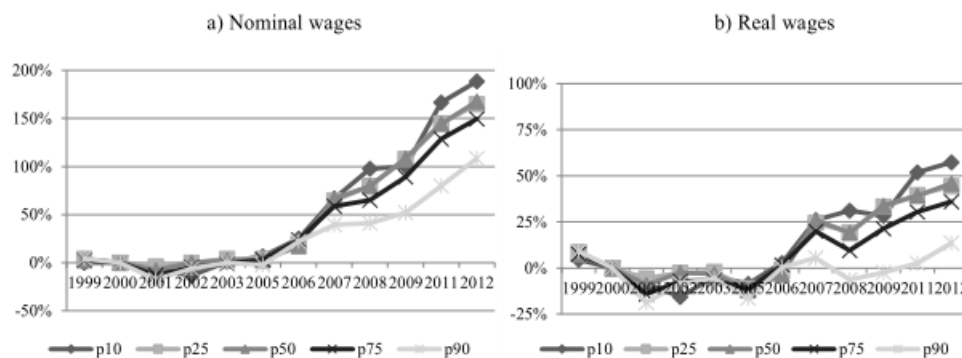


Source: Author estimations based on Household Surveys and Dossier UDAPE (2013).

*Note:* Real wages are deflated using 2007 as the base year. Average wages are estimated using workers in the urban waged and salaried sector only, applying survey weights.

The main factor explaining the decline in wage inequality was the asymmetric growth of wages across the whole wage distribution. Before 2005, wages across the whole distribution showed little, if any, changes compared to 2000 levels (Figure 2a), and small negative changes in real terms (Figure 2b). After 2006, while the bottom 75 percent of wages exhibited a similar increase in wage growth, wages at the top of the distribution showed much lower growth, exhibiting only a 15-percent growth compared to the 40-percent growth in the average real wage.

Figure 2: Trend of Nominal and Real Wages, Cumulative Growth Since 2000, Selected Percentiles



*Note:* Real wages are deflated using 2007 as the base year. Wage percentiles are estimated using workers in the urban waged and salaried sector only, applying survey weights.

### 3. DATA AND METHODOLOGY

#### 3.1 Data

This paper uses the publicly available and nationally representative household surveys collected annually by the National Institute of Statistics (INE) for the years 2000 through 2012.<sup>6</sup> While the sample design and the survey structure has changed over the years, making a year-by-year comparison difficult, the information can still be used to make inferences at the national level.

In order to provide a representative sample of the labor force at the national level, and improve comparability across years, the sample was restricted as follows. We included adults between 15 and 65 years of age who could be classified as a wage or salary worker at their primary jobs.<sup>7</sup> Given the volatility of the rural labor market, the sample includes workers in the urban sector only. Individuals classified as self-employed, employers, and family workers, as well as those working in the military, and extraterritorial organizations, were excluded from the sample. The final sample contained a total of 27,995 individuals across all years, which represents approximately 47 percent of the employed population between 15 to 65 years old in urban areas and 25 percent of the total employed population in Bolivia.

Given the purpose of the paper, wages were measured as monthly labor earnings from primary jobs, inclusive of tips, overtime, and commissions. Wages were measured in the local currency, adjusted for inflation using 2007 as the base year. In order to improve the sample size for our analysis, we divided the sample into four groups. The first two groups correspond to the years 2000–02 and 2003–06, which are denominated as the period before Evo Morales, and the last two groups of 2007–09 and 2011–12 cover the period of his presidency. While the corresponding pooled samples do not provide an exact picture of the labor market structure for any given year, they provide an adequate representation of the evolution and average characteristics within pooled years.

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<sup>6</sup>Until 2004, these surveys had been 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. Since 2004, the national statistical office, the Instituto Nacional de Estadísticas (INE), has independently carried them out. The surveys are typically collected in November and December of each year. The 2003/04 household surveys, however, were collected monthly from November 2003 through November 2004. In 2010, no information was collected. Data are available at the INE webpage, [www.ine.gob.bo](http://www.ine.gob.bo).

<sup>7</sup>Wage and salaried workers represent approximately 47 percent of the employed population in the urban labor market, while self-employed workers represent almost 34 percent. The remaining 19 percent is composed of workers who cannot be classified in either group, including family workers or apprentices, and household services.



Tables 1 and 2 provide a statistical summary of the demographic and labor market characteristics across year groups.<sup>8</sup> Based on these statistics, the demographic characteristics of the labor force have experienced some compositional changes. First, there has been an increase in female labor force participation, which reflected an increase in the percentage of women in the workforce from 31 percent to 36 percent. Similarly, the percentage of people in the workforce who are identified as indigenous (based on first language learned) decreased. At the same time, while there were no major changes regarding the age structure of the labor force, there was a small reduction in the percentage of younger workers in the labor market. In addition, there was a clear increase in average education level, particularly an observed decrease in the share of workers with less than a high school education (19.6 percent to 12.6 percent) and an increase in the share of workers with at least a college degree (16.1 percent to 25.1 percent).

Table 1: Statistical Summary: Demographics

	2000-2002	2003-2006	2007-2009	2011-2012
Sex				
Men	68.7%	68.2%	66.0%	63.7%
Women	31.3%	31.8%	34.0%	36.3%
Ethnicity				
Non Indigenous	79.1%	82.8%	86.7%	86.0%
Indigenous	20.9%	17.2%	13.2%	14.0%
Age				
15-19	7.8%	8.9%	7.7%	7.0%
20-29	36.2%	34.2%	33.9%	32.9%
30-39	26.0%	27.0%	28.3%	28.5%
40-49	19.9%	18.4%	17.9%	17.2%
50-59	8.8%	9.8%	10.1%	11.7%
60-65	1.3%	1.6%	2.2%	2.7%
Education				
Primary Education (1-6)	19.6%	18.0%	14.6%	12.6%
Secondary Education (6-11)	25.0%	23.3%	20.2%	18.8%
High School Finished	19.6%	21.6%	24.6%	22.4%
Some College	19.8%	18.4%	18.7%	21.0%
College or more	16.1%	18.7%	21.9%	25.1%
N	6,154	6,240	6,200	9,401

*Note:* Based on our own calculations using weighted averages for salaried workers in the urban sector, using survey expansion factors.

<sup>8</sup>All statistics are estimated using the survey expansion factors as weights.

Table 2: Statistical Summary: Labor Market

	2000-02	2003-06	2007-09	2011-12
Wage Level				
Less than 1 Min wage	17.4%	17.9%	9.9%	12.1%
1-2 min wages	34.3%	35.9%	25.2%	29.9%
2-3 min wages	20.7%	19.8%	25.5%	25.6%
More than 3 min wages	27.7%	26.5%	39.5%	32.5%
Private sector	75.0%	77.5%	75.8%	74.3%
Public sector	25.0%	22.5%	24.2%	25.7%
Industry				
Agriculture-Silviculture	3.6%	3.2%	2.5%	2.9%
Mining	1.9%	1.7%	2.1%	2.6%
Manufacture	17.9%	17.8%	15.6%	14.5%
Electricity, Gas & Water	1.3%	1.1%	0.7%	1.2%
Construction	11.3%	12.0%	12.6%	12.1%
Retail and repair	12.1%	12.1%	12.1%	13.2%
Food and hospitality	3.9%	4.4%	4.4%	5.5%
Transport	9.4%	10.5%	10.2%	8.5%
Financial services	2.0%	1.5%	2.2%	2.5%
Real State	5.4%	5.4%	5.3%	5.7%
Public Administration	7.6%	7.7%	9.3%	8.8%
Education	14.0%	12.5%	13.4%	12.8%
Social Services and Health	4.6%	4.7%	5.3%	5.9%
Other Services	5.1%	5.5%	4.2%	3.6%
Occupation				
Management	3.3%	3.5%	2.5%	3.3%
Professionals	12.5%	13.6%	16.4%	20.6%
Technicians and Support	13.8%	13.3%	14.7%	11.5%
Clerical workers	10.6%	9.5%	9.9%	9.5%
Services and Retail	11.9%	12.8%	14.0%	14.3%
Agriculture	1.2%	1.7%	0.7%	0.7%
Mining, construction and manufacture	24.9%	24.7%	22.5%	17.0%
Machine operators/installation	10.7%	10.6%	9.3%	8.6%
Unqualified/unskilled jobs	11.2%	10.3%	10.0%	14.5%
N	6,154	6,240	6,200	9,401

*Note:* Based on our own calculations using weighted averages for salaried workers in the urban sector, using survey expansion factors.

Regarding the labor market itself, there has been a sustained increase in average real wages, higher than the growth in minimum wages. Between 2000 and 2006, there were no significant changes in the percentage of workers per level of monthly earnings. In the last two periods, however, the percentage of people working for less than one minimum wage drastically decreased by about 7 percentage points while the percentage of people earning more than three times the minimum wage substantially increased. In terms of industry and occupation composition, while most industry and occupation categories have shown little change over time, there are two changes worth noting. The percentage of workers in the manufacturing industry has shown a significant decline in the past five years, falling overall by about 4 percent compared to the percentage from the 2000–02 period. With respect to occupation, the statistics show that the percentage of workers in manufacturing and technical support has decreased while the percentage of workers in professional occupations and jobs for unqualified workers has increased.

## 3.2 Methodology

To evaluate and decompose changes in inequality across time, we applied the methodology proposed by Firpo et al. (2007). This methodology is a generalization of the Blinder-Oaxaca decomposition approach (Blinder 1973; Oaxaca 1973), which allows one to extend the decomposition analysis to statistics other than the mean. This method has two steps. The first involves the construction of an appropriate counterfactual distribution with which the wage distribution can be compared across time, maintaining changes in worker and market characteristics. Subsequently, the constructed counterfactual wage distributions are used to obtain a decomposition of the inequality change of any statistic ( $v$ ) into portions explained by measured differences in worker and job characteristics (referred to as the “composition” effect) and by differences in the coefficients or “returns” on observables (the “wage structure” effect).

Although the counterfactual wage distribution cannot be observed directly, Firpo et al. (2007) show that under the assumptions of ignorability (conditional on measured covariates) and overlapping support of the covariates, it is possible to construct a counterfactual wage distribution that would be observed if the people living in period  $t_0$  (2000-02) had experienced the wage structure observed in period  $t_k$  (2011-12) ( $\hat{v}_{t_0,k}$ ). Firpo et al. demonstrate this using a reweighting procedure where any distributional statistic corresponding to the counterfactual distribution is estimated using observations from period  $t_0$  and a weight equal to  $\hat{\omega}_c(X) = \frac{\hat{p}(X)}{1-\hat{p}(X)}$ , where  $\hat{p}(X)$  is an estimated probability (propensity). The propensity score is estimated using a probit model, where the dependent variable is a dummy variable that takes the value 0 if the person was observed in the 2000-02 period and 1 if the person was observed in any other year. The explanatory variables include a vector of characteristics  $X$  that determine wages.<sup>9</sup> Once the counterfactual statistic is found, the overall wage decomposition can be estimated as follows:

$$\Delta v = v_{t_k} - v_{t_0} = \underbrace{(v_{t_k} - \hat{v}_{t_0,k})}_{\Delta S_v: \text{Wage structure effect}} + \underbrace{(\hat{v}_{t_0,k} - v_{t_0})}_{\Delta X_v: \text{Composition effect}} \quad (1)$$

where  $\Delta v$  is the overall intertemporal gap on the distributional statistic  $v$ ,  $v_{t_k}$  and  $v_{t_0}$  are the statistics corresponding to the observed wage distributions in time  $k$  and time 0, and  $\hat{v}_{t_0,k}$  is the estimated statistic of the counterfactual wage distribution, with characteristics fixed to time 0 and

<sup>9</sup>This set of variables includes age, age square, sex, ethnicity, education level, public-or private-sector employment, affiliation to labor unions, and dummy variables indicating industry and occupation classifications.

time  $k$ .

The second step uses the novel “recentered influence function” (RIF) regression to obtain an approximation of the contribution of each of the observed variables to the composition and wage structure effects.<sup>10</sup> RIF regression is similar to standard regression, except that instead of using the dependent variable directly, in this case  $\log(\text{wages})$ , it uses the recentered influence function of the statistic of interest associated with that observation  $RIF(w_{i,k}; v_{t_k})$ .<sup>11</sup> The RIF can be intuitively understood as a first-order approximation of the overall contribution that each observation makes to the estimation of the statistic of interest  $v$ . Once this RIF variable is estimated for each observation, it can be used to obtain a linear estimate of the average marginal effect each  $X$  has on the distributional statistic  $v$ . A linear approximation for the conditional expectation of the RIF is constructed in the form

$$E(RIF(w_i; v)|X) = X' \gamma \quad (2)$$

from which three sets of parameters are estimated:

$$\hat{\gamma}_k = (\sum X'_{i,k} X_{i,k})^{-1} \sum X'_{i,k} \widehat{RIF}(w_{i,k}; v_k) \text{ for } k = k, 0 \quad (3)$$

$$\hat{\gamma}_c = (\sum \hat{\omega}_c(X_{i,k}) \times X'_{i,k} X_{i,k})^{-1} \sum \hat{\omega}_c(X_{i,k}) \times X'_{i,k} \widehat{RIF}(w_{i,k}; v_c) \quad (4)$$

Here,  $\hat{\omega}_c(X_{i,0})$  is the implicit weight found in the first step. Using these parameters, we can define terms equivalent in spirit to an Oaxaca decomposition for any statistic  $v$ , thus providing a detailed decomposition of the wage structure and composition effects, shown below:

$$\Delta S_v = X'_k(\hat{\gamma}_k - \hat{\gamma}_c) \text{ and } \Delta X_v = (X_k \hat{\gamma}_c - X_0 \hat{\gamma}_0) \quad (5)$$

Using the familiar Oaxaca terminology, the left-side “wage structure” effect is the portion accounted for by coefficient differences, whereas the right-side “composition” effect is the portion accounted for by differences in endowments.

<sup>10</sup>Details on the procedures used in the decomposition can be found in Firpo et al. (2007; 2009).

<sup>11</sup>The functional form for the RIF functions corresponding to the statistics proposed in this analysis can be found in Firpo et al. (2007, pp. 22-24) and Fortin, Lemieux, and Firpo (2011, pp. 74-87).

## 4. RESULTS

As indicated above, the RIF regression decomposition can be used to analyze any statistic that describes changes in wage distribution. Given the interest of this paper in analyzing wage inequality changes over time, we implemented the procedure to analyze changes in the Gini coefficient and provide results across quintiles and selected interquintiles. The first statistic provides an overview of the change in income concentration across time, while the interquintiles provide a better picture of changes in inequality along the distribution.

### 4.1 Unconditional Quantile Regressions

To understand how wage structures in Bolivia have changed through time, Table 3 presents the unconditional quintile regressions for selected quintiles for the first and last periods in the analysis.<sup>12</sup> Overall, while wages for lower quintiles have increased by about 0.46 log points between 2000-02 to 2011-12 (about 58 percent), the observed wage growth at the highest quintile was only 0.08 log points (8 percent) for the same periods.

The estimated parameters provide some evidence regarding the trends of returns on different characteristics. The parameters related to age show that there has been a drop in returns on experience, particularly for people in the top of the wage distribution. The wage gap between men and women, while still large, is showing some reduction in the top and bottom of the distribution. Returns (or rather penalties) among indigenous people show important progress, with estimates suggesting that for the 2011-12 period, the wage penalties have practically been eliminated for low wages, although at the top of the distribution the indigenous wage penalty remains high.

Perhaps some of the most important changes are the changes in the return on education. Compared to workers with less than six years of formal education, all other levels of education have shown improvements on returns for people at the bottom of the wage distribution. Looking at the middle and top of the wage distribution, however, returns on a college education show a strong reduction, with moderate improvements for workers with less than a high school education.

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<sup>12</sup>The unconditional quintile regressions are estimated using the RIF regressions described above, which, for the case of quintiles, follow the strategy described by Firpo et al. (2009).

Table 3: Unconditional Quantile Regressions, Selected Quantiles

	Q10		Q50		Q90	
	2000–02	2011–12	2000–02	2011–12	2000–02	2011–12
<b>Quantile (Log real wages)</b>	6.007	6.461	6.962	7.336	8.058	8.133
Age	0.127* (0.015)	0.107* (0.008)	0.068* (0.006)	0.048* (0.004)	0.036+ (0.016)	0.006 (0.007)
Age <sup>2</sup>	-0.002* 0.000	-0.001* 0.000	-0.001* 0.000	-0.000* 0.000	0.000 0.000	0.000 0.000
Sex (female)	-0.462* (0.061)	-0.335* (0.036)	-0.268* (0.024)	-0.239* (0.017)	-0.242* (0.081)	-0.166* (0.030)
Indigenous	-0.279* (0.064)	0.019 (0.041)	-0.134* (0.030)	-0.025 (0.024)	-0.178* (0.067)	-0.137* (0.034)
Education						
Secondary Education (6-11)	-0.083 (0.076)	0.132+ (0.058)	0.056 (0.036)	0.120* (0.030)	-0.006 (0.063)	0.093+ (0.041)
High School Finished	0.180+ (0.073)	0.110◇ (0.058)	0.147* (0.042)	0.061+ (0.029)	0.119 (0.086)	0.078+ (0.037)
Some College	0.109 (0.091)	0.173* (0.064)	0.220* (0.046)	0.149* (0.032)	0.523* (0.119)	0.164* (0.044)
College or more	0.269* (0.086)	0.306* (0.065)	0.533* (0.051)	0.343* (0.036)	2.230* (0.216)	0.622* (0.060)
Public Sector (non Administrative)	0.149+ (0.060)	0.201* (0.045)	-0.023 (0.037)	0.128* (0.028)	-0.411* (0.122)	0.064 (0.060)
Union member	0.195* (0.044)	0.109* (0.027)	0.123* (0.028)	0.086* (0.021)	0.061 (0.096)	0.123* (0.043)
N	6154	9401	6154	9401	6154	9401

*Note:* The base group comprises workers in the private sector, non-unionized, with less than a middle school education, working in the transportation industry and a clerical occupation. Estimations are weighted using survey expansion factors. Bootstrap standard errors in parentheses. \*  $p < 0.01$ , +  $p < 0.05$  and ◇  $p < 0.1$

Table 3: Unconditional Quantile Regressions, Selected Quantiles (Continued)

	Q10		Q50		Q90	
	2000–02	2011–12	2000–02	2011–12	2000–02	2011–12
Industry (base Transportation)						
Agriculture	-0.145 (0.148)	0.249+ (0.119)	0.038 (0.065)	0.227* (0.056)	-0.256 (0.172)	0.238+ (0.103)
Mining	-0.074 (0.133)	0.243* (0.065)	0.170+ (0.082)	0.361* (0.051)	0.006 (0.329)	1.713* (0.150)
Manufacture	0.131 (0.087)	0.260* (0.063)	0.122+ (0.052)	0.089+ (0.036)	-0.031 (0.133)	0.137+ (0.062)
Electricity, Gas & Water	0.191◇ (0.102)	0.287* (0.098)	0.378* (0.117)	0.140◇ (0.083)	0.214 (0.327)	0.372+ (0.167)
Construction	0.469* (0.097)	0.494* (0.067)	0.247* (0.061)	0.407* (0.039)	-0.024 (0.151)	0.127◇ (0.066)
Retail and repair	-0.106 (0.114)	0.206* (0.070)	0.066 (0.054)	0.012 (0.037)	-0.147 (0.144)	0.009 (0.058)
Food and hospitality	-0.268 (0.166)	0.022 (0.106)	-0.088 (0.073)	0.002 (0.041)	-0.191 (0.173)	0.015 (0.060)
Financial services	0.034 (0.117)	0.433* (0.075)	0.290* (0.073)	0.249* (0.052)	0.839+ (0.365)	0.214◇ (0.126)
Real State	0.072 (0.108)	0.134 (0.086)	0.157+ (0.067)	-0.04 (0.041)	-0.046 (0.209)	-0.046 (0.069)
Public Administration	0.205+ (0.089)	0.444* (0.061)	0.279* (0.053)	0.217* (0.037)	0.241 (0.187)	0.045 (0.069)
Education	-0.089 (0.109)	0.066 (0.078)	-0.164* (0.061)	-0.247* (0.042)	-1.422* (0.202)	-0.604* (0.087)
Social Services and Health	0.098 (0.106)	0.221* (0.079)	0.099 (0.066)	-0.004 (0.044)	-0.381◇ (0.230)	-0.057 (0.089)
Other Services	-0.308+ (0.131)	-0.124 (0.115)	-0.05 (0.066)	-0.085◇ (0.050)	-0.266 (0.186)	-0.099 (0.074)
Occupation (base Clerical workers)						
Management	-0.181+ (0.091)	-0.003 (0.062)	0.084◇ (0.050)	0.304* (0.043)	2.476* (0.331)	0.909* (0.123)
Professionals	-0.113 (0.082)	-0.032 (0.053)	-0.065 (0.052)	0.243* (0.035)	0.913* (0.240)	0.388* (0.070)
Technicians and Support	-0.280* (0.084)	-0.182* (0.060)	-0.062 (0.044)	0.049 (0.034)	0.284◇ (0.157)	0.139+ (0.057)
Services and Retail	-0.256+ (0.101)	-0.267* (0.065)	-0.264* (0.051)	-0.143* (0.033)	-0.256◇ (0.147)	-0.003 (0.044)
Mining, construction and manufacture	-0.353* (0.096)	-0.177* (0.066)	-0.336* (0.052)	-0.026 (0.037)	-0.377+ (0.146)	-0.065 (0.054)
Machine operators/installation	-0.112 (0.090)	0.081 (0.063)	-0.164* (0.058)	0.106+ (0.042)	-0.424* (0.152)	0.102 (0.070)
Agriculture and Unqualified workers	-0.319* (0.114)	-0.195* (0.069)	-0.422* (0.050)	-0.230* (0.034)	-0.291+ (0.131)	-0.084◇ (0.043)
Constant	3.938* (0.282)	4.178* (0.187)	5.638* (0.114)	6.114* (0.080)	7.067* (0.293)	7.458* (0.122)
N	6154	9401	6154	9401	6154	9401

*Note:* The base group comprises workers in the private sector, non-unionized, with less than a middle school education, working in the transportation industry and a clerical occupation. Estimations are weighted using survey expansion factors. Bootstrap standard errors in parentheses. \*  $p < 0.01$ , +  $p < 0.05$  and ◇  $p < 0.1$

For the estimation of the impact of the market structure, industry and occupation, on wage levels, the transportation industry and clerical occupations are used as base group categories. Re-

garding labor market characteristics, there is a strong increase in the returns on working in the public sector (excluding public administration) across the wage distribution, especially at the top. In contrast, the premium associated with working in public administration has declined in particular for wages at the top of the distribution. The industry parameters suggest that, compared to transportation, all industries have shown gains in wage premiums across the wage distribution, with the exception of real estate, food and hospitality, and financial services. Similarly, regarding occupations, while improvements are observed across most occupations and wage distributions, at the very top, the returns among management and professionals have experienced a sharp drop.

Based on the estimated constants for all of the models shown in Table 4, it is important to note that there has been little change in the base wage at the top and bottom of the wage distribution, as seen in the constant. Around the middle of the wage distribution, however, the base wage seems to have experienced the largest change across time.

## **4.2 Decomposition**

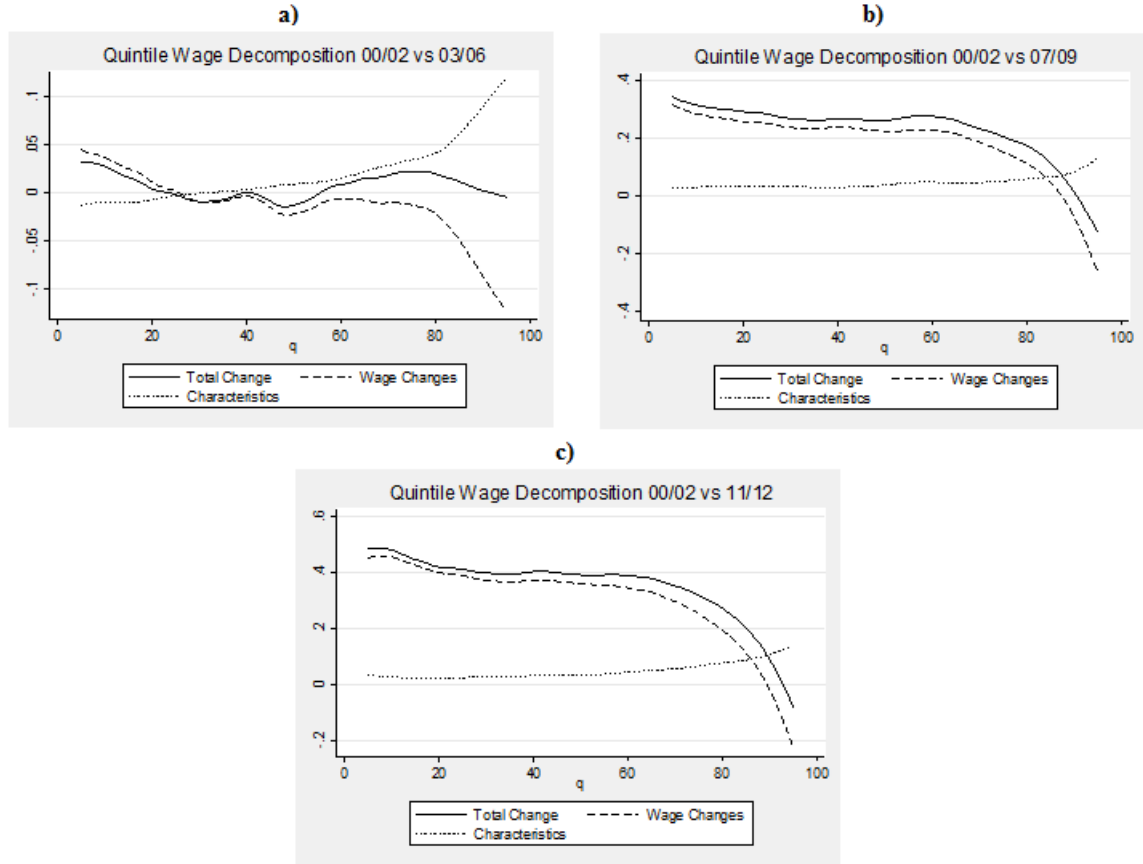
Figure 3 provides a first look at wage decomposition across time. Panel A presents the overall decomposition of wage changes between 2000–02 and 2003–06. As expected, there has been little change in real wages across the distribution. The aggregate decomposition shows that the changes in the returns to characteristics have had little if any effect on wages for most of the distribution. The results also suggest that, at the top of the distribution, there was an early tendency of reducing returns on endowments. The change in endowments, however, was large enough that it compensated for the fall in returns, translating to a virtually unchanged wage distribution between 2000 and 2006.

The 2000–02 to 2003–06 and 2007–09 to 2011–12 periods show similar trends regarding the aggregate wage decomposition. On the one hand, the observed improvements in workers' characteristics explain only a small fraction of the wage improvements observed across these years, except for workers at the top of the wage distribution. On the other hand, while the returns on observed characteristics (wage structure changes) had a rather homogenous improvement across most of the wage distribution, the change has been smaller and even negative at the very top of the distribution. This suggests that the inequality improvements observed across time have been mainly driven by changes in the wage structure, not by improvements in endowments. Similar results were also found by Landa (2002), when analyzing the increase in wage inequality be-



tween 1989 and 1999. The results regarding the first two periods are also similar to Gutierrez (2008), where the author presents evidence that the wage structure effect, for the 1999–2005 period, slightly improved wage inequality.

Figure 3: Aggregate Quintile Wage Decomposition, 2000–2002



*Note:* The information corresponds to the smoothed contributions of the wage structure and characteristics changes to the total wage change between 2000 and 2002 and other periods.

Rather than looking at each individual quintile, it is more informative to implement the decomposition on statistics such as the Gini coefficient and interquintile differences (Table 4). As shown above, between 2000–02 and 2003–06, there was almost no change in wage inequality, with only small differences in the interquintile gaps.

Comparing the base period to the 2007–09 and 2011–12 periods, the Gini coefficient decreased by 0.08 and 0.1 points, respectively. Because wages across most of the distribution experienced similar growth, the interquintile estimations show that the improvements can be explained by a reduction in the gap at the top of the distribution. As suggested by the unconditional quintile

regressions, these results also indicate that all the inequality improvements have been caused by changes in the wage structure and that changes in worker and market characteristics have played a marginal role in decreasing the wage gap.

Table 4: Wage Inequality Decomposition, Selected Statistics

	Gini			q10-q90		
	03-06	07-09	11-12	03-06	07-09	11-12
2000/02	0.487	0.487	0.487	2.050	2.050	2.050
Other period	0.490	0.398	0.370	2.045	1.766	1.672
Total Change	0.003 (0.013)	-0.089* (0.009)	-0.117* (0.008)	-0.005 (0.065)	-0.284* (0.052)	-0.379* (0.046)
Change on Wage Structure	-0.021◇ (0.012)	-0.104* (0.010)	-0.138* (0.008)	-0.123+ (0.059)	-0.329* (0.052)	-0.450* (0.049)
Change on Characteristics	0.024* (0.005)	0.015* (0.004)	0.021* (0.003)	0.118* (0.042)	0.044* (0.009)	0.072* (0.021)
N	12,394	12,354	15,555	12,394	12,354	15,555
	q10-50			q50-q90		
	03-06	07-09	11-12	03-06	07-09	11-12
2000/01	0.955	0.955	0.955	1.096	1.095	1.095
Other period	0.941	0.913	0.846	1.105	0.853	0.796
Total Change	-0.014 (0.030)	-0.042◇ (0.024)	-0.079* (0.022)	0.009 (0.062)	-0.242* (0.046)	-0.299* (0.043)
Change on Wage Structure	-0.033 (0.039)	-0.046◇ (0.024)	-0.101* (0.027)	-0.090◇ (0.049)	-0.283* (0.045)	-0.349* (0.048)
Change on Characteristics	0.019 (0.021)	0.004 (0.013)	0.022 (0.017)	0.099* (0.032)	0.041+ (0.016)	0.049* (0.016)
N	12,394	12,354	15,555	12,394	12,354	15,555

Note: Bootstrap Standard errors in parentheses. \*  $p < 0.01$ , +  $p < 0.05$  and ◇  $p < 0.1$ .

To better understand which factors are driving the observed changes in the wage structure, Table 5 presents the detailed decomposition of the Gini coefficient with respect to all worker and market characteristics. As described before, there was an important decrease in the Gini coefficient between the 2000–02 and 2011–12 periods, most of which can be attributed to changes in the wage structure.

Among other factors, while the gender gap has shown some reduction along the wage distribution, the Gini decomposition shows that these changes have increased wage inequality by 0.008 points between the first and last periods of the analysis. The reduction of the wage gap between indigenous and non-indigenous people, however, has been large enough to contribute to a decline

in inequality (0.009). In contrast, the changes in the levels of participation among women and indigenous people in the labor market have created increased wage inequality. Regarding education, the systematic decline in returns on education, particularly for workers with some college and a college degree, has been one of the most important factors contributing to the decline of the Gini coefficient (0.032 points). The increasing share of workers with college education, however, has contributed to a small increase in wage inequality.

In contrast with expectations, the increase in the wage associated with working in the public sector has no effect on wage inequality. Regarding the benefit of being unionized, while unions have reduced wage inequality on average (Rios-Avila and Hirsch, 2014), the evidence shown here indicates that across time, the changes in union wage benefits have contributed to an increase in wage inequality (0.015).

Finally, changes on returns of working in specific industries have had an insignificant effect on wage inequality in the aggregate. On the other hand, the decline in wages among occupations such as management, professional jobs, and technology has contributed to a strong decline in inequality (0.06 points). Still, the increase in the percentage of professionals in services and retail had a small positive contribution to inequality.

Table 5: Wage Inequality, Detailed Decomposition (Gini)

	00/02 vs 03/06		00/02 vs 07/09		00/02 vs 11/12	
	Wage Structure	Comp	Wage Structure	Comp	Wage Structure	Comp
Total	-0.021◇ (0.012)	0.024* (0.005)	-0.104* (0.010)	0.015* (0.004)	-0.138* (0.008)	0.021* (0.003)
Demographics						
Age	0.138 (0.212)	-0.004 (0.004)	-0.072 (0.181)	-0.014+ (0.006)	0.051 (0.154)	-0.024* (0.005)
$Age^2$	-0.040 (0.118)	0.006 (0.005)	0.061 (0.094)	0.015* (0.006)	-0.020 (0.080)	0.026* (0.005)
Sex (1 = <i>Woman</i> )	-0.011 (0.007)	0.000 (0.000)	0.004 (0.008)	0.001 (0.001)	0.008 (0.007)	0.002* (0.000)
Indigenous	-0.010* (0.004)	0.001+ (0.000)	0.002 (0.005)	-0.002 (0.002)	-0.009+ (0.004)	0.002* (0.001)
Education						
Sec. Education (6-11)	-0.004 (0.004)	0.000 (0.000)	0.004 (0.005)	-0.001 (0.001)	-0.004 (0.005)	0.000 (0.001)
High School Finished	0.007 (0.006)	0.000 (0.000)	0.011◇ (0.006)	0.002 (0.001)	0.002 (0.005)	0.000 (0.000)
Some College	0.004 (0.008)	0.000 (0.000)	0.004 (0.007)	0.000 (0.000)	-0.005 (0.006)	0.000 (0.000)
College or more	0.013 (0.009)	0.008* (0.002)	-0.019* (0.007)	0.007* (0.001)	-0.032* (0.008)	0.006* (0.002)
Public Sector (non-administrative)	-0.019◇ (0.010)	0.006+ (0.003)	0.014 (0.010)	0.000 (0.001)	0.011 (0.007)	0.000 (0.000)
Union	0.013 (0.010)	0.000 (0.001)	0.002 (0.008)	0.001 (0.001)	0.015+ (0.006)	0.000 (0.000)
Industry	0.001 (0.003)	0.008 (0.049)	0.002 (0.002)	-0.022 (0.052)	0.028 (0.034)	0.005 (0.003)
Occupation	0.003 (0.002)	-0.303 (0.309)	0.005* (0.002)	-0.016 (0.028)	-0.048+ (0.021)	0.006* (0.001)
Constant	-0.089 (0.106)		-0.076 (0.102)		-0.137 (0.088)	
Error		0.004 (0.002)		0.000 (0.002)		0.000 (0.002)
N	12,394		12,354		15,555	

*Note:* The base group comprised workers in the private sector, non-unionized, with less than a middle school education, working in the transportation industry and a clerical occupation. Bootstrap standard errors in parentheses. \*  $p < 0.01$ , +  $p < 0.05$  and ◇  $p < 0.1$ . Industry and occupation report aggregated effect of all industry and occupation dummies wage structure and composition effect.

### 4.3 Beyond the Formal Labor Market: Self-employed Workers and Market Opportunities

In the previous section, we presented and analyzed the decomposition of the evolution of wage inequality within the wage and salaried labor market. While wages in this segment of the labor market can be most directly affected by policies in the labor market, they represent only a fraction of the urban labor force (47 percent), although its share has increase in 4 percentage points during the period analyzed. To provide a more complete view of trends in labor income inequality, this section provides a brief overview of the changes in inequality for self-employed workers. The self-employed labor market has unique characteristics that differentiate it from the wage/salaried labor market. On the one hand, earned income is lower on average, but its inequality is much larger compared to that among salaried workers (Gini of 0.54 vs. 0.48 in the formal market). In addition, while the salaried market can be directly affected by labor/wage changes via employment contracts, the self-employed market lacks contracts that would otherwise regulate wages and employment. In this sense, one might expect the evolution of labor income inequality in the self-employed to be less sensitive to wage economic policies.

In Table 6, we present the decomposition of the Gini index and interquintile differences in wages for self-employed workers in urban areas, using the same specifications as those used in the previous sections. Different from salaried workers, between the first and second periods, wage inequality showed a significant, albeit small, decline in inequality, with a fall of 0.03 Gini points. In the salaried market, comparing the first period to the 2007–09 period, a large decline in inequality was observed, with very little progress among the self-employed. Only when comparing Gini changes with respect to the last period (2011–12) can we see an important reduction in inequality, fully explained by changes in the market wage structure.

The estimations regarding the interquintile gaps also tell a different story compared to the salaried market. In the salaried market, there were small, if any, improvements closing the wage gap in the lower part of the wage distribution (q10–q50), while most of the inequality improvements were explained by a reduction in the upper section of the wage distribution (q50–q90), which was observed in the later periods. In the self-employed market, the estimates indicate that wage inequality was reduced by closing the wage gap both in the upper and lower sections of the wage distribution. This economic structure change, however, had a delayed impact on wage

inequality, and its effects could not be observed until the later years (2011–12). The changes in characteristics across years had a negligible effect on the trends in inequality.

Table 6: Wage Inequality Decomposition for Self-employed Workers, Selected Statistics

	Gini			q10-q90			q50-q90		
Alternative year:	03/06	07/09	11/12	03/06	07/09	11/12	03/06	09/12	11/12
Index in 2000/01	0.535	0.535	0.535	1.597	1.597	1.597	1.180	1.180	1.180
Index in Other period	0.503	0.505	0.454	1.397	1.420	1.316	1.098	1.134	0.976
Total Change	-0.032+	-0.029+	-0.080*	-0.199*	-0.177*	-0.281*	-0.082	-0.046	-0.204*
	(0.014)	(0.013)	(0.012)	(0.047)	(0.050)	(0.050)	(0.052)	(0.042)	(0.043)
Change on Wage Structure	-0.036*	-0.029+	-0.078*	-0.189*	-0.164*	-0.278*	-0.089◇	-0.058	-0.236*
	(0.014)	(0.013)	(0.013)	(0.046)	(0.060)	(0.062)	(0.049)	(0.049)	(0.045)
Change on Characteristics	0.004	0.000	-0.003	-0.01	-0.012	-0.003	0.007	0.012	0.032
	(0.003)	(0.004)	(0.005)	(0.017)	(0.030)	(0.039)	(0.019)	(0.021)	(0.024)
N	11,758	9,07	11,553	11,758	9,07	11,553	11,758	9,07	11,553

*Note:* The sample includes self-employed workers in the urban area only. Bootstrap standard errors in parentheses.

\*  $p < 0.01$ , +  $p < 0.05$  and ◇  $p < 0.1$ .

## 5. CONCLUSIONS

Contrary to the trend in the developed world, Latin American countries have shown a sharp decline in wage inequality during the past decade (2000–12). Bolivia has also experienced this decline, especially in the second part of the past decade. Using the methodology of RIF regression decomposition, we found that after 2006, wages increased across the wage distribution, with the largest changes observable at lower quintiles. This may be related to legislation, such as increases in the minimum wage as well as anti-discrimination policies.

Among other factors, we find that there has been a sharp reduction in returns on higher education at the top of the distribution, as well as increases for returns for low educated workers, which has contributed to the decline of wage inequality. Similarly, wages in occupations with traditionally highly paid jobs have consistently decreased, further contributing to the wage inequality decline. It is possible that the observed changes in inequality are related to increases of the minimum wage, which have multiplicative effects on public-sector wage rates due to salary structures. While these changes have contributed to the decline of wage inequality, improving the earnings of those with otherwise low incomes, the decline in returns on higher education might

create incentives for educated workers to look for better job opportunities, leading to potential emigration (brain drain).

A lesson from the decompositions is that most of the changes occurred during the second part of the decade in question (2005–12). This implies that a combination of economic policies and favorable macroeconomic conditions have been successful in reducing wage inequality in urban areas in Bolivia. It remains to be seen, however, if these improvements are long lasting, since the reduction in labor income inequality has not been accompanied by improvements in workers' characteristics (education, experience, and skill). Although improvements in the working conditions (wages) of the most vulnerable populations is an important step toward reducing income inequality, to the extent that these changes are not accompanied by equal gains in workers' productivity, the reductions in inequality might not be sustainable in the long run.

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