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UNEXPLAINED WAGE GAPS IN THE TRADABLE AND NONTRADABLE SECTORS: CROSS-SECTIONAL EVIDENCE BY GENDER IN BOLIVIA

BRECHAS SALARIALES NO EXPLICADAS POR GÉNERO EN LOS SECTORES TRANSABLES Y NO TRANSABLES: EVIDENCIA TRANSVERSAL PARA BOLIVIA

Oscar Molina-Tejerina[1] y Luis Castro-Peñarrieta[1,2]
[1] *Centro de Investigaciones Económicas y Empresariales*
Universidad Privada Boliviana
[2] *Centro de Investigación y Docencia Económicas, A.C.*
oscarmolina@upb.edu
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ABSTRACT

This document analyzes the gender wage gap between in tradable and non-tradable sectors. The tradable sector is defined by the value of exports and imports in an industry based on the four-digit codes of the International Standard Industrial Classification. Based on Gary Becker's work, in an economy prone to discrimination against women, the document proposes a model from which discrimination is possible if companies generate supra-normal profits. These benefits will be determined by market power, which in turn depends on the number of companies participating in the industry, so under the assumption that tradable sectors are directly influenced by international trade and with the possibility of greater competition, this competition will generate a trend towards normal benefits, making it impossible to finance discrimination against women, so the wage gender gap should be lower in tradable than non-tradable sectors. Using the traditional Oaxaca-Blinder decomposition and the Oaxaca-Blinder decomposition with Recentered Influence Function (RIF) regressions for the 2013 Household Survey, we find that unexplained wage differences against women are significantly lower in the tradable sector, suggesting that the impact of international trade on the tradable sector helps to reduce the gender wage gap in Bolivia.

Keywords: Bolivia, Decomposition, Gender, Inequality, Oaxaca-Blinder, RIF Regression, Wage.

RESUMEN

El presente documento analiza la brecha salarial entre hombres y mujeres en los sectores transables y no transables. El sector transable se define por el valor de las exportaciones e importaciones en una industria con base en los códigos de cuatro dígitos de la Clasificación Industrial Internacional Uniforme de todas las actividades económicas. A partir de los planteamientos de Gary Becker, en una economía con propensión a la discriminación hacia las mujeres, el documento propone un modelo a partir del cual la discriminación es posible si las empresas generan beneficios supra normales. Estos beneficios estarán determinados por el poder de mercado, que a su vez depende del número de empresas que participan en la industria, es así que bajo el supuesto de que los sectores transables se ven directamente influenciados por el comercio internacional y con la posibilidad de mayor competencia, esta competencia generará una tendencia hacia beneficios normales, imposibilitando financiar la discriminación hacia las mujeres, por lo que las diferencias salariales por género deberían ser menores en los sectores transables que los no transables. Utilizando la descomposición tradicional de Oaxaca-Blinder y la descomposición de Oaxaca-Blinder con Regresiones de Funciones de Influencia Recentrada (RIF) para la Encuesta de Hogares del 2013, los resultados muestran que las diferencias salariales no explicadas contra las mujeres son significativamente menores en el sector transable, sugiriendo que el impacto del comercio internacional sobre el sector transable ayuda a disminuir las brechas salariales por género en Bolivia.

Palabras Clave: Bolivia, Descomposición, Género, Desigualdad, Oaxaca-Blinder, Regresión RIF, Salario.

1. INTRODUCTION

One of the most recent large fields in economic research is related to the gender wage gap, which has a long history: Smith (1776), Mill (1869), Mill (1877), Mill (1884), and Becker (1971) [1-5] analyzed it from an economic perspective. A study of these differences in a country is important because of its large impact on global inequality.

Becker (1971) [5] states that an increase in competition tends to narrow wage gaps because it reduces discriminatory incentives. One aspect examined in Becker's theoretical model is discrimination against women, which has long been present in many economies.

Molina (2011) [6] proposes a variation on Becker's theoretical model, separating the tradable and nontradable sectors. International trade affects primarily the tradable sector, and the model suggests that gender-based wage gaps are lower in the tradable sector than in the nontradable sector; under conditions of extreme competition, it is even plausible that wage differences could disappear in the tradable sector.

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Bolivia is one of the most unequal and poorest countries in the Americas. This inequality takes multiple dimensions, among them geographic, ethnic, economic, and gender. As in other developing countries, in Bolivia inequality has not noticeably declined. Many sorts of inequality emerged with the arrival of globalization, which has had supporters and detractors since it began.

Given the different political and academic views about globalization, attention has been focused on the relationship between trade liberalization, poverty, and inequality—among which one that is often studied is that based on gender. In developing countries, many programs have been implemented to address poverty and inequality, as they are the priority at international agencies as Word Bank or Inter-American Development Bank.

According to official data in 2013, 39% of Bolivians, numbering 4,060,277 people, were poor (approximately less than 1.9 dollars a day); Bolivia's Gini index for that year was 0.45.[1] As one of the poorest countries in the Americas, Bolivia was one of the first to implement the liberalization policies recommended by the Washington Consensus in the 1980s. These reforms affected the country's commercial strategy, which included a substantial reduction in artificial trade barriers.

As mentioned by Canavire-Bacarreza and Rios-Avila (2017, 465) [7]: Different explanations for the decline in wage inequality in Latin America have been offered. Lustig, López-Calva, and Ortiz-Juarez (2013), Fortun-Vargas (2012), Gasparini and Lustig (2011) and López-Calva and Lustig (2010) [8-11] 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) [12, 13], 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) and Eid and Aguirre (2013) [14, 15], 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), Cornia (2014) and Cord et al. (2014) [16-19] have attributed the decline in wage inequality to a structural shift in occupations and industries caused by macroeconomic shocks.

Research on gender inequality focuses on one of the most important variables in economic analysis—wages—as well as the main reasons for the current wage gaps. Therefore, it is worth studying whether an increase in competition, due to an increase in international trade, reduces discrimination against women in a country in which cultural values tend to perpetuate this discrimination.

We test whether unexplained wage gaps are lower in the tradable sector because it is influenced by international trade and has less opportunity to pay different salaries because the benefit of doing so could tend toward zero. Using household survey data in Bolivia from 2013, we analyze unexplained wage gaps by gender. This survey is the latest one that distinguishes the tradable and nontradable sectors by their four-digit codes in the International Standard Industrial Classification (ISIC) of All Economic Activities, which enable us to have enough variation in the data.

The rest of the paper is organized as follows. Section 2 summarizes the relevant literature and empirical studies about the gender wage gaps and their relation to variables related to international trade; in addition, we explain the proposed model. Section 3 describes the methodology; section 4 presents the results; and section 5 offers our conclusions.

2. GENDER WAGE GAPS: THEORY AND EMPIRICAL EVIDENCE

For families in developing countries, income through the labor market is the most important resource; in addition, wages offer insights into a family's welfare and economic activity. The emphasis on the labor market is justified by its role as a bridge between economic actors and their living standards, as stated by Horton et al. (1991) [20].

A high degree of inequality between men and women is seen in wages. The gender wage gap has been extensively documented. According to Bøler et al. (2018) [21], women earn less than men, even after controlling for observable characteristics. Blau and Kahn (2017, 791-792) [22] show that, even though the gender wage gap declined in the US in 2010, it is still present in the labor market.

One theoretical approach used to understand wage gaps is the Heckscher-Ohlin/Stolper-Samuelson model (1941) [23] developed in Krugman and Obstfeld (2002) [24]; they conclude that trade liberalization can decrease the wage gap between men and women in developed countries.

The second approach is Becker's (1971) [5] discrimination-based theoretical model, which explains the negative correlation between international trade and gender wage gaps. It also shows that international competition might eliminate companies' windfall profits, thus preventing them from paying different salaries to women and men who have the same level of education and skills. Thus, firms that engage in trading experience an increase in competition, which reduces employers' tendency to discriminate by gender.

Becker (1971) [5] states that trade liberalization can affect wages by changing the relative demand for different types of workers. Based on his results, many studies such as Artecona an Cunningham (2002), Black and Brainerd (2004), Fontana et. al. (1998), Hellerstein et. al. (1997) and Molina and Bobka (2016) [25-29] state that international trade tends to increase competition and reduce discrimination and preference for a certain type of workers, including discrimination against women. Other studies, for example, Berik et. al. (2004), Black and Strahan (2001), Menon and Van der Meulen

[1] Bolivian National Statistics Institute: https://www.ine.gob.bo/

Rodgers (2009) and Seguino (1997) [30-33] claim that an increase in competition could reduce negotiating power for workers, especially women.

Becker's theoretical model has been challenged by studies on the US, where Hellerstein et al. (1997) [28] and Black and Strahan (2001) [31] find greater wage gaps between men and women in regulated markets and smaller gaps when these markets are deregulated.

Moreover, participating in trading could have a positive as well as a negative effect on gender wage gaps. Many factors—including resource allocation, labor market institutions, systems of property rights, and socioeconomic characteristics—should be considered (Fontana 2009) [34].

One important aspect is whether international trade increases labor opportunities for women more than for men. Over the past few years (1970-1990, 535)., women's participation in paid work has increased in the majority of countries according to Mehra and Gammage (1999) [35]. Many studies focus on manufacturing, because the ease of access to data on it. These studies show that liberalization has increased the number of female employees in manufacturing, especially in developing countries. Using data from 1960 to 1985, Wood (1991) [36] shows a strong relationship between an increase in exporters and an increase in the number of jobs held by women in manufacturing, and similar results were found by Standing (1999) [37].

However, the relationship between trade liberalization and the gender wage gap is not fully understood in the context of the tradable and nontradable sectors. For example, Cagatay (2001), Beneria and Lind (1995), and Fontana et al. (1998) [38, 39, 27] show a negative relationship between gender wage gaps and international trade. Although it is important to consider the scarce and controversial literature on these relationships, it is not possible to find data that allows us to filter the effects of liberalization from other effects.

Empirical evidence shows that international trade benefits certain groups of women. For example, Black and Brainerd (2004) [26] show an increase in the female labor force in high-profit manufacturing, and Fontana et al. (1998) [27] note an increase in demand for services (in which there is a strong female presence, especially in Latin America). These results suggest that the benefits of international trade depend on several conditions, such as a country's industrial structure and level of trade liberalization.

Using data on Taiwan and South Korea (1980-1999), Berik et al. (2004) [30] examined the impact of some trade-related measures on the gender wage gap. Their analysis suggests a positive relationship in both countries between the degree of international competition in concentrated industries and the gender wage gap, obtaining results that differ from those of Becker (1971) [5].

Black and Brainerd (2004) [26] study changes in the residual gender wage gap in the US from 1976 to 1993, comparing the results between concentrated and competitive industries. They conclude that an increase in competition due to international trade has improved women's relative wages in concentrated industries.

Oostendorp (2002) [40] examines the relationship between globalization and the gender wage gap with data on the 161 jobs defined in 1983 and 1999 by the International Labour Organization. The main result of this empirical analysis is a negative relationship between the gender occupational wage gap and the per-capita gross domestic product, but they did not find evidence on a reduction in the gap due to trade.

Artecona and Cunningham (2002) [25] found a significant wage gap between industries in Mexico that participated in international trade and those that did not. Fleck (2001) [41] shows that, in the Mexican maquila (assembly) sector, the wage gaps vary across industries. Ghiara (1999) arrives at conclusions similar to those of Artecona and Cunningham (2002) [25] in a study emphasizing the differences in the impact on skilled and unskilled women. He concludes that, although conditions have improved for skilled women in the services sector (nontradable), they have declined for unskilled women in manufacturing (tradable).

Using data on Taiwan and Korea from 1981 to 1992, Seguino (1997) suggests that wage gaps are related to differences inflows of foreign direct investment in both countries, showing that women are more vulnerable to losing wage negotiating power in Taiwan, and in Korea, companies with less capital mobility remain competitive using other strategies, such as technological as well as quality improvements in a product. Finally, the study suggests that gender wage gaps have fundamentally narrowed since 1990, because of an excess supply of female workers. Based on these studies, it is possible to assert that discrimination has apparently decreased, but the wage gap may have increased, mainly because of segregation at the industry.

More recent studies on the subject include Menon and Van der Meulen Rodgers (2009) [32] and Ma and Dei (2009) [43]. The first examines how trade liberalization has affected relative wages for men and women in India; combining databases from 1983 to 2004, it shows that the increasing liberalization of trade is associated with wider wage gaps in concentrated manufacturing. The second examines a quality differentiation model for China, concluding that when a tariff on products with different levels of quality is reduced, welfare inequality and wage inequality change in opposite directions.

Moreover, research on changes in gender wage gaps as a consequence of international trade, in particular trade liberalization, tend to focus on manufacturing in developing countries, but informal sectors tend to be excluded because of limitations associated with the lack of data.

As mentioned in Fontana (2009) [34], wage information for men and women is not disaggregated to account for skill levels, and the effects of an expansion of trade on relative wages for women are not direct theoretically; therefore, it is not possible to arrive at a general conclusion from the new studies available.

These particularly varying patterns between regional and sectoral results support the hypothesis that resource endowments and systems of property rights determine the opportunities for women.
Additionally, culture determines that many responsibilities fall entirely onto women, as suggested in the results by Newman on Ecuador (2001) [44], Kusago (2000) [45] on Malaysia, and Katz (1995) [46] on Guatemala. On the one hand, many kinds of work are traditionally associated with women but do not promise long-term opportunity. Standing (1999) [37] emphasizes the growing flexibility and vulnerability of labor conditions in trade-oriented industries. On the other hand, Tzannatos (1999) [47] and Mehra and Gammage (1999) [35] find a reduction of gender segregation in the past few years; however, discrimination continues in work that require low skill and pays low wages, which suggests a reduction in horizontal segregation. By contrast, Paul-Majumder and Begum (2000) [48], in studying Bangladesh, and Fleck (2001) [41], looking at Mexico, suggest that segregation remains, and women in these countries have better jobs than men.
Raynolds (2002) [49], using agricultural data in the Dominican Republic, indicates that the expansion of nontraditional agriculture has increased women's ability to negotiate their labor rights, enabling them to obtain higher wages, a result that differs from those by Katz (1995) [46] for Guatemala, Von Braun (1995) [50] for Kenya, and Dolan (2001) [51] for Uganda. Molina and Bobka (2016) [29] examine agriculture in Bolivia, showing evidence that wage differences between men and women in agriculture are reduced by participating in the tradable sector.

2.1 Discrimination and Wage Gaps in Bolivia

The first work related to discrimination and trade in Bolivia was by Molina (2011) [6], who used the Instituto Nacional de Estadística (INE)'s national household survey for 2002 to extend Becker's theoretical model. Following the same line, De Ferari (2012) [52] analyzed an application of the work by Molina (2011) [6]. However, it is possible to find studies that analyze discrimination. Andersen *et al*. (2003) [53] studied ethnic discrimination in Bolivia, in particular, pre-market segregation (when a certain group of people do not have access to the acquisition of human capital in the same conditions as others) and post-market (when the individual finds a place in the workforce). The results show that, when educational quality is controlled for, rural areas have no ethnic discrimination. In urban areas, discrimination seems to be explained mainly by occupational segregation, in which indigenous people are in sections of the labor force characterized by lower income, which shows a reduction in ethnic discrimination due to improvements in education. Villegas and Núñez (2005) [54] show that discrimination in the Altiplano is too low to explain income differences, while in the lower and upper valleys, discrimination is more important than productivity differences among workers.
Escalante (2004) [55] presents an application of the human capital investment return model in Bolivia. The results show that the socioeconomic variables are more relevant than education and work experience, strongly emphasizing the importance of selection bias and endogeneity in the estimations.
Jiménez and Lizárraga (2003) [56] analyze the distribution of rural household income and income contribution from its main sources. The results show a high concentration of household income in rural areas, reflecting a Gini index of more than 0.62; they also suggest that non-agricultural income distribution contributes 42% to inequality in household income.
Yáñez (2004) [57] analyzes the microeconomic process behind changes in inequality in the period 1999-2002, finding that the evolution of inequality responds negatively to labor performance and positively to modification of the education structure.
Landa (2004) [58] hypothesizes that inequality in Bolivia is countercyclical, which means that in recessionary years, inequality increases and during recoveries, inequality narrows. He concludes that inequality increases because of market returns in education and labor experience, as well as unobservable variables related to labor market imperfections, social protection, and security networks. Contreras et al. (2007) [59] analyze the role of social networks in the determination of female participation in the generation of income and how this new variable influences women's economic options and its importance relative to other individual characteristics, such as education and the number of children in the household. Social networks are a more effective channel for many women to access jobs, compared to men.
Some other research studies were conducted by Contreras and Galván (2004) [60], who analyze the evolution of gender and ethnic wage discrimination in Bolivia, concluding that between 1944 and 1999 ethnic discrimination did not decrease and that women of ethnic origin are in the most disadvantageous situation when trying to negotiate wages in the labor market.
More recently, Canavire-Bacarreza and Rios-Avila (2017) [7] state that wages make up 85% of the average Bolivian's household income. They use Recentered Influence Function (RIF) regressions with an intertemporal decomposition approach, finding that changes in demographic and labor market characteristics can explain only a small proportion of the reduction in inequality in Bolivia between 2000 and 2014.

2.2 The Proposed Model

The model presented is based on Becker's (1971) [5] theoretical model, including a variation that allows to understand the difference between tradable and nontradable sectors in the economy. In this theory, wage inequality can be caused by what Becker calls a "taste for discrimination" from employers and some other factors. This tendency represents a

voluntary resign to windfall benefits in order to satisfy an employer's prejudice. In consequence, discrimination is a cost and generates a loss of productive efficiency.

In discrimination favoring men, Becker uses the term "nepotism" to refer to the behavior that pushes employers to pay wages above the equilibrium wage to some individuals, and "discrimination" to refer to the act of paying less than the equilibrium wage.

The corresponding discrimination coefficients (d) can be derived from the model as described by Neumark (1988) [61]. Including Molina (2011)'s [6] variation, the prejudiced employer's utility maximization problem can be represented as follows:

$$U = U(\pi, L_M, L_W) \tag{1}$$

$$\pi = f(L_M, L_W, p) - (w_w)L_W - (w_M)L_M \tag{2}$$

$$p = g(u) \tag{3}$$

$$u = h(t) \tag{4}$$

with $U_{LM} > 0$; $U_{LW} < 0$; $U_t < 0$; $U_{tt} > 0$; $f_t < 0$; L_x: labor of group x = {Men, Women}, respectively; w_x: wage of group x = {Men, Women}, respectively; p: market power; u: number of firms in the market, and t: level of trade openness.

Following this logic, a firm's profit depends directly on market power and the amount of competition it encounters. As the number of competitors increases, the price falls until it converges with the marginal cost, making it less affordable for firms to discriminate over time.

Solving the maximization problem:

$$FOC:\ f_{LM} - w_M = -\frac{U_{LM}}{U_\pi} \tag{5}$$

$$f_{LW} - w_W = -\frac{U_{LW}}{U_\pi} \tag{6}$$

f_{LX}: marginal labor productivity of group x = {*Men*, *Women*}, respectively.

Assuming discrimination against women but no nepotism in favor of men, equation (5) can be rewritten as:

$$f_{LM} = w_M = w^* \tag{7}$$

w^*: is the equilibrium salary.

Under the assumption that marginal labor productivity between men and women is the same, we combine equations (6) and (7):

$$f_{LM} = f_{LW} d_W = w_M - w_w = \frac{U_{LW} * f_t}{U_t} \tag{8}$$

d_W: coefficient of discrimination against women

Because f_t decreases with trade liberalization, discrimination against women (d_W) declines as liberalization increases.

The model implies that because trade liberalization increases competition, it should also achieve a reduction of windfall benefits, thus reducing the chances of wage discrimination between men and women. This happens because when a country opens its borders to trade, the presence of international companies' increases.

In the absence of discrimination against women, employers hire female workers at a wage equal to marginal productivity. However, with the taste for discrimination against women (d_W), employers who are prejudiced compare the wages of men and women and hire women if and only if:

$$w_M \geq w_w + d_W \tag{9}$$

The higher the discrimination coefficient, the lower the women's salary and the fewer the women hired by the employer. Although the discriminating company pays wages lower than the equilibrium, doing so is not a benefit for the company but a cost, because at any given level of production, the firm ceases to hire women whose marginal productivity is between w_w y w^* and should hire men with salary of at least w* (or w_M if in addition to discrimination there is nepotism in favor to men), which increases the firm's production costs.

In an economy with a group of men (M) and women (W) who can work in two different economic sectors—the tradable (t) and the nontradable (nt) sectors—international trade should directly affect the tradable sector. If employers in these sectors have a tendency to discriminate, then:

$$(w_M^t - w_w^t) \geq a \tag{10}$$

$$(w_M^{nt} - w_w^{nt}) > b \tag{11}$$

$$b \gg a \tag{12}$$

a and b: positive constants, where a takes value of zero; w_x^t: wage in the tradable sector of group x = {*Men*, *Women*}, respectively; w_x^{nt}: wage in the nontradable sector of group x = {*Men*, *Women*}, respectively.

Then:

$$(w_M^t - w_W^t) \ll (w_M^{nt} - w_W^{nt}) \quad (13)$$

3. GENDER WAGE INEQUALITY BETWEEN THE TRADABLE AND NONTRADABLE SECTORS

3.1. Methodology

To show empirical evidence in the model presented in the previous section, we use the Oaxaca-Blinder decomposition by Oaxaca (1973), Blinder (1973), and Oaxaca and Ransom (1994, 1999) [62-65]. The method presented in this paper has been used in many other studies, and the work by Oaxaca (1973) [62] as well as Blinder (1973) [63] are crucial in this area; an extensive bibliographic review of studies that used this method is in Borjas (2013) [66] and Molina (2011) [6].

Creating a counterfactual decomposition divides wage gaps into two groups: the visible component, which is explained by productivity characteristics, such as education and professional experience, and the residual component, which cannot be explained by productivity characteristics. This unexplained component is what is known in the Oaxaca-Blinder decomposition as a measure of discrimination. The theoretical explanation of the proposed decomposition is as follows.

Let there be two groups, men (*M*) and women (*W*), with wages w_M y w_w , respectively, and a group of control variables that explain productivity, demography, and a series of socioeconomic characteristics.

Defining:

$$R = E(ln\, w_M) - E(ln\, w_w) \quad (14)$$

R: difference in expected values of log of the wages from *m* and *w*; $E(ln\, w_m)$: expected value of the natural log of men's; $E(ln\, w)$: expected value of the natural log of women's wage

Given the following linear regression:

$$ln\, w_i = X_i'\beta_i + \varepsilon_i\,, i = W, M \quad (15)$$

$$E(\varepsilon_i) = 0 \quad (16)$$

For simplicity, individual observations have no subscript. X_i': a matrix of control variables; β_i: a vector of regression parameters; ε_i: error term.

Adding equations (15) and (16) to equation (14):

$$R = E(ln\, w_M) - E(ln\, w_w) = E(X_M)'\beta_M - E(X_w)'\beta_w \quad (17)$$

Following Winsborough and Dickinson (1971), Jones and Kelley (1984), Daymont and Andrisani (1984), cited in Jann (2008) [67-70], Equation (17) can be revised as follows:

$$R = [E(X_M) - E(X_w)]'\beta_w + E(X_w)'(\beta_M - \beta_w) - [E(X_M) - E(X_w)]'(\beta_M - \beta_w) \quad (18)$$

This decomposition has three components:

$$R = D + C + I \quad (19)$$

where:

$$D = [E(X_M) - E(X_w)]'\beta_w \quad (20)$$

$$C = E(X_w)'(\beta_M - \beta_w) \quad (21)$$

$$I = [E(X_M) - E(X_w)]'(\beta_M - \beta_w) \quad (22)$$

Equation (20) is focused on the portion of the difference that is due to the effect of the control variables (endowment effect); equation (21) measures the portion of the difference due to coefficients, including the differences in the constant (coefficients effect); equation (22) measures the difference caused by simultaneous interaction of the difference in endowment and in the coefficients of men and women (interaction effect).

The decomposition presented in equation (18) is from the women's viewpoint, so the differences in the control variables are measured by the women's coefficients to determine the endowment effect (D). In other words, (D) measures the expected changes in the mean of the results found for women, if women had the same control variable levels as men. Similarly, for the second component (C) the differences in coefficients, measure the expected change in the mean result found for women, if women had the same coefficients as men. Respectively, R can be expressed from men's point of view, resulting in a similar but inverse decomposition of the three components.

$$R = [E(X_M) - E(X_w)]'\beta_M + E(X_M)'(\beta_M - \beta_w) - [E(X_M) - E(X_w)]'(\beta_M - \beta_W) \quad (23)$$

In labor market studies, it is very common to find the selection bias correction being applied to income equations, using the procedure proposed by Heckman (1979) [71]. Problems arise because wages are observed only for people who

participate in the labor market; therefore, any group selection is biased, resulting in possible biased estimators, and the conclusions generated do not apply to the universe studied. In this document, the models are corrected for selection bias using the proposed two-step Heckman (1979) [71] method.

3.2. Oaxaca-Recentered Influence Functions

Garofalo (2018) [72] points out that the estimations of wage structure and composition effects can be misleading if the linear model is unspecified and the contribution of each covariate is very sensitive to the choice of the base group. Therefore, we include the methodology proposed by Firpo, Fortin, and Lemieux (2007) [73] and Canavire-Bacarreza and Rios-Avila (2017) [7], which implement a generalization of the Blinder-Oaxaca decomposition approach [63, 62], enabling us to extend the decomposition analysis to statistics other than the mean.
Rios-Avila (2019) [74, 75] defines the complete procedure in the Oaxaca-Blinder RIF regression. In this paper, we follow the original methodology created to analyze outcome differences at the mean, and other papers provide extensions and refinements to extend the analysis to other distributional statistics—for example, Fortin, Lemieux, and Firpo (2011) [76] and, for Bolivia, Canavire-Bacarreza and Rios-Avila (2017) [7].
As stated by Rios-Avila ([75], pp.15): Firpo, Fortin, and Lemieux (2018) describe the use of RIF regressions in combination with a reweighted strategy (DiNardo, Fortin, and Lemieux 1996) as a feasible methodology for decomposing differences in distributional statistics beyond the mean. This is referred to as RIF decomposition. This methodology has three advantages compared to other strategies in the literature: the simplicity of its implementation, the possibility of obtaining detailed contributions of individual covariates on the aggregate decomposition, and the possibility of expanding the analysis to any statistic for which an RIF can be defined.
The main idea in this strategy is as follows: Suppose there is a joint distribution function that describes all relationships between the dependent variable Y, the matrix with independent variables *X*, and the categorical variable Tin which $(f_{Y,X,T(Y_I,X_I,T_i)})$. Because we have only two groups based on T, the joint probability distribution function and cumulative distribution of *Y* conditional on T is:

$$f^k_{Y,X} = (y,x) = f^k_{Y|X}(Y|X)f^k_X(X) \tag{24}$$

$$F^k_Y(y) = \int F^k_{Y|X}(Y|X)dF^k_X(X) \tag{25}$$

where k indicates that the density is conditional on T = k with k ∈ [0,1]. To analyze the differences between groups for men and women for a given distributional statistic v, the cumulative conditional distribution of *Y* can be used to calculate the gap:

$$\Delta v = v_1 - v_0 = v(F^1_Y) - v(F^0_Y) \tag{26}$$

$$\Delta v = \left(\int F^1_{Y|X}(Y|X)dF^1_X(X)\right) - v\left(\int F^0_{Y|X}(Y|X)dF^0_X(X)\right) \tag{27}$$

Equation (26) shows the differences in the statistics of interest that increase because of differences in the distribution of Xs $(dF^1_X(X) \neq dF^0_X(X))$ or due to differences in the relationship between *Y* and *X* $(F^1_{Y|X}(Y|X) \neq F^0_{Y|X}(Y|X))$. In the Oaxaca-Blinder decomposition, it is the same, so as to compare the differences in average characteristics and coefficients.
To see the effects of characteristics and coefficients for the overall gap (Δv), we need to generate a counterfactual scenario, as follows:

$$v_c = v_c(F^c_Y) = v\left(\int F^0_{Y|X}(Y|X)dF^1_X(X)\right) \tag{28}$$

With this counterfactual, it is possible to estimate the gap in the distribution statistic v in two components:

$$\Delta v = \underbrace{v_1 - v_c}_{\Delta v_S} + \underbrace{v_c - v_0}_{\Delta v_X} \tag{29}$$

Δv_x: shows the gap attributed to differences in characteristics: Δv_s: shows the differences attributed to the relationship between *Y* and *X*.
As mentioned in Rios-Avila (2019) [74, 75], the most difficult thing is identification of the counterfactual statistic v_c, because the combination of characteristics and outcomes is not observed in the data. For the estimation in this paper, we follow the proposal of Fortin, Lemieux, and Firpo (2011) [76], i.e., we use the standard Oaxaca-Blinder decomposition to approximate v_c.

$$v_1 = E\left(RIF\left(y_i; v(F^1_Y)\right)\right) = \bar{X}^{1\prime}\hat{\beta}^1 \tag{30}$$

$$v_0 = E\left(RIF\left(y_i; v(F^1_Y)\right)\right) = \bar{X}^{0\prime}\hat{\beta}^0 \tag{31}$$

$$v_c = \bar{X}^{1\prime}\hat{\beta}^0 \tag{32}$$

In this methodology, the Oaxaca-Blinder decomposition is shown as:

$$\Delta v_x = (\bar{X}^1 - \bar{X}^0)\beta^0 \tag{33}$$

$$\Delta v_s = \bar{X}^1(\hat{B}^1 - \hat{B}^0) \tag{34}$$

As mentioned in Rios-Avila (2019) [74, 75] and discussed in Barsky et al. (2002, pp.8) [77]: In the context of conditional means, is the counterfactual statistic v_c, may be incorrectly identified if the model is misspecified, or if the local approximation obtained using RIF cannot be extended beyond the local extrapolations.

4. RESULTS

4.1. Oaxaca-Blinder

Least squares model estimations with corrected heteroskedasticity are achieved based on the variables presented earlier. Following Molina (2011)'s [6] recommendations, the estimations are conducted excluding the agricultural sector, given that this sector strongly deviates from the assumptions made by the model.

$$ln\, w_j = X_j'\beta_j + \varepsilon_j\,, j = full\ sample \tag{35}$$

$$E(\varepsilon_j) = 0 \tag{36}$$

Table 1 shows the estimations for the general wage model; at first, it does not differentiate between men and women, and then it treats men and women separately. In addition, it presents the estimation of the income model by gender, dividing sectors in tradable and nontradable.

As the literature suggests, selection bias was corrected for women, where the inverse Mills ratio appeared to be significant. The selection of the variables in the Heckman procedure comes from Mroz (1987) [78]. One limitation in the estimations is that it is impossible to fix the possible selection problem between the tradable and nontradable sectors because the data lack enough information for that. All variables have the expected signs in all estimations. The general model is able to differentiate between men and women with help of the dummy variable woman.

Results by gender show that returns to education are greater for women than for men, which is contrary to what happens with experience, which brings greater returns for men than women. Additionally, experience has diminishing yields for both groups.

The dummy variable indigenous is negative in both cases as expected, although it is more determinant for women than for men in defining their wage. The variable rural is significant with a negative sign. The corresponding estimations of the tradable and nontradable sectors suggest that education is significant and positive for both groups and sectors; this implies that the higher an individual's education, the higher that person's wage on average. Experience is significant, for both groups and sectors; this means that on average an individual receives a higher wage with longer experience. Just as in education, returns to experience are greater in the nontradable sectors for men.

4.2 Oaxaca-Blinder Decomposition by Gender

In Table 2, the existence of gender wage gaps is confirmed. The wage gap between men and women in terms of the natural logarithm is BOB 0.217 (USD 0.031). Furthermore, 0.034 of this difference is explained by endowment allocations. In consequence, BOB 0.184 is not due to endowments, where 0.189 represents non-observable differences, which include the pure discrimination component, which represents 73.7% (δ^G = 0.189/0.217 = 0.737) of the difference between men and women. According to these results, it is possible to claim that a non-observable difference is caused by discrimination.

TABLE 1 - BOLIVIA, GENERAL INCOME MODEL, BY GENDER AND BY SECTOR, 2013

Independent Variable	General		General		Tradable Sector		Nontradable Sector	
			Women	Men	Women	Men	Women	Men
Cities	0.149	***	0.187 ***	0.151 ***	0.575 ***	0.061	0.151 **	0.169 ***
	0.039		0.063	0.047	0.168	0.115	0.066	0.051
Education	0.042	***	0.054 ***	0.035 ***	0.038 ***	0.034 ***	0.055 ***	0.035 ***
	0.002		0.002	0.002	0.008	0.006	0.003	0.002
Experience	0.020	***	0.020 ***	0.030 ***	0.009	0.030 ***	0.021 ***	0.030 ***
	0.002		0.002	0.002	0.008	0.004	0.003	0.002
Experience Sq.	-0.0003	***	-0.0002 ***	-0.0005 ***	-0.00005	-0.0005 ***	-0.0002 ***	-0.0005 ***
	0.000		0.000	0.000	0.000	0.000	0.000	0.000
Indigenous	-0.147	***	-0.147 ***	-0.140 ***	-0.205 ***	-0.149 ***	-0.137 ***	-0.136 ***
	0.014		0.023	0.018	0.06	0.039	0.024	0.021
Women	-0.241	***						
	0.013							
Mining	0.308	***	0.345 ***	0.299 ***	0.032	0.136	0.925 **	0.426 ***
	0.041		0.135	0.041	0.253	0.142	0.404	0.073
Manufacturing	-0.208	***	-0.261 ***	-0.173 ***	-0.500 **	-0.347 **	-0.144	0.043
	0.019		0.033	0.023	0.220	0.137	0.129	0.069
Wholesale and retail	-0.247	***	-0.272 ***	-0.178 ***			-0.267 ***	-0.177 ***
	0.017		0.026	0.027			0.026	0.027
Transportation and warehousing	-0.201	***	-0.158 **	-0.203 ***			-0.176 **	-0.203 ***
	0.023		0.075	0.024			0.074	0.024

Accommodation and food services	-0.055 **	-0.002	-0.136 **			0.002	-0.134 **
	0.026	0.034	0.057			0.034	0.057
Professional and business services	-0.080 **	-0.079 *	-0.040	0.059	-0.089	-0.111 **	-0.064
	0.032	0.045	0.042	0.243	0.153	0.047	0.047
Administrative services	-0.298 ***	-0.170 ***	-0.374 ***			-0.167 ***	-0.373 ***
	0.048	0.057	0.063			0.057	0.063
Educational services	0.287 ***	0.313 ***	0.264 ***			0.308 ***	0.267 ***
	0.024	0.027	0.031			0.028	0.032
Other services	-0.197 ***	-0.105 **	-0.26 ***	0.157	-0.123	-0.109 **	-0.277 ***
	0.035	0.051	0.055	0.451	0.214	0.051	0.057
Mills		-0.248 *		-0.388		-0.247 *	
		0.131		0.380		0.140	
Constant	2.047 ***	1.631 ***	1.962 ***	2.197 ***	2.141 ***	1.602 ***	1.968 ***
	0.050	0.069	0.037	0.324	0.171	0.072	0.040
No. of obs.	12.374	4.987	6.613	5.66	1.325	4.421	5.288
F-Test		136.14	95.39	15.30	30.34	120.93	78.51
F-Test value		0.000	0.000	0.000	0.000	0.000	0.000
R-squared		0.256	0.160	0.179	0.172	0.259	0.158
Wald chi2(15)-Test	2927.37						
Wald chi2(15)-Test value	0.000						

Below the coefficient is the standard error.

*** significant at 1%, ** significant at 5%, * significant at 10%.

TABLE 2 - BOLIVIA, OAXACA-BLINDER DECOMPOSITION RESULTS, 2013

Model Estimations	**Coefficients**	
Estimated value for men	2.652 0.008	***
Estimated value for women	2.435 0.025	***
Difference	0.217 0.027	***
Decomposition	**Coefficients**	
Endowments	0.034 0.014	**
Coefficients	0.189 0.027	***
Interaction	-0.005 0.014	
No. of obs.	**11.600**	
Below the coefficient is the standard error. *** significant at 1% **significant at 5% *significant at 10%		

4.3 Oaxaca-Blinder Decomposition by Gender and Sector

Table 3 shows the relative distribution of individuals who are of working age and in the labor force (11,600 observations) by gender and sector. It also shows that 11% of the sample consists of men who work in the tradable sector, while 46% of the sample consists of men who work in the nontradable sector. Women who work in the tradable sector comprise 5% and those in the nontradable sector, 38%.

TABLE 3: BOLIVIA, GENDER AND SECTOR DISTRIBUTION OF INDIVIDUALS IN THE LABOR FORCE, 2013

Gender	**Nontradable**	**Tradable**	**Total**
Men	46%	11%	57%
Women	38%	5%	43%
Total	84%	16%	100%

Having identified the number of observations in each sector, it is possible to perform the Oaxaca-Blinder decomposition for each group and analyze the wage gaps between them.
Table 4 shows the decomposition by sector. It can be observed in the tradable sector that the expected value of the natural logarithm of the hourly wage is BOB 2.597 for men and BOB 2.236 for women.

The wage gap between men and women is BOB 0.362, with 0.126 explained by endowment differences. It can be then concluded that the difference of BOB 0.235 is not due to productivity differences between men and women (δ^T= 0.235/0.362 = 0.649).

In the nontradable sector, the expected value of the natural log of the hourly wage in the tradable sector is BOB 2.667 for men and BOB 2.464 for women. The wage gap between men and women is BOB 0.202, of which BOB 0.033 can be explained by endowment differences. It can be then concluded that BOB 0.168 is not due to productivity differences between men and women (δ^{NT} = 0.168/0.202 = 0.831).

TABLE 4 - BOLIVIA, OAXACA-BLINDER DECOMPOSITION RESULTS BY GENDER AND SECTOR, 2013

Model Estimations	**Coefficients**			
	Tradable		**Nontradable**	
Estimated value for men	2.597 0.019	***	2.666 0.009	***
Estimated value for women	2.236 0.076	***	2.464 0.027	***

Difference	0.362 0.079	***	0.202 0.028	***
Decomposition	**Coefficients**			
Endowments	0.126 0.026	***	0.033 0.015	**
Coefficients	0.246 0.078	***	0.177 0.029	***
Interaction	-0.011 0.024		-0.009 0.016	
Number of observations	1.891		9.709	
Below the coefficient is the standard error. *** significant at 1% **significant at 5% *significant at 10%				

4.4 Unexplained Wage Gaps, by Gender

- **Difference in Proportions**

This section contrasts unexplained wage gaps in both tradable and nontradable sectors to determine which gap is lower. The test evaluates the proposed hypothesis: unexplained wage gaps in the tradable sector should be less than unexplained wage gaps in the nontradable sector.

Null Hypothesis:	**Alternate Hypothesis:**
$\delta^{Tradables} = \delta^{Non-Tradables}$	$\delta^{Tradables} < \delta^{Non-Tradables}$

In this case, the test statistic is:

$$z = \frac{\bar{\delta}_T - \bar{\delta}_{NT}}{\sqrt{\frac{\bar{\delta}_c(1-\bar{\delta}_c)}{n_{Tradable}} + \frac{\bar{\delta}_c(1-\bar{\delta}_c)}{n_{Non-tradable}}}}$$

$$\bar{\delta}_c = \frac{(\bar{\delta}_T \times n_T) + (\bar{\delta}_{NT} \times n_{NT})}{(n_T + n_{NT})}$$

$\bar{\delta}_c$: combined estimator measuring the unexplained proportions; $\bar{\delta}_T$: portion of the unexplained component in the tradable sector; $\bar{\delta}_{NT}$: portion of the unexplained component in the nontradable sector; n_T: tradable sector sample size; n_{NT}: nontradable sector sample size.

With a test statistic of -18.146, the null hypothesis is rejected at a confidence level of 99%. These results confirm the existence of fewer unexplained differences in the tradable sector.
This results show that wage discrimination (in this case represented by the proportion of unexplained differences) against women is lower in the tradable sectors than the nontradable sectors.

4.5. Oaxaca-Recentered Influence Functions

Table 5 confirms the existence of wage gaps by gender, using an improvement in the methodology. In the Oaxaca-Blinder RIF regression, the wage gap between men and women in terms of the natural logarithm of wages is BOB 0.264. Furthermore, 0.031 of this difference is explained by endowment allocations. In consequence, BOB 0.233 is not explained.

TABLE 5 - BOLIVIA, OAXACA-BLINDER RECENTERED INFLUENCE FUNCTION DECOMPOSITION RESULTS BY GENDER3, 2013

Model Estimations	**Coefficients**	
Estimated value for women	2.387 0.011	***

Estimated value for men	2.652 0.008	***		
Difference	-0.265 0.014	***		
Explained	-0.031 0.014	**		
Unexplained	-0.234 0.017	***		
	Explained		**Unexplained**	
Cities	-0.001 0.001		0.001 0.002	
Education	-0.034 0.005	***	0.236 0.040	***
Experience	0.023 0.006	***	-0.148 0.058	**
Experience Sq.	-0.019 0.005	***	0.110 0.033	***
Indigenous	0.002 0.001		-0.001 0.007	
Mining	-0.007 0.006		-0.003 0.007	
Manufacturing	0.014 0.002	***	-0.015 0.007	**
Wholesale and retail	-0.044 0.005	***	-0.014 0.005	***
Transportation and warehousing	0.020 0.010	**	0.007 0.011	
Accommodations and food services	-0.0003 0.003		0.003 0.002	*
Government	0.0007 0.0005		-0.001 0.003	
Educational services	0.0001 0.0004		0.003 0.001	**
Arts, entertainment, and recreation	0.014 0.0004	***	0.003 0.003	
Other services	-0.001 0.0005	*	0.004 0.002	**
Constant			-0.420 0.059	***
Number of observations: women	**4.994**			
Number of obsservations: men	**6.613**			
Below the coefficient is the standard error. *** significant at 1% **significant at 5% *significant at 10%				

Table 6 shows the decomposition by sector. In the tradable sector, the expected value of the natural logarithm of the hourly wage is BOB 2.59 for men and BOB 2.16 for women. The wage gap between men and women is BOB 0.436, with 0.208 explained by endowment differences. It can be then concluded that the difference of BOB 0.235 is not due to productivity differences between men and women (T = 0.235/0.436 = 0.538).

In the nontradable sector, the expected value of the natural log of the hourly wage in the tradable industries is BOB 2.665 for men and BOB 2.420 for women. The wage gap between men and women is BOB 0.245, in which endowment differences explain BOB 0.077. It can be then concluded that BOB 0.168 is not due to productivity differences between men and women (NT = 0.168/0.245 = 0.685).

Using the same hypothesis test in Section 4.4, we conclude that the proportion of unexplained wage gaps in the tradable sector is significantly smaller than the proportion of unexplained wage gaps in the nontradable sector.

TABLE 6 - BOLIVIA, OAXACA-BLINDER RECENTERED INFLUENCE FUNCTION DECOMPOSITIONRESULTS BY GENDER, TRADABLE SECTOR, 2013

Model Estimations	**Coefficients**			
Estimated value for women	2.161 0.031	***		
Estimated value for men	2.597 0.019	***		
Difference	-0.436 0.036	***		
Explained	-0.201 0.071	***		
Unexplained	-0.235 0.074	***		
	Explained		**Unexplained**	
Cities	-0.001 0.004		0.010 0.004	**
Education	-0.039 0.013	***	0.045 0.115	
Experience	0.010 0.011		0.224 0.096	**
Experience Sq.	-0.004 0.012		0.224 0.096	**
Indigenous	-0.005 0.005		-0.016 0.021	
Mining	-0.004 0.036		-0.018 0.051	
Manufacturing	-0.080 0.036	**	-0.116 0.196	
Government	-0.001 0.005		0.007 0.014	
Other services	0.000 0.001	*	0.002 0.004	
Mills	-0.074 0.073	*		
Constant			0.056 0.367	
Number of observations: women Number of obsservations: men			**566** **1.325**	
Below the coefficient is the standard error. *** significant at 1% **significant at 5% *significant at 10%				

With a test statistic of -12.354, the null hypothesis is rejected at a confidence level of 99%. These results confirm the existence of fewer unexplained differences in the tradable sector. This result shows that, with a variation in the methodology (Oaxaca-Blinder RIF regressions), we reach similar conclusions, showing the consistency of the paper's approaches.

As in Section 4.4, it can be inferred that wage discrimination (in this case represented by the proportion of unexplained differences) against women is lower in the tradable sectors than the nontradable sectors.

5. CONCLUSIONS

This document analyzes the wage gap between men and women in the tradable and nontradable sectors in Bolivia. The tradable sector is defined by the value of imports and exports in each industry based on the four-digit code of the International Standard Industrial Classification of All Economic Activities.

The main goal was to demonstrate that tradable sectors have fewer opportunities than the nontradable sector to pay different salaries in an economy with a propensity to pay lower wages to women (so called taste for discrimination). We study Bolivia because of its poverty and because it is one of most unequal countries in the Americas despite being a pioneer in the implementation of free trade policies, which have been partially abandoned by the current administration.
We conducted our empirical analysis of Bolivia with a model for 2013, omitting the agricultural sector, because according to Molina (2011) [6], this sector strongly deviates from the assumptions needed for the model. The explained and applied methodology in each case shows that all the selected variables have the expected signs based on economic theory; salaries are determined by specific characteristics, such as ethnic origins or living in a rural area, as well as education, experience, and gender. Along the same lines, participation in different economic sectors also generates wage gaps between economic sectors within a country.
Concerning the analysis of unexplained wage gaps, both the Oaxaca-Blinder decomposition and Oaxaca-Blinder RIF regression show wage discrimination against women because the endowment effect does not fully explain wage gaps detected by the model. This result confirms the assumptions made for a country with a tendency toward discrimination.
Consequently, estimations for the tradable and nontradable sectors prove the existence of less wage discrimination against women in the tradable sector. Thus trade openness reduces tendencies toward discrimination against women in Bolivia; an increase in trade reduces enterprises' windfall benefits, forcing them to offer equilibrium salaries, so it reduces employer preference for discrimination.
Based on our results, we present some policy suggestions. First, in Bolivia, it is crucial for the government to continue implementing policies oriented toward reducing inequality between social groups. The results suggest that strong differences between men and women remain regarding labor opportunities, and this can also be generalized to ethnic groups and the area of residence.
We have shown that sectors influenced by open trade reduce inequality by deterring the incentives for discrimination; this is why Bolivia should promote competition in various sectors of its economy and prevent trade barriers, especially in markets with a competitive advantage.

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