Sticky Floor and Glass Ceiling in Ecuador. The Evolution of the Gender Wage Gap, 2010-2021

Diego Linthon-Delgado[1], Lizethe Méndez-Heras[2,*] and Gino Cornejo-Marcos[2]

[1]*Universidad de Guayaquil, Guayaquil, Ecuador*
[2]*Universidad Ecotec, Samborondón, Ecuador*

Abstract

This research focuses on the evolution of the Gender Wage Gap (GWG) and its components (endowment effect and coefficients effect) over the entire wage distribution in Ecuador between 2010 and 2021. It was used Melly's decomposition method based on quantile regressions along the wage distribution with Data from Ecuador's National Survey of Employment, Unemployment, and Underemployment (ENEMDU for its name in Spanish). There was found strong evidence of a Sticky Floor (a larger GWG at the tenth percentile than the median) and of a Glass Ceiling (a larger GWG at the ninetieth percentile than the median) for Ecuador. The results show that women with low and high income have limited mobility and invisible barriers which prevent them from getting better positions and salaries. The ninety-nine (99) regressions also suggest a GWG favoring men, which is explained by a discrimination factor (coefficient effect). Public policy must be geared towards fighting discrimination against women to reduce gender wage inequality.

Keywords

Gender, Wage Gap, Discrimination, Quantiles Regressions

1. Introduction

Over the past decades, concerns about inequality have grown significantly worldwide, particularly those related to gender because of the Covid-19 pandemic. According to the World Economic Forum gender inequality indices, in 2021, the global gender gap favoring men reached 32.3%. Meanwhile, over the Political Empowerment and the Economic Participation and Opportunity areas, it got up to 78% and 42%, respectively. The lowest inequality level was over Educational Attainment (5) and Health and Survival 4% [1].

The International Labor Organization (ILO) estimated that globally Covid-19 caused a drop in the weekly worked hours ratio (2.4%), over employment (2.5%), and workforce participation (1.9%) in 2020 compared to 2019. Furthermore, this indices recovery will be slow since, according to some of ILO's estimates, the levels we had before the pandemic will not be reached by 2023. Covid-19 also provoked a dropped in employment of 2.8% for men and 2.2% for women between

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*Corresponding author

diego.linthondel@ug.edu.ec (D. Linthon-Delgado); lmendez@ecotec.edu.ec (L. Méndez-Heras); gcornejo@ecotec.edu.ec (G. Cornejo-Marcos)

0000-0003-2115-2807 (D. Linthon-Delgado); 0000-0002-3885-4584 (L. Méndez-Heras); 0000-0002-7541-203X (G. Cornejo-Marcos)

2019 and 2020. However, women already had a significantly lower employment rate than men by 2019 (45.2% against 69.4%), and by 2022 there have not been any relevant changes in rates.

Gender inequality in Latin America has had a long concerning story with data, resulting in old multiple academic pieces of research aiming at analyzing the wage gap3. Ecuador is no stranger to this matter4. As seen in the following part of this work, factual evidence shows a wage gap in Ecuador, considerably persistent benefiting men. Most empiric research on the determiners of this gap in Ecuador has been based on the Blinder [2] and the Oaxaca [3] methodology, a pioneer back in their time, which focuses on trying to distinguish two main groups of causes. On the one hand, some originated from specific, quantifiable differences over the study subject (i.e., academic level).

On the other hand, we have those whose root is discrimination5. Based on this method, the bibliography used for the national analysis tends to conclude that the gender gap results from discrimination and not due to employees' different characteristics. Likewise, part of the literature finds that the wage gap shows a downtrend, although most papers only analyze short terms.

This study analyzes and identifies critical factors in the evolution of the wage gap along with its observable and non-observable components in Ecuador for the period 2010-2021. This research contributes to the empirical literature in two fundamental aspects. First, we analyze the gap for all wage distribution (quantiles 1 to 99). This is especially relevant since it helps approach the "Sticky Floor" and "Glass Ceiling" issues6. It also provides evidence of Covid-19's impact on the evolution of the wage gap and its components.

On top of this introduction, this article is built as follows. In the first section, we will conduct relevant research on gender wage inequality in Ecuador. In the second section, we present the traditionally used Blinder [2] and Oaxaca [3] decomposition methodologies, and Melly [4] applied to this research. In the third section, we describe the data of the taken sample for the National Survey of Employment, Unemployment, and Underemployment (ENEMDU) carried out by the National Institute of Census and Statistics (INEC for its name in Spanish) for the 2010-2021 period. In the fourth section, we will review the results of applying the methodology for Ecuador's case. Finally, we present conclusions and recommendations.

2. Reviewing the literature

Amid the first research on the gender wage gap in Ecuador, we find the one conducted by Ñopo et al. [5], who analyzed wage inequality by gender and ethnicity during the 2003-2007 period. These authors found that the gender wage gap benefits men less than the ethnic wage gap. Regarding gender, the wage gap showed a stable pattern, fluctuating between 7% and 12% between 2003 and 2007. Moreover, this gap was mainly explained by 'discrimination' due to women having higher human capital7 than men. When analyzing the wage distribution, they found evidence of the 'Sticky Floor' and 'Glass Ceiling' patterns, meaning women with high or low income have little mobility or face invisible barriers preventing them from achieving better jobs and salaries. They used annual figures from the ENEMDU and applied a technique designed by one of the authors [6], which consists in decomposing the wage gap into four additive components: 1) differences between the combination of some characteristics that non-minorities do have

but that minorities do not have, 2) the opposite to the first component, differences between the combination of some characteristics that minorities do have but that non-minorities do not have, 3) differences between observable characteristics between both comparable groups, and, 4) differences between the non-observable characteristics (discrimination).

Pérez et al. [7] focused on applying four decomposition methodologies for ethnicity and gender wage gap known as 1) multiple linear regression, 2) Blinder-Oaxaca's method, 3) Machado et al. [8] quartiles decomposition method and 4) Juhn et al. [9] quantiles decomposition method to analyze the evolution of the wage gap. These authors use data from the Survey of Urban and Rural Employment and Unemployment (ENEMDUR for its name in Spanish) for 2007 and the ENEMDU for 2013. Using the first methodology, they found that women earned an average wage 13% lower than men. The second methodology, Blinder-Oaxaca's, was used by Pérez et al. [7]. They realized that in 2013 the wage gap benefitted men, mainly due to discrimination. Implementing Machado et al. [8] methodology, they noticed that the gap is significantly higher on the lower side of the wage distribution (quantiles 1, 10, and 25) than on the higher side (quantiles 75, 90, and 99). Finally, to assess the changes over time, by using the same methodology, they found evidence of a settling 'Sticky Floor' phenomenon, although they did not observe any changes over the 'Glass Ceiling' patterns. In summarizing, they found that the gender wage gap dropped during the studied year and the discrimination factor had a similar trend.

Aligned with the works that used Blinder-Oaxaca's methodology with bias selection corrections, we have Linthon-Delgado et al. [10], who used data from ENEMDU for September 2020, estimated that the gender wage gap was about 35.6 percent points in favor of men where the coefficients component (discrimination) explained this gap since women had a better endowment of human capital.

So far, the analysis for literature in Ecuador had as its primary source the ENEMDU. Antón et al. [11] found similar results by using data from the administrative records of the Labor and Entrepreneurial Dynamics Laboratory (LDLE for its name in Spanish) from INEC in 2016. They used three methodologies to estimate the gender wage gap in Ecuador's public and private sectors. The first is a multiple linear regression model considering gender as a Dummy variable. They estimated that women earn a lower salary than men. Their second methodology was Blinder-Oaxaca's decomposition. With this method, they found that the gender wage gap is mainly explained by discrimination within the private sector, while in the public sector, they could not find any evidence of gender wage inequality. The third methodology was a decomposition of quantiles [12], and they applied it to the 25, 50, and 75 quantiles, and they found that women earned less than men in all three quantiles, meaning that 'Sticky Floor' and 'Glass Ceiling' phenomena were present. A limitation of this research is that they restrain the sample to people with a third (university) and fourth (postgraduate) levels of education.

The research analyzing the wage gap over different distribution points shows the coexistence of the 'Sticky Floor' and 'Glass Ceiling' patterns, although there is a wider discrepancy in its magnitude and evolution. Some say that 'Sticky Floor' is similar in size to the 'Glass Ceiling,' and others think the 'Glass Ceiling' is a much bigger phenomenon than the 'Sticky Floor.' The main conclusion of all this research is that the gender wage gap is due to discrimination, not human capital differences.

3. Methodology

The most used methodology to decompose wage gaps is Blinder [2] and Oaxaca [3]. This allows to decompose wage gaps into two groups, A and B, into two components: i) the observable component, which comes from the differences in the socio-demographic characteristics of individuals, and ii) the non-observable, which is associated with discriminatory policies or behaviors against certain groups.

This method consists of estimating Mincer's regressions [13] for a wage on both groups, A and B, in order to obtain the wage returns of the observable characteristics of each group:

$$\ln W_i^A = \beta_0^A + \sum_{j=1}^{n} \beta_j^A X_{ji}^A + \mu_i^A \tag{1}$$

$$\ln W_i^B = \beta_0^B + \sum_{j=1}^{n} \beta_j^B X_{ji}^B + \mu_i^B \tag{2}$$

Where subindices "i" and "j" represent employees and coefficients, respectively. $\ln W$ is the natural logarithm of wages, X represents the human capital component for employees, β are the regressors, and reflect the returns from the labor market to the characteristics of employees or the 'prices' of services associated with them [14] and is the error term.

Stressing equations 1 and 2, the Blinder-Oaxaca's decomposition results in the following expression:

$$\sum_j \beta_j^A \bar{X}_j^A - \sum_j \beta_j^B \bar{X}_j^B = \sum_j \beta_j^A \left(\bar{X}_j^A - \bar{X}_j^B\right) + \sum_j \bar{X}_j^B \left(\beta_j^A - \beta_j^B\right) \tag{3}$$

Where the first term, $\sum_j \beta_j^A \left(\bar{X}_j^A - \bar{X}_j^B\right)$ represents the observable component, meaning the part of the wage gap that can be explained by the differences observed in the characteristics of groups A and B, and the second term $\sum_j \bar{X}_j^B \left(\beta_j^A - \beta_j^B\right)$ expresses the non-observable component, in other words, the part of the wage gap that can be explained by the differences in the coefficients related to each of the estimations of the equations for employees' wages in groups A and B, typically considered as the discrimination effect.

Blinder-Oaxaca's methodology is strongly present in the field; however, it only allows the calculation of the mean and not of all the wage distribution [9, 12, 8].

We used Melly's methodology [4], which allows us to decompose the wage gap for the entire distribution. This method calculates the conditional distribution by using quantile regression. Melly [4] proposes to estimate the unconditional distribution through quantile regressions and integrate the conditional distribution over a covariables range.

Melly's decomposition methodology allows us to obtain a numerically equivalent estimator when the number of simulations used in Machado et al. [8] decomposition tends to infinity and is also computationally faster to obtain since when it does not depend on simulations [4].

Therefore, Melly [4] proposes the following process to estimate by integrating the unconditional counterfactual distributions:

- **Step 1.** Estimate through quantile linear regression all the conditional distributions.
- **Step 2.** Integrate the conditional function over the covariable range to obtain the unconditional distribution function.
- **Step 3.** Obtain the unconditional quantile function of interest by inverting the unconditional distribution function.
- **Step 4.** Invert the counterfactual distribution of interest to obtain the counterfactual quantile of interest $Q^C_{F,\theta} = F^{-1}_{W^C_F}(\theta)$ with women's wage structure, indicated as follows:

$$F_{W^C_{M,\theta}}(W) = \int F_{W_{M,\theta|X_M}}(W|X) dF_{x_H}(X) \tag{4}$$

Decompose the changes in wage density [15]:

$$\Delta_\theta = \left[Q_{M,\theta} - Q^C_{H,\theta}\right] + \left[Q^C_{M,\theta} - Q_{H,\theta}\right] \tag{5}$$

After having estimated the counterfactual, it is now possible to decompose the gender wage gap of the unconditional quantile function.
Equation 5 shows the decomposition of the gender wage gap for different quantiles, where the first term on the right of the equation represents the effect of the characteristics (observable components) and the second the effect of the coefficients (non-observable components), commonly understood as the discrimination effect.

4. Description of the data

Data used for this research were taken from the ENEMDU, which is made on a quarterly basis by INEC. We used figures for September within the 2010-2021 period. We limited the sample to people between 18- and 65 years old living in an urban area. Table 1 shows the main statistics for the total sample and Table 2 shows the main statistics for employees.

The structure of the age groups is very similar between men and women; about 50% of the people in the sample are between 25-49 years old. This percentage grows by about 5% for all employees. Almost 56% of people from the sample are married or live in Free Union, but when it comes to the employees' group, the percentage for women in either of these marital statuses is, on average, 13% lower than for men. Concerning the head of household, the percentage of men is on average 33% higher than women for the total sample; this percentage reaches up to 38% when only employees are considered; this suggests there is a gender social division of household roles in Ecuador just as the literature pinpointed [16, 17, 18]. The descriptive statistics of these three variables (age, married, head of household) reveal no significant change throughout the studied years.

In the labor context, we can see a rise in the average hourly wage from 0.81 in 2010 to 1.11 in 2021 for men and from 0.81 in 2010 to 1.15 in 2021 for women; meaning that by the last year of the sample, there is a wage gap benefiting women. This wage gap in favor of women could be connected to the fact that the percentage of women with higher education is, on average, 13% higher than their male peers.

Figure 1 shows the observed gender wage gap for the whole sample per quantiles (1 to 99) for the years 2010, 2015, and 2021. We can see a U shape, which means men have higher salaries

Table 1
Descriptive statistics. People between 18-65 years old (2010-2021)

	All					
	2010		*2015*		*2021*	
	Man	*Woman*	*Man*	*Woman*	*Man*	*Woman*
Age	37.4	38.2	37.3	37.6	37.9	38.9
Married	58.0	57.6	62.0	59.2	52.4	50.5
Head of Household	55.2	15.7	59.8	20.0	51.4	21.8
18-24	23.3	20.7	21.6	20.1	22.3	19.7
25-34	23.7	23.4	24.7	25.9	23.9	22.7
35-49	30.0	31.8	32.1	31.6	29.1	30.6
50	23.1	24.1	21.6	22.3	24.7	27.1
Work						
Log hourly wage	0.81	0.82	1.15	1.15	1.11	1.15
Weekly hours	44.9	38.7	42.9	37.6	40.5	35.6
School level						
Below elementary	1.4	2.4	1.2	1.8	1.0	1.3
Basic	23.8	25.5	24.3	23.1	16.9	17.6
High-School	42.2	39.7	44.5	42.0	46.1	43.6
Higher education	32.7	32.5	30.0	33.2	36.0	37.5
N	12026	13434	19690	21408	6002	6696

than women in the low part of the wage distribution ('Sticky Floor') and the high part too ('Glass Ceiling'). Firstly, the 'Glass Ceiling' phenomenon shows a higher magnitude, suggesting that women with higher salaries face the largest inequality compared with their male peers. Secondly, women have better compensation in the middle part of the wage distribution, which can result from better human capital skills for women during the last years. Thirdly, excluding 2021 (a pandemic period), we can see a practically constant uptrend for 'Sticky Floor' and 'Glass Ceiling'; in other words, between 2010 and 2015, there was a wage inequality process between men and women with the lowest income, while women with the highest wages did not experience higher inequality with men between 2010 and 2015. Covid-19 seems to have affected the gender wage gap since 2021, showing a more even U shape than the previous two periods; this confirms the existence of a 'Sticky Floor' and 'Glass Ceiling.'

In summarizing, the descriptive statistics analysis of the gender wage gap in Ecuador for the 2010-2021 period showed the following fundamentals: i) an uptrend in the 'Sticky Floor' and 'Glass Ceiling' patterns, ii) women have better income in a great part of the wage distribution, iii) women with low school levels are in an evident disadvantage compared to men, iv) regarding employees in the higher education group, men have better salaries in the low and the high side of the distribution, v) Covid-19 seems to have increased the total female labor participation, but it dropped the participation of married women, vi)the period affected by Covid-19, the 'Sticky Floor' and 'Glass Ceiling' phenomena show a drop.

Table 2
Descriptive statistics. Employees between 18-65 years old (2010-2021)

	Employees					
	2010		*2015*		*2021*	
	Man	*Woman*	*Man*	*Woman*	*Man*	*Woman*
Age	39.0	39.1	38.7	38.8	39.5	40.2
Married	66.6	53.4	69.6	55.9	60.9	48.6
Head of Household	63.3	21.0	67.0	26.3	59.3	28.7
18-24	15.4	12.3	14.1	12.1	13.7	10.3
25-34	25.8	27.4	27.1	28.5	26.2	26.0
35-49	34.7	37.2	36.7	37.9	34.4	37.5
50	24.2	23.1	22.1	21.5	25.7	26.2
Work						
Log hourly wage	0.81	0.82	1.15	1.15	1.11	1.15
Weekly hours	44.9	38.7	42.87	37.6	40.5	35.6
School level						
Below elementary	0.9	1.3	0.9	1.1	0.4	1.0
Basic	25.0	20.2	26.2	20.5	18.3	15.9
High-School	42.6	35.3	43.9	37.7	46.8	39.9
Higher education	31.6	43.2	29.0	40.8	34.5	43.2
N	9636	6668	16356	11778	4686	3694

5. Results

We will go through the results of the decomposition of the gender wage gap in observable factors (endowment effect) and non-observable (coefficients effect) after having applied Melly's methodology.

Figure 1 shows that during the three studied years, 2010, 2015, and 2021, the relevance of the observable components (characteristics) and the non-observable (coefficients) for the gender wage gap varies through the quantiles. In 2010, there is no wage gap for people with the lowest income (until quantile 19), while after quantile 20 and up to the 80th, women's salaries are slightly higher than men's, and then forward the gap expands in favor of men. In other words, it can be said that in 2010 there was an ongoing 'Glass Ceiling' phenomenon. More importantly, results show that if the characteristics of employees had determined wages, the wage gap would have benefitted women along the entire wage distribution. In fact, the observed wage gap had such a trend due to discrimination.

Discrimination mainly affected women in the high part of the distribution. In 2015, the observed wage gap showed a U trend, meaning it favored men in the high and low part of the distribution; these phenomena are known as the 'Sticky Floor' and 'Glass Ceiling'. Likewise, in 2010, the observed wage gap in 2015 is mainly explained by discrimination; in other words, men's human capital had better compensation than women. Finally, in 2021, a year impacted by Covid-19, we can see more even wages, the result of a drop in the 'Sticky Floor' and 'Glass Ceiling' patterns compared with previous years (2010 and 2015). In the last mean of the wage distribution, women have better average wages than men, but this is due to them having broader

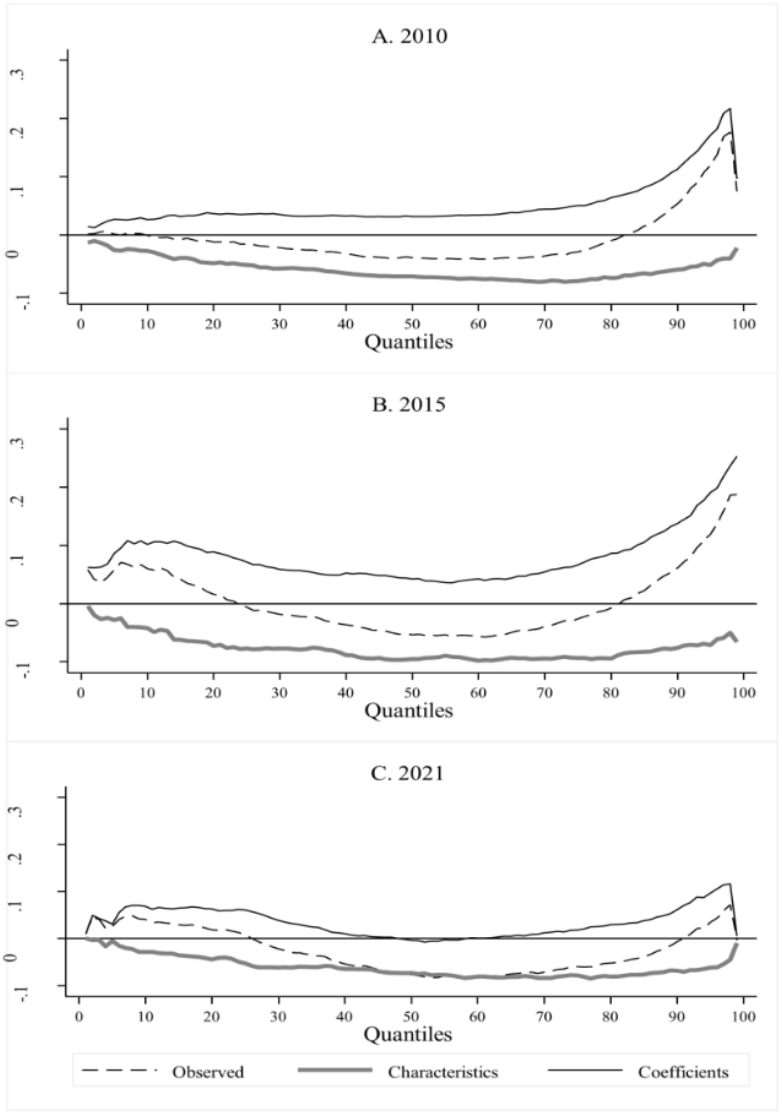

Figure 1: Decomposition of the gender wage gap. Total, 2010, 2015 y 2021

human capital.

Furthermore, results show that the coefficients effect is higher than the endowment effect along the distribution. This allows us to reinforce the gender discrimination hypothesis present in the Ecuadorian labor market. However, the discrimination effect is higher for women in the high part of the wage distribution, meaning that for the best-paid employees' group, women's human capital is worth less in the labor market than men's. This was particularly true in 2010 and 2015 since, in 2021, discrimination affected both women in the high part and women in the low part of the distribution. These results also mean that if women were to bring the same human capital as men to the labor market, the wage gap benefitting men would be way higher

than observed. In a non-discriminatory scenario, the wage gap would benefit women along the entire wage distribution.

We can see in Figure 1 two key aspects: 1) men's wages have benefitted from discrimination, and 2) women have broader human capital than men. When we compare 2021 with 2010, we can see a slight upturn in the 'Sticky Floor' and an essential downturn in the 'Glass Ceiling'

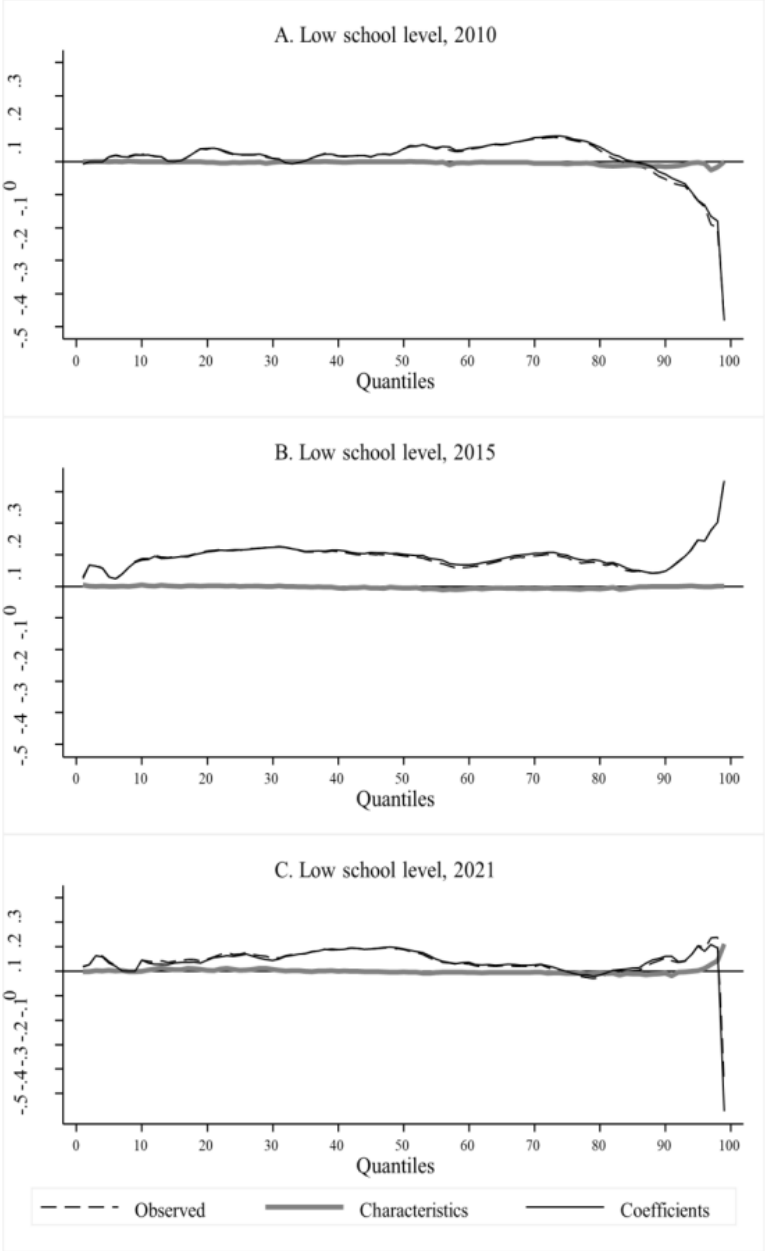

Figure 2: Decomposition of the gender wage gap. People with low school levels, 2010,2015 y 2021

phenomena. We can say that when it comes to gender wage equality matters, women with the lowest income are worse than ten years ago, and women with the highest income have experienced an improvement. Finally, women were paid in the middle part of the distribution in the three studied years.

In the same sense, Figure 2 shows the gender wage decomposition for people with low school levels (primary or less). In 2010 the gender wage gap (observed) slightly benefitted men in quantiles 1 to 83; ever since it has benefitted women. Moreover, this gap is mainly explained by the coefficients effect, suggesting positive discrimination against women. In 2015, the wage gap mostly favored men over women in all quantiles; although the gap was higher in the higher part of the distribution, this uneven wage gap was also the result of discrimination. In 202, the wage gap trend is like the one in 2010, suggesting that gender wage inequality dropped during

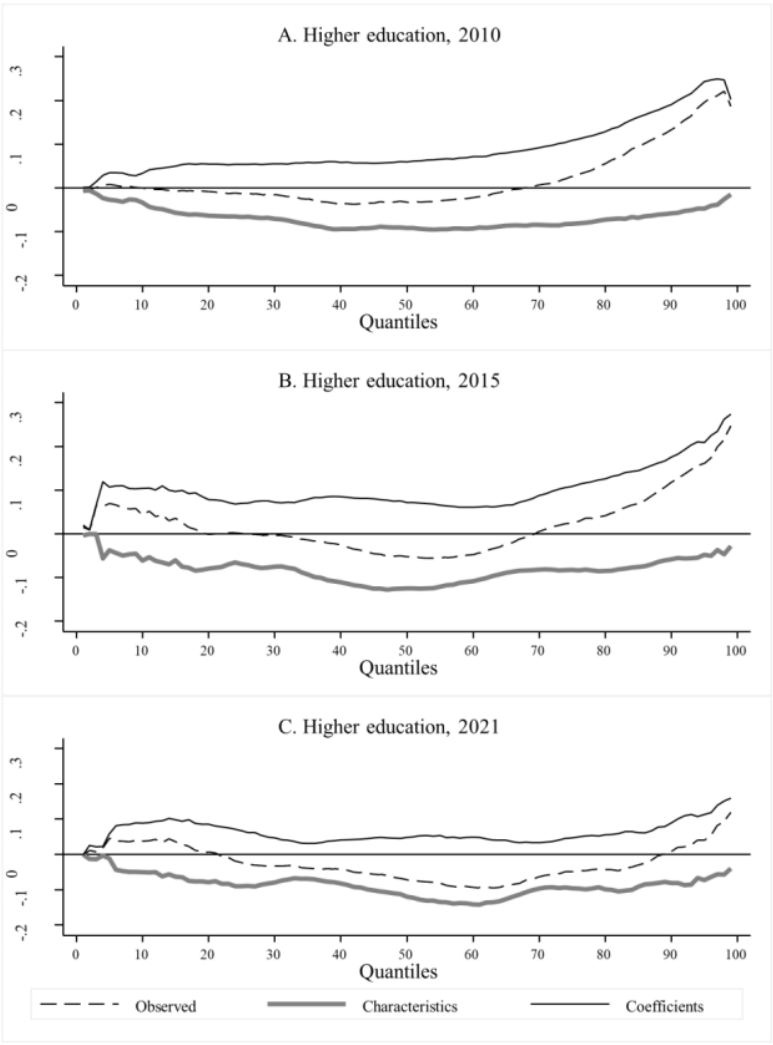

Figure 3: Decomposition of the gender wage gap. People with higher education, 2010, 2015 y 2021

the Covid-19 pandemic.

On the other hand, the decomposition of the gender wage gap showed that the coefficients effect prevails for the higher education employees' group (Figure 3). In 2010, the coefficient effects grew significantly right after the 70th quantile, meaning that discrimination affects women with higher education and high income. In 2015, the pattern was similar to 2010, where the main difference is that it also affected women in the low quantiles. In 2021, we can see a trend toward wage equality, although the 'Glass Ceiling' phenomenon persists due to discrimination.

In summary, gender wage inequality is significantly different for lower and higher-education employees. The main factor preventing gender wage equality is discrimination against women. Without it, the gender gap in the lower education level employees' group would be indiscernible for almost all earnings' quantiles; furthermore, wage inequality would significantly drop for men and women with higher education. Finally, Covid.19 seems to have dropped gender wage inequality.

6. Conclusions

This research aimed to analyze the evolution of the gender wage gap and its components (observed and non-observed) in Ecuador during the period between 2010 and 2021. We used Melly's process, which allows the decomposition of the gender wage gap per quantiles in observed factors (characteristics effect) and non-observed (coefficients effect).

This research results showed that the gender wage gap is widely different over most quantiles, which means that studies that only analyze the changes in the wage mean or in some points of the distribution (quantiles 10, 50, and 90, for most cases), using Blinder-Oaxaca's method or methodologies based on quantile regressions present important limitations.

This study has proven that women in quantiles between 30 and 80 are better paid than men and that during the analyzed period, this gap widened, even during the pandemic. However, this is due to women having better school levels than men.

On the low part of the distribution, we found an evident pattern of 'Sticky Floor,' which rose between 2010 and 2015. Still, it slightly dropped in 2021, which leads to conclude that less educated women engaged in low-productivity jobs face working more challenging than men with similar characteristics. The problem with this gap is that it results from discrimination, meaning the coefficients effect is the one that explains the wage gap benefitting men and not the differences in the human capital (characteristics effect). Furthermore, although this research results coincide with most of the investigation, many quantiles differ. Therefore, when we consider the entire distribution, we can infer that the 'Sticky Floor' mainly affects 20 percent of the distribution (below quantile 20) and not only those in quantile 10, as it has usually been studied.

Moreover, we found conclusive evidence showing 'Glass Ceilings,' which is also the result of discrimination. Nevertheless, during the Covid-19 pandemic period, there was an evident downturn in this phenomenon, meaning there was more wage equality between men and women with the highest income. This pattern is also more apparent after quantile 90. This last quantile is the one that most studies consider analyzing the gap between employees with better wages.

During the Covid-19 pandemic, we observed a change toward gender wage equality, especially for women with low school levels; however, discrimination continues to be an essential obstacle to wage parity for men and women with higher education.

This research provides a broad perspective on evaluating the gender wage in Ecuador during the last decade. However, for further investigation, we recommend examining the gender wage gap in more specific groups, such as employees in the public and private sectors, urban and rural areas, and formal and informal sectors, amongst others. This will undoubtedly bring a broader understanding of the domestic trends for wage gaps. Future research should also consider bias correction over sample selection since this would lead to more precise estimations.

Concerning public policy, this research shows that policies should focus on fighting discrimination and women exclusion, mainly in jobs with low and high productivity. Results prove that women have more than enough human capital to hold such positions and that granting access to those jobs will significantly contribute to dropping the gender wage gap and to the seeking of a more egalitarian society.

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