Effects of Gender and Ethnicity on the Wage Gap Among Farmworkers in Northwestern Mexico

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Motivation

- Agriculture is a relevant sector in the economy of many countries as it serves as a cornerstone for ensuring their food supply and security, while also contributing to job creation and various other benefits.

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- The Mexican agricultural sector is characterized by its heterogeneity due to the coexistence of both subsistence producers and agro-industrial companies, as indicated by Yúnez Naude (2010).

- Stabridis (2022) shows that, despite subsistence production units (with up to two hectares in size) accounting for half of the total, they only possess 5.5% of the total agricultural land, whereas the large units (over 20 hectares) possess 65% of productive lands. These larger units predominantly utilize irrigation water systems, employ the majority of the labor force, and cultivate crops through one or more cycles annually.

- Over time, they have developed agricultural practices that facilitate export to international markets through producer-exporter associations or under production contracts with transnational companies.

Motivation

- The labor demand patterns associated with these types of production ensure year round, consistent export stream to regions like the United States, Europe, or Asia, resulting in substantial profits for these production units.

- This creates a heterogeneous demand for agricultural labor that depends on the type of production unit, whether commercial or subsistence. Regarding the latter, they typically rely solely on family labor; small commercial units tend to hire workers for short seasons; whereas large productive units that supply the domestic and export markets sustain a continuous demand for wage labor, which is fulfilled by farmworkers.

- Farmworkers are (mostly) temporary workers who endure precarious working conditions. Many of them are forced to migrate from their places of origin—usually from the poorest states—to the major agricultural regions located in the western and northwestern parts of Mexico in pursuit of improved wages. Precariousness characterizes the occupational landscape of agricultural laborers (Lara Flores, 2011).

Goal

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The objective of this research is to analyze the impact of gender and ethnicity on the wage gap among farmworkers in the northwest region of Mexico, using the census sample data from the 2020 Population and Housing Census.

Through the application of matching methods, we aim to uncover the direct influence of gender and ethnicity on the wage gap among farmworkers and determine whether this association can be attributed to discrimination.

The advantage of employing this methodological approach is that it not only allows us to isolate the effects of gender and ethnicity on wages from other characteristics, but also facilitates the examination of the impact of additional variables such as age, education, and migration status.

The study focuses on the northwest region of Mexico—encompassing Baja California, Baja California Sur, Sinaloa, and Sonora—due to its significance as a major agricultural area, characterized by high agricultural production value, substantial export levels, and a continuous demand for farmworkers throughout the year.

The farmworker job in Northwestern of Mexico

- There are discrepancies regarding the number of farmworkers in Mexico, which may be due to the definition considered regarding who is a farmworker For this research, farmworkeris considered a salaried worker who works in the agricultural sector (Stabridis and Salgado, 2022). The self-employed, employers and unpaid family workers were excluded.

Table 1. Crop Region of Mexico

South-southeast	Center	Center-west	Northeast	Northwest
CAMP	CDMX	AGS	COA	BC
CHIS	HGO	COL	CHIH	BCS
GRO	MEX	GTO	DUR	SIN
QROO	MOR	JAL	NL	SON
OAX	PUE	MICH	TAMPS	
TAB	TLAX	NAY		
YUC		QRO		
VER		SLP		
		ZAC		

Source: Self elaboration by authors

The farmworker job in Northwestern of Mexico

- There are two reasons why it was chosen to analyze the northwest region: the first, because the agricultural units that are concentrated in it form one of the most productive regions; and the second, because the intensification of its productive processes has a great demand for day labor, as pointed out by Barrón Pérez (2000) and Grammont and Lara Flores (2004). The latter have detailed the important flow of demand for day labor that the northwest region has as an export region, which is characterized by its migrant and multiethnic origin.

Table 2. Area and Value of Crop Production by Region (2021)

Región	Planted Area (hs)	Cropped Area (hs)	Value of Crop Production (millions of pesos)	% of Part of Value of Crop Production	Average Value of Crop Production by hect.(pesos)
Sur-sureste	5,108,795	4,932,383	114,981	17	23,311
Centro	2,376,057	2,321,911	66,174	10	28,500
Centro-occide	5,709,845	5,458,630	275,904	40	50,545
Noreste	3,265,220	2,847,053	95,931	14	33,695
Noroeste	1,691,118	1,669,640	139,839	20	83,754
México	18,151,035	17,229,617	692,829	100	40,212

Fuente: Datos de Producción Agrícola 2021 obtenidos del Sistema de Información Agroalimentaria y Pesquera (SIAP)

Wage Gaps: Previous Works

- Wage gaps have been analyzed through their decomposition: one part explains the differences in human capital and the other refers to the salary structure, which is associated with discrimination. For this analysis, we start from the seminal works of Oaxaca (1973) and Blinder (1973). This method consists of decomposing the differences between the average salaries through two mutually exclusive groups.

- $\hat{\gamma}_O^\mu = \hat{\bar{Y}}_{NI} - \hat{\bar{Y}}_I = (\bar{X}_{NI} - \bar{X}_I)\hat{\beta}_I + (\hat{\beta}_I - \hat{\beta}_I)\bar{X}_{NI}$ (1)

$$\hat{\gamma}_O^\mu = \hat{\gamma}_S^\mu + \hat{\gamma}_X^\mu \qquad (2)$$

- The first term is called explained difference, which if positive (negative) would be showing that people from the group that has an advantage (in this case non-indigenous or men) have more (less) work experience and/or schooling. And another, which is called unexplained and is interpreted as the indigenous (or gender) wage discrimination factor.

Wage Gaps: Previous Works

- From these investigations, others have been developed that use more statistically robust methods and that can extend the study of the gap to other statistics such as quintiles or deciles (DiNardo et al., 1996; Machado and Mata, 2005; Firpo et al. , 2009; Firpo et al., 2018).

- The gender gap has been studied by various authors: Ahmed and Maitra (2015) for Bangladesh; Biewen et al. (2020) for Germany; Zhang et al. (2008) for China; Arabsheibani et al. (2018) for India; Arulampalam et al. (2007) for several European countries.

- For Mexico, Popli (2013) and Arceo-Gómez and Campos-Vázquez (2014), the analysis of the gap goes beyond the average since it also includes the quantiles. In turn, Arceo-Gómez and Campos-Vázquez (2014) are based on the decomposition proposed in DiNardo et al. (1996).Regarding the wage gap by ethnicity or race, the work of Blinder (1973), Bucheli and Porzecanski (2011) for Uruguay stands out; Gradín (2016) did it for Costa Rica; Both works argue that a good part of the gap is attributed to discrimination. . Recently, Arceo-Gómez and Torres (2021) and Canedo (2019) for the case of Mexico.

Wage Gaps: Propensity Score Matching

- The objective of matching methods is to determine if there are statistically significant differences in a given outcome variable between two groups that are comparable to each other, one that receives the treatment and the other that does not receive it (control group), considering the characteristics observable from both groups. Matching methods use information on observable characteristics in both groups (for example, the treatment is being female or indigenous) so that, with the control of these variables, estimates of ATET or ATE can be made. It is expressed in this way so that the effect of gender and ethnicity on the wage gap is observed in the estimates.

- Matching requires two basic assumptions to eliminate selection bias. The first is the support assumption in which it is required that $0 < \Pr[D = 1 | X] < 1$

- he second assumption requires that, when controlling the vector of explanatory variables, participation in the treatment is independent of the outcome variables (in this case the salary). Thus, it will be possible to have an estimate of the effect attributable to the treatment.

Wage Gaps: Estimating Multi-treatment Matching

- To consider the simultaneous effect of gender and ethnicity, the treatment effects models formulated by Cattaneo (2010) were taken as a basis, in which an efficient estimator is proposed that consists of two steps: the first consists of estimating the probability of each type of treatment for all individuals (IPW: that is, being a non-indigenous man, a non-indigenous woman, an indigenous man and an indigenous woman), and the second consists of estimating the treatment effect of each category through least squares, using as a weight the inverse of the estimated probabilities of the first stage. By generating probabilities for each group (observed and counterfactual) it is then possible to obtain the ATE. This is an inverse probability weighted regression adjusted (IPWRA) model.

Wage Gaps: Estimating Multi-treatment Matching

- Another great advantage of IPWRA models is that they have the property of double robustness, so that, as long as one of the models is correctly specified, the results will be consistent. An important assumption required by the IPWRA model is that the probabilities obtained for each individual in the sample must be positive. Furthermore, not only will the gap be analyzed in the average of the salary distribution but in the entire distribution, from the 10th to the 90th percentile.

- Following Meara et al. (2020) and Fisher et al. (2021), the multitreatment variable is defined as follows:

- 0=non-indigenous man; 1=non-indigenous woman; 2=indigenous man; 3=indigenous woman.

- The effects will be compared, first with respect to the reference category (zero) and then between all categories.

Database

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Norte

- The database used is the census sample derived from the collection of the expanded questionnaire of the 2020 Population and Housing Census. The census sample consists of approximately one tenth of the households in Mexico. From this, only salaried farmworkers who live in the northwest region were selected, considering the population between 12 and 75 years old in order to broadly capture the agricultural labor force.

Table 3. Means of Farmworker database in North-west Region 2020*

Variables	Total	Hombres	Mujeres	No Indígenas	Indígenas	No Indígenas Hombres	No Indígenas Mujeres	Indígenas Hombres	Indígenas Mujeres
Hourly wage (Mx pesos)	33.29	33.76	31.73	35.10	29.57	35.59	33.29	29.65	29.36
Woman=1	0.23	-	-	0.21	0.28	-	-	-	-
Self-declared indigenous=1	0.33	0.31	0.40	-	-	-	-	-	-
Age	37.36	38.04	35.14	38.07	35.90	38.59	36.12	36.79	33.65
Years of scholing	6.97	7.02	6.81	7.22	6.47	7.22	7.23	6.58	6.18
Speak indigenous language=1	0.14	0.12	0.19	0.01	0.40	0.01	0.01	0.38	0.46
Immigrant=1	0.30	0.27	0.40	0.23	0.44	0.21	0.30	0.40	0.54
Married=1	0.61	0.62	0.57	0.60	0.61	0.61	0.57	0.62	0.58
Extreme labor poverty=1[1]	0.15	0.17	0.10	0.14	0.17	0.15	0.09	0.20	0.11
Live rural area=1	0.41	0.45	0.30	0.44	0.35	0.47	0.31	0.38	0.28
Live in municipality ZLFN=1[2]	0.13	0.12	0.14	0.14	0.11	0.13	0.15	0.10	0.13

Source: Self-elaboration from Census Sample 2020

*Data without weights

[1] People whose per capita labor income is less value of food basket (CONEVAL)

[2] The "Zona Libre de la Frontera Norte" are municipalitiies of México that are border with USA but include all municipalities of Baja California

Table 4. Treatment Effect of Gender in Wage Gap from Mexican Farmworkers in Nort-west Region 2020

Sample	Treatment =woman	Control =Man	Difference	Standard Errors	T Value	ATET as % of Gap
Matching by Mahalanobis						
Nearest neighbor						
Unmatched	3.3024	3.3435	-0.0411	0.0085	4.83	-3.3%
Matched	3.3024	3.3357	-0.0333***	0.0129	-2.57	
Caliper radius 0.001						
Unmatched	3.3024	3.3435	-0.0411	0.0085	-4.83	-4.2%
Matched	3.2896	3.3326	-0.0431***	0.0110	-3.93	
Kernel (Epanechnikov)						
Unmatched	3.3024	3.3435	-0.0411	0.0085	-4.83	-4.2%
Matched	3.3003	3.3435	-0.0432***	0.0110	-3.92	
Propensity Score Matching						
Nearest neighbor						
Unmatched	3.3024	3.3435	-0.0411	0.0085	-4.83	-4.3%
Matched	3.3024	3.3459	-0.0435***	0.0135	-3.22	
Caliper radius 0.001						
Unmatched	3.3024	3.3435	-0.0411	0.0085	-4.83	-4.4%
Matched	3.3025	3.3475	-0.0450***	0.0080	-5.64	
Kernel (Epanechnikov)						
Unmatched	3.3024	3.3435	-0.0411	0.0085	-4.83	-4.3%
Matched	3.3024	3.3464	-0.0440***	0.0084	-5.21	

Source: Self-elaboration from Census Sample 2020

* Significant 90%, **, 95%; *** 99%

Estimates ATET for Log. Hourly wage

Standard errors by bootstraping, 200 replications

Table 5. Treatment Effect of Ethnicity in Wage Gap from Mexican Farmworkers in Nort-west Region 2020

Sample	Treatment =indigenous	Control =Non-indigenous	Difference	Standard Errors	T Value	ATET as % of Gap
Matching by Mahalanobis						
Nearest neighbor						
Unmatched	3.2216	3.3922	-0.1706	0.0075	-22.76	-17.7%
Matched	3.2216	3.4160	-0.1944***	0.0289	-6.72	
Caliper radius 0.001						
Unmatched	3.3024	3.3922	-0.1706	0.0075	-22.76	-16.8%
Matched	3.2896	3.3699	-0.1845***	0.0095	-19.33	
Kernel (Epanechnikov)						
Unmatched	3.2216	3.3922	0.1706	0.0075	-22.76	-15.7%
Matched	3.2216	3.3922	-0.1706***	0.0078	-21.89	
Propensity Score Matching						
Nearest neighbor						
Unmatched	3.2216	3.3922	-0.1706	0.0075	-22.76	-15.9%
Matched	3.2216	3.3943	-0.1727***	0.0341	-5.06	
Caliper radius 0.001						
Unmatched	3.2216	3.3922	-0.1706	0.0075	-22.76	-15.6%
Matched	3.2135	3.3836	-0.1701***	0.0212	-8.03	
Kernel (Epanechnikov)						
Unmatched	3.2216	3.3922	0.1706	0.0075	-22.76	-15.7%
Matched	3.2216	3.3922	-0.1706***	0.0202	-8.44	

Source: Self-elaboration from Census Sample 2020

* Significant 90%, **, 95%; *** 99%

Estimates ATET for Log. Hourly wage

Standard errors by bootstraping, 200 replications

Results

- According to Meara et al. (2020), the treatment effect of being female on the wage gap is the difference between the matched groups. That is, when comparing men and women with similar characteristics (age, education, etc.), it is observed that women receive 4% less hourly wage, which may be associated with discrimination and other unobservable characteristics, such as productivity. In the occupation of farmworkers, it is difficult to see occupational segregation that does not favor women, since rather there is a segregation by the type of productive unit towards those that operate with more informal schemes, such as piece-rate payment.

- The effect of ethnicity is largely unfavorable for indigenous farmworkers, who receive a 16% lower wage (15.7% to 17.7% with Mahalanobis and 15.7% to 15.9% with PSM) compared to non-indigenous workers. This lower 16% may be related to discrimination and, if applicable, it can be observed in several entities in the country that they are assigned tasks of greater physical effort and less possibility of extra payment, or that they also prioritize working in informal productive units that They offer them piece-rate payment without access to benefits.

Table 6. IPWRA Models of Effects of Gender and Ethnicity in Wage Gap for Mexican Farmworkers in North-west Region

Category	Mean	Percent 10	Percent 25	Percent 50	Percent 75	Percent 90
Non-indigenous man	3.4060*** (0.0103)	2.9345*** (0.0163)	3.2005*** (0.0194)	3.3022*** (0.0116)	3.5899*** (0.0254)	3.9154*** (0.0192)
Non-indigenous woman	3.3315*** (0.0161)	2.925*** (0.0200)	3.1326*** (0.0317)	3.2222*** (0.0221)	3.4453*** (0.0095)	3.7612*** (0.0516)
Effect comp. non-ind. man	*-7.5%*	*-1.0%*	*-6.8%*	*-8.0%*	*-14.5%*	*-15.4%*
Indigenous man	3.2411*** (0.0081)	2.7114*** (0.0055)	2.9345*** (0.0096)	3.2020*** (0.0073)	3.4436*** (0.0111)	3.7186*** (0.0173)
Effect comp. non-ind. man	*-16.5%*	*-22.3%*	*-26.6%*	*-10.0%*	*-14.6%*	*-19.7%*
Indigenous woman	3.1648*** (0.0129)	2.7114*** (0.0170)	2.9221*** (0.0239)	3.1858*** (0.0195)	3.3557*** (0.0118)	3.5507*** (0.0335)
Effect comp. non-ind. man	*-24.1%*	*-22.3%*	*-27.8%*	*-11.6%*	*-23.4%*	*-36.5%*

Source: Self-elaboration from Census Sample 2020

* Significant 90%, **, 95%; *** 99%

Two-step model: first stage is multinomial logit

Standard errors by bootstraping, 3000 replications

Table 7. Comparative of Effects by Categories of Farmworkers in Wage Gap in North-west Region

Comparative Categories	Mean	Percent 10	Percent 25	Percent 50	Percent 75	Percent 90
Non-indigenous woman vs non-indigenous man	-0.0745***	-0.0096	-0.0680*	-0.0800***	-0.1446***	-0.1542***
	(0.0192)	(0.0259)	(0.0372)	(0.0251)	(0.0271)	(0.0552)
Indigenous man vs non-indigenous man	-0.1650***	-0.2231***	-0.2660***	-0.1002***	-0.1463***	-0.1967***
	(0.013)	(0.0173)	(0.0215)	(0.0137)	(0.0280)	(0.0258)
Indigenous woman vs non-indigenous man	-0.2412***	-0.2231***	-0.2784***	-0.1164***	-0.2342***	-0.3646***
	(0.0164)	(0.023)	(0.0304)	(0.0227)	(0.0280)	(0.0388)
Indigenous man vs non-indigenous woman	-0.0904***	-0.2136***	-0.1981***	-0.0202	-0.0018	-0.0426
	(0.0179)	(0.0207)	(0.0328)	(0.0232)	(0.0146)	(0.0547)
Indigenous woman vs non-indigenous woman	-0.1667***	-0.2136***	-0.2105***	-0.0364	-0.0896***	-0.2105***
	(0.0203)	(0.0260)	(0.0389)	(0.0291)	(0.0149)	(0.0611)
Indigenous woman vs indigenous man	-0.0763***	0.0000	-0.0124	-0.0162	-0.0879***	-0.1679***
	(0.0153)	(0.0180)	(0.0260)	(0.0207)	(0.0162)	(0.0375)

Source: Self-elaboration from Census Sample 2020

* Significant 90%, **, 95%; *** 99%

Marginal effects from IPWRA model of table 6

Standard errors by bootstraping, 3000 replications

Results

- The values of the logarithm of wages and the treatment effect are reported. In the case of the average, it is observed that non-indigenous women earn 7.5% less than non-indigenous men, controlling for observable characteristics, so that this 7.5% lower is the effect of being a non-indigenous woman. Indigenous men receive a salary 16.5% that of non-indigenous men. The most disadvantaged category is that of indigenous women, since their wage is 24.1% lower than that of non-indigenous men, which reflects the vulnerability that indigenous farmworkers suffer through their income.

- As one moves towards the highest percentiles, the gender difference becomes important and the ethnicity difference increases, being very high in the 90th percentile, where non-indigenous women have a wage that is 15% lower than their male peers and the extreme is occurs in indigenous day laborers, whose salary is 36.5% lower than that of non-indigenous men. This increase in gaps in the highest percentiles denotes the presence of glass ceiling, as measured by Arulampalam et al. (2007).

- When indigenous men are compared with non-indigenous women, it is observed that the former have a wage 9% lower than their average; this difference is highest in the lower part of the distribution (19.8% at the 25th percentile), but in the middle and upper part of the distribution the differences are not significant in the wages of these groups.

Results

- Comparing women, the effect of ethnicity can be observed: non-indigenous women have a wage that is 16.7% higher than indigenous women on average, and when explored through the distribution it is observed that this difference is wider at the extremes. of the distribution and not significant at the median. In the 25th percentile, non-indigenous women have a salary 21.1% higher than their indigenous peers; Likewise, this difference is 21.1% in the 90th percentile. This could be interpreted as the presence of a sticky floor and a glass ceiling.

- The comparison between indigenous men and women allows us to observe the gender effect on indigenous people. On average, indigenous women tend to receive a wage that is 7.6% lower than their male counterparts, but when the difference is explored through the wage distribution, it is observed that it only occurs in the upper part of the distribution, that is, 16.8%. % difference in the 90th percentile. The importance of these results lies in the interaction that the effects of gender and ethnicity can have on wage and that these can vary depending on the part of the distribution to which reference is made. In this way, it is shown that the gender-ethnicity interaction (indigenous women) denotes a wide difference that ranges from 21% to 36%, being reduced only in the median of the distribution; In this way the two effects widen the differences.

Conclusions

- The results with the matching show that there is a direct negative effect of gender and ethnicity on wages, so that women tend to have lower wages than men, as well as indigenous people lower than non-indigenous people, in an environment where farmworkers with similar observable characteristics are compared. The effect of ethnicity is larger than that of gender (16.5% vs. 4%). The advantage of matching estimates over DOB is that it controls for heterogeneity and thus substantially reduces selection bias in observable characteristics.

- When these gaps were analyzed throughout the wage's distribution, it was observed that in the lower part of the distribution only the effect of ethnicity is present, with the effect of gender being non-significant. However, as we advanced to the highest percentiles, then the effect of ethnicity was reduced a little but that of gender increased, which is why non-indigenous women receive salaries almost equal to their male peers in the 10th percentile, but far superior to the indigenous people. However, in the 90th percentile they had wages 15% lower than non-indigenous farmworkers, and the distance between indigenous workers and non-indigenous men increased, so a glass ceiling appeared in terms of gender.

Conclusions

- While, in the case of indigenous men, compared to non-indigenous men, the effect of ethnicity was reduced as the distribution progressed. When the effect of ethnicity on women was compared, it was observed that the gap is larger at the extremes and that even at the median salary differences cannot be distinguished, which denotes the presence of a sticky floor at the same time as a sticky ceiling. glass.

- As noted before, there is little work on the wage gap for farmworkers. For the case of the United States, Fisher et al. (2021) found that women earn six percent less than men, which is partly due to discrimination. In the case of Mexico, Stabridis and Salgado Viveros (2022) found that day laborers had a salary that was 15 percent lower than farmworkers and that part of this difference is due to discrimination.

- The fact that negative effects regarding gender and ethnicity are found in salaries cannot only be attributed to factors such as discrimination, since there are some unobservable characteristics such as the type of payment (integrated salary, mixed, piecework), some type of selection in occupation (some tasks may be assigned to women or indigenous people, or they choose to perform them to obtain higher remuneration) or the difficulty that women, due to their gender role, may have in accessing some extra payments for working longer working hours. extensive, so they could have lower salaries. However, it is possible to attribute this negative effect to a certain degree of discrimination based on gender and ethnicity.