THESIS

EXPLORING LABOR DYNAMICS: INDIGENOUS IDENTITY, WAGE DIFFERENTIALS, AND POVERTY RISK AMONG MEXICAN-BORN FARMWORKERS IN THE U.S. AGRICULTURAL SECTOR

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ABSTRACT

EXPLORING LABOR DYNAMICS: INDIGENOUS IDENTITY, WAGE DIFFERENTIALS, AND POVERTY RISK AMONG MEXICAN-BORN FARMWORKERS IN THE U.S. AGRICULTURAL SECTOR

This thesis examines the challenges faced by Mexican Indigenous farmworkers within the U.S. agricultural landscape, with a specific focus on an observed wage differential when compared to their Mexican Non-Indigenous counterparts. While existing research has extensively investigated various facets of the U.S. farm labor force, there remains a gap in understanding the specific economic and earnings hurdles encountered by Mexican Indigenous farmworkers. Most of the existing literature has concentrated on overarching demographic trends, farm labor productivity, and the ramifications of immigration policies, leaving the experiences and labor market outcomes of Mexican Indigenous farmworkers insufficiently examined.

This research explores the relationship between Indigenous identity, wages, and poverty within the U.S. agricultural sector, using data from the National Agricultural Workers Survey (NAWS) spanning 2003 to 2020. This study focuses on Mexican-born workers, distinguishing between Indigenous and non-Indigenous individuals. Over 17 years, we found a significant average wage gap of -5.25% between the two groups, with Indigenous farmworkers earning less. We investigate the factors contributing to the observed wage gap and examine the relationship of Indigenous identity and farmworkers' earnings. Specifically, we analyze whether Indigenous identity is independently associated with lower earnings among farmworkers, while controlling for various factors that may explain differences in earnings compared to Non-Indigenous counterparts. Additionally, we explore if Indigenous identity increases one's risk of poverty, while also controlling for factors influencing this risk.

We conduct additional analyses by examining whether Indigenous identity affects earnings within specific farmworker cohorts. The second data approach examines the distribution of farmwork weeks worked in the past year by Indigenous farmworkers surveyed by the NAWS. It explores the average characteristics of Indigenous farmworkers who have worked very few weeks compared to those who have worked more extensively. The third is a marginal effects analysis which quantifies the economic significance of employee and employment characteristics on earnings across Indigenous and Non-Indigenous farmworkers. This approach enables us to assess the specific cumulative influence of Indigenous identity on earnings, while also considering the average effects associated with Indigenous status.

Findings from this research will identify the determinants of the wage gap between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers, potentially attributable to observable characteristics (such as education and years of experience), Indigenous identity (indicative of wage discrimination), or a combination of both. Depending on the results, we can recommend policy initiatives aimed at improving educational attainment and other skills for Mexican-Indigenous farmworkers, enabling them to earn wages comparable to their Non-Indigenous counterparts. Additionally, we can inform new legislation seeking to improve the types of work arrangements between Indigenous farmworkers and agricultural employers, in efforts to take a step towards preventing wage discrimination based on Indigenous identity as part of those work arrangements.

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DEDICATION

I would like to dedicate this thesis to my parents, and the Indigenous community.

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Chapter 1

Introduction

U.S. farmworkers are a particularly vulnerable population and Indigenous workers, who comprise roughly 10% of the farmworker population, likely face even greater challenges (Gold et al., 2022). Most U.S. farmworkers are foreign-born, with approximately 80% of them originating from Mexico (Martin, 2022). This population of Mexican-born farmworkers has seen a decline over recent years, however with a 12.9% decrease being found from a peak of 7 million in 2007 to 2013 (Hertz and Zahniser, 2013). This decrease in the farmworker supply has had important implications for agricultural producers as this scarcity of farmworkers has been linked to resulting in labor shortages across the farm labor sector such as farm labor contractors, crew leaders, soil preparation, planting and cultivating, and overall production in states such as California and Michigan (Hertz and Zahniser, 2013). As such, trends within the U.S. farm labor force signal important implications for farm labor shortages and producers on a grand scale. Despite the seemingly modest representation of Indigenous farmworkers within the overall farm labor force, Indigenous farmworkers emerge as a disadvantaged group among an already socioeconomically disadvantaged labor force.

This paper investigates the challenges encountered by Mexican Indigenous farmworkers in the U.S. agricultural labor market and to explore whether their Indigenous identity magnifies the already significant obstacles faced by farmworkers at large. The core inquiry of this research is rooted in the examination of how Indigenous identity influences both wages and the risk of poverty among farmworkers. This paper addresses the question of whether being an Indigenous farmworker is associated with disparities in wage earnings and an elevated risk of falling below

the poverty threshold. Through this work, we look to contribute to the broader discourse on farmworker welfare. Furthermore, we seek to illuminate the implications that a deeper understanding of farmworkers, beyond their production-related aspects, may have on overall producer welfare.

While existing research has looked into various aspects of the U.S. farm labor force, there remains a notable gap in understanding the specific challenges faced by Indigenous farmworkers. Existing research has predominantly concentrated on overarching demographic trends, encompassing the overall composition of the farm labor force and the repercussions of immigration policies. The examination of farmworker welfare has proven to be a valuable perspective in deciphering the challenges confronted by agricultural producers. Notably, work by Taylor et al. (2012) has spearheaded this exploration, highlighting the welfare and lifestyle changes of Mexicans in rural Mexico, thereby providing insights into the shifts observed in the U.S. farm labor supply. While this work has shed light on critical aspects influencing the U.S. farm labor supply, there remains an incomplete conversation concerning economic changes among Indigenous farmworkers, warranting further investigation in this study.

This paper contributes to the existing literatures in three key ways. Firstly, it informs us of the unique economic challenges experienced by Mexican-Indigenous farmworkers across the entire U.S., acknowledging their distinct experiences within the broader farm labor market. Second, by focusing on wage differentials and poverty risk specifically among Indigenous farmworkers, this study aims to fill a gap at the intersection of farmworker and immigration status in the current research landscape, where broader demographic trends have taken precedence. Third, drawing on established methodologies and insights from prior work, we strive to offer policy implications based on the findings of our research.

In the subsequent sections, we carry out our analyses geared at answering our research questions. Section 2 provides a review of the existing literature, emphasizing gaps in our understanding and laying the groundwork for our study on Indigenous farmworkers. Section 3 outlines the data and methodology employed, explaining the approach taken to address our research questions. Section 4 presents and discusses our key findings on wage differentials and poverty risk among Indigenous farmworkers, incorporating a cohort/subset analysis, farmwork weeks analysis, and marginal effect analysis. Finally, Section 5 concludes with a synthesis of our contributions, their implications for policymakers, and avenues for future research.

Chapter 2

Literature Review

2.1 Indigenous Peoples

Indigenous people are defined as the original or earliest known inhabitants of a region and are estimated to number 476.6 million worldwide (Yupsanis, 2010). They are concentrated primarily in Asia and the Pacific (70.5%), followed by Africa (16.3%), Latin America and the Caribbean (11.5%), Northern America (1.6%), and Europe and Central Asia (0.1%)(WHO, 2023). Historically, the ancestral territories of Indigenous peoples have faced colonization by dominant ethnic groups, who rationalized their actions through notions of racial and religious supremacy, land utilization, or economic prospects (Miller et al., 2010). Numerous Indigenous nations around the globe presently reside in nations where they constitute a minority ethnic group (Saito, 2019).

2.2 Trends in The Presence of Indigenous Peoples in U.S. Agriculture

This study is primarily concerned with indigenous populations in Mexico, due to their historical involvement in U.S. agriculture. Most U.S. farmworkers are foreign-born, with approximately 80% of them originating from Mexico (Martin, 2022). The demographic patterns are shaped by historical factors, such as legislative initiatives like the Bracero program, which facilitated the migration of workers from Mexico to the U.S. (Mandeel, 2014).

Much of U.S. agriculture still relies on Mexican-Indigenous peoples as a source of farm labor. This is evidenced with their presence in certain U.S. agricultural sectors. California has been known as a strong hub for agricultural activity (10% of the all U.S. commodity receipts) (USDA ERS, 2022) and having the most Indigenous farmworkers. (Richard Mines et al., 2010). A unique characteristic differentiating these Indigenous and non-Indigenous farmworkers are their native dialects that many of them speak. Mixteco, Zapoteco or Triqui are the languages spoken by a large majority of California's Indigenous farmworkers (Richard Mines et al., 2010).

The presence of Mexican-Indigenous workers in certain agricultural areas can be traced back to colonization. More specifically, the colonization of Mexico by Spain resulted in economic abandonment by the Mexican-Mestizo government on Mexican-Indigenous peoples (Richard Mines et al., 2010). Some noteworthy ways that the economic abandonment impacted Indigenous communities were through the withdrawal of government support for Indigenous corn producers and the expanding cash economy from the urban areas of Mexico. As such, migration into the U.S. to work in agriculture served the only means of economic stability for Mexican-Indigenous peoples.

The fruits & nuts and vegetable sectors are often associated with more arduous workforce roles (Richard Mines et al., 2010) given how much of the tasks for the respective operations involve harvesting and transplanting plants, operating irrigation equipment, repairing and maintaining farm vehicles, and harvesting fruits and vegetables by hand (Marinoudi et al., 2021). Additionally, many of these crop jobs are seasonal in nature which drives farmworker migration while other agricultural jobs such as in the dairy industry provide yearlong employment.

2.3 Challenges for Mexican-Indigenous Peoples

The motivation for exploring potential employment discrimination against Mexican-Indigenous farmworkers in the U.S. farm labor market arises from their longstanding history of discrimination in Mexico, both historically and currently. Mexican-Indigenous people have historically faced numerous challenges related to their status and interactions with non-Indigenous groups. These challenges can be traced back to the colonial regime established by the Spanish colonization of Mexico, where an individual's social standing was determined by their ethnic background (Nieto, 2018). This systematic discrimination resulted in the marginalization of the Mexican-Indigenous population, particularly through more limited employment and educational opportunities orchestrated by the Mestizo-dominated government (Richard Mines et al., 2010).The ramifications of this historical discrimination persist, with Mexican-Indigenous women being associated with higher mortality rates, less access to healthcare services, elevated poverty levels, and poorer overall health outcomes compared to non-Indigenous communities (Gamlin and Osrin, 2020).

The historical discrimination against Mexican Indigenous people, rooted in colonial regimes and perpetuated by systematic biases, motivates questions about the transference of such discrimination to the U.S. setting and its impact on Mexican-Indigenous farmworkers in U.S. agriculture. Some discrimination adjacent research in this field looks at hiring discrimination against Non-Mexican-Indigenous peoples in the United States but it was found that no discrimination concerning interview rates, did not differ from race (Button and Walker, 2020). Limitations of this study lie in only being able to speak to hiring discrimination but not to whether Indigenous experience some form of wage discrimination or if the proportion of Indigenous workers in more disadvantaged occupations is a function of discrimination itself.

2.4 Farmworkers as a Disadvantaged Group

The exploration of socioeconomic disadvantages amongst Mexican Indigenous farmworkers unravels the roots of their socio-economic vulnerabilities and discern how these challenges manifest in the U.S. agricultural setting. Farmworkers constitute a disadvantaged group in the agricultural sector, facing multifaceted challenges that intersect with their socio-economic status and occupational conditions. One aspect contributing to their challenges is the hazardous nature of agricultural labor. A series of acute and chronic injuries and illnesses have been consistently identified within agricultural work such as musculoskeletal disorders, respiratory diseases, noise induced hearing loss, pesticide-related illnesses, and an elevated incidence of reported cancer cases being recurrently documented (Quandt et al., 2004; Arcury et al., 2002; Earle-Richardson et al., 2003; Gamsky et al., 1992; Garcia et al., 1996; Kirkhorn and Schenker, 2002; Lantz et al., 1994; McCurdy et al., 2003; Mobed et al., 1992; Rautiainen and Reynolds, 2002; Von Essen and McCurdy, 1998). Additionally, climate change appears to pose significant dangers to outside laborers with weather related challenges. Heat stress cases have become increasingly pertinent due to rising global temperatures, posing serious risks to the health and safety of farmworkers (Becker and Stewart, 2011; Mac and McCauley, n.d.). Limited access to healthcare further exacerbates these health challenges, creating a complex web of vulnerabilities that migrant farmworkers navigate (Hansen and Donohoe, 2003).

The disadvantages that farmworkers face are also largely due to restricted English proficiency, limited U.S. work experience, and lower levels of education compared to their counterparts in other sectors (Kandel, 2008). These challenges span into different aspects of farmworkers lives. Limited English proficiency hinders effective communication, creating barriers in interactions with

employers, colleagues, and local communities. This linguistic constraint not only impedes the assimilation of essential job instructions but also limits the ability of farmworkers to advocate for their rights and access critical services, such as healthcare. Moreover, language barriers may contribute to social isolation, exacerbating the already demanding and isolated nature of agricultural work (Mora et al., 2014; Nawyn et al., 2012).

Economic disparities also exist among farmworkers. In 2020, over 2 million farmworkers earned an average wage of approximately $14.62 per hour, translating to earnings at just under 60% of what comparable workers in non-agricultural sectors made (Costa, 2021). Additionally, the issue of wage theft has been a notable challenge that farmworkers are vulnerable to. Costa and Martin (2023) find that the frequency of investigations by the Department of Labor's Wage and Hour Division has declined by over 60% since 2000, covering fewer than 1% of farm employers annually. Their comprehensive report on federal labor standards investigations reveals an annual occurrence of reported wage theft, stemming from investigations into employers violating federal wage and hour laws Costa et al., 2020. The convergence of lower wages and the prevalence of wage theft emphasizes the economic challenges faced by farmworkers. Additionally, food insecurity is a prevalent concern among numerous farmworkers (Quandt et al., 2004; Weigel et al., 2007).

2.5 Impacts of Worker Challenges on Workplace Performance

As supported by data and research-based evidence presented in the previous sections, farmworkers face many challenges across many dimensions while living in the U.S. This is of importance for agricultural producers given how many of these challenges have been connected to the workplace itself. "Well-being" is a commonly studied measure in the literature with well-being encompassing many different measures in and of itself. Bryson et al. (2017) decide on the aver-

age level of job satisfaction as an appropriate measure of well-being and explore its relationship with workplace performance. Bryson et al. (2017) find a positive association between the average level of job satisfaction and workplace performance. Additionally, Isham et al. (2021) find experimental evidence showing a causal effect of worker wellbeing on productivity. More extensively, productivity growth presents a negative impact on worker well-being while accounting for resource-intensive mediators.

Much of the literature has uncovered that farmworkers work in more hazardous conditions which link farmworkers to musculoskeletal dis- orders, respiratory diseases, noise induced hearing loss, pesticide-related illnesses, and an elevated incidence of reported cancer cases being recurrently documented (Quandt et al., 2004; Arcury et al., 2002; Earle-Richardson et al., 2003; Gamsky et al., 1992; Garcia et al., 1996; Kirkhorn and Schenker, 2002; Lantz et al., 1994; McCurdy et al., 2003; Mobed et al., 1992; Rautiainen and Reynolds, 2002; Von Essen and McCurdy, 1998). This evidence, combined with findings from Das et al. (2008) suggesting that safer workplaces contribute to enhanced quality outcomes in supply chain performance, emphasizes the notion that the challenges faced by farmworkers due to the nature of agricultural work have significant implications for agricultural output and productivity.

In essence, the correlation between deterioration in worker well-being, including aspects like job satisfaction and the prevalence of occupational illnesses, holds significant implications for both the productivity and resiliency of the workforce and employers. Improvements in job satisfaction correlate with enhanced workplace performance, whereas improved workplace safety is linked to improved workplace/operations performance. Recognizing these relationships is critical for understanding the broader impact of worker challenges within the specific context of the agricultural sector, particularly concerning Indigenous farmworkers and their unique set of challenges.

2.6 Workplace Outcomes and Labor Market Inequality

When it comes to labor market inequality, wage disparities emerge as a focal point and a commonly observable outcome. One group of common interest has been women and the accompanying gender wage gap. Some literature by Blau and Kahn (2017) explored the extent of the gender wage gap and found that the gender pay gap shrunk dramatically from 1980 to 1989, with slower convergence thereafter until 2010. The female wage gap remained present, however which was most notable in highly skilled fields which suggests that developments in the labor market for high skilled positions still favored men over women. Such findings prove that forms of discrimination still play out within the labor market despite laws in place to prevent such discrimination from occurring. This has presented important policy implications for reducing the gender wage gap and reducing hiring bias favoring men over women. In the context of our research on Indigenous farmworkers and labor market inequality within the agricultural sector, examining wage disparities becomes crucial. By extending our focus beyond traditional gender-based analyses, we provide a unique perspective on wage inequality within farm labor, offering insights on whether inequality compounds within an already marginalized workforce, particularly among Indigenous farmworkers.

In the examination of labor market inequality, another method arises when considering wage structures and payment methods. Pena (2010) analyzes the interplay between poverty, legal status, and wage payment methods within the agricultural sector. The findings from Pena (2010) found a relationship between participating in piecerate payment schemes and hourly wages with piecerate work being associated with 22.5% higher hourly wages. Considering the approach of measuring the association of certain self-selected factors on earnings, the issue of endogeneity comes to mind.

More specifically, these self-selected factors include payment schemes. Individuals may self-select into or out of specific payment schemes based on unobservable characteristics correlated with their wages or productivity, We leverage modeling from Pena (2010) modeling but narrow our focus on Indigenous identity which alleviates some endogeneity concerns given how Indigenous identity is not endogenous. By leveraging Pena's methodology, we can further explore whether Indigenous farmworkers earn lower hourly wages in comparison to their non-Indigenous counterparts, whether due to terms of employment or pay levels, ultimately allowing us to discern whether they are disproportionately affected by poverty within the agricultural labor market.

2.7 Empirical Methods for Finding Labor Market Discrimination

Empirical methods have proved useful for providing evidence of different types of discrimination in the labor market. Early investigations into the relationship between discrimination and labor market outcomes came in the form of decomposing wages using a regression-based approach (R. Oaxaca, 1973; Neumark, 1988). This approach allowed researchers to control for productivity-related differences, leaving the remaining wage gap as an estimate of potential discrimination. As we go into our research, we recognize the historical significance of such regression-based approaches and explore them in a new context of the US farm workforce.

Our focus shifts to the strengths and pitfalls of the decomposition of wages regression approach in understanding labor market discrimination. This method, prevalent in early investigations, offers insights into the wage gaps generated by potential discrimination between different groups. We recognize the limitations inherent in this approach. The regression decomposition method

faces challenges in fully accounting for the myriad worker characteristics impacting productivity, a critical consideration given the multifaceted nature of discrimination. Moreover, concerns arise from the use of certain variables as controls, which may themselves be influenced by discrimination. For instance, the experience and tenure levels of workers, often used as controls, might be affected if a group, such as Indigenous workers, faces discrimination on the job (Gronau, 1988). These reflections guide our exploration into alternative approaches, such as leveraging the full set of data on worker characteristics available in the National Agricultural Workers Survey (NAWS) for estimating wage differentials.

The regression decomposition method has laid a foundation for understanding wage gaps,which are indicative of potential discrimination. New developments in the literature with respect to wage discrimination has come in the form of experimental studies. These studies, conducted in laboratory and field settings, use diverse strategies, such as vignette studies, to model real-world decisions and more fully discern discrimination patterns (Neumark, 2018). More specifically, vignette studies examine discrimination by presenting participants hypothetical scenarios related to the selection process of job candidates for hiring or employees for training, promotion, etc. Subsequently, they may inquire about participants' attitudes toward these individuals or gather additional information to explain the rationale behind participants' decisions. Despite their capabilities in explaining discrimination in decision-making hiring processes, vignette studies fall short in speaking to wage discrimination, or identifying the exact mechanism for the root cause of the hiring discrimination. Recognizing these nuances, our study strategically aligns with the strengths of the regression approach, given data availability constraints. However, we acknowledge the potential of experimental research as a future avenue, offering an opportunity for deeper exploration into

the causes and manifestations of discrimination within the agricultural sector, particularly among Indigenous farmworkers.

Audit or correspondence (AC) studies emerge as prevalent tools for examining hiring disparities (Neumark, 2018). These studies, common in field experiments, involve individuals posing as job candidates ("testers") representing various racial, ethnic, or other demographic groups. Alternatively, correspondence studies deploy hypothetical job applicants on paper or electronically, systematically varying only in terms of group membership. Audit studies measure outcomes in terms of "callbacks," while correspondence studies focus on actual job offers. The strength of AC studies lies in their ability to reveal the true impact of discrimination, as they remove the influence of group differences. However, limitations persist, with these studies primarily detecting discrimination in hiring practices rather than delving into its underlying causes.

Additionally, recent literature explores experimental research methods assessing whether providing more information about job applicants' characteristics mitigates selection differences between groups. A consensus within the literature posits that revealing additional information about candidates, beyond their salient characteristics (e.g., sex, race, ethnicity), reduces adverse selection outcomes (Tosi and Einbender, 1985; Davison and Burke, 2000; Hosoda et al., 2003). This nuanced perspective adds depth to our understanding of discrimination's manifestations, acknowledging the potential benefits of information disclosure in ameliorating hiring disparities.

Despite the literature covering mainly hiring discrimination, this approach becomes less feasible concerning agricultural workers. The hiring discrimination issue becomes less important due to the nature of hiring being largely informal and thus unlikely to capture discrimination. Our study leverages a regression approach, acknowledging its practicality, while laying the groundwork for

potential future exploration using experimental research to uncover the causal mechanisms of discrimination within the agricultural sector, especially concerning Indigenous farmworkers.

Chapter 3

Conceptual Framework

We investigate the wage gap between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers, focusing on their causes. When thinking about the observed wage differentials and what causes it, two main categories of factors come to mind: worker heterogeneity and firm heterogeneity. In terms of worker heterogeneity, some of the empirical literature has attributed certain worker characteristics as the determinant for differing levels of wages across workers. Other possible determinants for wage differentials may be linked to the firm level, but work by Abowd et al. (1999) found that worker heterogeneity is more important than firm heterogeneity in explaining variations in wage rates across individuals and industries in France. Additional work by Abowd and Creecy (2002) provides more evidence to support his 1999 findings.

Taking this into account, we focus on worker heterogeneity and how worker characteristics drive the wage gap between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers. We couple these ideas visually to think about the determinants of wages and how these determinants vary across Mexican-Indigenous vs Mexican-Non-Indigenous farmworkers. First, we begin with a conceptual model that models the general determinants of wages according to previous literature.

Figure 3.1 illustrates the relationship between worker and job attributes identified by prior work. Pena (2010) found that legal status (citizenship, green card, or other authorization), education, and farm experience are positively associated with earnings. Additionally, working in certain crops—such as field crops, fruits & nuts, and vegetables—was associated with lower earnings compared to horticultural crops. The significance of work experience as a robust predictor of

earnings is corroborated by Fogg et al. (2018), who also emphasizes the importance of educational attainment. Similarly, R. L. Oaxaca and Ransom (1994) provides evidence supporting the positive influence of both experience and years of schooling on earnings.

We tie these ideas to how we think about explaining the observed wage gap between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers. Controlling for these worker characteristics is important, as previous studies have identified them as key contributors to wage differentials among workers. By controlling for these key factors, we aim to obtain a true estimate of how Indigenous identity influences earnings, thereby addressing the potential occurrence of wage discrimination.

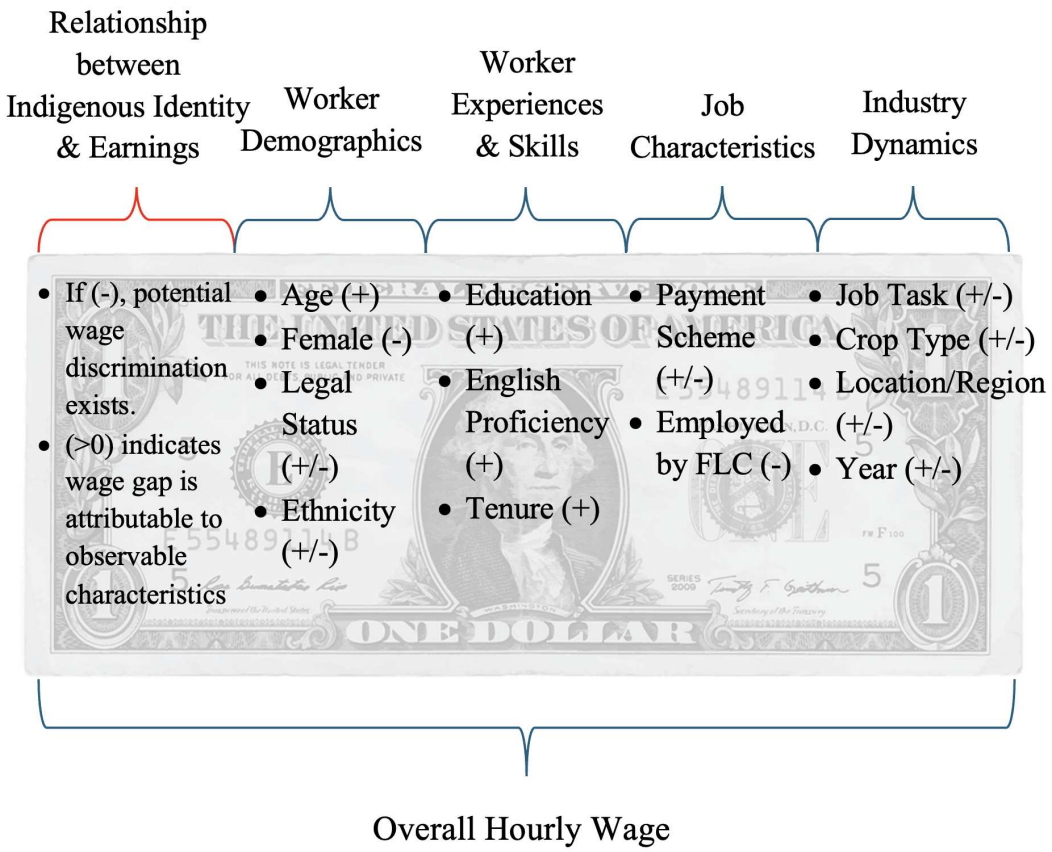
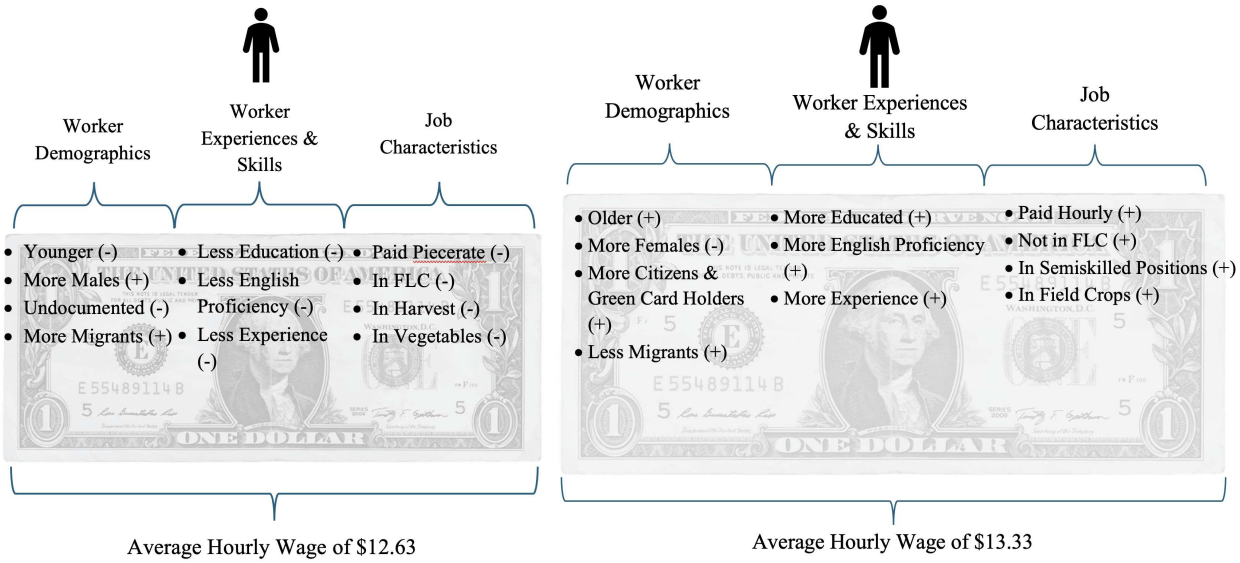


Figure 3.1: Modeling for Potential Wage Discrimination

If a negative association between Indigenous identity and earnings persists after controlling for observable characteristics typically driving wage gaps among farmworkers, it may signal wage discrimination for those of Indigenous status. Conversely, if no significant association is detected, the wage gap can be attributed to other observable characteristics.

Mexican-Indigenous workers have different relationships with the aforementioned characteristics compared to Mexican-Non-Indigenous farmworkers. While we can isolate the impact of Indigenous identity on earnings, it's important to recognize that Mexican-Indigenous farmworkers often possess traits contributing to their lower average wages. These characteristics, such as less work experience and lower educational attainment, can affect hourly wages, as we show visually in Figure 3.2. The observed wage gap suggests that Mexican-Indigenous farmworkers are associated with traits that result in lower earnings.



(a) Mexican-Indigenous **(b)** Mexican-Non-Indigenous

Figure 3.2: Cumulative Average Characteristics Across Worker Groups

By comparing the average set of characteristics for each group and analyzing the differences in accumulation between them, we can estimate the cumulative impact of being Mexican-Indigenous versus Mexican-Non-Indigenous on wages. While the previous framework addresses the potential for wage discrimination, this approach focuses on estimating the overall wage penalty experienced by Indigenous farmworkers.

Chapter 4

Data

Data used in this study is from the National Agricultural Workers Survey (NAWS), which is a comprehensive and nationally representative dataset. The NAWS is an employment-based, random-sample survey of U.S. crop workers, specifically designed to collect demographic, employment, and health data through face-to-face interviews. The NAWS is conducted by the U.S. Department of Labor.

The survey uses a stratified random sampling technique which, when combined with the provided survey weights produces a nationally-representative sample within regions and interview cycles. The NAWS provides robust information for the profile of U.S. farmworkers, specifically for Indigenous farmworkers which is often scarce information. To identify Indigenous farmworkers, the NAWS incorporates supplemental questions about languages spoken by adults and childhood language exposure. These questions are key indicators of Indigenous identity, as many Indigenous dialects are robust indicators of Indigenous peoples. The NAWS composes information from these responses to these questions as well as questions regarding race to classify individuals as Indigenous peoples.

4.1 Methods

We compare Mexican-Indigenous farmworkers to Mexican-Non-Indigenous farmworkers. Focusing on Mexican farmworkers for this paper is particularly relevant for several reasons. Firstly, Mexicans constitute a large portion of the agricultural labor force in the United States. Secondly,

narrowing our focus to just Mexican-born farmworkers provides a more reasonable comparison between Indigenous and Non-Indigenous individuals. This is because, although there are significant differences between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers, the disparities between Mexican-Indigenous and U.S.-born Indigenous farmworkers are expected to be even more pronounced. Thus, Mexican farmworkers are a more reasonable comparison group.

On top of the job and crop type that farmworkers report working in, the NAWS collects a series of additional worker characteristics such as educational obtainment, English proficiency, birth state, legal status, and farmwork experience (years & weeks). Workers self-report the highest grade of education completed. For variables like English proficiency, workers respond on a four-level scale: 'Not at all,' 'A little,' 'Somewhat,' and 'Well.' For our statistical analyses, we create and use an "Educated" variable which takes on a 1 if a worker reports at least the 'Somewhat' proficiency and 0 otherwise. Similarly, we create an "Educated" variable which takes on a 1 and 0 otherwise if a worker reports having completed at least the 9th grade.

Survey weights are made available with the NAWS dataset to account for differences in sampling probabilities. There are years when the number of workers responding to the NAWS differs and survey weights serve to correct for non-response at the region and cycle levels.

4.2 Exploratory Data Analysis

We restrict our analysis with survey weights applied for observations from 2003 to 2020 on Mexican-born workers to compare Mexican-Indigenous workers to Mexican-Non-Indigenous workers. By narrowing our analysis to this demographic group, we create a comparable sample for examining differences between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers.

Among Indigenous workers, 89.21% are identified as Mexican born. Among Mexican workers, approximately 10.5% are identified as Indigenous.

Summary statistics for Indigenous and Non-Indigenous farmworkers are presented in Table 4.1 which reveal significant differences between Indigenous and Non-Indigenous farmworkers. It's important to note that '*Family Income Below Poverty Level*' classifies individuals as being in poverty by matching poverty thresholds with an individual's reported family size and year of observation.

In terms of employment patterns, Indigenous workers stand out with a higher prevalence in piecerate work (12.71%) compared to their non-Indigenous counterparts (9.79%). Conversely, non-Indigenous workers are participating more in hourly jobs, constituting 85.44% as opposed to 82.13% for Indigenous workers. A closer examination of employment sectors uncovers that Indigenous workers are more actively involved in vegetable farming, while non-Indigenous workers predominate in field crops and horticulture.

A notable gap is present in language proficiency and educational obtainment, with a higher percentage of Indigenous workers demonstrating little to no English proficiency and a lower proportion of Indigenous farmworkers having at least a 9th-grade education. Income disparities are evident, emphasizing that a higher percentage of Indigenous workers fall into lower income brackets, a trend especially noticeable in the 'under $500 annually' category.

Indigenous farmworkers also possess less farmwork experience, on average, compared to Non-Indigenous farmworkers. Indigenous farmworkers, on average, have approximately 4 years less experience, work 17 fewer days per year, and spend about 2 weeks less on the job annually. Indige-

Table 4.1: Summary Statistics with Weights Applied (Mexican Workers, 2003 to 2020)

Variable	Non-Indigenous N=21,253	Indigenous N=2,501	P-value
	Average	Average	
Below Minimum Wage	0.76% (0.0006)	1.56% (0.0025)	<0.001***
Family Income Below	28.57% (0.0031)	37.19% (0.0097)	<0.001***
Female	20.07% (0.0027)	19.63% (0.0079)	0.603
Age	38.80 (0.0860)	34.35 (0.2427)	<0.001***
Educated (At Least 9th Grade)	33.73% (0.0032)	24.51% (0.0086)	<0.001***
English Speaking	18.61% (0.0027)	7.76% (0.0053)	<0.001***
Migrant	21.63% (0.0028)	33.55% (0.0094)	<0.001***
Citizen	6.61% (0.0017)	2.32% (0.0030)	<0.001***
Green Card	30.74% (0.0032)	15.83% (0.0073)	<0.001***
Other Work Auth.	1.63% (0.0009)	0.72% (0.0017)	<0.001***
Undocumented	61.02% (0.0033)	81.13% (0.0078)	<0.001***
Hourly	85.44% (0.0024)	82.13% (0.0077)	<0.001***
Piecerate	9.79% (0.0020)	12.71% (0.0067)	<0.001***
Combo, Hourly & Piecerate	1.69% (0.0009)	3.84% (0.0038)	<0.001***
Salary	3.08% (0.0012)	1.32% (0.0023)	<0.001***
Field Crops	10.74% (0.0021)	5.36% (0.0045)	<0.001***
Fruits & Nuts	43.65% (0.0034)	44.98% (0.0099)	0.204
Horticulture	17.99% (0.0026)	17.15% (0.0075)	0.303
Vegetables	23.05% (0.0029)	29.03% (0.0091)	<0.001***
Employed by FLC	14.68% (0.0024)	21.91% (0.0083)	<0.001***
Owns Home	21.46% (0.0028)	8.56% (0.0056)	<0.001***
Rents Non-Employer/Non-Relative	57.93% (0.0034)	74.41% (0.0087)	<0.001***
Total Income, Over 40000	11.98% (0.0022)	5.24% (0.0045)	<0.001***
Preharvest	24.91% (0.0030)	27.15% (0.0089)	0.015*
Harvest	23.04% (0.0029)	31.95% (0.0093)	<0.001***
Postharvest	13.00% (0.0023)	10.24% (0.0061)	<0.001***
Semiskilled	31.51% (0.0032)	23.39% (0.0085)	<0.001***
Supervisor	0.07% (0.0002)	0.04% (0.0004)	0.577
Real Hourly Wage	13.33 [3.83]	12.63 [3.68]	<0.001***
Years in U.S. Farmwork	15.39 [11.07]	11.11 [9.40]	<0.001***
Actual Farmwork Days	236.63 [80.42]	218.52 [79.55]	<0.001***
Farmwork Weeks in Last Year	41.27 [13.03]	39.23 [13.18]	<0.001***

[1]Source: National Agricultural Workers Survey
[2]Survey Weights Applied
[3](Standard Error)
[4][Standard Deviation]
[5]Significance Levels:*** p < 0.001; ** p < 0.01; * p < 0.05

nous farmworkers are also younger which can explain the experience/participation gap. Indigenous farmworkers are, on average, about 4 years younger. Most importantly, Indigenous farmworkers earn $0.70 cents less than their Non-Indigenous counterparts.

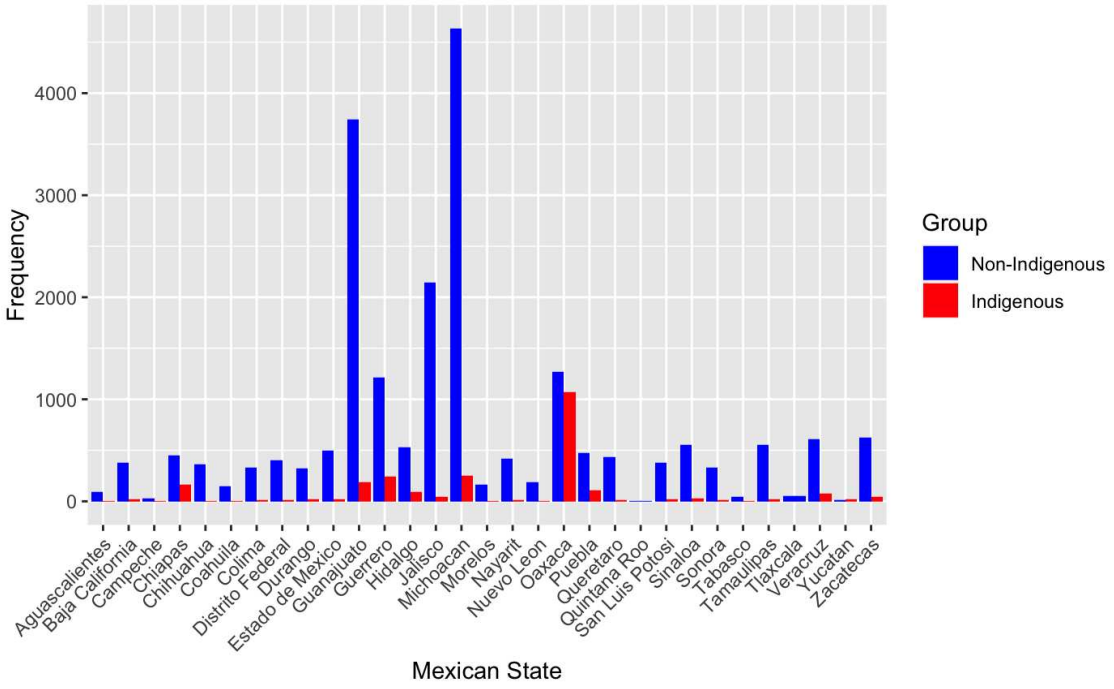


Figure 4.1: Distribution of Indigenous vs Non-Indigenous Workers by Mexican Birth State

The examination of Indigenous and Non-Indigenous agricultural laborers across various states in Mexico reveals nuanced patterns in their distribution. Oaxaca stands out with the highest proportion of Indigenous farmworkers, constituting approximately 43% of Mexican-Indigenous workers. Additionally, states such as Michoacan (9.97%), Guerrero (9.53%), and Guanajuato (7.47%) demonstrate significant Indigenous representation. Conversely, Coahuila, Campeche, and Aguascalientes exhibit the lowest proportions, with Indigenous workers constituting less than 1% of the workforce. These findings highlight the regional concentration of Indigenous farmworkers.

An examination of overall average earnings across demographic groups reveals that Indigenous farmworkers have the second-lowest average earnings and the lowest median earnings (tied with migrants).

Table 4.2: Real Hourly Wage by Demographic Group (2003-2020)

Demographic	Average Real Hourly Wage	Median Real Hourly Wage
Indigenous	$12.62	$11.52
Non-Indigenous	$13.32	$12.30
Citizen	$16.04	$14.70
Green Card Holders	$13.80	$12.78
Other Work Authorization	$13.84	$12.73
Undocumented	$12.70	$11.75
Migrant	$12.51	$11.52
Farm Labor Contracted	$12.96	$11.70

[6]Source: National Agricultural Workers Survey
[7]Survey Weights Applied

Mexican-Indigenous farmworkers' average hourly wages have consistently trailed Mexican-Non-Indigenous wages over time except for 2008 and 2016. In terms of median wages, Indigenous workers' earnings lag behind Non-Indigenous for all years, except for in 2018, when they are indistinguishable.

The wage differences across both demographic groups become statistically significant for earlier years and for certain years after. The data presented may be evidence that the wage gap has shrunk over time but still remains present. Although most yearly wage gaps are not as statistically significant, Mexican-Indigenous farmworkers, at the lowest, face a minimum $0.30 less earnings on average. Of the 17 years of data, Mexican-Indigenous earn less in 15 of those years.

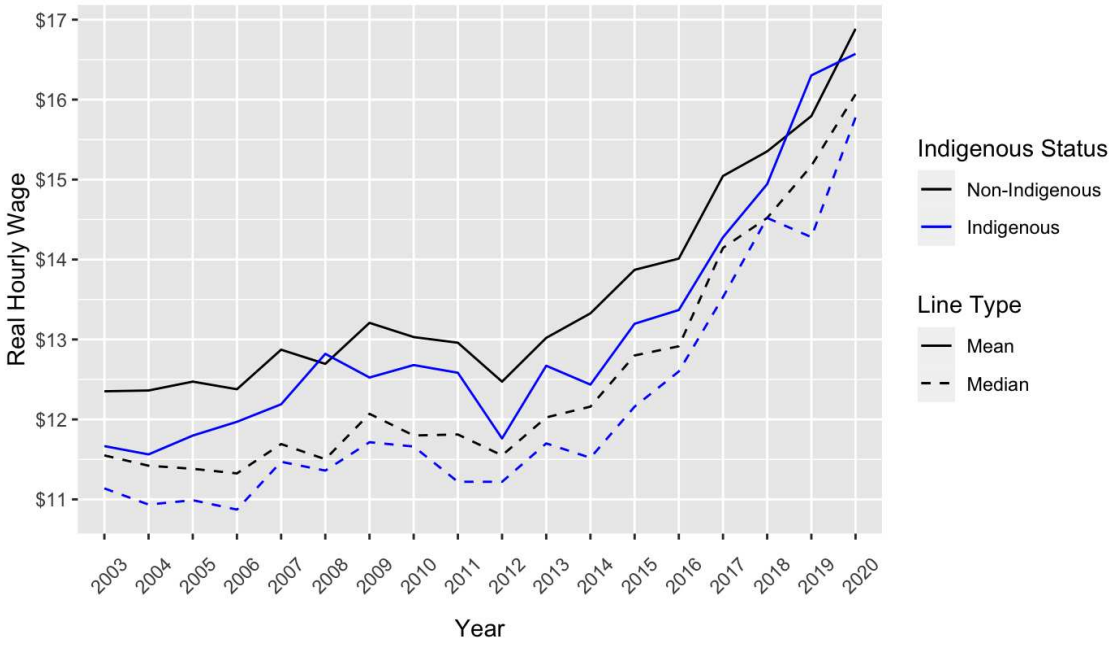


Figure 4.2: Median and Mean Real Hourly Wage Over Time by Ethnic Group

Table 4.3: Differences in Mean Wages Between Indigenous and Non-Indigenous Farmworkers by Year

Year	Indigenous Mean	Non-Indigenous Mean	p-value
2003	11.68	12.38	0.0002 ***
2004	11.58	12.38	0.0002 ***
2005	11.81	12.46	0.0091 **
2006	11.98	12.34	0.3436
2007	12.20	12.85	0.0106 *
2008	12.79	12.71	0.8220
2009	12.53	13.17	0.0067 **
2010	12.70	13.03	0.3410
2011	12.62	12.92	0.4324
2012	11.77	12.50	0.0045 **
2013	12.68	13.04	0.3825
2014	12.38	13.35	0.0005 ***
2015	13.22	13.88	0.0366 *
2016	13.39	14.02	0.0172 *
2017	14.31	15.04	0.0992
2018	14.97	15.38	0.3103
2019	16.30	15.78	0.4703
2020	16.57	16.88	0.5246

Chapter 5

Empirical Methodology

In this section, we detail the empirical approaches used to investigate the dynamics of wage differentials and poverty risks among Indigenous farmworkers in the United States.

The first approach uses an econometric framework to assess the relationship between Indigenous identity and wages, as well as Indigenous identity and poverty. Building upon an established econometric framework by Pena (2010), we use regression analysis to measure the association of Indigenous identity with earnings while controlling for a comprehensive set of covariates. This methodological approach enables us to identify to which extent Indigenous identity itself and other observable characteristics explain the wage gap between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers.

In addition to the econometric analysis, we incorporate a cohort-based examination to see whether the general Indigenous and wages relationship results remain stable even within certain demographic and occupational characteristics. We do so by disaggregating the data based on key demographic variables, such as English proficiency and employment status.

Furthermore, we extend our investigation to explore the role of employee characteristics on labor-participation patterns. By examining the average characteristics of individuals who work the fewest amount of weeks worked in a work year, we look to answer if certain worker characteristics are more commonly linked than others to the small amount of farmwork weeks worked in the past year.

Lastly, we introduce a marginal effects analysis aimed at quantifying the marginal effects of our 5.1 regression covariates on wage differentials, thereby providing insights into the economic significance of individual characteristics. This allows us to aggregate the marginal effects to understand the cumulative impact of being Indigenous on earnings, the opposite of ceteris paribus.

Collectively, these empirical methods enable us to understand whether Indigenous identity in and of itself is associated with lower, higher, or indistinguishable earnings and poverty risks. Additionally, taking into account our farmwork weeks and marginal effects analysis, we can better understand the issue of the Indigenous pay gap present amongst Mexican-born farmworkers.

5.1 The Relationship of Indigenous Identity on Wages

What is the relationship of Indigenous identity and Wages? To understand the relationship of Indigenous identity and earnings, we use a straightforward regression strategy to isolate the impact of Indigenous identity and examine its' relationship with wages. This method is useful in addressing challenges related to differing productivity levels and characteristics across groups of interest which contribute to differences in wages such as differences in education, gender, etc to which the literature has commonly pointed to. We build on Pena (2010) to model the isolated impact of Indigenous identity on hourly earnings. Considering this approach, the regression strategy is as follows:

$$ln(wage_i) = X_i\beta + \gamma Indigenous_i + \epsilon_i \tag{5.1}$$

where the dependent variable, $ln(wage_i)$, represents logarithmic hourly equivalent wage rates. The effect of piecerate pay method on wages is represented by γ. A vector of observable characteristics,

X_i, is used to control for worker features including legal status group, gender, age, education, experience, tenure, English language ability, crop, task, survey year, and region.

We control for education by creating an "Educated" variable which takes on a "1" for those who have completed at least the 9th grade and onwards. The determination of who is classified as educated can come in different forms but for this analysis, we relied on statistics of educational obtainment levels of Mexican farmworkers in the U.S and Mexican citizens at large. Farm laborers generally have lower levels of educational attainment and are more likely to be Hispanic of Mexican origin ("USDA ERS - Farm Labor", 2023). According to data from the American Community Survey (ACS), the "USDA ERS - Farm Labor" (2023) finds that 45% of U.S farm laborers lack a high school diploma, 34% have a high school diploma and 22% percent have at least some college. In regards to Mexicans at large, Rama (2011) states that most young children attend primary school but only 62 percent reach secondary school and at secondary level about half of students drop out and only a quarter reach higher education, according to non-governmental organization Mexicanos Primero (Mexicans First). Coupling these facts together, we find that classifying an educated person as having completed at least the 9th grade proves sufficient. We use this "Educated" variable for our poverty model and additional wage regressions done on subsets of Mexican-Indigenous farmworkers in sections 5.2 and 5.3, respectively. Limitations of this method come down to unobserved characteristics which could explain the negative or positive relationship between Indigenous identity on wages.

5.2 Does Indigenous Identity Correlate to Higher Poverty Risk?

Does Being Indigenous Expose You to Greater Poverty Risk? On the conversation of wages, our focus shifts to understanding if Indigenous workers are exposed to a greater risk of being in

poverty. In our analysis of the NAWS, we find the average real hourly wage for Indigenous workers is $12.63 while it is $13.33 for Non-Indigenous workers. This motivates not just the exploration for understanding if Indigenous identity is the factor contributing to lower earnings but also if Indigenous farmworkers are exposed to a higher probability of being in poverty.

We refer to previous work by Pena (2010), to inform our model of measuring how Indigenous identity impacts the probability that a worker's total annual family income is below the poverty threshold. This serves as a simple and straightforward approach while replicating several useful elements from our wage model such as controlling for characteristics that could be contributing to Indigenous workers being more likely to be in poverty. To understand how being Indigenous exposes you to poverty risk, we build on Pena's (2010) work and model:

$$Pr(poverty_i) = \alpha_i \rho + \delta Indigenous + \varphi_i \tag{5.2}$$

where $Pr(poverty_i)$ represents the probability that a worker's total annual family income is below the poverty threshold. We use a logistic regression model to examine the relationship between Indigenous identity and earnings.

5.3 Cohort Analysis: Demographic and Occupational Influences on Wage Differentials

In this section, a comparative analysis of wage differentials among distinct demographic and occupational groups within the farmworker population is presented. By disaggregating the farmworker sample based on key characteristics such as immigration status, educational attainment,

migration status, language proficiency, and agricultural sector specialization, we look for additional evidence for the relationship between Indigenous identity and earnings within these subpopulations.

We use the same econometric framework used in section 4.1, but apply it to specific subsamples of the NAWS to investigate how the association between Indigenous identity and earnings varies across different demographic and occupational cohorts.

This approach allows us to isolate the impact of Indigenous identity on earnings by controlling for specific characteristics within each subset. For example, by running the regression exclusively on undocumented workers, we eliminate the confounding effect of legal status. A positive estimate on the Indigenous coefficient in this subset would indicate that, even among undocumented workers, Indigenous farmworkers earn less. This method ensures that the observed wage differentials are more likely attributable to Indigenous identity itself, rather than being influenced by other confounding variables.

Similarly, we can explore how the impact of Indigenous identity on wages may differ among female workers, those with limited education levels, migrant workers, non-English speakers, and workers in specific agricultural sectors such as fruits and nuts.

5.4 Farmwork Weeks Analysis: Understanding Employment Participation among Indigenous Farmworkers

The analysis of farmwork weeks among Indigenous farmworkers complements the regression results as a means to better understand the direct relationship of Indigenous identity on wages. While the regression model helps us understand how Indigenous identity affects wages by consid-

ering other measurable factors, it doesn't fully show us how different each Indigenous farmworker is in terms of their education, work experience, and other important characteristics. More specifically, we are able to look at the different levels of farmwork weeks worked in the past year for all Indigenous farmworkers and what the worker characteristics are for differing levels of farmwork weeks worked.

The intuition for this exercise is to determine whether the demographics of Mexican-Indigenous workers who work the fewest amount of farmwork weeks (at or below the 10th percentile of observed farmwork weeks worked in a year) differ to Mexican-Indigenous workers who work more than the minimum (above the 10th percentile of observed farmwork weeks worked in a year). Focusing on the number of farmwork weeks worked, rather than other characteristics, is critical for several reasons: The number of weeks worked is a direct indicator of employment stability and economic security. Workers with more consistent employment throughout the year are likely to have greater financial stability. The extent to which Indigenous farmworkers are integrated into the labor market can be indirectly assessed by looking at the number of weeks they work. Workers who secure more weeks of employment may be better integrated, possibly due to higher skill levels, better networks, or other beneficial work-related characteristics. By examining the extremes of the farmwork weeks distribution, particularly those at or below the 10th percentile and those above, we can investigate whether certain worker characteristics correlate with the amount of work secured. This can highlight disparities in education, language proficiency, legal status, and other factors that might influence employment opportunities

The hypothesis is as follows: Let $X_1, X_2, ..., X_k$ be the k different characteristics. Let μ_{X_i,G_H} and μ_{X_i,G_L} be the means of the i-th characteristic for the high and low number of weeks groups,

respectively.

$$H_0^i : \mu_{X_i,G_H} = \mu_{X_i,G_L} \quad \text{for all } i = 1, 2, \ldots, k$$

$$H_A^i : \mu_{X_i,G_H} \neq \mu_{X_i,G_L} \quad \text{for all } i = 1, 2, \ldots, k$$

Significant differences could indicate that certain demographic, educational, or occupational characteristics are associated with the ability to secure more stable and longer-term employment in agriculture. For example, higher educational attainment or better English proficiency might enable some workers to obtain more weeks of work. The presence of significant differences may also suggest that systemic barriers or discrimination exist, preventing certain groups from accessing consistent employment. For instance, if non-English speakers or less-educated workers are disproportionately represented among those working fewer weeks, it could point to structural challenges within the labor market. Significant differences could reflect personal preferences or life circumstances that lead some workers to opt for fewer weeks of work. For example, older workers or those with family responsibilities might choose to work fewer weeks, highlighting the importance of understanding worker choices in employment patterns. A lack of significant differences could suggest that the factors influencing the number of weeks worked are uniformly experienced across different demographics. This might indicate that the barriers to consistent employment affect all workers similarly, regardless of their characteristics.

5.5 Marginal Effects Analysis: Quantifying the Economic Significance of Covariates and Indigenous Identity

Wage differentials between Mexican-Indigenous and Mexican-Non-Indigenous farmworkers highlight potential wage discrimination across the two groups. In section 5.1, we looked to isolate

the impact of Indigenous identity and its' relationship with wages. However, our analysis also revealed an interaction between Indigenous identity and other worker characteristics that contribute to lower wages. Indeed, being Indigenous is linked with a distinct set of characteristics that contribute to wage differentials. For instance, data from the National Agricultural Workers Survey (NAWS) reveals that Indigenous farmworkers exhibit particular levels of education, English language proficiency, and other demographic factors. Looking at the average set of characteristics allows us to understand what a representative Indigenous farmworker looks like (as an aggregation of their relevant characteristics). Taken as a whole, the question becomes: *What are the implications on earnings based on the average characteristics of indigenous and non-indigenous workers?*.

In section 3.1, we found that Mexican-Indigenous farmworkers earned the second lowest average hourly wage and the first lowest (tied with Migrants) median hourly wage amongst certain groups of farmworkers, based on data from the NAWS. In comparison to Mexican-Non-Indigenous farmworkers, the average Mexican-Indigenous hourly wage was $0.70 lower (-5.25%) and the median hourly wage was $0.78 (-6.77%) lower.

The motivation behind this analysis stems from our desire to comprehensively understand the role of Indigenous identity in shaping wage disparities among farmworkers. By examining the cumulative impact of Indigenous identity on earnings through a marginal effects analysis, we add an angle of understanding to the Indigenous earnings gap. This allows us to recognize the average characteristics of an Indigenous farmworker and essentially remove ceteris paribus from our understanding of Indigenous identity's impact on earnings.

To conduct the marginal effects analysis, we rely on estimates from our OLS model from section 5.1. Next, we calculate the marginal effects of each covariate, including Indigenous identity,

on wages. The marginal effect of Indigenous identity indicates the additional or reduced earnings associated with being Indigenous, relative to being Non-Indigenous, while holding all other covariates constant at their average values. Equations for the calculations can be found in the appendix.

We do this same calculation, but for Non-Indigenous farmworkers. By computing the marginal effects separately for Indigenous and Non-Indigenous farmworkers and summing these effects, we obtain insight into the cumulative impact of being Indigenous on earnings compared to being Non-Indigenous.

Chapter 6

Results

We first explore the results focused on examining the impact of Indigenous identity on hourly wages and poverty outcomes using an econometric OLS framework, controlling for key variables. A detailed cohort analysis follows, revealing wage differentials within various demographic and occupational subgroups. We also investigate seasonal employment patterns to identify characteristics of Indigenous farmworkers with insufficient work weeks. Lastly, a marginal effects analysis quantifies the cumulative impact of each characteristic on wage differentials and poverty risks. These findings provide insights for policy interventions to enhance the earning potential and economic well-being of Mexican Indigenous farmworkers.

6.1 Relationship of Indigenous Identity on Wages

In our models, the reference category for immigration status is Citizen status. For payment schemes, the Hourly payment scheme is the reference category. For crops, miscellaneous crops is the reference category and ”Other” tasks is the reference for tasks.

Table 6.1: Regression Results for Real Hourly Wages: Baseline and Controlled Models

Variable	(1)	(2)	(3)	(4)
	Log(Wage)	Log(Wage)	Log(Wage)	Log(Wage)
	No Controls	FEs	FEs & Worker Characteristics	All Controls
Indigenous	-0.0531***(0.0051)	-0.0398***(0.0047)	-0.0144***(0.0041)	-0.0139***(0.0041)
Female			-0.0589***(0.0033)	-0.0603***(0.0034)
Age			-0.0011***(0.0001)	-0.0012***(0.0001)
Green Card			-0.0670***(0.0069)	-0.0671***(0.0068)
Other Work Auth			-0.0737***(0.0122)	-0.0744***(0.0121)
Unauthorized			-0.1160***(0.0071)	-0.1171***(0.0071)
Education (At Least 9th Grade)			0.0200***(0.0030)	0.0201***(0.0030)
Migrant			-0.0310***(0.0037)	-0.0291***(0.0036)
Farm Experience (Years)			0.0028***(0.0002)	0.0028***(0.0002)
Farmwork Weeks			0.0018***(0.0001)	0.0016***(0.0001)
English Speaking			0.0448***(0.0039)	0.0442***(0.0039)
Paid Piecerate			0.1704***(0.0078)	0.1727***(0.0082)
Paid Combo			0.4009***(0.0176)	0.4015***(0.0179)
Salary			0.3743***(0.0112)	0.3783***(0.0112)
Employed by FLC			-0.0289***(0.0039)	-0.0243***(0.0040)
Field Crops				-0.0632***(0.0069)
Fruits & Nuts				-0.0432***(0.0063)
Horticulture				-0.0233***(0.0064)
Vegetables				-0.0548***(0.0064)
Pre-harvest				-0.0440***(0.0056)
Harvest				-0.0381***(0.0061)
Post-harvest				-0.0486***(0.0062)
Semiskilled				-0.0450***(0.0057)
Supervisor				-0.0297 (0.0907)
(Intercept)	2.5559***(0.0017)	2.4222***(0.0069)	2.4562***(0.0118)	2.5405***(0.0137)
Observations	23,935	23,935	23,935	23,935
R^2	0.0043	0.1572	0.3836	0.3900

[8]Source: National Agricultural Workers Survey

[9]Survey Weights Applied

[10]Significance Levels:*** p < 0.001; ** p < 0.01; * p < 0.05

Across all model specifications, Indigenous identity correlates negatively with wages, highlighting the potential for wage discrimination towards Indigenous farmworkers or other unobservable characteristics contributing to the negative relationship. Based on our initial specification, Indigenous workers experience a wage gap, with the coefficient estimate suggesting that, on average, Indigenous farmworkers earn approximately 5.31% less than their non-Indigenous counterparts.

Subsequent model specifications introduce fixed effects and additional observable characteristics to account for unobserved and observable factors influencing wages. The inclusion of fixed effects captures some of the variability in wages attributable to time-invariant individual characteristics, such as innate ability or unmeasured cultural factors. Despite this, Indigenous identity remains a significant predictor of lower wages, albeit with slightly smaller effects. This suggests that even after controlling for time-invariant individual characteristics, such as innate ability or unmeasured cultural factors, Indigenous workers still experience a wage disadvantage.

Notably, female workers emerge as another significant covariate, with a negative coefficient (-0.0589, $p < 0.001$), indicating lower wages for women farmworkers. This is evident in results for specifications (3) and (4). Skills that are shown to be the most influential on earnings include Education, years of farm experience, and English speaking ability, consistent with prior literature.

In the final model, incorporating a comprehensive set of controls, Indigenous identity is associated with about 1.4% lower hourly wages, holding all other factors constant. Linking this back to the results from specification (1), we can make three key observations: i) Indigeneity as a characteristic explains about 27% of the wage gap experienced by Mexican-Indigenous farmworkers, ii) approximately 53% of the wage gap can be attributed to observed characteristics such as education and work experience, and iii) undocumented farmworkers experience the largest earnings gap,

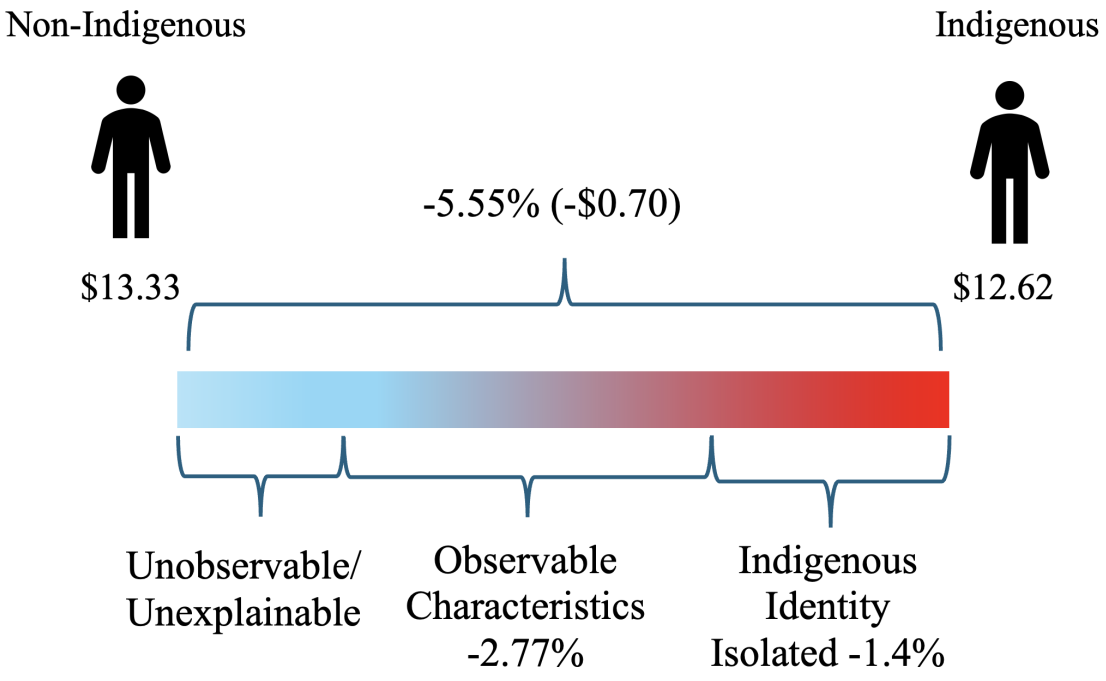


Figure 6.1: Relationship of Indigenous Identity and Earnings

with earnings 11.75% lower than those of citizen farmworkers. The second lowest earning group is women, who earn 6.03% less than men

The findings from our analysis of the impact of Indigenous identity on wages offer insights into the economic challenges faced by Indigenous farmworkers in U.S. farmwork. Across various model specifications, Indigenous workers consistently experience a wage gap compared to their non-Indigenous counterparts, indicating the presence of potential wage discrimination within the agricultural sector. While the magnitude of this wage gap is minimal (1.39% lower wages compared to Non-Indigenous farmworkers), this finding has more significant implications given the fact that farmworkers, in general, are already one of the lowest earners in the entire U.S. labor force Costa, 2021. In the context of the initially observed wage gap (5.25%, -$0.70), we can attribute that observable characteristics explain 2.77% of the wage gap. When isolated, Indigenous

identity in and of itself explains 1.39% of the observed wage gap. This finding signals potential wage discrimination against Mexican-Indigenous farmworkers. The remaining 1.39% of the wage gap can be attributed to unobservable characteristics.

6.2 Indigenous Status and Poverty Risk

Among Mexican farmworkers, 37.19% of Indigenous farmworkers are found to have a family income below the poverty level compared to 28.57% of Non-Indigenous farmworkers having a family income below the poverty level according to our analysis of the NAWS. The difference is statistically significant at the 5% significance level. Poverty status is indicated at the annual family income level.

Table 6.2: Logistic Regression Results for Probability of Poverty: Baseline and Controlled Models

Variable	(1)	(2)	(3)	(4)
	Pr(Poverty)	Pr(Poverty)	Pr(Poverty)	Pr(Poverty)
	No Controls	FEs	FEs & Worker Characteristics	All Controls
Indigenous	0.0859***(0.0101)	0.0697***(0.0100)	0.0015 (0.0091)	-0.0012 (0.0091)
Female			0.0318***(0.0074)	0.0254***(0.0077)
Age			-0.0012***(0.0003)	-0.0011***(0.0003)
Green Card			0.0145 (0.0098)	0.0135 (0.0098)
Other Work Auth.			0.0451 (0.0233)	0.0423 (0.0232)
Undocumented			0.1136***(0.0112)	0.1107*** (0.0112)
Education (At Least 9thth Grade)			-0.0359***(0.0063)	-0.0341***(0.0063)
Migrant			0.1128***(0.0078)	0.1095***(0.0078)
Farm Experience (Years)			-0.0027***(0.0004)	-0.0027***(0.0004)
Farmwork Days			-0.0006***(0.0001)	-0.0006***(0.0001)
Farmwork Weeks			-0.0048***(0.0006)	-0.0048***(0.0006)
English Speaking			-0.0178*(0.0074)	-0.0150*(0.0074)
Piecerate			0.0410***(0.0102)	0.0160 (0.0111)
Combo, Piecerate & Hourly			0.0053 (0.0219)	-0.0171 (0.0224)
Salary			-0.0563***(0.0119)	-0.0502***(0.0120)
FLC			0.0577***(0.0085)	0.0523***(0.0086)
Field Crops				0.0328*(0.0150)
Fruits & Nuts				0.0752***(0.0136)
Horticulture				0.0584***(0.0141)
Vegetables				0.0641***(0.0139)
Preharvest				0.0586***(0.0129)
Harvest				0.0723***(0.0137)
Postharvest				0.0567***(0.0143)
Semiskilled				0.0362**(0.0130)
Supervisor				-0.0725 (0.0680)
(Intercept)	0.2860***(0.0031)	0.5074***(0.0140)	0.7113***(0.0230)	0.6076***(0.0277)
Observations	23,859	23,859	23,859	23,859
R-Squared	0.00	0.05	0.18	0.18

[11] Source: National Agricultural Workers Survey

[12] Survey Weights Applied

[13] Significance Levels:*** p < 0.001; ** p < 0.01; * p < 0.05

The logistic regression results from estimating equation (2) are presented in Table 5 and allow one to explore the probability of poverty among agricultural workers, considering various model specifications with different levels of control. These models provide insights into the factors influencing the likelihood of experiencing poverty within this population, drawing parallels with similar research conducted by Anita Pena (2010) on farmworker economic outcomes.

Model 1, which includes no controls beyond the Indigenous variable, reveals that Indigenous status has a statistically significant positive effect on the probability of poverty among Indigenous agricultural workers. Indigenous farmworkers are approximately 8.59% more likely to experience poverty compared to their non-Indigenous counterparts.

Expanding our analysis to include observable worker characteristics, the coefficient estimate loses statistical significance and magnitude, rendering the relationship almost non-existent. Despite that, being in a piecerate payment scheme contributes positively to the risk of poverty compared to being in an hourly payment scheme. More specifically, being in a piecerate payment scheme elevates the risk of poverty by 4.1% percent compared to being in an hourly payment scheme, holding all else constant. This aligns with the findings of Pena (2010), which also presented results linking those working under piecerate payment schemes with an elevated risk of poverty.

In our final model, we find that the relationship between Indigenous identity and poverty remains negligible. Despite this, we find that being undocumented and/or a migrant elevates poverty risk significantly. Undocumented farmworkers are 11% more likely to be below the poverty line compared to citizen farmworkers. Migrants are also 11% more likely to be below the poverty line compared to non-migrants.

6.3 Results: Demographic and Occupational Influences on Wage Differentials

Transitioning away from the examination of poverty risk, we now examine the demographic and occupational factors contributing to wage differentials within this population. Building upon the insights gleaned from the regression models, we rerun our original wage regression from 5.1 but on subsetted groups to explore if the negative relationship between Indigenous identity and wages is also present within certain groups.

We only report models on subsets in which a statistically significant relationship between Indigenous identity and earnings was found. Results for additional subsets can be found in the appendix. The analysis confirms the presence of a significant and stable negative association between Indigenous identity and wages across various subsetted groups. This presents a key finding given the results of our original wage model from section 6.1.

Indigenous farmworkers remain negatively associated with earnings amongst undocumented, women, non-English speaking, and fruits & nuts workers, respectively. The association remains stable within the mentioned groups, providing robust evidence for the negative relationship between Indigenous identity and earnings.

Migrants consistently exhibit a negative association with lower earnings across all subgroups analyzed. Women also experience significant earning penalties, consistently associated with approximately 6% lower earnings. Additionally, undocumented workers face substantial wage penalties, with their earnings being 8-13% lower compared to citizen farmworkers, on average.

Table 6.3: Demographic and Occupational Influences on Wage Differentials Among Different Subgroups of Farmworkers

Variable	Undocumented	Women	Non-English Speaking	Fruits & Nuts
	Log(Wage)	Log(Wage)	Log(Wage)	Log(Wage)
Indigenous	-0.0161*** (0.0045)	-0.0261** (0.0093)	-0.0170*** (0.0043)	-0.0249*** (0.0063)
Gender	-0.0580*** (0.0040)		-0.0578*** (0.0037)	-0.0539*** (0.0057)
Age	-0.0007*** (0.0002)	-0.0008* (0.0003)	-0.0015*** (0.0002)	-0.0016*** (0.0002)
Green Card		-0.0541*** (0.0156)	-0.0567*** (0.0091)	-0.0776*** (0.0110)
Other Work Auth.		-0.0471 (0.0264)	-0.0531*** (0.0158)	-0.0532** (0.0199)
Undocumented		-0.0829*** (0.0153)	-0.1127*** (0.0094)	-0.1258*** (0.0114)
Employed by FLC	-0.0194*** (0.0045)	-0.0243** (0.0081)	-0.0206*** (0.0042)	-0.0125* (0.0053)
Migrant	-0.0266*** (0.0046)	-0.0288** (0.0091)	-0.0314*** (0.0039)	-0.0231*** (0.0058)
Piecerate	0.1604*** (0.0094)	0.1604*** (0.0094)	0.1755*** (0.0085)	0.1608*** (0.0095)
Combo: Piecerate & Hourly	0.4095*** (0.0209)	0.4095*** (0.0209)	0.4013*** (0.0187)	0.2943*** (0.0187)
Salary	0.3567*** (0.0175)	0.3567*** (0.0175)	0.3747*** (0.0146)	0.3585*** (0.0200)
Field Crops	-0.0488*** (0.0083)	-0.0852*** (0.0203)	-0.0560*** (0.0075)	
Fruits & Nuts	-0.0290*** (0.0074)	-0.0290*** (0.0074)	-0.0388*** (0.0068)	
Horticulture	-0.0144 (0.0074)	-0.0439** (0.0158)	-0.0224** (0.0069)	
Vegetables	-0.0475*** (0.0076)	-0.0647*** (0.0158)	-0.0506*** (0.0070)	
English Speaking	0.0380*** (0.0050)	0.0194* (0.0085)		0.0291*** (0.0065)
Farm Experience (Year)	0.0034*** (0.0003)	0.0034*** (0.0003)	0.0026***(0.0002)	0.0026***(0.0003)
Farmwork Weeks in Past Year	0.0011*** (0.0001)	0.0014*** (0.0002)	0.0013*** (0.0001)	0.0022*** (0.0002)
Educated (At Least 9th Grade	0.0219*** (0.0033)	0.0189** (0.0069)	0.0212*** (0.0032)	0.0250*** (0.0048)
Preharvest	-0.0343*** (0.0064)	-0.0302* (0.0127)	-0.0398*** (0.0058)	-0.0576*** (0.0111)
Harvest	-0.0244*** (0.0070)	-0.0340* (0.0143)	-0.0334*** (0.0063)	-0.0329** (0.0116)
Postharvest	-0.0388*** (0.0073)	-0.0502*** (0.0134)	-0.0435*** (0.0065)	-0.0597*** (0.0126)
Semiskilled	-0.0470*** (0.0067)	-0.0361* (0.0143)	-0.0422*** (0.0059)	-0.0694*** (0.0110)
Supervisor	0.2094*** (0.0242)	0.0771 (0.0712)	-0.0662 (0.1143)	0.0280 (0.0773)
(Intercept)	2.3919*** (0.0136)	2.4654*** (0.0311)	2.5450*** (0.0158)	2.5184*** (0.0229)
R^2	0.3753	0.3567	0.3731	0.3449
Observations	15,135	4,793	19,757	10,469

[14]Source: National Agricultural Workers Survey

[15]Survey Weights Applied

[16]Significance Levels:*** p < 0.001; ** p < 0.01; * p < 0.05

Additionally, worker skills & experience continue to influence wage differentials, even among subgroups. Years spent in U.S farmwork and farmwork weeks worked in a year carry a significant, stable, and positive relationship with earnings. Having at least a 9th grade education and English speaking ability is also consistently, positively associated with earnings while also being stable across specifications.

The subset analysis serves as a de facto robustness check and supports the initial findings, emphasizing the persistent negative impact of Indigenous identity on earnings. This relationship is particularly pronounced among undocumented workers, women, non-English speakers, and those working in fruits and nuts. Additionally, migrants, women, and undocumented workers continue to experience significant wage penalties.

6.4 Results: Analysis of Seasonal Employment Participation Among Indigenous Farmworkers

Table 6.4 presents the descriptive statistics and the results of significance testing for various variables stratified by Mexican-Indigenous farmworkers' position relative to the 10th percentile threshold of farmwork weeks in the last year. This stratification allows us to examine differences in characteristics and outcomes between Mexican-Indigenous farmworkers with different levels of engagement in farmwork.

Starting with the proportion of Mexican-Indigenous workers earning below the minimum wage, we observe a statistically significant difference between those at or below the 10th percentile and those above it. Workers below the 10th percentile threshold exhibit a notably higher percentage of

Table 6.4: Descriptive Statistics and Comparison of Variables Between Mexican-Indigenous Farmworkers at or Below the 10th and Above the 10th Percentile of Farmwork Weeks Distribution

Variable	Mean		P-value
	At or Below 10th Percentile	Above 10th Percentile	
Adjusted Wage	11.75	12.72	<0.001***
Family Income Below Poverty Level (%)	82.61	32.07	<0.001***
Below Minimum Wage (%)	6.32	1.02	<0.001***
Female (%)	26.09	18.91	0.006**
Age	29.72	34.87	<0.001***
Real Hourly Wage	11.75	12.72	<0.001***
Paid Hourly (%)	78.26	82.56	0.091
Paid Piecerate (%)	17.39	12.19	0.019*
Paid Combo, Hourly & Piecerate (%)	4.35	3.78	0.657
Paid Salary (%)	0.00	1.47	0.051
Field Crops (%)	5.14	5.38	0.870
Fruits & Nuts (%)	49.41	44.48	0.136
Horticulture (%)	12.25	17.70	0.029*
Vegetables (%)	30.43	28.87	0.603
Citizen (%)	0.00	2.58	0.009**
Green Card (%)	8.30	16.68	<0.001***
Other Wrk Auth (%)	0.00	0.80	0.152
Undocumented (%)	91.70	79.94	<0.001***
Employed by FLC (%)	30.83	20.91	<0.001***
Migrant (%)	77.08	28.65	<0.001***
English Speaking (%)	3.95	8.19	0.017*
Educated (At Least 9th Grade) (%)	26.88	24.24	0.356
Total Income, Over 40000 (%)	1.19	5.69	0.002**
Years Since First Did Farmwork	29.72	34.87	<0.001***
Farmwork Weeks in Last Year	10.35	42.48	<0.001***
Preharvest (%)	32.02	26.60	0.067
Harvest (%)	38.34	31.23	0.022*
Postharvest (%)	4.35	10.90	0.001**
Semiskilled (%)	15.02	24.33	<0.001***
Supervisor (%)	0.00	0.04	0.737

[17]Source: National Agricultural Workers Survey

[18]Survey Weights Applied

[19]Significance Levels:*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

earnings below the minimum wage compared to their counterparts above the threshold, indicating potential disparities in wage compliance or bargaining power.

Gender distribution also shows a significant discrepancy between the two groups, with a higher proportion of women observed among farmworkers at or below the 10th percentile of farmwork weeks. This finding raises questions about gender-specific factors contributing to differential participation in farmwork.

Age distribution presents another striking difference, with farmworkers above the 10th percentile threshold being, on average, older than those below it. This suggests that older Indigenous individuals might be more likely to sustain longer periods of engagement in farmwork, possibly due to differences in financial obligations, employment opportunities, or physical ability.

Real hourly wage, an essential indicator of economic well-being, exhibits a significant disparity between the two groups, with farmworkers above the 10th percentile threshold earning higher wages on average. This finding supports the importance of farmwork duration in determining earnings levels, with prolonged engagement likely associated with higher wages.

The distribution of employment arrangements, including paid hourly, piecerate, combo, and salary, also varies significantly between the two groups. Notably, a higher percentage of workers above the 10th percentile threshold are compensated through salary arrangements, reflecting potentially more stable or higher-paying employment opportunities for this group.

Moreover, differences in immigration status, such as citizenship, possession of green cards, or undocumented status, are pronounced between the two groups. Farmworkers at or below the 10th percentile of farmwork weeks exhibit higher percentages of undocumented status and lower percentages of legal authorization for work, indicating potential vulnerabilities or barriers to formal employment for this group.

Additionally, the proportion of Indigenous farmworkers employed by Farm Labor Contractors (FLCs) and the percentage of migrants vary significantly between the two groups. This suggests differential access to employment intermediaries and mobility patterns among farmworkers with different levels of engagement in farmwork.

Furthermore, linguistic proficiency, as indicated by English-speaking ability, differs substantially between the two groups, with a higher percentage of English speakers among farmworkers above the 10th percentile threshold. This finding emphasizes the potential role of language barriers in shaping employment opportunities in the agricultural sector.

Educational attainment is comparable across both groups, potentially indicating that education does not influence labor participation. A stark difference exists in terms of farmworkers living below the poverty level. Those who work the fewest farmwork weeks in a year have higher reports of family income below the poverty level. Another potential relationship exists between years since having first done farmwork and labor participation. Those who worked more than the minimum number of farmwork weeks have, on average, about 6 more years of experience in farmwork compared to those who worked very few weeks. All in all, there exist significant differences between Mexican-Indigenous farmworkers who work a few weeks to those who more than a few weeks.

6.5 Results: Marginal Effects

Table 6.5 presents the results of our marginal effects analysis to understand the cumulative impact of being Indigenous on earnings.

Table 6.5: Regression Coefficients and Marginal Effects of Demographic and Occupational Factors on Wage Differentials Between Indigenous and Non-Indigenous Farmworkers

Variable	Coefficient	Indigenous Average	Non-Indigenous Average	Indigenous Marginal Effect	Non-Indigenous Marginal Effect
Indigenous	-0.0139	1	0	-0.0139	0
Female	-0.0603	0.1963	0.2007	-0.0118	-0.0121
Age	-0.0012	34.35	38.80	-0.0412	-0.0466
Green Card	-0.0674	0.1583	0.3074	-0.0107	-0.0207
Other Work Auth	-0.0744	0.0072	0.0163	-0.0005	-0.0012
Unauthorized	-0.1168	0.8113	0.6102	-0.0948	-0.0713
Educated (At Least 9th Grade)	0.0201	0.2451	0.3373	0.0049	0.0068
Migrant	-0.0291	0.3355	0.2163	-0.0098	-0.0063
Years in Farmwork	0.0028	11.1	15.36	0.0311	0.0430
Farmwork Weeks	0.0016	39.23	41.27	0.0628	0.0660
English Speaking	0.0442	0.0776	0.1861	0.0034	0.0082
Piecerate	0.1727	0.1271	0.0979	0.0220	0.0169
Combo, Hourly-Piecerate	0.4015	0.0384	0.0169	0.0154	0.0068
Salary	0.3783	0.0132	0.0308	0.0050	0.0117
FLC	-0.0243	0.2191	0.1468	-0.0053	-0.0036
Field Crops	-0.0632	0.0536	0.1074	-0.0034	-0.0068
Fruits & Nuts	-0.0432	0.4498	0.4365	-0.0194	-0.0189
Horticulture	-0.0248	0.1715	0.1801	-0.0043	-0.0045
Vegetables	-0.0548	0.2903	0.2305	-0.0159	-0.0126
Preharvest	-0.0440	0.2715	0.2491	-0.0119	-0.0110
Harvest	-0.0381	0.3195	0.2304	-0.0122	-0.0088
Postharvest	-0.0486	0.1024	0.1300	-0.0050	-0.0063
Semiskilled	-0.0450	0.2339	0.3151	-0.0105	-0.0142
Supervisor	-0.0297	0.0004	0.0007	-0.0000	-0.0000
Sum				-0.1261	-0.0853

[20]Source: National Agricultural Workers Survey
[21]Survey Weights Applied
[22]Significance Levels: *** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

As mentioned previously, the goal of this exercise was to answer the following question: can we find the cumulative relationship of Indigenous and the characteristics associated with being Indigenous and earnings? Our analysis revealed distinct patterns. Demographic factors emerge as key determinants of wage outcomes. Female farmworkers experience lower wages, indicative of gender-based variations in labor market opportunities. Age demonstrates a negative association

with wages, suggesting potential differences in experience, skill levels, or job roles across age cohorts.

Legal status and work authorization drive notable influences on wage differentials. Unauthorized farmworkers face considerable wage penalties, highlighting the vulnerability of undocumented workers in accessing fair compensation. Conversely, possessing legal documentation, such as a Green Card or other work authorization, mitigates wage disparities, emphasizing the importance of legal status in labor market outcomes.

Educational attainment and occupational characteristics also play significant roles in shaping wages. Higher levels of education correlate positively with earnings, reflecting the impact of human capital on wage determination. Occupational factors, such as employment in piecerate or combo arrangements, are associated with higher wages, indicating differences in payment structures and skill requirements across agricultural tasks.

Moreover, industry and task specifics contribute to wage dynamics within the agricultural sector. Certain agricultural sectors, like field crops, fruits & nuts, and vegetables, exhibit negative wage effects, possibly influenced by factors such as seasonality and labor demand. Similarly, specific tasks, such as preharvest and harvest, are associated with wage penalties, suggesting potential differences in labor productivity or working conditions.

In section 5.1, we isolated the impact of Indigenous identity on wages, recognizing the challenge of disentangling Indigenous identity from associated characteristics. For instance, Indigenous farmworkers typically possess certain educational levels, English-speaking abilities, and other attributes, making it complex to isolate the pure effect of Indigenous identity on earnings.

When summing the marginal effects of all covariates, The results indicate that Indigenous farmworkers experience a cumulative wage penalty of approximately 12.61% compared to their

Non-Indigenous counterparts. Conversely, Non-Indigenous farmworkers face a cumulative wage penalty of approximately 8.53%. The difference between these estimated penalties is 4.08%. We can link the results from our previous models to conclude that Indigenous identity and the characteristics associated with being Indigenous, has an overall effect of 4.08% on earnings.

Chapter 7

Discussion & Conclusions

Our study provides comprehensive insights into the seasonal employment patterns, economic well-being, and wage differentials among farmworkers, with a particular focus on the influence of Indigenous identity.

Central to our findings is a stable wage disparity between Indigenous and Non-Indigenous farmworkers across multiple model specifications. Being an Indigenous farmworker, in and of itself, is associated with 1.39% lower earnings, holding all else constant. In our analysis incorporating the cumulative effects of the average characteristics of Indigenous farmworkers, Indigenous farmworkers experience about 4% lower wages compared to Non-Indigenous farmworkers. In short, our evidence supports the point that Indigenous farmworkers experience lower earnings, signaling potential wage discrimination.

The exact mechanism of this potential wage discrimination remains ambiguous, as it is uncertain whether Indigenous farmworkers face lower earnings due to their association with poorer economic conditions, which are crucial for enhancing earning prospects, or if it stems from an explicit discriminatory practice among employers who opt to pay Indigenous workers less based solely on their identity.

Certain demographic groups emerge as being significantly associated with lower wages which exacerbates their status compared to Indigenous farmworkers. Women consistently earn approximately 6% lower wages across multiple model specifications. Migrants and undocumented workers are also those among with significant wage differentials, being associated with about 3% and

9% lower earnings, respectively. Not only do they share a relationship with lower earnings, but significantly elevated risk of being in poverty. Women face a 2.5% increased probability of being in poverty compared to men while undocumented farmworkers face an 11% increase of being in poverty.

Our findings emphasize the significance of farmwork intensity and duration in determining earnings levels, with the ability to secure prolonged engagement often linked to higher wages. Notably, differences in employment arrangements, such as hourly, piecerate, or salary compensation, reflect variations in job stability and payment structures, contributing to disparities in economic security among farmworkers. On top of farmwork participation, farmwork experience and education are significantly associated with improving earnings.

Language proficiency also emerges as a critical determinant of employment opportunities and outcomes, highlighting the need for language support and educational initiatives to empower farmworkers with limited English proficiency.

Our findings highlight the role of farmwork intensity and duration in shaping earnings levels among farmworkers. Several potential relationships between experience and earnings are possible. Mexican-Indigenous farmworkers who work more than the minimum number of farmwork weeks per year, on average, have higher hourly earnings, are older, are more frequently paid hourly, are more likely to be citizens, are less likely to be undocumented, and are less often at risk of poverty compared to those who work very few weeks per year.

Given that lower educational attainment is linked with lower wages among Indigenous farmworkers, initiatives to improve access to education and vocational training are essential. Providing educational support tailored to the needs of Indigenous communities, such as bilingual education programs and adult literacy classes, can help bridge the educational gap and enhance earnings.

Our findings indicate that Indigenous farmworkers are more likely to be undocumented. Immigration policies that offer pathways to legal status and work authorization can significantly improve their bargaining power and access to better-paying jobs. Additionally, our research reveals that Indigenous farmworkers paid on a piece-rate basis are more at risk of poverty. Policies promoting hourly wage employment over piece-rate schemes can provide more stable and predictable income, contributing to economic security. The observed gender imbalance, with more females in lower engagement levels, points to the need for gender-sensitive policies. Programs aimed at enhancing women's participation in agricultural work, providing childcare support, and ensuring equal pay for equal work can help address these disparities.

The findings of this research hold significant implications for agricultural producers, highlighting the need for more equitable labor practices within the industry. By addressing the wage disparities and potential discrimination faced by Mexican-Indigenous farmworkers, agricultural producers can enhance the overall productivity and sustainability of their workforce. Ensuring fair wages and improving working conditions can lead to higher worker satisfaction, reduced turnover, and increased efficiency. Additionally, adopting inclusive labor practices can enhance the reputation of agricultural producers, attracting a more diverse and committed workforce. Recognizing and addressing these disparities is not only a matter of social justice but also a strategic move to ensure the long-term viability and ethical standing of the agricultural industry.

For policymakers, these findings highlight the need for regulations that promote fair labor practices and protect vulnerable workers. Implementing policies that ensure equitable wages and decent working conditions through more formal work arrangements can mitigate exploitation and improve the well-being of farmworkers. For society, addressing these disparities is essential for social equity, ensuring that all individuals have the opportunity to work in fair and respectful con-

ditions. Recognizing and addressing these issues is vital for the long-term viability and ethical standing of the agricultural industry, benefiting workers and the broader Indigenous & farmworker community.

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Appendix A

$$Cumulative_{Indigenous} = \sum_{n=1}^{i} \beta_n \times \overline{X}_{n,Indigenous} \tag{A.1}$$

- β_n is the coefficient estimate of the nth covariate from the OLS wage model.
- $\overline{X}_{n,Indigenous}$ is the average value of the nth covariate for Indigenous farmworkers.
- $\sum_{n=1}^{i}$ is the sum of the product for all the covariates.

Appendix B

Table B.1: Non-Linear Regression Results for Real Hourly Wages: Baseline and Controlled Models

Variable	(1) Log(Wage)
Indigenous	-0.0149***(0.0041)
Female	-0.0615***(0.0034)
Age	-0.0012***(0.0001)
Green Card	-0.0672***(0.0068)
Other Work Auth	-0.0744***(0.0121)
Unauthorized	-0.1173***(0.0071)
Education (At Least 9th Grade)	0.0201***(0.0030)
Migrant	-0.0285***(0.0037)
Farm Experience (Years)	0.0028***(0.0002)
Farmwork Days	-0.0002*(0.0001)
Farmwork Days^2	0.0000 (0.0000)
Farmwork Weeks	0.0027***(0.0004)
English Speaking	0.0437***(0.0039)
Paid Piecerate	0.1737***(0.0082)
Paid Combo	0.4022***(0.0180)
Salary	0.3785***(0.0112)
Employed by FLC	-0.0250***(0.0040)
Field Crops	-0.0611***(0.0069)
Fruits & Nuts	-0.0422***(0.0062)
Horticulture	-0.0239***(0.0064)
Vegetables	-0.0530***(0.0064)
Pre-harvest	-0.0454***(0.0056)
Harvest	-0.0388***(0.0061)
Post-harvest	-0.0504***(0.0062)
Semiskilled	-0.0456***(0.0057)
Supervisor	-0.0307 (0.0910)
(Intercept)	2.5450***(0.0148)
Observations	23,846
R^2	0.39

Appendix C

Table C.1: Logistic Regression Results for Probability of Poverty: Probit & Linear Probability Models

Variable	(1) Pr(Poverty)	(2) Pr(Poverty)
	Linear Probability	Probit
Indigenous	-0.0045 (0.0092)	-0.0178 (0.0298)
Female	0.0219**(0.0077)	0.0774***(0.0244)
Age	-0.0012***(0.0003)	-0.0038***(0.0011)
Green Card	0.0139 (0.0097)	0.1511**(0.0501)
Other Work Auth.	0.0432 (0.0232)	0.2448**(0.0906)
Unauthorized	0.1117***(0.0111)	0.4643***(0.0521)
Education (At Least 9th Grade)	-0.0338***(0.0063)	-0.1135***(0.0217)
Migrant	0.1120***(0.0078)	0.3212***(0.0237)
Years Spent in U.S. Farmwork	-0.0026***(0.0004)	-0.0099***(0.0015)
Farmwork Days	-0.0006***(0.0001)	-0.0022***(0.0004)
Farmwork Weeks	-0.0048***(0.0006)	-0.0113***(0.0022)
English Speaking	-0.0156*(0.0074)	-0.0586*(0.0277)
Piecerate	0.0160 (0.0111)	0.0505 (0.0333)
Combo, Piecerate & Hourly	-0.0171 (0.0224)	-0.0349 (0.0660)
Salary	-0.0482***(0.0120)	-0.3151***(0.0708)
FLC	0.0506***(0.0086)	0.1755***(0.0270)
Field Crops	0.0371*(0.0151)	0.1339*(0.0559)
Fruits & Nuts	0.0765***(0.0136)	0.2681***(0.0504)
Horticulture	0.0540***(0.0141)	0.1838***(0.0517)
Vegetables	0.0666***(0.0139)	0.2266***(0.0511)
Preharvest	0.0560***(0.0129)	0.1653***(0.0422)
Harvest	0.0707***(0.0137)	0.2079***(0.0442)
Postharvest	0.0524***(0.0143)	0.1543**(0.0470)
Semiskilled	0.0361**(0.0130)	0.0876*(0.0430)
Supervisor	-0.0759 (0.0672)	-0.4507 (0.5096)
(Intercept)	0.6054***(0.0277)	0.2296*(0.0986)
Observations	23,846	23,846
R^2	0.18	0.24

Appendix D

Table D.1: Demographic and Occupational Influences on Wage Differentials Among Different Subgroups of Farmworkers

Variable	Non-Undocumented	English Speaking	Men	Educated
	Log(Wage)	Log(Wage)	Log(Wage)	Log(Wage)
Indigenous	-0.0101 (0.0095)	-0.0010 (0.0134)	-0.0106* (0.0046)	0.0017 (0.0079)
Female	-0.0693*** (0.0064)	-0.0774*** (0.0089)		-0.0651*** (0.0059)
Age	-0.0023*** (0.0003)	0.0007 (0.0004)	-0.0013*** (0.0002)	-0.0001 (0.0003)
Green Card	-0.0729*** (0.0069)	-0.0707*** (0.0106)	-0.0707*** (0.0075)	-0.0475*** (0.0118)
Other Work Auth.	-0.0889*** (0.0123)	-0.0711*** (0.0194)	-0.0806*** (0.0136)	-0.0493** (0.0173)
Undocumented		-0.1161*** (0.0109)	-0.1261*** (0.0080)	-0.0931*** (0.0118)
Employed by FLC	-0.0342*** (0.0078)	-0.0517*** (0.0111)	-0.0266*** (0.0046)	-0.0338*** (0.0070)
Migrant	-0.0267*** (0.0059)	-0.0324** (0.0108)	-0.0273*** (0.0040)	-0.0252*** (0.0068)
Field Crops	-0.0786*** (0.0115)	-0.0871*** (0.0160)	-0.0590*** (0.0073)	-0.0815*** (0.0117)
Horticulture	-0.0314** (0.0116)	-0.0565*** (0.0149)	-0.0430*** (0.0068)	-0.0415*** (0.0109)
Vegetables	-0.0607*** (0.0111)	-0.0677*** (0.0155)	-0.0543*** (0.0070)	-0.0595*** (0.0112)
English Speaking	0.0446*** (0.0060)		0.0499*** (0.0043)	0.0352*** (0.0055)
Farmwork Weeks in Last Year	0.0025*** (0.0002)	0.0027*** (0.0003)	0.0018*** (0.0001)	0.0017*** (0.0002)
Educated (At Least 9th Grade)	0.0119 (0.0062)	0.0258*** (0.0075)	0.0206*** (0.0033)	0.0041*** (0.0004)
Preharvest	-0.0607*** (0.0103)	-0.0666*** (0.0170)	-0.0466*** (0.0062)	-0.0443*** (0.0105)
Harvest	-0.0640*** (0.0114)	-0.0672*** (0.0188)	-0.0385*** (0.0067)	-0.0370*** (0.0112)
Postharvest	-0.0638*** (0.0113)	-0.0758*** (0.0180)	-0.0468*** (0.0071)	-0.0373*** (0.0112)
Semiskilled	-0.0463*** (0.0102)	-0.0657*** (0.0173)	-0.0462*** (0.0063)	-0.0412*** (0.0107)
Supervisor	-0.0822 (0.1021)	0.0007 (0.1520)	-0.0996 (0.1497)	0.0251 (0.0880)
(Intercept)	2.6276*** (0.0235)	2.5578*** (0.0318)	2.5417*** (0.0153)	2.5027*** (0.0226)
R^2	0.37	0.40	0.39	0.42
Observations	8,800	4,178	19,142	7,827

Table D.2: Demographic and Occupational Influences on Wage Differentials Among Different Subgroups of Farmworkers

Variable	Hourly	Piecerate	Field Crops	Vegetables
	Log(Wage)	Log(Wage)	Log(Wage)	Log(Wage)
Indigenous	-0.0096** (0.0030)	-0.0283 (0.0219)	0.0070 (0.0136)	-0.0032 (0.0080)
Female	-0.0548*** (0.0025)	-0.1023*** (0.0212)	-0.0743*** (0.0137)	-0.0592*** (0.0064)
Age	-0.0007*** (0.0001)	-0.0053*** (0.0010)	-0.0006 (0.0004)	-0.0009** (0.0003)
Green Card	-0.0640*** (0.0065)	-0.1054 (0.0630)	-0.0125 (0.0168)	-0.0338* (0.0142)
Other Work Auth.	-0.0810*** (0.0111)	0.0515 (0.0907)	-0.0712* (0.0278)	-0.1428*** (0.0230)
Undocumented	-0.1075*** (0.0066)	-0.1830** (0.0636)	-0.0704*** (0.0160)	-0.1466*** (0.0158)
Employed by FLC	-0.0289*** (0.0027)	0.0056 (0.0177)	-0.0778*** (0.0159)	-0.0374*** (0.0066)
Migrant	-0.0292*** (0.0028)	-0.0243 (0.0169)	-0.0376*** (0.0091)	-0.0242*** (0.0069)
Field Crops	-0.0668*** (0.0066)	-0.1762 (0.1276)		
Horticulture	-0.0458*** (0.0060)	0.0507 (0.0991)	-0.0186 (0.0121)	-0.0494*** (0.0140)
Vegetables	-0.0648*** (0.0061)	0.0292 (0.0990)	0.1323*** (0.0178)	0.0385** (0.0123)
English Speaking	0.0525*** (0.0035)	-0.0638* (0.0279)	0.0525*** (0.0095)	0.0362*** (0.0079)
Farmwork Weeks in Last Year	0.0012*** (0.0001)	0.0032*** (0.0006)	0.0006* (0.0003)	0.0009*** (0.0002)
Educated (At Least 9th Grade)	0.0145*** (0.0024)	0.0504** (0.0177)	-0.0003 (0.0082)	0.0216*** (0.0059)
Preharvest	-0.0421*** (0.0050)	0.0091 (0.1123)	-0.0433** (0.0154)	-0.0401* (0.0188)
Harvest	-0.0432*** (0.0051)	0.0088 (0.1074)	-0.0401* (0.0172)	-0.0392* (0.0191)
Postharvest	-0.0503*** (0.0054)	0.0715 (0.1108)	-0.0504** (0.0165)	-0.0354 (0.0192)
Semiskilled	-0.0327*** (0.0051)	-0.1811 (0.1079)	-0.0420** (0.0151)	-0.0318 (0.0188)
Supervisor	0.0592 (0.0364)	-0.2440 (0.2774)	-0.2440 (0.2774)	-0.2440 (0.2774)
Hourly			-0.0017 (0.0743)	0.1922*** (0.0185)
Piecerate			0.4055** (0.1463)	0.7080*** (0.0439)
Combo			0.3733*** (0.0176)	0.4426*** (0.0266)
Salary			0.3733*** (0.0176)	0.4426*** (0.0266)
(Intercept)	2.5469*** (0.0120)	2.5961*** (0.1666)	2.4334*** (0.0296)	2.4952*** (0.0300)
R^2	0.42	0.23	0.53	0.46
Observations	20,368	2,417	2,439	5,670

Table D.3: Demographic and Occupational Influences on Wage Differentials Among Different Subgroups of Farmworkers

Variable	Migrant	Non-Migrant	Horticulture	Minimal Education (Less than 9th Grade)
	Log(Wage)	Log(Wage)	Log(Wage)	Log(Wage)
Indigenous	-0.0193* (0.0080)	-0.0118* (0.0047)	-0.0147* (0.0075)	-0.0142** (0.0046)
Female	-0.0655*** (0.0094)	-0.0564*** (0.0037)	-0.0651*** (0.0057)	-0.0628*** (0.0038)
Age	-0.0011*** (0.0003)	-0.0012*** (0.0002)	-0.0009** (0.0003)	-0.0015*** (0.0002)
Green Card	-0.0482*** (0.0149)	-0.0643*** (0.0069)	-0.0101 (0.0132)	-0.0156** (0.0075)
Other Work Auth.	-0.0561*** (0.0186)	-0.0727*** (0.0124)	-0.0443* (0.0155)	-0.0756*** (0.0150)
Undocumented	-0.0849*** (0.0166)	-0.1015*** (0.0069)	-0.0645*** (0.0135)	-0.1298*** (0.0084)
Employed by FLC	-0.0329*** (0.0073)	-0.0298*** (0.0047)	-0.0713*** (0.0135)	-0.0227*** (0.0044)
Migrant			-0.0353*** (0.0082)	-0.0358*** (0.0040)
Field Crops	-0.0427*** (0.0086)	-0.0499*** (0.0083)	-0.0764*** (0.0110)	-0.0701*** (0.0075)
Horticulture	-0.0487*** (0.0084)	-0.0540*** (0.0082)		
Vegetables	-0.0488*** (0.0083)	-0.0502*** (0.0081)	-0.0942*** (0.0135)	-0.0444*** (0.0069)
English Speaking	0.0381*** (0.0103)	0.0449*** (0.0042)	0.0710*** (0.0082)	0.0514*** (0.0048)
Farmwork Weeks in Last Year	0.0017*** (0.0002)	0.0017*** (0.0001)	0.0016*** (0.0002)	0.0014*** (0.0001)
Educated (At Least 9th Grade)	0.0240*** (0.0065)	0.0193*** (0.0033)	0.0137* (0.0060)	0.0152*** (0.0035)
Preharvest	-0.0459*** (0.0101)	-0.0446*** (0.0067)	-0.0205* (0.0101)	-0.0458*** (0.0061)
Harvest	-0.0220* (0.0110)	-0.0445*** (0.0073)	-0.0573*** (0.0137)	-0.0418*** (0.0067)
Postharvest	-0.0433*** (0.0120)	-0.0511*** (0.0073)	-0.0314** (0.0111)	-0.0533*** (0.0069)
Semiskilled	-0.0575*** (0.0107)	-0.0430*** (0.0068)	-0.0114 (0.0112)	-0.0471*** (0.0063)
Supervisor		-0.0306 (0.0910)	0.2423*** (0.0365)	-0.0040 (0.0947)
Hourly	0.1488*** (0.0130)	0.1840*** (0.0107)	0.0023 (0.0753)	0.1755*** (0.0089)
Piecerate	0.4222*** (0.0345)	0.3894*** (0.0209)	0.5645*** (0.0606)	0.3934*** (0.0197)
Combo	0.3222*** (0.0401)	0.3839*** (0.0115)	0.3410*** (0.0343)	0.3690*** (0.0124)
Salary	0.3222*** (0.0401)	0.3839*** (0.0115)	0.3410*** (0.0343)	0.3690*** (0.0124)
(Intercept)	2.4707*** (0.0265)	2.5512*** (0.0158)	2.5305*** (0.0251)	2.5832*** (0.0157)
R^2	0.36	0.39	0.43	0.39
Observations	5,502	18,433	4,289	18,933