Revista Científica
INTEGRACIÓN
e-ISSN: 2790-2145
ISSN: 2618-1207

Social security in the Mexican fruit and vegetable sector: an econometric analysis with a social focus in Sinaloa

Seguridad social en el sector hortofrutícola mexicano: análisis econométrico con enfoque social en Sinaloa

Janeth Beltrán Reyes
Maestría en Estudios Sociales, Universidad Autónoma indígena de México, México
janethbeltranreyes@gmail.com
https://orcid.org/0009-0003-4792-960X

Claudia Selene Castro Estrada
Investigación y postgrado, Universidad Autónoma indígena de México, México.
draclaudiacastro@uaim.edu.mx
https://orcid.org/0000-0003-4461-9633

Recibido: 15/10/2025
Aceptado: 14/12/2025
Publicado: 25/03/2026

Autor corresponsal:
Janeth Beltrán Reyes
janethbeltranreyes@gmail.com

Cómo citar:
Beltrán Reye, J. y Castro Estrada, C. S. (2026). Social security in the Mexican fruit and vegetable sector: an econometric analysis with a social focus in Sinaloa. *Integración,* 10(1), 40-53. https://doi.org/10.36881/ri.v10i1.1285

Fuente de financiamiento: No financiado.

Declaración de conflictos de interés: Las autoras declaran no tener conflictos de interés.

Resumen

El rezago social de la población jornalera la ubica como grupo de atención prioritaria. El objetivo de estudio es analizar el derecho a la seguridad social de la población jornalera en México en el contexto del mercado laboral agrícola. Llevado a cabo bajo una metodología cuantitativa emplea tres modelos: un análisis econométrico de la producción hortofrutícola (2003–2022), otro sobre afiliación al seguro social (2000–2024), y un análisis estadístico descriptivo sobre acceso a salud y prestaciones laborales (2005–2024). Metodológicamente, se usan datos de panel con Mínimos Cuadrados Ordinarios (MCO) y estadística descriptiva. Los resultados muestran que el rendimiento por hectárea y el valor de la producción son claves en el crecimiento hortofrutícola. Asimismo, que el trabajo agrícola en Sinaloa influye significativamente al empleo nacional. Sin embargo, la informalidad persiste con desigualdades regionales. Concluyendo en la necesidad de políticas públicas que garanticen derechos laborales y acceso a seguridad social.

Palabras claves: seguridad social, producción hortofrutícola, econometría, jornaleros agrícolas, informalidad laboral.

Abstract

The social lag of the seasonal agricultural workers is a priority care group. The objective of study is to analyze the right to social security of the seasonal agricultural workers in Mexico in the context of the agricultural labor market. Carried out under a quantitative methodology uses three models: an economic analysis of horticultural and fruit production (2003–2022), another on social security affiliation (2000–2024), and a descriptive statistical analysis of access to health and labor benefits (2005–2024). Methodologically, panel data with ordinary squares (MCO) and descriptive statistics are used. The results show that the yield per hectare and the value of the production are key in fruit and vegetable growth. Also, that agricultural work in Sinaloa significantly influences national employment. However, informality persists with regional inequalities. Concluding in the need for public policies that guarantee labor rights and access to social security.

Keywords: social security, horticultural and fruit production, econometric, seasonal agricultural workers, labor informality.

Introduction

The social security system in Mexico is geared towards the working population, primarily those with formal, permanent employment contracts. In cases of informal or temporary work, gaps exist that have been a focus of attention for years. This is the situation that persists for many agricultural day laborers, who work seasonally according to crop cycles. Motivated by necessity, they are willing to work even under vulnerable conditions, facing social, economic, cultural, and political difficulties.

The Mexican agricultural sector has taken advantage of trade liberalization, particularly with its northern neighbor through the USMCA, becoming a major exporter of horticultural products. As a result, many producers have opted to shift their crops, focusing specifically on the export market. This has led to changes in the labor market, reflecting the demand for labor and representing both an abundant source of employment and, at the same time, a problem related to informal employment.

De Grammont et al. (2024) analyze the relationship between the trade liberalization processes experienced by Mexico since the late 1980s and the dynamics of rural migration associated with export agriculture. From a neoclassical perspective, the authors explain that labor migration flows respond to the mechanisms of labor supply and demand. However, they conclude that agricultural labor markets tend to expose day laborers and their families to highly vulnerable living conditions, characterized by precarious employment and limited guarantees of human and labor rights.

Under this scenario, the day laborer population is a focus of study for numerous organizations. In the international context, they are included within the framework of the United Nations Sustainable Development Goals (SDGs). Related to: number 1. End poverty, number 3. Ensure healthy lives and promote well-being, number 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all, and number 16. Promote just, peaceful and inclusive societies. And at the national level, they are observed in the 2030 Agenda, the National Development Plan 2025-2030, and are also integrated into state and municipal government plans.

Furthermore, in scientific discourse, the Secretariat of Science, Humanities, Technology and Innovation (SECIHTI), through the National Strategic Programs (PRONACES), considers this a priority within the framework of Human Security. Additionally, the academic community and social actors carry out activities and initiatives through civil associations, working groups, and research networks focused on the problems and needs of the agricultural day laborer population. Therefore, this study is considered to have social, economic, theoretical, and administrative value in the pursuit of social well-being.

In a multidimensional poverty study conducted by the National Council for the Evaluation of Social Development Policy (CONEVAL, 2024) on the agricultural day laborer population in Mexico, 2.3 million day laborers were identified in 2022, of whom 87.6% lacked access to social security and 67.7% lacked access to health services. In other words, their main finding lies in the challenges related to social security and working conditions. Therefore, they propose inter-institutional coordination to articulate social policies and programs.

According to the 2022 agricultural census by the National Institute of Statistics and Geography (INEGI), there are a total of 26,984,247 jobs in Mexico, of which 15,863,731 are temporary farmworkers (INEGI, 2023a). The census also indicates that Sinaloa ranks 6th among the country's federal entities in vegetable production, with 1,270,829 hectares planted in open fields, and 1st in protected agriculture area, registering a total of 10,339 hectares, employing 386,397 farmworkers (INEGI, 2023b). This suggests a nationally representative sample.

Given the aforementioned factors and the social disadvantages that characterize the agricultural worker population, the objective of this research is to conduct a study with three methodological sections, providing a broader perspective on the analysis of the agricultural labor market. The first section involves an econometric analysis using panel data with Ordinary Least Squares (OLS) on fruit and vegetable production in Mexico during the period 2003-2022. The second section comprises a second econometric analysis of the social security of the agricultural worker population during the period 2000-2024. Finally, a descriptive statistical analysis of access to health services and labor benefits in the agricultural sector during the period 2005-2024 is presented.

To achieve this purpose, an econometric methodology is employed, based on dynamic panel data models using sources such as the Agri-Food Information System (SIACON) of the Agri-Food and Fisheries Information Service (SIAP) and open data from the Mexican Social

Security Institute (IMSS), and applying descriptive statistics to historical data from the National Survey of Occupation and Employment (ENOE). The aim is to provide evidence that contributes to the design of public policies aimed at promoting economic and social well-being.

It is worth noting that panel data methodologies are used in the social sciences, sociology, economics, and political science to quantify phenomena through statistical and mathematical models, as seen in the studies by Ramoni-Perazzi and Orlandoni-Merli (2014), Pignataro (2018), Jiménez and Flores-Chamba (2022), and Minchón-Medina et al. (2023) and López-Machado (2024). These authors implemented the models to analyze the impact assessment of social programs, electoral studies, inequality and public spending worldwide, the fatality rate of COVID-19 in Peru, and the economic growth of Latin America, respectively.

This document is presented in five sections in addition to this introduction. The first section develops a conceptual and regulatory review of social security and agricultural labor markets. The second presents a literature review of previous studies in an international and national context. The third details the methodological aspects and the econometric models used, specifically the panel data model. Subsequently, the fourth section presents the analysis of results for the econometric and descriptive statistical models. Finally, the fifth section presents the conclusions of the study.

Conceptual and Regulatory Review of Agricultural Labor Markets and Social Security.

A review of various references reveals different ways of defining agricultural labor markets, especially when viewed from diverse perspectives. However, given that the defining characteristic of the labor market is the supply and demand of employment and is linked to social problems, similar characteristics can be observed in most cases, such as: temporary employment, labor flexibility, forms of contracting, the vulnerability of workers, persistent labor deregulation, problems in the quality of life, various forms of segmentation, and above all, the violation of their human and labor rights.

Rangel Zaragoza et al. (2021) argue that the agricultural labor market has historically been characterized by markedly precarious working conditions, where subcontracting mechanisms restrict the full exercise of labor rights. The high demand for labor fosters a dynamic of constant mobility among workers, many of whom lack formal contracts, access to health services, and social benefits established by current labor legislation. This situation is exacerbated by weak union organization and persistent deregulation of the sector, contributing to a progressive decline in the quality of life for farmworkers.

Ortiz Marín and López Estrada (2022) conceptualize the agricultural labor market as a manifestation of the demand for labor derived from the inherent dynamism of the sector's productive activities. In contrast, the labor supply is concentrated primarily in rural areas characterized by a limited availability of employment alternatives. These conditions favor the integration of day laborers as a temporary, flexible, and subordinate workforce, willing to move along migratory routes determined by agricultural cycles. However, in intensive agricultural production systems, the high demand for labor not only structures the forms of work organization but also fosters the emergence of labor unions focused on defending workers' rights.

In turn, Núñez Vera et al. (2023) argue that the dynamics of labor markets are conditioned by various factors, primarily production cycles, hiring practices, wage levels, social benefits, and working conditions. In the agricultural sector, and particularly in intensive farming, the hiring of cheap labor significantly impacts the working conditions of day laborers. Hidden negative impacts under the guise of social welfare, through the promotion of flexible labor schemes that, while presented as a response to social demands, actually allow employers to capitalize on the productive boom without assuming formal labor commitments, thus evading employer obligations.

In the area of social security, there are multiple conceptualizations and approaches depending on the analytical perspective, from institutional, organizational, structural, or academic studies, each with its own particular focus. However, all these approaches converge on its recognition as a fundamental human right embedded in the legal framework. Therefore, regardless of the analytical approach adopted, it is essential to incorporate legal considerations. In particular, it is necessary to start from the principle of universality and, in turn, emphasize the conditions of vulnerability that characterize labor markets in the agricultural sector.

According to Sánchez-Belmont et al. (2019), social security constitutes a human right of every person, regardless of age or employment status, aimed at providing protection against social risks, reducing vulnerability, and mitigating inequalities through

e-ISSN: 2790-2145 ISSN: 2618-1207

the promotion of social welfare. Therefore, the State must assume the responsibility of guaranteeing such protection, particularly for historically excluded sectors, such as informal workers, day laborers, the unemployed or unpaid workers, Indigenous people, people with disabilities, and migrants, among others. This should be achieved through solidarity-based and public mechanisms, such as cash transfers and the provision of essential services.

Similarly, Flores Mariscal (2020) conceptualizes social security as a human right whose guarantee falls to each country and must be safeguarded through institutional systems that promote social responsibility, solidarity, and fiscal redistribution. These systems must be based on flexible public policies capable of addressing the diverse needs of the population, especially those groups facing higher levels of marginalization and vulnerability. Consequently, all forms of employment must be recognized, ensuring that workers receive fair wages and adequate working conditions that allow them to achieve a dignified and decent quality of life.

Likewise, according to Hernández Trujillo and Pérez Méndez (2023), social security is a fundamental right to an adequate standard of living that guarantees both individuals and their families access to health services and general well-being. This right implies the protection of basic needs such as food, clothing, housing, medical care, and other essential social services. It also encompasses insurance for unemployment, illness, disability, widowhood, old age, and other social risks. In this context, the importance of effective labor market regulation is emphasized, given the high levels of precariousness and informality that characterize employment, which excludes workers from the mandatory social security system.

In this regard, social security is an integral part of human rights and constitutes a priority within international legal frameworks, as well as in the specific regulations of each nation. In the case of Mexico, the right to social security, particularly with respect to the agricultural workforce, is enshrined in various legal instruments, including the Political Constitution of the United Mexican States, Chapter 23 of the United States-Mexico-Canada Agreement (USMCA), the Federal Labor Law (LFT), and the Social Security Law (LSS). These legal instruments establish the principles and provisions that govern labor and social security protection.

It should be noted that the Official Gazette of the Federation (2007b) published on July 24, 2007, the Decree granting tax benefits to employers and seasonal agricultural workers. This instrument promotes equity, inclusion in the workplace, the strengthening of social security, and the guarantee of decent working conditions. Likewise, in the corresponding agreement, the Official Gazette of the Federation (2007a) specifies the rules related to the tax benefits granted to the agricultural sector. And recently, the Official Gazette of the Federation (2024), dated January 24, 2024, published the Decree that amends, adds to, and repeals various provisions of the Federal Labor Law and the Social Security Law, regarding the labor rights of agricultural workers.

Literature review of previous studies in an international and national context

Labor market theories arise from capitalist studies of labor production. From an economic and spatial perspective, significant aspects of the labor market can be observed in the duality between the flexibility of hiring practices and labor legislation. These social, cultural, and political aspects highlight the connections between production needs and social structures. In this sense, Martín Gil (1995) analyzes the rural labor market in Spain and points out that, from an economic and spatial perspective, significant aspects of employment can be observed through the existence of unions, the regulation of companies, and public policies.

According to Ríos's (2020) analysis of the historical evolution of agricultural labor markets in a region of northwestern France, a pattern of mixed labor exploitation is identified during periods of high agricultural productivity, characterized by an overdemand for labor that encourages the arrival of seasonal workers. Noting that, during harvest seasons, a portion of the industry shuts down, and workers migrate to the fields in search of high seasonal wages. It is observed that daily wages are determined at the time of hiring, commonly under a piece-rate system, adjusted to labor needs. This highlights the lack of regulations, as agreements considered to be freely negotiated between the parties involved prevail.

For his part, Ghiglione (2023) conducted research in Argentina examining the characteristics and dynamics of the agricultural labor market from a theoretical and critical perspective, contrasting two opposing approaches. On the one hand, he analyzes the institutional discourse promoted by the Argentine Agricultural Foundation for Development (FADA), and on the other, he presents

a view that describes the agricultural labor market as markedly seasonal, informal, and fragmented, where labor flexibility and intermediation predominate in the hiring process. Therefore, the proposal is to go beyond political discourse to make visible the real conditions that shape this market.

When analyzing agricultural labor markets from the perspective of labor flexibility as a central category, it is necessary to address, through a rigorous evaluation, the formality of employment, wage conditions, and, fundamentally, the human right to social security. This implies the need to promote legal reforms aimed at guaranteeing the protection of labor rights. In this regard, Neiman et al. (2024) warn that temporary or precarious employment is closely linked to low levels of protection and access to social security. This situation is exacerbated by weak or nonexistent regulatory frameworks, which deepen the precarity and devaluation of work.

In the Mexican context, various studies have been conducted on agricultural labor markets, particularly since the period of implementation of economic liberalization policies. During this period, the agro-export sector has undergone significant transformations resulting from trade liberalization. This has led to changes in work organization, production intensification processes, and recruitment mechanisms. While flexible labor schemes persist, allowing for the continuity of commercial activity, this has resulted in increased employment and precarious working conditions for day laborers.

Hernández Trujillo and Barrón Pérez (2013) conducted an analysis of the agricultural labor market in Mexico, focusing on hiring practices and the strategies adopted by companies to ensure a continuous supply of labor. The authors note that a considerable number of farmworkers choose to work for large agribusinesses, which generally offer greater job stability. However, many companies use contracting schemes, meaning that even when workers remain for extended periods, they are still considered temporary workers, without access to labor rights or social security. Therefore, they conclude that this practice constitutes a form of non-compliance with labor laws.

In a subsequent study, Barrón Pérez and Hernández Trujillo (2019) argue that the most favorable job opportunities in rural labor markets are primarily found in export-oriented commercial agriculture. They associate variables such as social marginalization, educational level, and immigration status with the demand for farm labor according to the type of crop and the agricultural production model. Focusing the study on productive diversification and the transformations observed in migration flows linked to agricultural work, this research considers that the behavior of agricultural workers is determined by structural factors such as poverty and the expansion of intensive horticultural crops.

On the other hand, Arellano Gálvez et al. (2023) compiled and analyzed a series of news articles on the situation of agricultural workers in Mexico, which revealed multiple human rights violations in economic, social, cultural, and environmental dimensions. These studies agree that the working conditions faced by this population are highly precarious, characterized by persistent extreme poverty, food insecurity, and difficulties in accessing health services. These problems are linked to the flexibilization of employment contracts. The studies also highlight the demands for access to health services from the social movement originating in San Quintín, Baja California.

Methodological Framework

To comprehensively analyze agricultural labor markets, it is necessary to examine agricultural production in crops characterized by intensive labor use. This study selects the fruit and vegetable subsector due to its high demand for workers, allowing for a more precise understanding of labor dynamics. Access to social security is examined through the enrollment of day laborers in social insurance. Finally, data related to the agricultural sector without access to health services or labor benefits are analyzed.

Therefore, it is necessary to begin with the definition of econometrics as the branch of economics used in the social sciences, sociology, and political science to quantify economic phenomena using statistical and mathematical models. It is primarily implemented to estimate causal relationships and generate predictions based on empirical data. According to Gujarati and Porter (2010), it is the use of statistical methods to analyze economic data in order to generate empirical knowledge for economic theories; that is, a combination of economic theory and statistics to study observable and unobservable phenomena in reality.

An econometric model is an economic representation constructed mathematically and statistically to explain or analyze phenomena based on real-world data. Ruiz Porras (2016) explores econometric research using

e-ISSN: 2790-2145 ISSN: 2618-1207

panel data in Mexico, presenting it according to the area of knowledge in which it is used (Social Sciences, Macroeconomics, Microeconomics, International Economics, Private Finance, Public Economics) based on articles published between 2000 and 2013 in the REDALYC database. He suggests a growing interest in conducting empirical research across various disciplines, and that macroeconomic studies may have greater reach within the international community.

It is worth noting that the methodologies employed in panel data analysis, also known as longitudinal studies, simultaneously integrate information from cross-sectional data and time series. This type of data can include multiple variables that can be observed over extended periods. According to Stock and Watson (2020), these techniques allow modern economics not only to increase the amount of data but also to evaluate temporal dynamics by identifying causal relationships through robust methods that go beyond simple variable correlation.

According to Alvarez (2020), time series studies can be conducted using various software programs, such as the Statistical Package for the Social Sciences (SPSS), Statistical Analysis Software (SAS/STAT), R-Studio, and Eviews. He highlights that Eviews, in addition to its strong international reputation, specializes in working with cross-sectional, time series, and panel data. He concludes that, by applying certain techniques, the model resulting from OLS estimation can be validated using linear models to perform inference with time series data.

This research presents three methodological sections. For the first, data was collected through the Agri-Food Information System (SIACON) provided by the Agri-Food and Fisheries Information Service (SIAP). This data presents fruit and vegetable production for the period 2003-2022. An econometric analysis was conducted using Ordinary Least Squares (OLS) estimation, performing statistical inference on time series data with panel data generated using version 13 of the Eviews software.

The second part involved collecting information on temporary and permanent agricultural workers through the IMSS Open Data application for the period 2000-2024, conducting a second econometric analysis with panel data. Finally, a descriptive statistical analysis was incorporated using data from the ENOE (National Survey of Occupation and Employment), obtained from INEGI (National Institute of Statistics and Geography). For this purpose, data corresponding to the third quarter of each year, from 2005 to 2024, were selected, focusing on the agricultural sector.

It is important to define: “Temporary worker: a worker who has an employment relationship for a specific project or for a fixed term, as defined by the Federal Labor Law.” (LSS, Last amendments 07-06-2024, Article 5 A, Section VII). “Agricultural workers are natural persons who perform work aimed at obtaining food or primary products through various agricultural, horticultural, livestock, forestry, aquaculture, poultry, beekeeping, or other similar tasks, provided that these are not subjected to any type of industrial process and as long as they are carried out in rural areas. All agricultural workers, regardless of the type of contract, have the right to access social security.” (LFT, Last amendment 21-02-2025, Article 279).

The objective is to construct a historical series that allows us to identify the evolution of the working population without access to health services or employment benefits, with special emphasis on the states with the highest agricultural production nationwide. Using a quantitative methodology, econometric models are employed through the Ordinary Least Squares (OLS) estimator to make statistical inferences from panel data with time series. Finally, descriptive statistical techniques are implemented.

Model for the Analysis of Fruit and Vegetable Production

Within the framework of this research, we seek to identify the main determinants that explain the growth dynamics of fruit and vegetable production in Mexico. To this end, an econometric methodology based on panel data is used, which allows us to capture both the temporal evolution and the structural differences between the states. In this context, the following econometric model is specified through equation (1):

$$PROD_t = \alpha + \beta SS_{i,t} + \beta SC_{i,t} + \beta REND_{i,t} + \beta PREC_{i,t} + \beta VP_{i,t} + u_{i,t} \quad (1)$$

IIn this model, the dependent variable □PROD□_t corresponds to the annual growth rate of fruit and vegetable production per entity. The explanatory variables included are: SS_(i,t), the planted area, representing the area dedicated to the cultivation of fruit and vegetable products; SC_(i,t), the total available area, as an indicator of territorial capacity; REND_(i,t), the yield per hectare, which measures productive efficiency; PREC_(i,t), the average rural price, as an approximation

of the market environment; and VP_(i,t), the value of production, which reflects the economic result generated by the sector. Finally, u_(i,t), the error term, captures the disturbances not explained by the model.

All variables have been transformed into annual growth rates to ensure comparability and standardize the interpretation of the coefficients. The estimation was performed using Ordinary Least Squares (OLS) with annual panel data from the 32 federal entities of Mexico for the period 2003–2022.

Model for Social Security Analysis

To analyze the regional influence on national employment dynamics, an econometric model is specified to evaluate the contribution of employment in Sinaloa, a state with a high concentration of agriculture and agro-industry, to the overall number of registered jobs in Mexico. This is achieved using a methodology based on monthly panel data, which allows for capturing both temporal variations and structural relationships throughout the study period. The general formulation of the model is presented in equation (2):

$$TRABMX_t = \alpha + \beta EVENT_{i,t} + \beta PERM_{i,t} + u_{i,t} \quad (2)$$

In the model, the dependent variable TRABMX_t corresponds to the total number of jobs registered nationally, while the independent variables are: EVENT_(i,t), which corresponds to the number of temporary workers, and PERM_(i,t), which refers to permanent workers in the state of Sinaloa. These variables allow us to identify the relative weight of each job category in the national employment landscape. Meanwhile, u_(i,t) is the error term, representing unobserved factors that affect employment trends and are not explicitly included in the model.

The estimation was carried out using Ordinary Least Squares (OLS) with monthly panel data from January 2000 to November 2024, obtained from the open data of the Mexican Social Security Institute (IMSS). This section collects information relating only to workers under modality 13, which corresponds to the special regime for permanent and temporary agricultural workers. This modality provides access to the various branches of mandatory insurance, including: Occupational Risks; Sickness and Maternity; Disability and Life; Retirement, Unemployment in Old Age and Old Age Pension; as well as Childcare and Social Benefits, under conditions equivalent to those of any formally affiliated worker.

Results and Analytical Reflections

Econometric Analysis of the Results in Fruit and Vegetable Production

The econometric model estimates the annual growth rate of fruit and vegetable production based on five explanatory variables: planted area, total available area, yield per hectare, average rural price, and production value. The estimation was carried out using the Ordinary Least Squares (OLS) method, using annual panel data corresponding to the 32 federal entities of Mexico during the period 2003-2022. To ensure comparability between variables, all were transformed into annual growth rates. The results obtained from the application of equation (1) are presented in Table 1.

Table 1

Regression of the growth rate of fruit and vegetable production with respect to a set of variables: 2003-2022.

Statistics	Coefficient	t-test	p-value
Constant	0.004816	1.536549	0.1249
Sown area	-0.282009	-6.477836	0.0000
Harvested area	0.721880	13.48363	0.0000
Yield	0.348600	12.49536	0.0000
Average rural price	-0.154683	-8.213974	0.0000
Production value	0.216570	11.34434	0.0000
Durbin Watson	2.489498		
Adjusted R2	0.618316		
Prob F	0.000000		

Source: Prepared by the author using data from SIACON: 2003-2022.

In individual terms, statistically significant relationships are observed for all explanatory variables. The planted area shows a negative coefficient, indicating that an increase in its growth rate is paradoxically associated with a reduction in production. This result may be due to the incorporation of marginal lands or inefficient extensive planting practices. Conversely, the harvested area and yield per hectare have positive and significant effects on production, highlighting the importance of land availability and productive efficiency.

Meanwhile, the average price, with a negative coefficient, shows an inverse relationship with production, possibly reflecting supply shocks in which price increases result from reductions in the volume produced. Finally, the value of production shows a positive association, demonstrating consistency between increases in economic value and the physical quantities produced. The model confirms that yield, total available area, and the value of production are the factors that most drive the growth of agricultural production in Mexico.

e-ISSN: 2790-2145 ISSN: 2618-1207

Regarding the econometric tests applied, the model results demonstrate strong explanatory power. The adjusted coefficient of determination (adjusted R^2) is 0.618, indicating that approximately 62% of the variation in agricultural production is explained by the included variables. The F-statistic is highly significant, supporting the overall validity of the model. Furthermore, the low standard error suggests precision in the estimates. Finally, the Durbin-Watson statistic indicates no autocorrelation in the residuals, reinforcing the reliability of the results.

Overall, the model results suggest that agricultural production growth in Mexico is more closely linked to the efficient use of productive resources, particularly soil and technology, than to the mere extensive expansion of planted area. Variables such as yield per hectare and production value showed a positive and significant impact, highlighting the importance of productive efficiency, the adoption of modern agricultural practices, and a shift towards higher value-added crops.

Econometric Analysis of Social Security Results

The following are the estimates corresponding to the Ordinary Least Squares (OLS) econometric model, presented in equation (2), based on monthly panel data from January 2000 to November 2024. The model aims to evaluate the relationship between the total number of registered jobs nationwide (dependent variable) and temporary and permanent workers in the state of Sinaloa (independent variables). This approach allows us to explore the extent to which employment in a federal entity with strong agricultural and agro-industrial activity like Sinaloa influences national employment trends.

Table 2

Regression of the relationship between national employment and temporary and permanent workers in Sinaloa: 2000-2024.

Statistics	Coefficient	t-test	p-value
Constant	0.001603	0.737882	0.4612
Temporary Workers	0.073286	13.04071	0.0000
Permanent Workers	0.498343	6-488063	0.0000
Durbin Watson	2.071280		
Adjusted R^2	0.501150		
Regression Error	0.036883		
Prob F	0.000000		

Source: Prepared by the author using open data from the IMSS: 2000-2024.

The model results presented in Table 2 show that both explanatory variables are statistically significant and have positive coefficients. A 1% increase in temporary jobs in Sinaloa is associated, on average, with a 0.0733% increase in jobs nationwide. Meanwhile, a 1% increase in permanent jobs in Sinaloa is associated with a 0.4983% increase in jobs nationwide, holding all other variables constant. This suggests that permanent jobs in Sinaloa have a much greater impact on national job creation than temporary jobs.

Regarding the econometric tests of the model, the F-statistic is highly significant, confirming the overall validity of the model. Furthermore, the adjusted coefficient of determination indicates that approximately 50% of the variability in national employment can be explained by fluctuations in Sinaloa's employment. The model's explanatory power is moderate, which is adequate in economic contexts where many other variables exert influence. The standard error of the regression is low, suggesting precision in the estimates. Finally, the Durbin-Watson statistic indicates no evidence of autocorrelation in the residuals, which reinforces the robustness of the model.

Therefore, it is clear that jobs in Sinaloa are positively associated with job creation at the national level. This can be interpreted as a sign of Sinaloa's role in the country's labor market dynamics, although it does not imply direct causality, but rather a statistically significant relationship. That is, although Sinaloa is only one of the 32 federal entities, its employment performance, especially in permanent positions, appears to have a high correlation with national dynamics, which may reflect the state's relevance in certain key sectors or seasonal employment cycles.

Analysis of Access to Health Services and Labor Benefits in the Agricultural Sector Using Descriptive Statistics

Table 3 below presents the descriptive statistical analysis of the number of salaried agricultural workers without access to health services in nine Mexican states between 2005 and 2024. These states were selected based on their contribution to national agricultural production. The analysis includes measures of central tendency, dispersion, and ranges, as well as an interpretation for each case.

Table 3

Number of subordinate and paid agricultural workers without access to health services in the agricultural sector of selected entities: 2005-2024.

Year	BC	Chihuahua	Jalisco	Michoacán	Oaxaca	Sinaloa	Sonora	Veracruz	Annual Average
2005	15256	9706	67676	86239	39095	39216	21938	162941	55258
2006	10613	12513	43545	88601	27623	37300	19959	166398	50819
2007	11265	9318	46693	85019	37046	33002	20734	152237	49414
2008	12062	11103	57547	106115	35564	36069	21350	167365	55897
2009	13280	15876	65499	101920	45550	39264	22193	163139	58340
2010	16085	17639	65006	120447	29047	39212	24239	144571	57031
2011	16832	19265	84342	134944	34603	44249	26273	165778	65786
2012	21289	12898	86722	116027	43912	37744	26639	203030	68533
2013	12886	18017	73044	118443	29375	43198	18527	203567	64632
2014	12951	18440	90198	119974	55765	42723	19883	203248	70398
2015	13457	14552	81256	134371	62304	46167	21953	224984	74880
2016	19454	25938	96913	147827	63801	51307	28988	199347	79197
2017	13835	15616	118897	156049	69052	46707	28385	247139	86960
2018	16153	22203	98095	157825	65000	43413	23743	224731	81395
2019	13583	19580	95749	182500	64100	50744	39926	206804	84123
2020	9866	22542	67609	134214	51982	36129	21959	184158	66057
2021	9677	19111	83450	166371	91172	41058	24760	215736	81417
2022	10661	20278	103074	185152	60349	45173	28270	207657	82577
2023	10720	18285	105016	202686	71802	47736	27973	213449	87208
2024	14702	19992	128184	157471	78361	32417	24604	214194	83741
Average	13731	17144	82926	135110	52775	41641	24615	193524	70183
St. Dev.	3114	4422	22473	34028	18134	5422	4780	28181	12721
TAC	-0.18	3.68	3.25	3.06	3.54	-0.95	0.58	1.38	2.10

Source: Prepared by the author using data from the ENOE: 2005-2024 to the third quarter of each year.

The data show significant regional heterogeneity. Veracruz leads with the highest average number of workers without access to healthcare (193,524), followed by Michoacán (135,110) and Jalisco (82,926). These three states, along with Oaxaca, also have the highest standard deviations, indicating unstable trends. In contrast, Baja California (13,731), Sonora (24,615), and Chihuahua (17,144) show lower values and greater relative stability.

However, in terms of annual growth rates, Chihuahua (3.68%) and Oaxaca (3.54%) register the highest figures, suggesting a worrying increase in informal employment in these territories. On the other hand, Sinaloa (-0.95%) and Baja California (-0.18%) show negative rates, possibly associated with efforts to formalize or reconfigure agricultural employment. The national average was 70,183 workers, with an annual growth rate of 2.10%.

The analysis reveals that the central and southern states of the country concentrate both the highest levels and the greatest growth rates of agricultural employment without access to healthcare, suggesting a persistence of structural informality. Despite advances in healthcare coverage in Mexico, this group of workers remains outside the basic social protection system. On the other hand, some northern states, such as Sinaloa and Baja California, appear to have made progress in reducing these figures, which could be linked to more formalized production structures due to production for the international market.

The results of this analysis show a marked territorial inequality in access to healthcare for agricultural workers in Mexico. To address this problem, it is recommended to implement regionally differentiated policies, including tax incentives, simplified enrollment programs, and specific monitoring of rural employment. Statistical evidence suggests that, without a targeted strategy, the gaps in formalizing rural employment could continue to widen.

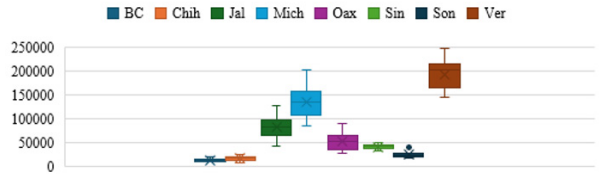
Figure 1, a box and whisker plot, provides a visual representation of the dispersion, central tendency, and potential outliers in the distribution of the number of salaried, salaried agricultural workers without access to healthcare services in eight states between 2005 and 2023. In this type of plot, the median (the line inside the box) identifies the central position of the data, while the box borders indicate the interquartile ranges (Q1 and Q3), and the whiskers reflect the acceptable range of

e-ISSN: 2790-2145 ISSN: 2618-1207

variation. It is noteworthy that Veracruz and Michoacán have the highest medians and interquartile ranges, confirming their status as the states with the largest number of workers in the informal sector. Furthermore, their larger boxes reflect significant dispersion over time. Oaxaca and Jalisco also show high dispersion, although with a smaller overall volume.

Figure 1

Scatter plots of workers without access to health (2005-2023).



Source: Prepared by the author based on the ENOE: 2005-2024 to the third quarter of each year.

In contrast, Baja California, Chihuahua, and Sonora are located in the lower part of the graph, with more compact boxes, suggesting a smaller number of affected workers and greater relative stability during the period. The presence of potential extreme values in states like Michoacán and Veracruz reinforces the existence of anomalous or cyclical peaks. In short, this graph demonstrates the regional heterogeneity in the magnitude and variability of informal agricultural employment, highlighting the urgent need to implement differentiated strategies to address structural disparities in access to healthcare in rural Mexico.

Table 4 details the evolution of the number of salaried, non-wage workers in eight Mexican states during the period 2005–2024. Measures such as the mean, standard deviation, annual growth rate (AGR), and national average are presented. Veracruz stands out as the state with the highest absolute volume of non-wage employment, with an average of 170,336 workers, representing an extreme case of labor informality. They are followed by Michoacán (122,047) and Jalisco (60,302), both also with critical levels.

Table 4

Number of subordinate and paid agricultural workers without access to labor benefits in the agricultural sector of selected entities: 2005-2024.

Year	BC	Chihuahua	Jalisco	Michoacán	Oaxaca	Sinaloa	Sonora	Veracruz	Annual Average
2005	19553	9015	55382	79181	36541	33707	20820	149340	50442
2006	11727	10320	34514	80246	26177	29852	19255	142988	44385
2007	12926	10030	36681	77790	35334	27152	21601	139557	45134
2008	12633	12167	45481	100022	33813		21405	146636	49980
2009	14277	16606	50545	96001	43307	28659	21908	146292	52199
2010	17213	18953	48101	112334	26786	27831	23960	127826	50376
2011	17992	20856	62586	125656	32803	30551	26171	142419	57379
2012	22526	14848	64648	105949	42320	25351	25262	187430	61042
2013	12537	17983	48358	107034	27725	26261	16531	182118	54818
2014	12463	17546	66117	109708	53005	30123	17384	179239	60698
2015	13188	14587	57839	125145	58053	32188	19961	199800	65095
2016	16845	24076	70951	136575	59555	34676	25574	173812	67758
2017	12591	14398	86258	145578	65113	32339	25501	231289	76633
2018	14600	18111	73098	142184	61320	29870	18425	205920	70441
2019	13611	16883	69559	168750	59769	35802	33448	177475	71912
2020	8499	18154	48251	116504	49645	27576	18882	148294	54476
2021	7246	14822	58235	144794	85604	30728	20875	183814	68265
2022	9729	15694	74312	159786	56428	30560	25494	188338	70043
2023	9455	12601	72097	179834	66094	29315	24727	177622	71468
2024	11373	13972	83021	127872	69747	20578	20283	176505	65419
Average	13549	15581	60302	122047	49457	29540	22373	170336	60398
St. Dev.	3780	3735	14428	29162	16591	3458	3949	26525	9778
TAC	-2.67	2.22	2.04	2.43	3.28	-2.44	-0.13	0.84	1.31

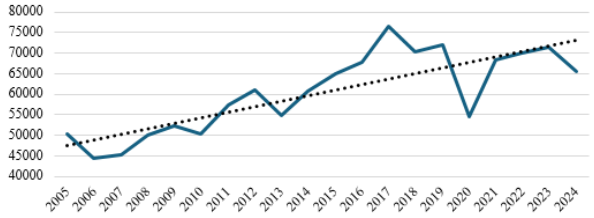
Source: Prepared by the author based on the ENOE: 2005-2024 to the third quarter of each year.

In contrast, Baja California (13,549), Chihuahua (15,581), and Sonora (22,373) report the lowest levels, with moderate to low coefficients of variation. This relative stability could be linked to greater formalization of agricultural employment in the north of the country, influenced by factors such as proximity to international markets. In terms of growth, Oaxaca (3.28%), Michoacán (2.43%), and Chihuahua (2.22%) show the highest compound annual growth rates, indicating a sustained increase in work without benefits in these regions.

Graph 2 illustrates the evolution of the average number of workers without benefits in the selected states. A general upward trend is observed, rising from 50,442 in 2005 to 76,633 in 2017, before stabilizing around 70,000 in recent years. This behavior suggests that, despite legislative and administrative efforts, informality has not been structurally contained. Some critical points stand out, such as the surge between 2012 and 2017, which coincides with a period of expansion in the demand for agricultural labor, but without a corresponding improvement in labor rights.

Figure 2

Average evolution of workers without employment benefits (2005-2024).



Source: Prepared by the author based on the ENOE: 2005-2024 to the third quarter of each year.

Statistical analysis reveals a deeply structural and unequal problem. The persistent and increasing levels of workers without benefits particularly affect the central and southern states of the country, while the north shows greater progress toward formalization. The decline in 2020 may be related to the disruption of the labor market resulting from the COVID-19 pandemic.

Meanwhile, Baja California, Chihuahua, and Sonora reflect greater stability and formalization. In these regions, local policies promoting regularization or agro-industrial production schemes with greater oversight may be influencing the situation. Meanwhile, in Michoacán and Veracruz, marked by occasional spikes in workers without benefits, the hypothesis of cyclical factors and sudden increases in temporary hiring is reinforced.

Finally, Table 5, which analyzes salaried agricultural workers without access to health services and labor benefits in the agricultural sector of Sinaloa, shows a fluctuating trend in both the total number of workers and the proportion of those excluded from fundamental labor rights. While some years, such as 2016 and 2019, saw peaks in the total number of workers (132,819 and 130,556, respectively), these increases did not translate into a systematic improvement in access to social security.

Table 5

Number of subordinate and paid agricultural workers without access to health services and labor benefits in the agricultural sector of Sinaloa: 2005-2024.

Year	Total number of workers	Without access to healthcare	Without benefits
2005	95,606	43,161	35,320
2006	97,412	41,866	33,183
2007	89,373	34,915	27,428
2008	90,075	39,161	30,950
2009	96,700	42,002	32,413
2010	96,985	43,725	32,354
2011	106,485	48,152	35,731
2012	92,082	42,724	31,849
2013	115,823	50,245	33,265
2014	118,289	51,288	37,595
2015	115,190	46,274	32,938
2016	132,819	56,100	41,071
2017	119,955	51,807	37,585
2018	113,094	46,866	34,924
2019	130,556	53,591	38,932
2020	107,055	42,008	29,980
2021	111,656	43,033	30,030
2022	120,711	45,872	33,071
2023	129,602	50,808	34,882
2024	92,410	37,111	24,036

Source: Prepared by the author based on the ENOE: 2005-2024 to the third quarter of each year.

Donde se puede observar que en 2016, más del 42% de los trabajadores (56,100) carecían de acceso a servicios de salud, mientras que el 31% no contaba con prestaciones laborales (41,071 trabajadores). En promedio, entre el 35% y el 50% de los trabajadores subordinados y remunerados en el sector agropecuario sinaloense no han contado con afiliación a instituciones de salud ni con prestaciones laborales, lo cual constituye una muestra clara de informalidad y rezago en el cumplimiento de los derechos sociales en el ámbito rural.

Conclusions

In order to conduct a comprehensive analysis of the agricultural labor market in Mexico, this document is structured in three methodological sections, and therefore the conclusions are presented in the same order. The first section provides solid evidence on the main determinants of the growth of fruit and vegetable

e-ISSN: 2790-2145 ISSN: 2618-1207

production in Mexico during the period 2003-2022. The findings reveal that yield per hectare and harvested area showed positive and statistically significant effects, highlighting the central role of technical efficiency and intensive use of available land.

The value of production, meanwhile, maintains a positive association with agricultural growth, confirming that increases in economic terms are aligned with increases in physical volumes. This underscores the need for an agricultural policy focused on strengthening productivity through investment in technology, agricultural innovation, and sustainable practices. The study concludes that the growth of fruit and vegetable production in Mexico is strongly conditioned by the efficient use of production factors, making it crucial to move towards intensive, technologically advanced, and higher value-added production models to ensure the sector's sustainability and competitiveness.

In the second study, analyzing the social security coverage of day laborers during the period 2000-2024, a positive and statistically significant relationship is identified between registered employment in the state of Sinaloa, both temporary and permanent, and the total number of jobs nationwide. In particular, the higher incidence of permanent jobs stands out. This difference indicates that structural employment in Sinaloa contributes more significantly to the overall trends in the Mexican labor market. Furthermore, the results suggest that the state's formal job stability in this sector acts as a determining factor in the integration of the regional workforce into the country's social security system.

The model suggests that employment patterns in Sinaloa, a state with significant agricultural and agro-industrial activity, are closely correlated with national employment dynamics. Taken together, these findings underscore Sinaloa's economic and labor relevance within the national context, while also opening the possibility of further studies examining the role of key states in job creation, especially in sectors characterized by strong seasonality and regional concentration.

Regarding the results of the descriptive statistical analysis of access to health services and labor benefits in the agricultural sector during the period 2005-2024, a deeply entrenched structural informality persists, with marked territorial inequalities. The central and southern states of the country concentrate the highest levels of informal employment, both in absolute terms and in year-on-year variability. Excluded workers face violations of social security and labor rights.

Conversely, some northern states exhibit lower levels of informality, suggesting greater institutionalization of the labor market. This regional difference could be related to various structural factors, such as proximity to international markets. It is not surprising that these states have fruit and vegetable production primarily destined for the export market. However, although, according to the Mexican Social Security Institute (IMSS), Sinaloa presents significant figures in terms of agricultural employment at the national level, the data from the National Survey of Occupation and Employment (ENOE) reveal considerable disparities in access to health services and labor benefits. This situation highlights the persistence of conditions of social and labor exclusion, and the urgent need for labor inspection mechanisms.

Therefore, it is evident that, despite advances in policies aimed at expanding health and social security coverage, a large part of the day laborer population remains excluded from these labor rights. The measures adopted have been insufficient to reverse the dynamics of precariousness that characterize rural work. And the structural gaps in labor rights, health, and social protection continue to be a social problem, perpetuating the exclusion of one of the most vulnerable sectors. In this context, Sinaloa presents a dual dimension in the labor market. On the one hand, it stands out as a productive and employment engine at the national level. On the other hand, it exhibits profound inequalities in access to social security and labor benefits, which demonstrates the persistence of exclusion of the day laborer population. This presents the challenge of moving towards a more inclusive model.

Regarding limitations and opportunities for future research, this study relies on official information presented by state, which limits the analysis of local dynamics that could be examined using production microdata generated during field visits. Furthermore, methodological differences between the ENOE (National Survey of Occupation and Employment) and the IMSS (Mexican Social Security Institute) make it difficult to accurately estimate informal employment. Therefore, future research could harmonize databases and comparable indicators. Likewise, the spatial and temporal limitations prevent the incorporation of elements such as labor mobility, living conditions, and migration—aspects that would allow for a deeper analysis of the agricultural labor market. This leads to qualitative social studies with focused observation and approaches.

References

Alvarez, R. (2020). Uso del estimador de mínimos cuadrados ordinarios en la inferencia con datos de series de tiempo en modelos lineales. *Universidad & Ciencia,* 9(1), 198–212. https://revistas.unica.cu/index.php/uciencia/article/view/1544/2343

Arellano Gálvez, M., Castro Vásquez, M., & Aranda Gallegos, P. (2023). ¿Apoyos o derechos?: Acceso a servicios de salud entre población jornalera del noroeste de *México. Iztapalapa. Revista de Ciencias Sociales y Humanidades*, 44(94), 221–249. https://www.scielo.org.mx/pdf/izta/v44n94/2007-9176-izta-44-94-221.pdf

Barrón Pérez, M., & Hernández Trujillo, J. (2019). Diversificación productiva y migración jornalera en México. *Política y Cultura,* (52), 61–85. https://www.redalyc.org/journal/267/26761739005/html/

Capítulo 23. Laboral. T-MEC. (2019). T*ratado entre México, Estados Unidos y Canadá.* Entró en vigor el 1 de julio de 2020. https://reformalaboral.stps.gob.mx/sitio/rl/doc/Capitulo%2023%20T-MEC.pdf

C. de Grammont, H., Bendini, M., Mascheroni, P., Pantaleón, J., Pedreño, A., Lara Flores, S. M., Sánchez, M. J., Sánchez, K., & Saldaña, A. (2024). *Sara María Lara Flores: Los olvidados del campo: Jornaleros y jornaleras agrícolas en América Latina. Antología.* Universidad Nacional Autónoma de México, Instituto de Investigaciones Sociales. https://www.iis.unam.mx/antologia-sara-maria-lara-los-olvidados-del-campo-jornaleras-y-jornaleros-agricolas-en-america-latina/

Consejo Nacional de Evaluación de la Política de Desarrollo Social. (2024). *La población jornalera agrícola en México y su situación de pobreza* (pp. 1–52). https://www.coneval.org.mx/Medicion/MP/Documents/contribucion_estrategias_pobreza/Analisis_pobreza_jornaleros_agricolas_Mexico.pdf

Constitución Política de los Estados Unidos Mexicanos [CPEUM]. (1917). *Última reforma 15 de abril de 2025.* https://www.diputados.gob.mx/LeyesBiblio/pdf/CPEUM.pdf

Diario Oficial de la Federación. (2007a). ACUERDO ACDO-HCT-150807/336.P. (D.I.R.) *relativo a las Reglas a que se refiere el Decreto por el que se otorgan beneficios fiscales a los patrones del campo y trabajadores eventuales del campo.* https://www.dof.gob.mx/nota_detalle.php?codigo=5001386&fecha=21/09/2007#gsc.tab=

Diario Oficial de la Federación. (2007b). *Decreto por el que se otorgan beneficios fiscales a los patrones y trabajadores eventuales del campo.* https://www.dof.gob.mx/nota_detalle.php?codigo=4994242&fecha=24/07/2007#gsc.tab=

Diario Oficial de la Federación. (2024). *Decreto por el que se reforman, adicionan y derogan diversas disposiciones de la Ley Federal del Trabajo y de la Ley del Seguro Social, en materia de derechos laborales de las personas trabajadoras del campo.* https://www.diputados.gob.mx/LeyesBiblio/ref/lft/LFT_ref44_24ene24.pdf

Flores Mariscal, J. (2020). *El trabajo jornalero agrícola: Sus condiciones de precariedad en México y experiencias en la región latinoamericana para mejorar su acceso a la seguridad social.* Seguridad Social para el Bienestar. https://ciss-bienestar.org/cuadernos/pdf/el-trabajo-jornalero-agricola-sus-condiciones-de-precariedad-en-mexico-y-experiencias-en-la-region-latinoamericana-para-mejorar-su-acceso-a-la-seguridad-social.pdf

Ghiglione, F. (2023) Caracterización de los mercados de empleo en el sector agropecuario argentino. *Revista Americana De Empreendedorismo e Inovação*. V.4. n.3. 19-27. https://ri.conicet.gov.ar/handle/11336/223167?show=full

Gujarati, D., & Porter, D. (2010). *Econometría* (5.ª ed.). McGraw-Hill. https://studylib.net/doc/26265992/econometria-gujarati.pdf-5%C2%BA-edici%C3%B3n---espa%C3%B1ol

Hernández Trujillo, J., & Barrón Pérez, M. (2013). *Las empresas agrícolas mexicanas y sus sistemas de aprovisionamiento de trabajadores. Sociológica, 2*8(80), 209–240. https://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S0187-01732013000300007

Hernández Trujillo, J., & Pérez Méndez, M. (2023). *Adulto mayor, trabajo y seguridad social en el campo mexicano. Análisis Económico,* 38(99), 167–182. https://www.scielo.org.mx/pdf/ane/v38n99/2448-6655-ane-38-99-167.pdf

Instituto Nacional de Estadística y Geografía. (2023a). *Censo Agropecuario 2022: Resultados definitivos* (pp. 1–62). https://www.inegi.org.mx/contenidos/programas/ca/2022/doc/ca2022_rdnal.pdf

Instituto Nacional de Estadística y Geografía. (2023b). C*enso Agropecuario 2022: Resultados definitivos.* Sinaloa (pp. 1–42). https://www.inegi.org.mx/contenidos/programas/ca/2022/doc/ca2022_rdSIN.pdf

Jiménez, C., & Flores-Chamba, J. (2022). Desigualdad y gasto público a nivel mundial: Un estudio con datos y metodologías de panel. *Revista Económica,* 9(2), 43–54. https://revistas.unl.edu.ec/index.php/economica/article/view/1209

Ley del Seguro Social [LSS]. (1995). *Ley del Seguro Social.* Última reforma 7 de junio de 2024. https://imss.gob.mx/sites/all/statics/pdf/leyes/LSS.pdf

Ley Federal del Trabajo [LFT]. (1970). *Ley Federal del Trabajo.* Última reforma 21 de febrero de 2025. https://www.diputados.gob.mx/LeyesBiblio//pdf/LFT.pdf

López-Machado, H. (2024). Modelos econométricos para predecir el crecimiento económico de América Latina. *Polo del Conocimiento,* 9(85), 1963–1985. https://

e-ISSN: 2790-2145 ISSN: 2618-1207

polodelconocimiento.com/ojs/index.php/es

Martín Gil, F. (1995). *Mercado de trabajo en áreas rurales:* Un enfoque integrador. Ministerio de Agricultura, Alimentación y Medio Ambiente. https://www.mapa.gob.es/ministerio/pags/Biblioteca/fondo/pdf/13055_all.pdf

Minchón-Medina, C., Timaná-Palacios, D., & Sanes-Berrú, L. (2023). Un modelo de datos panel para predicción de la fatalidad del COVID-19 en el Perú. *Revista de Investigación Estadística,* 5(1), 1–11. https://www.studocu.com/co/document/universidad-libre-de-colombia/introduccion-al-derecho/5660-texto-del-articulo-21312-1-10-20231115/85852207

Neiman, G., Caro, P., & Ortiz Marín, C. (2024). El trabajo asalariado agrícola y sus transformaciones en contextos de globalización de América Latina. *En Tratado latinoamericano de sociología del trabajo (II): Desafíos y debates en el siglo XXI* (1.ª ed.). CLACSO. https://libreria.clacso.org/publicacion.php?p=4038&c=1

Núñez Vera, M., Camacho Morales, A., & Rentería Cárdenas, A. (2023). Jornaleras agrícolas y desigualdad de género en la agroindustria en Michoacán, México. R*evista de Geografía Agrícola,* (71), 29–52. https://revistas.chapingo.mx/geografia/article/view/r.rga.2023.71.7

Ortiz Marín, C., & López Estrada, J. (2022). Agricultura de exportación, trabajadores agrícolas indígenas y asentamiento en Sinaloa. En A. R. Castellanos Domínguez & C. Ortiz Marín (Eds.), *Migración y asentamientos indígenas en México* (pp. 91–110). CICSEr. https://libros.uaem.mx/archivos/epub/migracion-asentamientos-indigenas/migracion-asentamientos-indigenasa.pdf

Pignataro, A. (2018). Análisis de datos de panel en ciencia política: Ventajas y aplicaciones en estudios electorales. *Revista Española de Ciencia Política,* (46), 259–283. https://doi.org/10.21308/recp.46.11

Ramoni Perazzi, J., & Orlandoni-Merli, G. (2014). *Modelos de regresión de datos panel y su aplicación en la evaluación de impactos de programas sociales. Telos,* 16(1), 157–164. https://www.redalyc.org/articulo.oa?id=99330402007

Rangel Zaragoza, J., Aguilar Ávila, J., Valdivia Alcalá, R., & Leos Rodríguez, J. (2021). Jornaleros agrícolas migrantes y su permanencia laboral en los campos agrícolas de México. *Agricultura, Sociedad y Desarrollo,* 18(4), 635–661. https://dialnet.unirioja.es/servlet/articulo?codigo=8565803

Ríos, M. (2020). El mercado de trabajo agrícola en el noreste francés (1789–1836). *Sociedades Precapitalistas,* 10, e047, 1–17. https://www.researchgate.net/publication/341887708_El_Mercado_de_trabajo_agricola_en_el_noreste_frances_1789-1836

Ruiz Porras, A. (2016). La investigación econométrica mediante paneles de datos: Historia, modelos y usos en México. *Revista Economía y Política,* 12(24), 11–32. https://www.redalyc.org/articulo.oa?id=571176614001&tab=2

Sánchez-Belmont Montiel, M., Ramírez Villela, M., & Romero Suárez, F. (2019). *Propuesta conceptual para el análisis de la seguridad social desde la CISS. Conferencia Interamericana de Seguridad Social.* https://ciss-bienestar.org/cuadernos/pdf/Propuesta-conceptual-para-el-analisis-de-la-seguridad-social-desde-la-CISS.pdf

Stock, J., & Watson, M. (2020). *Introduction to econometrics* (4th ed.). Pearson. https://api.pageplace.de/preview/DT0400.9781292264523_A37747486/preview-9781292264523_A37747486.pdf