Unequal Returns: Measuring Gender Gaps in Agricultural Income in Peru

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Abstract

Gender gaps in agricultural income remain poorly understood in low- and middle-income countries, particularly when distinguishing disparities between women and men and within groups of women. Using the 2024 Peruvian National Agricultural Survey (ENA), this paper analyzes both inter-gender and intra-gender income gaps among rural agricultural producers. We combine Blinder–Oaxaca decompositions with Propensity Score Matching to examine how differences in resource access, household composition, market participation, and structural constraints contribute to these disparities across geographic domains. Although the empirical results are currently in progress, the study is the first to apply recent national microdata to quantify gendered income gaps in Peruvian agriculture and to differentiate systematically between women who operate agricultural farms alone and those in conjugal partnerships. The paper aims to generate evidence on the mechanisms driving unequal returns to agricultural production and to inform gender-responsive policies within Ministry of Agriculture and other government initiatives focused on rural women's economic empowerment. This work is suitable for an egg-timer session given its ongoing empirical estimation and its contribution to emerging debates on gender, structural transformation, and rural livelihoods.

1. Introduction

The growing participation of women in land management has become increasingly central to debates on agricultural development and rural transformation. Over the past decades, women's contributions to family farming and to the stewardship of natural resources have gained greater recognition. In Peru, for example, the share of female agricultural producers rose from 29 percent to 33.4 percent between 2014 and 2022 (INEI, 2022). This upward trend raises an important question: has increased female participation in farm management translated into narrower gender gaps in agricultural income?

Using data from the 1994 and 2012 agricultural censuses, Zegarra et al. (2018, 2019) document a sustained rise in female operation of agricultural farms, but note substantial heterogeneity by marital status. Their findings indicate that the expansion of female farming among single women is often associated with processes of impoverishment—particularly limited access to productive resources and markets—contrasting markedly with the circumstances of women managing farms jointly within a couple. These patterns highlight that inter-gender comparisons alone are insufficient. Understanding gender inequality in rural economies also requires examining intra-gender differences, including how social, cultural, and structural constraints shape the experiences of distinct groups of women.

This study aims to analyze gender gaps in agricultural income among women who operate agricultural farms in Peru, with the goal of informing strategies to reduce gender-based inequalities in the rural sector. Specifically, the study seeks to: (1) quantify both inter- and intra-gender gaps in agricultural income; (2) identify the socioeconomic and cultural determinants underlying these disparities; and (3) assess whether the magnitude and structure of these gaps vary across geographic domains.

Existing research on gender and agricultural income in Peru remains limited. A small number of empirical studies—such as Alfaro and Guerrero (2013) and INEI (2015, 2022)—document income-related disparities, yet most analyses rely on older census data and focus primarily on inter-gender differences. Less is known about the heterogeneity among women farmers, despite evidence of significant variation in access to land, inputs, financial resources, training, and decision-making power. To address this gap, the present study utilizes the most recent National Agricultural Survey (ENA 2024) enabling an up-to-date examination of gender disparities in agricultural income and their determinants at both national and regional levels.

By generating quantitative evidence, this study seeks to deepen understanding of gender inequity in Peruvian agriculture and to inform policy design and implementation. The findings aim to support ongoing public initiatives—such as the Rural and Indigenous Women's Entrepreneurship Strategy of the Ministry of Agriculture of Peru—which seek to expand women's access to land titling, technical assistance, financial services, and social programs, and ultimately promote greater economic empowerment among rural women.

2. Literature review

Gender gaps in agriculture have attracted growing attention in both academic and policy debates over the past decades. This concern is embedded in a broader global context that recognizes women's contributions to economic development and seeks to address

persistent disparities between women and men across multiple sectors, including agriculture. Recent global assessments of agrifood systems show that women remain systematically disadvantaged in access to productive resources, employment quality and earnings, and that closing these gaps would yield substantial productivity and welfare gains. Female-managed farms of similar size are, on average, about 24 percent less productive than male-managed farms, and that women in agricultural wage employment earn roughly 82 cents for every dollar earned by men (FAO, 2023). In countries such as Peru, where agriculture and livestock play a crucial role in rural livelihoods, understanding and addressing these gender gaps in agricultural income is therefore an urgent priority.

Although a relatively limited body of studies directly focused on gender gaps in agricultural income, there is a substantial literature identifying the factors that unequally affect the agricultural performance and earnings of women and men. Existing studies, including those for Latin America and Peru (Deere et al., 2004; Alfaro and Guerrero, 2013; INEI, 2015, 2018), point to a set of structural determinants: access to and control over land and other assets; availability of agricultural credit; access to training, extension and technical assistance; integration into markets and value chains; and household-level characteristics that shape labor allocation and decision-making. Empirical analyses highlight, for example, the role of land rights and secure tenure (Deere and León, 2005; Deere and Durán, 2004), the distribution of productive assets and other household assets (Escobal et al., 1999; Deere et al., 2012), and differential access to agricultural credit (Sam, 2021; Orr et al., 2014) in explaining gaps in productivity and income. Studies on the gender gap in agricultural productivity also emphasize market imperfections and barriers to participation in high-value markets (Palacios-Lopez and López, 2015; Brenton et al., 2022), as well as differences in access to information, technology and advisory services (Haug et al., 2021; Peterman et al., 2014). More recent comparative research reinforces these patterns, showing that gendered constraints in time use, mobility, and input allocation systematically limit women's ability to generate income from similar productive activities (FAO, 2023; Doss, 2025). Taken together, this literature suggests that gender gaps in agricultural outcomes are rooted in a combination of resource constraints, institutional biases and unequal integration into agrifood markets.

Beyond inter-gender comparisons, scholars have underscored the importance of intra-gender heterogeneity and the need to move away from treating “women farmers” as a homogeneous category. In Ecuador, for instance, Twyman et al. (2015) show that single women who own land participate more in decisions over crop choice, resource use and sales than women who share land tenure with their partners, pointing to the relevance of marital status and intra-household bargaining power in shaping women’s agricultural agency and income. These findings echo broader arguments in the literature that stress how economic, social and cultural contexts condition women’s ability to translate asset ownership into effective control and higher returns (Doss, 2018). Recent reviews of gender and agricultural productivity also highlight that differences in time use, unpaid care responsibilities, and exposure to social norms constrain women’s capacity to adopt profitable technologies and to respond to market incentives, even when they formally have access to land or inputs (Doss, 2025). These insights underscore not only the existence of intra-gender disparities, but also the mechanisms through which such disparities may emerge in income generation—particularly through differences in commercialization capacity, ability to negotiate prices, or autonomy to decide on sales.

In the Peruvian rural context, several studies have documented gender disparities in access to education (Patel-Campillo and Salas, 2018), land (Del Pozo, 2016; La Riva and Castillo, 2019), property rights over land (Deere et al., 2004), participation in high-value agricultural markets (Deere, 2009), agricultural credit (Del Pozo, 2016), and access to training and technical assistance (INEI, 2012). Evidence also points to gendered differences in association membership and collective action: Patel-Campillo and Salas (2018) found that women who participate in producer organizations tend to have higher literacy rates and a greater likelihood of Spanish as a mother tongue than non-associated women, suggesting cumulative advantages in human and social capital. At the same time, qualitative and quantitative work indicates that rural women continue to face "invisibility" in extension and advisory services and receive differentiated treatment from predominantly male extension agents (Tafur et al., 2015). These constraints interact with barriers to participation in value chains—such as limited access to market information, logistical challenges and gender biases in commercial transactions (Brenton et al., 2022)—and with gaps in access to technology and agronomic advice among smallholders (Haug et al., 2021), all of which can depress women's productivity and income relative to that of men. Importantly, these constraints may reduce women's productive capacity and, in many cases, limit the share of output they are able to commercialize or the prices they can command—key pathways through which productivity-related disadvantages translate into income gaps.

There are still relatively few studies that quantify gender gaps in agricultural income in Peru using recent and nationally representative data. Existing empirical work (Alfaro and Guerrero, 2013; INEI, 2015, 2022) focus on inter-gender differences and relies on older sources such as the 1994 and 2012 agricultural censuses (CENAGRO). This leaves several questions insufficiently addressed such as the magnitude and determinants of intra-gender gaps among women farmers; the extent to which structural constraints translate into income inequalities; and the geographic differentiation of these patterns across the country's diverse rural territories. In this context, this study contributes to the literature by using the most recent National Agricultural Survey (ENA 2024) to provide an updated assessment of both inter- and intra-gender gaps in agricultural income in Peru, and by linking these gaps to a broad set of productive, household and contextual factors identified in the international literature.

3. Methodology

To quantify the gender gap and to identify the factors that contribute to differences in agricultural income, we employ quantitative methods. The analysis uses the Blinder–Oaxaca decomposition, which allows us to estimate how much of the income gap can be attributed to group differences in observable predictors (men versus women) and how much is due to other factors. As a complementary robustness check, we apply Propensity Score Matching (PSM) to assess the sensitivity of the results.

The Blinder–Oaxaca model was originally introduced by Blinder (1973) and Oaxaca (1973) and has since been widely applied in studies of wage differentials and other forms of inequality to understand disparities across population groups. The first step consists of estimating the net agricultural income equation separately for each group—one for men and one for women:

$$Y_i = \beta_i X_i + \varepsilon_i \quad (1)$$

Where $Y$is the natural logarithm of net agricultural income, X is a vector of control variables, and $\varepsilon$is the error term. The subscript $i$distinguishes between men and women. The vector Xincludes several categories of variables, such as characteristics of the household head and the household, characteristics of the agricultural farm, access to resources, and asset ownership, among others. Table 1 (see Annex) presents the full list of variables included in the model.

We then proceed to estimate the gender gap in net agricultural income:

$$\underline{Y_m} - \underline{Y_w} = \hat{\beta}_m(\underline{X_m} - \underline{X_m}) + \underline{X_w}(\hat{\beta}_m - \hat{\beta}_w) = E + U \quad (2)$$

The subscripts *m* and *w* refer to men and women, respectively. $\underline{Y_m} - \underline{Y_w}$ represents the difference in mean income between male and female producers. These means, along with the estimated coefficients β, are obtained from equation (1) for each group.

The total difference (i.e., the gender gap in agricultural income) is composed of two parts. The first component $\hat{\beta}_m(\underline{X_m} - \underline{X_m})$ —is interpreted as the explained component, which reflects differences in observable characteristics across groups. The second component—$\bar{X}_w(\hat{\beta}_m - \hat{\beta}_w)$ —captures the unexplained component, which reflects differences in coefficients (i.e., returns to characteristics) and unobserved factors.

Results from the Blinder–Oaxaca decomposition may be affected by specification issues stemming from differences in the distribution of characteristics across groups (Djurdjevic & Radyakin, 2007; Froehlich, 2007). In these cases, Propensity Score Matching is used to assess robustness and address comparability concerns between men and women (Froehlich, 2007; Ñopo, 2009). This method has been applied in recent research examining gender income gaps in agriculture in other countries (Fisher et al., 2021, 2023).

PSM allows us to identify and compare male and female producers with similar observable characteristics. This method evaluates the statistical significance of the average difference in the outcome variable (i.e., net agricultural income) between two groups: the treatment group (female producers) and the control group (male producers). The matching procedure involves the following steps:

1. Estimate a binary choice model (probit or logit) to calculate the propensity score, which represents the probability that a producer is a woman. The explanatory variables used in this model correspond to those listed in Table 1 (Annex).

2. Apply a matching algorithm to match each female producer with one or more male producers based on similarity in propensity scores. Among the different available algorithms, this study uses Kernel matching due to its flexibility and ease of implementation (Caliendo & Kopeinig, 2008).

3. Compute mean differences in the outcome variable between matched treatment and control units. The average difference is the Average Treatment Effect (ATE), which represents the portion of the gender gap unexplained by observable differences (Fisher et al., 2023).

The empirical analysis uses the National Agricultural Survey (ENA), whose unit of analysis is the agricultural farm, with representativeness at both national and

departmental levels. The study estimates the income gap for 2024 at the national level and across rural regions to explore differences in gender gaps across Peru's geographic domains (coast, highlands, and jungle; and northern, central, and southern macro-regions).

4. Expected outcomes

The study is expected to produce a clear and policy-relevant characterization of gender disparities in agricultural income in Peru, distinguishing explicitly between inter-gender and intra-gender gaps. By applying Blinder–Oaxaca decompositions and complementary matching techniques to the ENA 2024 dataset, the analysis will generate empirical evidence on:

1. The magnitude and structure of agricultural income gaps between men and women, and among women farmers with differing household and resource conditions.

2. The relative contribution of observable factors—such as access to land, inputs, credit, technical assistance, household composition, and market participation—to these disparities.

3. The extent of unexplained gaps, pointing to structural, institutional, or normative constraints that persist beyond differences in observable characteristics.

4. Geographic heterogeneity in gender gaps, identifying regions or production systems where inequalities are more pronounced.

These outcomes will provide the analytical foundation needed to inform gender-responsive policies in the rural sector. The findings are expected to support the design or refinement of interventions aimed at improving women's access to productive resources, strengthening their economic autonomy, and enhancing the effectiveness of public programs targeting rural women. The study thus contributes both to the empirical literature on gender and agricultural income and to ongoing policy debates on rural development and women's economic empowerment.

5. References

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6. Annex

Table 1: Control variables to be included in the empirical model

Type	Variable
Household head´s characteristics	Age
	Education level
	Mother tongue (Spanish, Quechua, aymara)
	Years of experience in agriculture
	Marital status (single, married/cohabiting, widowed)
	Membership in a peasant or native community
Household´s characteristics	Percentage of women in the household
	Total number of children in the household
	Share of children under age 14
Agricultural farm characteristics	Total agricultural area
	Share of agricultural area under irrigation
	Use of modern/drop irrigation systems
	Share of agricultural land with formal property title
	Crop characteristics: type (temporary/permanent), high-value vs. low-value crops
	Distance from the agricultural farm to the district capital (hours)
Agricultural sales	Share of agricultural production sold
	Main sales channel used for agricultural production
Access to resources, asset ownership, and information channels	Access to agricultural inputs (e.g., certified seeds, among others)
	Access to credit

Type	Variable
	Access to agricultural training
	Access to agricultural technical assistance
	Ownership of agricultural machinery
	Ownership of livestock
	Membership in producer associations
	Membership in an irrigation committee
	Types of channels used to access agricultural information (e.g., radio, phone, internet)
Access to social programs	Household benefits from social programs