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GENDER AND REGIONAL DISPARITIES IN INCOME LEVEL PERSPECTIVES IN UNITED STATES AGRICULTURE SECTOR*

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Abstract. Agriculture, as one of the most important sectors of the economy of many countries, has to deal with gender inequality, which is part of it, among other problems. For centuries, women have been excluded from this area, but nowadays, they have the opportunity to participate in agricultural activities to the same extent as men and achieve an adequate income. The success of women in US agriculture in the form of their income can be explained through the six indicators: age, family involvement, farm area, farming period, female operators, and partnership by applying the regression analysis. The coefficient of determination shows that the Heartland Region regression model has the highest statistical significance, explaining 51.03 % of the investigated data variability. The second position is kept very closely by the Upper Midwest Region with a value of 50.06 %; the next ones are the Delta Region with a value of 46.37 %, the Great Lakes Region with 44.44 %, and the Northwest Region with 43.24 %. All the regression models assigned to these regions are suitable for explaining. Surprisingly, there are cases where a mutual ratio of the regression coefficients of the same indicator for the two specific regions is twice as high or lower. It reveals there are deliberate regional disparities.

Keywords: agriculture; gender inequality; United States regions

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1. Introduction

The farms where women perform as the principal operators generate about 40 % less income than those led by men (Fremstad & Paul, 2020). A majority of the farms in the United States of America's agricultural sector are run as family businesses. Small family farms represent about 90 % of all farms, and thus, they operate on about 55 % of the whole farmland in the United States of America (Hoppe & MacDonald, 2013). The salary level for farmworkers is affected by productivity. It means that higher labor productivity advances the higher salary levels for workers. Between 1948 and 2017, their average salary level increased approximately 13 times (United States Department of Agriculture, 2022). The most noticeable characteristic of the principal farm operators is their age. The older operators are considered to be older than 65 years (United States Department of Agriculture, 2014). The principal operator is the person most responsible for all the farm operations.

This study aims to evaluate the income from an agricultural activity that affects the six explanatory variables – namely age, family involvement, the farming area, the farming period, the female operators, and the partnership. Specifically, the study focuses on investigating the regional approach that is important for the two main points. Firstly, it is crucial to obtain information about a potential area, and secondly, to reveal a possible relation among the explored regions. The analysis is carried out at the level of the regions of the United States of America, whose geographical division into the twelve regions is based on the National Agricultural Statistics Service of the United States Department of Agriculture. The sensitivity analysis is employed as the methodological approach, and the regression analysis is applied to demonstrate the analytical outcomes. Regression analysis, as the main analytical method, is believed to be the most appropriate tool to catch the coherence among the variables examined.

2. Theoretical background

Gender inequality in agriculture is addressed within a given state, as stated by Balezentis et al. (2021) in their study, where they examine gender inequality in agriculture across Lithuania. The analysis is aimed at young farmers and is based on the survey, which resulted in 473 questionnaires. T-test and chi-square tests were applied to observe whether the differences among the respondents' answers for checking the existence of gender inequality are significant. Their analysis shows that there are no significant differences across the gender, and the Lithuanian agricultural sector is equally advantageous for women and men farmers. However, many researchers evaluate gender inequality across regions, such as Pattnaik & Dutt (2020), who focus on analysing the main socioeconomic and cultural factors that influence women's participation in agriculture in two states, Gujarat and West Bengal, in India. The authors examine survey data of 800 households using the binary logit model. The regression analysis outcome demonstrates that women's participation in the farm sector differs over regions and depends on caste and economic factors. Loison (2019) analyses gender and regional disparities and livelihood diversification in the agricultural regions in rural Kenya. The author used panel data from 239 households between 2008 and 2013. Panel data models show that there are significant and positive relationship changes in household assets and livelihood diversification at a regional level. Broussard (2019) examines women's food security using the Gallup World Poll data for 146 countries, with a sample size of 132983 adults conducted in 2014. The analysis shows that the gender gap in food insecurity varies at the regional levels. Silva et al. (2018) focus on sustainable intensification at the farm, field, and regional levels. The authors use two International Rice Research Institute surveys to analyse constraints in Central Luzon, Philippines. Linear mixed models result indicate that changes in management practices over the past 50 years have positively affected labor productivity, but from the point of farm or regional level, no clear changes have been demonstrated in this study. Bianchi et al. (2021) focus on economic structures, material productivity, and socioeconomic determinants. The study uses panel data for 280 European regions collected from Eurostat. The authors use cluster analysis to classify European regions. The econometric analysis results show that socioeconomic factors on material productivity differ between regions.

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Studies on gender inequality in agriculture monitor its manifestations based on various indicators (Imran et al. 2023). For many researchers, income is one of the most reliable indicators for determining the level of gender inequality in agriculture. Smith & Floro (2020) focus on the roles of food insecurity and gender in the migration decision process for the final sample of 135078 individuals across 94 low- and middle-income countries from 2014 to 2015 in the Gallup World Poll Survey. Their analysis using a series of binary-choice models shows that these relationships differ significantly by gender and level of gross national income. The study by Profumo et al. (2021) draws attention to women's empowerment in agriculture in association with food production and dietary diversity among children. The authors apply the multivariate regression models using the Abbreviated Women's Empowerment in Agriculture Index. They analysed 156 dual-adult rural households, demonstrating that the dietary diversity scores of empowered women and their children are higher than those between disempowered women and their children. Based on the analysis results, the authors confirm that there are small gender gaps in a decision on production depending on access to resources or control over income.

Akter et al. (2021) focus on analysing gender inequality in Southeast Asian agriculture. The study is based on 37 focus groups with 290 women farmers from Myanmar, Thailand, Indonesia, and the Philippines. Focus groups were created on recommendations by the Women's Empowerment in Agriculture Index. The authors confirm, first based on a qualitative data collection method and then by content analysis, that in the mentioned countries, women have equal access to resources and higher control of household income than men. At the end of the study, the authors declare that to bridge gender gaps in agriculture. It is important to distinguish among gender intervention frameworks, as they proved to be country-specific. Tambo & Mockshell (2018) examine the impacts of conservation agriculture technologies on household income in Sub-Saharan Africa. The study uses survey data from 9 countries. A cross-sectional sample of 3155 smallholder maise-producing households was analysed based on the regression and mean values of the variables. The impact of conservation agriculture techniques on household income was analysed using inverse-probability-weighted regression adjustment and propensity score matching. At the end of the study, the overlap among adopters and non-adopters of alternative conservation agriculture practices is shown by Kernel density distribution. Balancing tests applied before and after the Kernel matching score show that the introduction of conservation agriculture technologies significantly increases household income. Herrera et al. (2018) examine the income, productivity, and diversification of smallholders in Brazil. The study uses a database of about 4,7 million family farmers in the country and is conducted by the Ministry of Agrarian Development. The result of two linear regressions and Tobit regression is that smallholders as members of an agricultural cooperative or members of an agricultural association positively influence observed parameters.

Schmidt et al. (2021) analyse the United States female farmers at the county level obtained from the Census of Agriculture using fixed-effects panel regression. The analysis shows that women are more involved in farming in counties where income distribution is more equal, income levels are higher, and childcare availability is provided. Social responsibility is a critical perspective in this field aiming at sustainable development of the principles leading to diminishing the disparities in the small and medium businesses functioning (Gavurova et al., 2022). Zhang et al. (2021) investigate the determinants of market-oriented activities in agriculture and their impact on farm performance. Their study is based on data from a nationally representative survey consisting of 4560 rural Chinese farm households. The multinomial endogenous switching treatment regression results indicate that farm profits can be increased by land ranting on cash cropping. Sainio et al. (2021) evaluate the farmer's views on the future of changing climate. They point to financial support, costs, and investments. The research sample consists of a total number of 6401 farmers in Finland. Kijima et al. (2020) analysed the agricultural efficiency in Uganda and Kenya. Panel data analysis shows that land rental is proving significant in both countries, and the land sales appear significant only in Uganda but not in Kenya. Špur et al. (2018) examine participants in small-scale farming in Slovenia. The research sample consists of 198 meadow owners from 2015-2016. The result of binominal logistic regression shows that factors like gender, income, age, or large meadow area significantly positively affect agri-environmental schemes. Richards et al. (2020) analyse private lands and reforestation. This study uses

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survey data from 189 farmers in Brazil. Multinomial logit regression for valuation data is used. Results of mixed logit regression show that variables like income or area size are significant.

Another research subject in this field is landownership, as Yoking & Lambrecht (2020) examine the landownership and gender gap in agriculture using Ghana's Feed the Future Baseline Dataset. For the survey, the sample used 230 enumeration areas, and 4410 households were surveyed. The observed variables' association is evaluated using recursive bivariate probit models. All variables using clustered standard errors were denoted as significant in this investigation. Some studies examine urban agricultural types, such as a study where urban agriculture participants are ensured using survey data from 74 urban agriculture sites in parts of Europe and the United States in the study by Kirby et al. (2021). Quantitative analysis, factor analysis, multivariate analysis of variance, and multilevel multivariate analysis show that there are significant differences among participants in distinct urban agriculture types or agriculture near cities such as Wästfelt & Zhang (2018), whose research sample consists of 150 farming properties from Hisingen, Swedenland, and a combination of methods is applied to process data, or urbanisation and agricultural impact on the ecosystem, such as a study by Narducci et al. (2019), who examine the urbanisation and agricultural impact on ecosystem services in the western United States. The investigation is based on face-to-face surveys of 392 respondents.

On the other hand, some studies address the situation in rural areas, such as the study by Barbosa et al. (2020), which analyses the success of family farms from the rural women's viewpoint. This study uses the Q methodology to identify the factors that influence this success. The result obtained from 28 women as a research sample is that five viewpoints exist. Sen et al. (2021) examine three types of households from agriculture in rural Bangladesh using data from the Force Survey of 2000 to 2013. The result shows that in all observed groups, there was an increase over the 2000 to 2013 period.

3. Research objective and methodology

A total of seven variables are investigated in the analysis. The explained variable is represented by income. The remaining six variables perform as explanatory variables. These are the age – A, the family involvement – FI, the farm area – FA, the farming period – FP, the female operators – FO, and the partnership – P. The age indicator is expressed as an average value of age in years. Family involvement is set to characterise a type of explored business unit. The farm area measures land belonging to the particular observed farm expressed in acres. The figures are rounded to whole numbers. An average value of the length of the period of the farm operation is introduced as the farming period. The female operators show a sum of the female employees on the farm. Finally, the partnership also demonstrates the farming area but is meant for the whole enterprise. The data set covers the period from the year 2002 to the year 2017 in all the available censuses. The United States Department of Agriculture carries them out.

The applied geographical division is based on the National Agricultural Statistics Service of the United States Department of Agriculture. The following twelve regions are distinguished – the Delta Region – DR, the Eastern Mountain Region – EMR, the Great Lakes Region – GLR, the Heartland Region – HR, the Mountain Region – MR, the Northeastern Region – NER, the Northern Plains Region – NPR, the Northwest Region – NWR, the Pacific Region – PR, the Southern Region – SR, the Southern Plains Region – SPR, and the Upper Midwest Region – UMR. The Delta Region consists of Arkansas, Louisiana, and Mississippi. The Eastern Mountain Region serves Kentucky, North Carolina, Tennessee, Virginia, and West Virginia. The Great Lakes Region contains Indiana, Michigan, and Ohio. The Heartland Region covers a couple of Missouri and Illinois. The Mountain Region comprises Arizona, Colorado, Montana, New Mexico, Utah, and Wyoming. The Northeastern Region includes Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The Northern Plains Region encompasses Kansas, Nebraska, North Dakota, and South Dakota. The Northwest Region consists of Alaska, Idaho, Oregon, and Washington. The

Pacific Region includes California, Hawaii, and Nevada. The Southern Region comprises Alabama, Florida, Georgia, and South Carolina. The Southern Plains Region involves a couple of Oklahoma and Texas. Finally, the Upper Midwest Region covers Iowa, Minnesota, and Wisconsin. The terminology applied in the case of the Northwest Region comes from its original name, as mentioned by the National Agricultural Statistics Service of the United States Department of Agriculture. Hence, it is stated in this way. There is noted that the District of Columbia is omitted from the analysis because of its characteristics. Apart from this, Alaska, Delaware, Hawaii, and Rhode Island do not offer the data provision.
Under the focus of the research activities, the following research questions were identified:

- the research question 1: the gender perspective play a significant role in the field of the management of agicultural businesses;
- the research question 2: the regional perspective play a significant role in the field of the management of agicultural businesses;
- the research question 3: the socioeconomic sphere dimension significantly influences the performance of agricultural businesses.

The sensitivity analysis is employed as the methodological approach. The regression analysis demonstrates the analytical outcome. Each region and every state is scrutinised individually besides the analysis. The main analytical method is the regression analysis. The coefficient of determination with its adjusted version is applied to learn the regression model's impact. The F test is applied to obtain the overall significance of the linear regression model. The potential errors regarding autocorrelation are explored through the Durbin–Watson statistic and heterogeneity through the Breusch–Pagan test. Statistical significance is determined by a common five-per-cent threshold. There is to note that the tables visualising the regression models demonstrate the regression coefficients marked as RC and the assigned p-values marked as P.

4. Results

Firstly, the regional approach needs to be investigated. It is important from the two main points. On the one hand, the regional aspect is suitable for obtaining information about a potential area, where indicators representing the explanatory variables play a key role. On the other hand, this approach reveals a possible relation between the states inside the analysed regions. The coefficient of determination shows that the Heartland Region regression model has the highest statistical significance, explaining 51.03 % of the investigated data variability. The second position is kept very closely by the Upper Midwest Region, with a significance at a level of 50.06 %. The next three positions, from the third one to the fifth one, are held by the Delta Region at a level of 46.37 %, the Great Lakes Region at a level of 44.44 %, and the Northwest Region at a level of 43.24 %. All the regression models assigned to these regions are suitable to be considered as very explaining, and thus, they demonstrate their interpretation power. The following two positions are occupied by the Pacific Region, with an explanation level of 33.10 %, and by the Northern Plains Region, at a level of 29.57 %. These numbers perform as sufficient still. The further triplet, including the Eastern Mountain Region, the Southern Plains Region, and the Northeastern Region, explains the data variability ranging from a level of 20.48 % through a level of 19.42 % to a level of 16.54 %. Hence, these numbers can be understood as average. The Mountain Region and the Southern Region keep the lowest significance values, explaining an 11.02 % share and an 8.65 % share of the data variability. These two regions perform very weakly, although some points could be considered important regarding certain explanatory variables. This is mentioned below in the particular regression models discussion.

To fulfil the standard normative requirements of the coefficient of determination interpretation, the adjusted versions are calculated too. Though, their numbers are very similar, meaning their interpretation is the same. The highest difference reaches a 12.68 % decrease. It is visible for the second lowest significance value of the Mountain Region regression model. The second highest difference with a value of 11.51 % is kept by the absolutely lowest significant model of the Southern Region for a change. On the other hand, the lowest

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differences are illustrated by the highest significant regression models. The lowest one, with a value of 0.97 %, is assigned to the second most significant regression model of the Upper Midwest Region, and the second lowest one, at a level of 1.09 %, to the best regression model of the Heartland Region. In other words, it is not needed to distinguish the standard version of the coefficient of determination from its adjusted version, as their difference is diminished by their own increase. The more significant the regression model, the lower the difference is, and vice versa. In the case of the lowest significant models, it is not needed to interpret such low numbers. Hence, their increasing difference is not interesting for this explanation.

Table 1. The Regional Regression Models

Region	Value	A	FI	FA	FP	FO	P
DR	RC	-6,50 . 10^{3}	-1,98 . 10^{-1}	2,43 . 10^{-1}	7,04 . 10^{3}	3,32	7,00 . 10^{-1}
	P	1,05 . 10^{-9}	8,29 . 10^{-5}	9,19 . 10^{-2}	5,23 . 10^{-9}	8,11 . 10^{-1}	2,20 . 10^{-51}
EMR	RC	-2,34 . 10^{3}	-9,31 . 10^{-2}	2,47 . 10^{-1}	2,45 . 10^{3}	-5,07 . 10^{1}	1,11
	P	1,38 . 10^{-3}	2,85 . 10^{-2}	1,39 . 10^{-1}	6,31 . 10^{-3}	8,27 . 10^{-8}	0
GLR	RC	-3,77 . 10^{3}	8,01 . 10^{-2}	3,13 . 10^{-1}	3,42 . 10^{3}	-5,20 . 10^{1}	4,31 . 10^{-1}
	P	1,76 . 10^{-17}	1,45 . 10^{-4}	1,75 . 10^{-4}	8,13 . 10^{-12}	5,61 . 10^{-24}	1,11 . 10^{-15}
HR	RC	-3,21 . 10^{3}	5,84 . 10^{-2}	2,60 . 10^{-3}	4,96 . 10^{3}	16,69 . 10^{1}	5,39 . 10^{-1}
	P	3,46 . 10^{-6}	2,73 . 10^{-4}	9,76 . 10^{-1}	3,73 . 10^{-14}	4,69 . 10^{-20}	4,22 . 10^{-26}
MR	RC	-7,43 . 10^{3}	-1,01 . 10^{-2}	5,45 . 10^{-3}	4,64 . 10^{3}	-1,11 . 10^{1}	2,21 . 10^{-2}
	P	4,61 . 10^{-10}	2,67 . 10^{-1}	7,25 . 10^{-1}	9,47 . 10^{-9}	5,50 . 10^{-2}	2,09 . 10^{-1}
NER	RC	-3,08 . 10^{3}	-5,65 . 10^{-2}	-4,15 . 10^{-2}	2,42 . 10^{3}	-1,18 . 10^{1}	8,47 . 10^{-1}
	P	3,37 . 10^{-5}	1,52 . 10^{-1}	7,51 . 10^{-1}	2,08 . 10^{-3}	6,51 . 10^{-2}	4,24 . 10^{-13}
NPR	RC	-6,95 . 10^{3}	-4,33 . 10^{-2}	-7,01 . 10^{-2}	6,87 . 10^{3}	-7,38 . 10^{1}	3,09 . 10^{-1}
	P	4,65 . 10^{-25}	1,38 . 10^{-6}	2,64 . 10^{-2}	4,89 . 10^{-17}	8,79 . 10^{-11}	6,28 . 10^{-26}
NWR	RC	-9,69 . 10^{3}	-1,00 . 10^{-1}	1,52 . 10^{-2}	5,67 . 10^{3}	-7,59	3,00 . 10^{-1}
	P	1,21 . 10^{-14}	1,46 . 10^{-5}	7,02 . 10^{-1}	1,31 . 10^{-6}	5,93 . 10^{-2}	2,81 . 10^{-14}
PR	RC	-5,07 . 10^{3}	4,19 . 10^{-2}	3,62 . 10^{-2}	1,09 . 10^{3}	-1,01 . 10^{1}	4,03 . 10^{-1}
	P	1,64 . 10^{-1}	5,27 . 10^{-1}	7,27 . 10^{-1}	6,57 . 10^{-1}	3,57 . 10^{-1}	1,43 . 10^{-7}
SPR	RC	-7,25 . 10^{3}	-6,13 . 10^{-2}	5,48 . 10^{-2}	1,04 . 10^{4}	-9,17	1,65 . 10^{-1}
	P	5,02 . 10^{-13}	2,74 . 10^{-5}	2,17 . 10^{-1}	4,91 . 10^{-27}	6,62 . 10^{-2}	1,93 . 10^{-11}
SR	RC	-1,54 . 10^{3}	-1,68 . 10^{-2}	-2,28 . 10^{-1}	-1,39 . 10^{3}	-1,77 . 10^{1}	7,19 . 10^{-1}
	P	1,00 . 10^{-1}	7,08 . 10^{-1}	2,13 . 10^{-1}	9,77 . 10^{-2}	7,01 . 10^{-3}	3,31 . 10^{-13}
UMR	RC	-7,22 . 10^{3}	1,1 . 10^{-2}	1,36 . 10^{-1}	1,10 . 10^{4}	-3,59 . 10^{1}	6,05 . 10^{-3}
	P	2,16 . 10^{-28}	8,78 . 10^{-6}	5,65 . 10^{-2}	4,45 . 10^{-59}	4,45 . 10^{-11}	8,98 . 10^{-1}

Source: own elaboration by the authors.

The verification stage of the analysis also covers the overall significance of the constructed regression models through the F test. All the regression models fulfill this elementary statistical requirement with their p-values much lower than a statistical significance threshold of 5 %. All the created models are below a 0.01-per-cent threshold which is the lowest one applied usually.

The verification stage is further phase comprises the Durbin–Watson statistic and the Breusch–Pagan test. No regression model, except the Eastern Mountain Region regression model, is affected by heteroscedasticity as all the p-values are higher than a five-percent level of statistical significance. Moreover, many regression models are without a presence of serial correlation. The Durbin–Watson statistic confirms this. Nevertheless, the Eastern Mountain Region regression model, the Great Lakes Region regression model, and the Upper Midwest Region regression model do not fulfil this requirement as their p-value is lower than a five-percent level of statistical significance. The Mountain Region regression model also only slightly crawls a statistical significance threshold. It looks like only this regression model possesses some issues in this field.

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Table 2. The Regression Regional Models Testing

Region	R^2	Adjusted R^2	F test	
			test statistic value	p-value
DR	$4.64 . 10^{-1}$	$4.56 . 10^{-1}$	$8.70 . 10^{1}$	$1.88 . 10^{-78}$
EMR	$2.05 . 10^{-1}$	$1.98 . 10^{-1}$	$4.82 . 10^{1}$	$8.87 . 10^{-53}$
GLR	$4.44 . 10^{-1}$	$4.39 . 10^{-1}$	$1.18 . 10^{2}$	$2.91 . 10^{-109}$
HR	$5.10 . 10^{-1}$	$5.05 . 10^{-1}$	$1.38 . 10^{2}$	$8.40 . 10^{-120}$
MR	$1.10 . 10^{-1}$	$9.63 . 10^{-2}$	$1.18 . 10^{1}$	$1.57 . 10^{-12}$
NER	$1.65 . 10^{-1}$	$1.55 . 10^{-1}$	$2.28 . 10^{1}$	$1.38 . 10^{-24}$
NPR	$2.96 . 10^{-1}$	$2.89 . 10^{-1}$	$6.97 . 10^{1}$	$1.65 . 10^{-72}$
NWR	$4.32 . 10^{-1}$	$4.17 . 10^{-1}$	$4.22 . 10^{1}$	$3.90 . 10^{-38}$
PR	$3.31 . 10^{-1}$	$3.13 . 10^{-1}$	$2.69 . 10^{1}$	$5.32 . 10^{-26}$
SPR	$1.94 . 10^{-1}$	$1.88 . 10^{-1}$	$4.39 . 10^{1}$	$3.34 . 10^{-48}$
SR	$8.65 . 10^{-2}$	$7.65 . 10^{-2}$	$1.30 . 10^{1}$	$4.02 . 10^{-14}$
UMR	$5.01 . 10^{-1}$	$4.96 . 10^{-1}$	$1.55 . 10^{2}$	$3.14 . 10^{-136}$

Source: own elaboration by the authors.

Age is the only explanatory variable that behaves negatively in all the investigated regions. The older the operator, the lower the income. It is very strange from an aspect of the wage evaluation in the industrial sectors and the entire business. On the other hand, the only positively influencing variable is the partnership for the whole scrutinised area. The farming period possesses the only negative case in the Southern Region. Otherwise, it positively influences the explained variable in all the remaining regions. A fascinating fact is that the farm area can also have a negative impact. This occurred in the Northeastern Region, the Northern Plains Region, and the Southern Region.

The highest negative impact of the age indicator is seen in the Northwest Region, peaking at a level of -9685.68. Oppositely, the lowest decline is reached at a level of -1536.9 in the Southern Region. Family involvement possesses the strongest power, with a multiplication of $8.0117 . 10^{-2}$ in the Great Lakes Region and the lowest influence at a level of $-6.1282 . 10^{-2}$ is seen in the Southern Plains Region. Only the three regions are influenced in a positive way by family involvement – besides the mentioned one, it is a triplet of the Heartland Region, the Pacific Region, and the Upper Midwest Region. There are three regions – the Northeastern Region, the Northern Plains Region, and the Southern Region – that behave strangely because the explained indicator is diminished through an increase in the farm area. It is absolutely unexpected outcome. Although all the remaining regions keep positive values. A value of $-2.2797 . 10^{-1}$ for the Southern Region is the lowest one. Conversely, the income in the Delta Region is multiplied by $2.4324 . 10^{-1}$ through its one-unit increment. The farming period as the explanatory variable behaves statistically significant for each region except for the Pacific Region. Its regression coefficients reach around several thousand. In the case of the Southern Region, each year of farming period length cuts income by 1.388.7 USD. The highest gain is reached in the Upper Midwest Region at a level of 11.028.59 USD, followed by the Upper Midwest Region at a level of 10.394.96 USD. The female operators indicator behaves considerably uniformly because only the income indicator of the sole region lies in a positive sphere. The income in the Delta Region is multiplied by 3.3250. On the other side, the absolutely extremely highest decline of income is demonstrated at a level of -7.38263 in the Southern Plains Region, which is more than ten times higher than the second one. The partnership indicator shows the strongest impact at a level of 1.1066 in the Eastern Mountain Region and the lowest influence with a value of $6.0531 . 10^{-3}$ in the Upper Midwest Region.

Secondly, the interregional observation is scrutinised for a mutual view of regional relations. Surprisingly, there are many occasions where a mutual ratio of the regression coefficients of the same indicator for the two particular regions is more than two times higher or lower, meaning the influence of the same regression coefficient is many times stronger or weaker regarding the income as the desired explained indicator. There are the 233 occurrences

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of such a situation. If a threshold is set to a value of 3, there are 165 such occurrences; hence, the numbers are being lowered till zero. The whole successions are visible in the following table with the thresholds set to the values 2, 3, 5, 10, 20, 50, and 100.

Table 3. Number of regression coefficients higher than a threshold

Indicator	Multiplication threshold							
	2	3	4	5	10	20	50	100
A	30	13	7	1	0	0	0	0
FI	32	23	17	11	2	0	0	0
FA	50	44	38	33	20	13	6	1
FP	38	21	16	8	1	0	0	0
FO	43	36	28	22	5	2	0	0
P	40	28	24	22	19	15	9	4

Source: own elaboration by the authors.

By and large, the contents of the previous table point out to the considerable heterogeneity of the explored data set. Therefore, further analytical steps are needed to investigate the data set's mutual relations. At least 30 occurrences for all the explored indicators are assigned with a multiplication factor higher than 2. This value is already relatively high to realise that each increment of the particular explored indicator influences more than a two times higher increase of the explained variable. The highest multiplication is seen at a level of 182.81 for the partnership from the Upper Midwest Region to the Eastern Mountain Region, meaning that a one-unit increment of this explanatory variable causes a 182.81-times higher increment of the income in the Eastern Mountain Region than in the Upper Midwest Region. The other three occurrences of such high multiplication are visible for the same indicator but for the Northeastern Region, the Southern Region, and the Delta Region in a descending way. Apparently, all these high values are caused by the very low regression coefficient in the Upper Midwest Region regression model. The remaining incidence happens for the farm area, whose a one-acre increment influences the income multiple times in the Great Lakes Region than in the Heartland Region.

6. Discussion

Men are more likely to be the primary landowners. Regarding participation in the decision-making process about income from agricultural activities, the gender gap is similar between primary and non-primary landowners (Yokying & Lambrecht, 2020). The gender dimension demonstrates that the female population is at the lower management levels, even though among the regular operators, the given explanatory variable is statistically significant in most of the regression models. The participation of women in agricultural activities is not very high also due to the cultural norms as in the Warri South local government area of the Delta State in the Federal Republic of Nigeria and thus, gender inequality in agricultural activity has a significant impact on the entire production process (Asamu et al., 2020). The study of the farmers' technical efficiency in the Federal Democratic Republic of Nepal shows that the specific region where the farm operates affects the improvement of performance and obtaining higher income from agricultural activities (Khanal et al., 2018). The regional aspect is a point that should be investigated further, too. Nevertheless, the relationship between productivity and the factors that influence it differs based on the economic structures of the individual European regions (Bianchi et al., 2021; Bilan et al. 2017). On the other hand, the quality factors demonstrate a significant entity in the production evaluation process (Belas et al., 2019; Stefko et al. 2017).

Though, the representation of young women in agriculture is still increasing. The analysis of the labour status of young female farmers confirms that on the farms that are led by young women, there is a higher probability of adopting various measures as climatic or environmental points to improve the state of agriculture of the different types of farms – whether family or nonfamily (Unay-Gailhard & Bojnec, 2021). Only the three regions show statistically insignificant dimensions expressing family involvement, and only the two ones for the partnership variable. Altogether, this is a point about to dispute further. The family farms in the Swiss Confederation represent a challenge to gender equality. However, the organisation of the family farms provides opportunities to maintain this aspect. The study traces inequalities on the family farms that are related to status on the farm rather than gender identity. Based on the outcomes of the study, family farms are considered to be those where gender equality can be achieved (Contzen & Forney, 2016).

The farms with more than 72 hectares of maintained land are likelier to have a family successor (Arend-Kuenning et al., 221). It is very difficult to confirm such a fact because the family involvement and the farming area are statistically significant only in the two regions – the Eastern Mountain Region and the Great Lakes Region – at the same time. There are also other attributes related to the farming area, such as the expenditures into the several areas of farming life; for instance, the analysis shows that farmers who manage larger farms are more willing to introduce new technologies into agricultural production and, thus, to invest more financial resources in education (Hu et al., 2022). Another aspect is pollution that can negatively affect the harvest, which can be considered a significant aspect (Simionescu et al., 2022).

7. Conclusions

Farming belongs to one of the most unequal professions in the United States today. Even though the number of women as principal operators is increasing, gender inequality in agriculture persists. Women tend to operate smaller farms, which concerns the farming area and the income from agricultural activities. The United States agriculture includes farms of various sizes and types. Most farms in the United States are small and makeup almost half of the farmland. Also, different types of farms produce specific commodities. Agriculture in the United States is represented by mainly family businesses.

The regression analysis is selected to examine the regional approach, which is considered to be important for two reasons. The first one reveals suitability for obtaining information on a potential territory, where the explored indicators representing the explanatory variables play a key role. Secondly, this approach discloses possible relations among the analysed regions. Applying the coefficient of determination, the five regions are found whose regression models with their estimated coefficients are considered statistically significant. Therefore, the regression models assigned to the Heartland Region, Upper Midwest Region, Delta Region, Great Lake Region, and Northwest Region are appropriate and highly explanatory. Thus, they demonstrate their interpretative power confirmed by the adjusted version of the coefficient of determination. The verification phase of the analysis consists of the overall significance of the constructed regression models through the F test. Interregional observation is also focused on getting a mutual view of regional relations. Surprisingly, many cases are found where a mutual ratio of the regression coefficients of the same indicator for the two specific regions is twice as high or lower. It reveals there are deliberate regional disparities. Moreover, a presence of considerable homogeneity in the explored data set can be mentioned. Therefore, further research is about to investigate the mutual relations inside the data set.

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