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ORIGINAL SCIENTIFIC PAPER

Determinants of the Establishment of Women-Owned Agricultural Entities: Evidence from Municipal Panel Data in the Republic of Srpska



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A B S T R A C T

This paper examines the determinants of the establishment of women-owned agricultural entities in the Republic of Srpska. The analysis uses municipal-level panel data for 2015-2024 and employs conditional fixed-effects Poisson panel specifications with municipality-clustered robust standard errors and estimated female population as an exposure term. The broader dataset covers 63 municipalities, while the preferred specification is estimated on 434 municipality-year observations from 47 municipalities. The results indicate that the effect of grants allocated to women through the agricultural payment agency on the rate of newly registered women-owned agricultural holdings depends on the municipality's level of development. Grants have a significantly stronger positive effect in highly underdeveloped and underdeveloped municipalities than in developed municipalities, but no significant effect in medium-developed municipalities. Female unemployment is negative and statistically significant in the preferred Poisson specifications, suggesting that weaker local labor market

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conditions are associated with lower rates of newly registered women-owned agricultural holdings. Descriptive evidence also shows that the share of support allocated to women in total agricultural payment agency support increased from 5.45% in 2014 to 7.50% in 2024, although it remains relatively modest. The findings suggest that public support matters, but that its effectiveness depends on local development conditions.

KEYWORDS: *women's entrepreneurship, agricultural entrepreneurship, women-owned agricultural entities, public support, municipal development, rural development, Poisson panel-data model, Republic of Srpska*

Introduction

Agriculture remains central to economic development because it supports food security, income generation, and rural livelihoods, while women make substantial contributions to agrifood systems and agricultural labor worldwide (FAO, 2002; Doss, 2011; FAO, 2023). At the same time, the growing importance of gender in economics has expanded scholarly attention from labor market participation to women's entrepreneurship and development more broadly (Olivetti et al., 2024; Goldin, 2014). In rural areas, women's entrepreneurship is increasingly recognized as important for local economic vitality, household income, innovation, and sustainability, despite persistent structural barriers and unequal access to resources (Anthopoulou, 2010; Li et al., 2026; Ge et al., 2022; Vuciterna et al., 2024). Women's entrepreneurial activity in agriculture is strongly shaped by local context. Poor infrastructure, distance, and limited accessibility can constrain access to essential agricultural services, while broader institutional barriers, weak access to finance, technology, advisory support, and social resources continue to limit women's participation in agrifood systems (Anang & Asante, 2020; Muhammad & Ximei, 2022; Hidrobo et al., 2024). This means that the establishment of agricultural entities depends not only on individual motivation and capabilities but also on local development conditions, service availability, and institutional support (Turlakova, 2023; Petrović, 2024). Rural development policy reflects this logic, as less developed and naturally constrained areas often receive more favorable treatment through higher aid intensity and compensatory support, including within the EU framework (Regulation (EU) No 1305/2013, 2013; Regulation (EU) 2021/2115, 2021; European Commission, 2023). Recent evidence likewise underlines the importance of institutional support,

finance, education, training, and targeted programs for women's economic empowerment and entrepreneurial participation in rural settings (Kademani et al., 2024; Allahmoradi et al., 2024; Vujadinović & Marjanović, 2025; Radović-Marković & Achakpa, 2018). Related evidence from the Western Balkans also highlights women's financial inclusion as an important factor for the advancement of women's entrepreneurship, with education, employment status, and income identified as significant positive determinants of financial inclusion (Antonijević et al., 2024). Previous studies have examined women's entrepreneurship mainly through national, regional, and sectoral indicators, while municipal-level formal agricultural entry by women remains insufficiently explored. Moreover, public support is usually treated as having an average effect, with limited evidence on whether grant effectiveness differs across local development contexts. This study addresses these gaps by examining newly registered women-owned agricultural holdings and testing whether grant effects vary across municipal development categories.

In the Republic of Srpska, the Agency for Agrarian Payments is a central institution supporting agriculture. Before 2019, support for women existed through rural development measures. A clear policy shift occurred in 2019: women-owned agricultural entities received additional points in evaluations and rankings. This step strengthened their position in the support system (Rulebook on the conditions and manner of obtaining financial incentives for the development of agriculture and rural areas in 2018; Rulebook on the conditions and manner of obtaining financial incentives for capital investments in agricultural production in 2019, 2019). This issue is also strategically relevant because the Strategy for the Development of Agriculture and Rural Areas of the Republic of Srpska 2021–2027 identifies gender equality and the improvement of women's position in rural areas as cross-cutting priorities, while rural-development measures are expected to support rural revitalization, employment opportunities, and stronger local development (Ministry of Agriculture, Forestry and Water Management of the Republic of Srpska, 2021). The importance of the topic is further supported by the Strategy for the Development of Women's Entrepreneurship of the Republic of Srpska 2025–2031, which shows that women-owned or co-owned business entities accounted for 27.95% of all business entities in 2023, while barriers to women owners and managers still remain (Government of the Republic of Srpska, 2025). This paper examines whether the creation of women-owned agricultural entities in the Republic of Srpska is influenced not only by

institutional support but also by local development differences across municipalities. This question is particularly relevant in the Republic of Srpska because agricultural support is implemented through a common institutional framework, while municipalities differ markedly in official development status, fiscal capacity, unemployment, demographic conditions, business activity, and infrastructure constraints (Decision on Criteria for Evaluating the Development Level of Local Self-Government Units in the Republic of Srpska, 2023; Ministry of Administration and Local Self-Government of the Republic of Srpska, 2023). This setting therefore allows the study to examine whether the same policy instrument produces different effects across local development contexts and whether public funds can be more effectively targeted toward municipalities where support is more likely to stimulate women's formal entry into agriculture. The paper contributes to the literature by using municipal-level administrative data on newly registered women-owned agricultural holdings and grants allocated to women, and by explicitly testing whether grant effects vary across municipal development categories. In doing so, it links women's agricultural entrepreneurship with place-sensitive rural development policy. Although the analysis is based on one institutional setting, the findings may be informative for similar rural and post-transition contexts where centrally designed agricultural support operates across territorially uneven local economies.

Literature Review

A considerable body of recent literature uses panel-data approaches to examine factors shaping women's entrepreneurship (Mirza, 2024; Hechavarría & Ingram, 2019; Mroczek-Dąbrowska & Gaweł, 2020; Kraska & Kot, 2021; Martínez-Rodríguez et al., 2022; Alam et al., 2024; Gaies et al., 2023; Williams, 2012; Bjuggren & Henrekson, 2022; Semykina, 2018; Georgellis & Wall, 2005). This approach is also widely used in studies of individual national settings. Analyses have been conducted at the country, municipal, and regional levels (Lo et al., 2020; Falavigna et al., 2024; Daymard, 2015; Ghani et al., 2014; Noguera et al., 2015; Li et al., 2026; Conroy & Rupasingha, 2025; Ghani et al., 2013). Within this literature, women's entrepreneurship is measured through related but distinct indicators. These include women's shares in self-employment and among employers (Mirza, 2024), GEM-based gender-specific entrepreneurship

rates (Hechavarría & Ingram, 2019), industry-level measures of female entrepreneurship (Mroczek-Dąbrowska & Gaweł, 2020; Gaweł & Mroczek-Dąbrowska, 2022), and female self-employment rates (Kraska & Kot, 2021). These differences reflect both data availability and the analytical level of each study. They are important because broad indicators capture general entrepreneurial participation, whereas registered agricultural holdings capture a more specific and policy-relevant form of formal entrepreneurial entry in rural areas.

Panel-data studies also identify several groups of determinants. Public policy, government support, and access to finance are used to capture whether targeted instruments reduce barriers to entry. This includes institutional and policy conditions (Hechavarría & Ingram, 2019), public grants for women entrepreneurs (Srhoj et al., 2022), public policy and support programs (Alam et al., 2024; Martínez-Rodríguez et al., 2022; Daymard, 2015; Kaya, 2018), and start-up subsidies for unemployed women (Caliendo & Künn, 2015). Evidence from Serbia similarly shows the relevance of institutionally sponsored entrepreneurship programs: women accounted for almost half of entrepreneurship-training participants and, in 2021 and 2022, received more than half of all subsidies for entrepreneurs (Ognjenović, 2023). Another group of studies uses indicators of economic development and income conditions, including GDP, GDP per capita, and regional income levels (Kraska & Kot, 2021; Martínez-Rodríguez et al., 2022; Gaweł & Głodowska, 2021; Gaies et al., 2023; Lo et al., 2020; Noguera et al., 2015; Li et al., 2026), wage and earnings-related measures (Kraska & Kot, 2021; Georgellis & Wall, 2005; Williams, 2012; Bjuggren & Henrekson, 2022), and income differences or income security within the household (Noguera et al., 2015; Bjuggren & Henrekson, 2022). These variables are used to capture market opportunities, expected returns from self-employment, and the attractiveness of entrepreneurship relative to paid employment. Labor-market conditions, particularly unemployment, are also widely used, but their expected effect is theoretically ambiguous. Unemployment may push women into self-employment when wage jobs are limited (Kraska & Kot, 2021; Martínez-Rodríguez et al., 2022), but it may also reduce women's entrepreneurial entry by signaling weaker business opportunities, lower household resources, and poorer local demand conditions (Mirza, 2024; Gaweł & Głodowska, 2021; Gaies et al., 2023). Previous studies also include childcare availability (Conroy & Rupasingha, 2025; Li et al., 2026; Semykina, 2018), household characteristics, family structure, and life-course factors (Romeu Gordo et al., 2022; Sałach-Dróżdż

& Goraus-Tańska, 2025; Semykina, 2018), infrastructure and access to services (Daymard, 2015; Ghani et al., 2013; Li et al., 2026), education and human capital (Daymard, 2015; Li et al., 2026), and demographic controls such as population density, age structure, fertility, and sex ratio (Daymard, 2015; Ghani et al., 2013), all of which are especially relevant in rural areas where distance, care responsibilities, infrastructure, and service availability shape women's ability to formalize or expand entrepreneurial activity.

Overall, the reviewed literature shows that women's entrepreneurship is shaped by public support, local economic conditions, labor-market constraints, human capital, infrastructure, and demographic factors. However, several important gaps remain insufficiently investigated and provide the foundation for the present study. First, municipal-level formal agricultural entry is less examined than broader national, regional, or sectoral indicators. Second, public support is often treated as an average effect, although its effectiveness may differ across local development contexts. Third, the effect of unemployment remains mixed, especially in rural and agricultural settings. This study addresses these gaps by examining whether grants allocated to women affect the rate of newly registered women-owned agricultural holdings and whether this effect differs across municipal development categories. Based on the above considerations, the following hypotheses are formulated:

H1: The effect of agricultural payment agency grants for women depends on the municipality's level of development.

H2: Agricultural payment agency grants for women have stronger positive effects in highly underdeveloped municipalities.

H3: Higher female unemployment negatively affects the rate of newly registered women-owned agricultural holdings.

Methodology

This study uses panel data for municipalities in the Republic of Srpska. Although data were initially collected for 2012–2024, the estimation period was restricted to 2015–2024 due to missing observations for several variables in earlier years. The broader dataset covers 63 municipalities. After applying the estimation-period restriction, constructing the lagged support variable, and excluding observations with missing values in the variables used in the model, the final estimation sample consists of 434

municipality-year observations. The preferred conditional fixed-effects Poisson specification is estimated on 47 municipalities. This reduction reflects the combined effect of lag construction, missing-value exclusions, and the requirements of the conditional fixed-effects Poisson estimator. The list of municipalities covered by the broader dataset and those included in the final estimation sample is reported in Appendix Table A1.

Given that the dependent variable measures the number of newly registered women-owned agricultural holdings, this study applies a conditional fixed-effects Poisson panel model. This specification is appropriate because the dependent variable is a non-negative count variable. At the same time, the fixed-effects structure allows the model to control for unobserved time-invariant municipal characteristics. These characteristics may include persistent geographic, institutional, demographic, cultural, and structural differences across municipalities. Controlling for them is important because they may influence both the establishment of women-owned agricultural holdings and the allocation or effectiveness of public support. A pooled Poisson model without municipality effects would not account for these time-invariant municipal differences. A random-effects Poisson model, on the other hand, would require the stronger assumption that unobserved municipal effects are uncorrelated with the explanatory variables. A population-averaged Poisson specification was not used as the main model because the objective is to control for municipality-specific unobserved heterogeneity through a conditional fixed-effects framework, rather than to estimate marginal average associations across municipalities. For this reason, the conditional fixed-effects Poisson model is used as the preferred specification. Year fixed effects are included to control for common shocks affecting all municipalities in a given year. Robust standard errors clustered at the municipality level are used to account for heteroskedasticity and within-municipality dependence. Accordingly, the empirical specification is defined as follows:

$$y_{it} \mid \alpha_i \sim Poisson\,(\mu_{it})$$

$$ln(\mu_{it}) = \alpha_i + \lambda_t + \ln(FemalePop_{it}) + \beta_1 Grants^{c}_{i,t-1} + \sum_{k=1}^{3}\delta_k D_{kit} + \sum_{k=1}^{3}\gamma_k\left(Grants^{c}_{i,t-1}\, x\, D_{kit}\right) + \theta' X_{it} \qquad (1)$$

where y_{it} denotes the number of newly registered women-owned agricultural holdings in municipality i and year t, and μ_{it} denotes the

expected number of registrations. α_i represents municipality fixed effects, while λ_t denotes year fixed effects, with 2015 used as the omitted reference year. $Grants^{c}_{i,t-1}$ denotes centered lagged grants allocated to women through the agricultural payment agency, expressed in units of 100,000 BAM. D_{kit} represents dummy variables for municipal development categories $k = 1,2,3$, with Category IV, developed municipalities, used as the reference category. The interaction term $Grants_{i,t-1}\, x\, D_{kit}$ allows the grant effect to differ across development categories. X_{it} is a vector of control variables, including female unemployment, average wage, kindergarten attendance rate, road length, and the combined education cycle variable. The estimated female population is included as an exposure term. In the Poisson model, this means that $\ln(FemalePop_{it})$ enters the specification as an offset with its coefficient constrained to one. This adjustment accounts for differences in the size of the population at risk across municipalities. Consequently, the model estimates the rate of newly registered women-owned agricultural holdings relative to the estimated female population, rather than only the absolute number of registrations. The coefficients should therefore be interpreted as effects on the expected registration rate, holding the population exposure constant.

Potential overdispersion and excess zeros were assessed as part of the count-data model selection. The descriptive statistics reported in Table 1 indicate that, in the broader available sample, the standard deviation of the dependent variable exceeds its mean, suggesting possible overdispersion under the strict Poisson variance assumption. Therefore, the share of zero outcomes was calculated in the final estimation sample, and overdispersion was evaluated using a Pearson goodness-of-fit diagnostic from an auxiliary Poisson model with municipality and year indicators. Alternative count-data specifications were also considered. Since zero outcomes were rare, a zero-inflated specification was not retained as the main alternative model. Given the possibility of overdispersion, the preferred conditional fixed-effects Poisson model is estimated with municipality-clustered robust standard errors, and a negative binomial model is estimated as an additional robustness check. To make this robustness check comparable to the preferred model, the negative binomial specification is estimated on the same estimation sample and includes municipality and year indicator variables, with the estimated female population included as an exposure term.

Data were compiled from several official sources. Information on women-owned agricultural holdings and grants allocated to women was obtained directly, upon request, from the Agency for Agrarian Payments of the Republic of Srpska. The remaining variables were collected from official municipal statistical bulletins and related publications. The municipal development category was based on annual decisions on the level of development of local self-government units in the Republic of Srpska. These were published in the Official Gazette of the Republic of Srpska for 2015-2024 (see References for the full list of decisions). For each estimation year, the official development classification referring to that year was used. These decisions are typically published in the Official Gazette in the preceding calendar year.

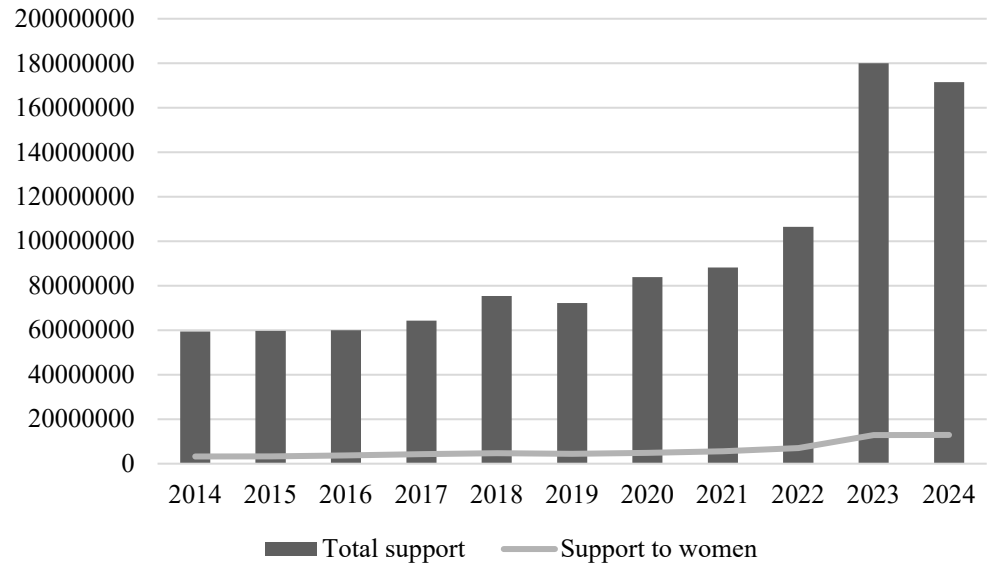
The dependent variable is the number of newly registered women-owned agricultural holdings. The main explanatory variable is centered lagged grants allocated to women through the agricultural payment agency, expressed in units of 100,000 BAM. The lagged specification is used because support approved or allocated in one year is expected to influence registration and investment decisions in the following year. The grant variable is interacted with the municipality development category, coded as 1 = highly underdeveloped, 2 = underdeveloped, 3 = medium-developed, and 4 = developed municipalities, with developed municipalities used as the reference category. Female unemployment and average net wage are included in logarithmic form. A robustness specification replaces average net wage with average gross wage, also in logarithmic form. The model also controls for the lagged kindergarten attendance rate, measured as the share of children enrolled in kindergartens in the total municipal population, road length, and the education variable, defined as the sum of first-, second-, and third-cycle female students per 1,000 estimated female population. In an additional robustness specification, the aggregate support variable is replaced with lagged support to current production for women, expressed in units of 100,000 BAM. As explained above, the estimated female population is included as an exposure term, so the estimated coefficients refer to registration rates relative to the female population rather than to absolute counts only. A negative binomial specification is also estimated as an additional robustness check for overdispersion and is reported in Appendix Table A2.

Results and Discussion

This section presents the study's main empirical results. First, it reports descriptive statistics, preliminary count-data diagnostics, and correlation coefficients for the main variables. Next, it discusses conditional fixed-effects Poisson estimates and the negative binomial robustness check. Because the model includes interaction terms, category-specific effects are reported to illustrate how grant impacts differ across municipal development categories.

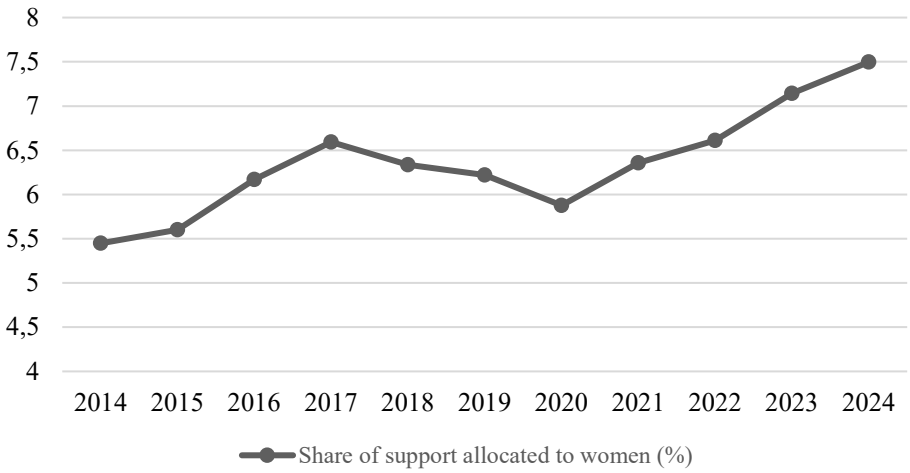
Before discussing municipality-level statistics and econometric results, it is useful to briefly present broader trends in the support allocated by agricultural payment agencies to women. Figures 1 and 2 show the evolution of both the absolute support received by women and their share of total agency support over the observed period.

Figure 1: Total agricultural payment agency support and support allocated to women, 2014-2024



Note: Monetary values are expressed in BAM.
Source: Author's calculation

Figure 2: Women's share in total agricultural payment agency support, 2014-2024



Source: Author's calculation

Overall, the figures suggest that both the absolute amount of support allocated to women and their share in total agricultural payment agency support increased over time, despite some fluctuations across years. These aggregate trends provide useful descriptive background for the analysis, but they do not reveal how support is related to the number of women-owned agricultural entities across municipalities. To address this gap, Table 1 presents descriptive statistics for the variables used in the subsequent empirical analysis, including the number of women-owned entities.

Table 1: Descriptive statistics

Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Women-owned agricultural entities	945	8.044	17.972	0	394
Grants allocated to women through the agricultural payment agency	658	-.095	1.787	-1.113	18.737
Municipal development category	939	2.444	1.182	1	4
Female unemployment	733	6.286	1.013	3.610	9.123

Variable	Obs	Mean	Std. Dev.	Min	Max
Average net wage	879	6.798	.259	6.001	7.559
Average gross wage	876	7.250	.247	6.467	8.007
Kindergarten attendance rate	614	.924	.504	.135	2.959
Road length	816	158.840	90.267	5	376
Combined education cycle	629	27.287	32.625	0	480
Estimated female population	880	9303.723	14546.03	19	96925
Support to current production for women	652	.805	1.310	.0004	13.578

Notes: Monetary support variables used in the regression are expressed in units of 100,000 BAM. The main grant variable is centered before estimation.

Source: Author's calculation

The dependent variable has a standard deviation substantially above its mean, suggesting that overdispersion may be present. This issue was therefore examined more formally in the final estimation sample. Only 10 out of 434 observations have a zero value for the dependent variable, corresponding to 2.30% of the sample. Thus, excess zeros do not dominate the data. The Pearson goodness-of-fit diagnostic from an auxiliary Poisson model with municipality and year indicators produced a Pearson chi-square statistic of 745.95 with 366 degrees of freedom, corresponding to a dispersion ratio of approximately 2.04. This indicates overdispersion relative to the strict Poisson variance assumption and motivates the use of municipality-clustered robust standard errors and a negative binomial robustness check.

Table 2 reports the pairwise correlation matrix, which offers a preliminary indication of the direction and strength of associations among the variables included in the analysis before turning to the multivariate panel estimates.

Table 2: Correlation matrix of the main variables used in the analysis

Variables	1	2	3	4	5	6	7	8
1. Women-owned agricultural holdings	1.000							
2. Grants allocated to women through the agricultural payment agency	0.568*	1.000						
3. Municipal development category	0.319*	0.335*	1.000					
4. Female unemployment	0.552*	0.318*	0.481*	1.000				
5. Average net wage	0.023	0.253*	0.131*	-0.131*	1.000			
6. Kindergarten attendance rate	0.130*	0.237*	0.297*	-0.055	0.481*	1.000		
7. Road length	0.267*	0.243*	0.096*	0.258*	0.056	0.017	1.000	
8. Combined education cycle rate	0.137*	-0.059	0.280*	0.270*	-0.109*	0.386*	0.082	1.000

Source: Author's calculation

The pairwise correlation matrix does not indicate serious multicollinearity, as the correlations among the explanatory variables are generally low to moderate and remain well below commonly used critical thresholds. This is further supported by the reported VIF values.

Table 3: Poisson panel estimates of women-owned agricultural holdings

Variables	Model 1: Main specification	Model 2: Robustness check	Model 3: Robustness check
Grants allocated to women through the agricultural payment agency	**-.046 *** **	**-.046*** **	
	(.013)	**(.013)**	
Support to current production for women			**-.054*** **
			(.015)
Municipal development category			
I	**-.524****	**-.526****	**-1.446*** **
	(.264)	**(.264)**	**(.303)**
II	**-.620 *** **	**-.625*** **	**-.969*** **
	(.226)	**(.224)**	**(.275)**
III	-.212	-.217	-.353
	(.218)	(.216)	(.290)
Interaction between municipal development category and the respective support measure			
I	**.679*** **	**.679*** **	**1.242*** **
	(.124)	**(.121)**	**(.214)**
II	**.353*** **	**.353*** **	**.499*** **

Variables	Model 1: Main specification	Model 2: Robustness check	Model 3: Robustness check
	(.103)	**(.103)**	**(.120)**
III	.038	.037	.108
	(.040)	(.040)	(.072)
Female unemployment	**-.330***	**-.329***	**-.301***
	(.183)	**(.180)**	**(.175)**
Average net wage	-.603		-.247
	(.982)		(.932)
Average gross wage		-.656	
		(.964)	
Kindergarten attendance rate	.131	.131	.085
	(.168)	(.169)	(.174)
Road length	-.0005	-.0005	-.0003
	(.001)	(.001)	(.001)
Combined education cycle	.002	.002	.001
	(.013)	(.013)	(.013)
Exposure	Estimated female population	Estimated female population	Estimated female population
2016	-.120	-.122	-.122
	(.085)	(.086)	(.085)
2017	**-.290****	**-.294****	**-.283****
	(.121)	**(.120)**	**(.123)**
2018	**-.245***	**-.256***	**-.245***
	(.143)	**(.143)**	**(.147)**
2019	**-.693*****	**-.714*****	**-.718*****
	(.183)	**(.178)**	**(.184)**
2020	**-.569*****	**-.587*****	**-.607****
	(.188)	**(.171)**	**(.186)**
2021	**-.430****	**-.451****	**-.498****
	(.203)	**(.181)**	**(.199)**
2022	-.219	-.246	-.346
	(.319)	(.271)	(.305)
2023	-.153	-.171	-.292
	(.412)	(.361)	(.391)
2024	-.143	-.150	-.360
	(.527)	(.477)	(.489)
Number of observations:	434	434	431
Model significance:			
.	Wald $\chi^2(21)$ = 6524.90 Prob >χ^2 = 0.000	Wald $\chi^2(21)$ = 4933.91 Prob >χ^2 = 0.000	Wald $\chi^2(21)$ = 37257.39 Prob >χ^2 = 0.000
VIF:	2.87	2.70	2.60
Joint significance of time effects:			
	Wald $\chi^2(9)$ = 42.88, p < 0.001	Wald $\chi^2(9)$ = 42.20, p < 0.001	Wald $\chi^2(9)$ = 41.72, p < 0.001

*Notes: Robust standard errors are reported in parentheses. Category IV (developed municipalities) is the reference category. Year fixed effects are included in all specifications, with 2015 as the omitted reference year. The joint significance of year effects is tested using the Wald chi-square test. * p < 0.10, ** p < 0.05, *** p < 0.01.*
Source: Author's calculation

Table 3 reports the results of the conditional fixed-effects Poisson models for newly registered women-owned agricultural holdings. Most notably, the effect of grants allocated to women through the agricultural payment agency varies substantially across municipal development categories. This supports H1, indicating that the municipality's level of development shapes the effect of grants to women. Furthermore, the interaction terms in Models 1 and 2 indicate that the impact of lagged grants is significantly stronger in highly underdeveloped and underdeveloped municipalities than in developed municipalities. No significant difference emerges for medium-developed municipalities. Importantly, Model 3 reinforces these results: even when the aggregate support measure is replaced by lagged support to current production for women, the baseline negative effect in developed municipalities and the statistically significant positive interaction effects in highly underdeveloped and underdeveloped municipalities persist. The same grant-related pattern is also supported by the negative binomial robustness check reported in Appendix Table A2. The negative baseline coefficient in developed municipalities deserves particular attention because it refers to the reference category in the interaction framework. It should not be read as evidence that grants are generally harmful. Rather, it suggests that, in more developed local contexts, additional support may not translate into higher registration rates, possibly because a larger share of potential beneficiaries is already formally registered or able to register without additional support. This robustness to an alternative support measure and to an alternative count-data specification underlines the reliability of the main results.

The findings are consistent with Hechavarría and Ingram (2019), who show that women's entrepreneurship is shaped by entrepreneurial ecosystem conditions, including supportive government policy and barriers to entry. However, this study shifts the analysis to the municipal level and shows that the effectiveness of public support depends on local development conditions. The results also extend Srhoj et al. (2022), who find that grants targeted to women entrepreneurs improve several business outcomes, by showing that grant effects are not uniform across local contexts. Similarly, Martínez-Rodríguez et al. (2022) emphasize policy measures related to training and mentoring, access to finance, networks, entrepreneurship education, and reconciliation between business and family life, while the present study shows that such support may be most effective where local constraints are more binding. This interpretation is also consistent with Li et al. (2026), who show that rural entrepreneurial ecosystems are

heterogeneous and that financial services, infrastructure quality, childcare availability, and social capital may matter differently across rural places.

Across all three preferred specifications, female unemployment shows a negative and statistically significant effect, indicating that less favorable local labor-market conditions are associated with lower rates of newly registered women-owned agricultural holdings. This result supports H3 in the main Poisson specifications. However, this finding is less robust than the grant-related results, since female unemployment remains negative but is no longer statistically significant in the negative binomial robustness check. The finding aligns with Mirza (2024), Hechavarría and Ingram (2019), Gaies et al. (2023), and Noguera et al. (2015), who also report a negative and statistically significant unemployment effect in at least one specification. However, the broader literature remains mixed, with some studies identifying positive effects. This suggests that the unemployment effect should be interpreted in light of local labor-market conditions, rather than as a uniform relationship across settings. Conversely, the coefficients on the wage variables and remaining controls remain insignificant and lack robust individual effects. Overall, the model is statistically significant, as indicated by the Wald chi-square test, and the year effects are jointly significant, underscoring the role of time-specific shocks. Throughout, VIF values are low and well below commonly used cutoffs, including when the estimated female population is part of the collinearity check, confirming that multicollinearity is not a concern.

Given the evidence of overdispersion, the strict Poisson variance assumption may be restrictive. Therefore, a negative binomial specification was estimated as an additional robustness check. To ensure comparability with the preferred conditional fixed-effects Poisson model, the negative binomial specification was estimated on the same estimation sample, with municipality and year indicators and estimated female population as an exposure term. The results support the main grant-related pattern: the grant coefficient remains negative for developed municipalities, the interaction terms for highly underdeveloped and underdeveloped municipalities remain positive and statistically significant, and the interaction term for medium-developed municipalities remains statistically insignificant. This suggests that the main grant-related conclusion is not driven by the strict Poisson variance assumption. Female unemployment remains negative but is no longer statistically significant, indicating that this result is less stable than the grant-related findings.

Since the preferred Poisson model includes interaction terms, the category-specific grant effects are reported in Table 4 to illustrate how the effect of support differs across municipal development categories.

Table 4: Category-specific log-rate effects of lagged grants across municipal development categories (Model 1)

Municipal development category	Marginal effect of lagged grants allocated to women through the agricultural payment agency	Robust SE	Z	p-value
Category I	0.6326***	0.1311	4.83	0.000
Category II	0.3066***	0.1045	2.93	0.003
Category III	-0.0085	0.0480	-0.18	0.860
Category IV	-0.0466***	0.0136	-3.42	0.001

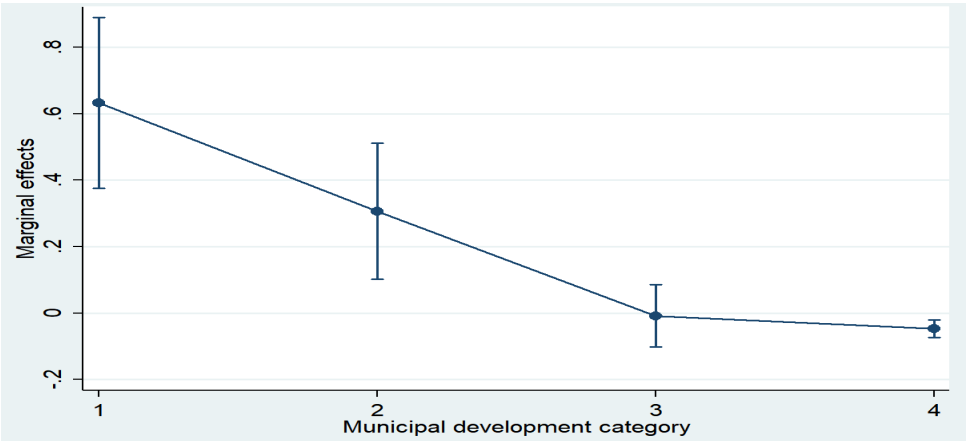
Source: Author's calculation

Table 4 presents the category-specific grant effects of lagged grants across municipal development categories. The results show that grants have the strongest positive effect in highly underdeveloped municipalities, followed by underdeveloped municipalities, while no statistically significant effect is found in medium-developed municipalities. The negative marginal effect in developed municipalities is consistent with the baseline coefficient discussed above. This pattern suggests that grants are most effective where public support relaxes stronger entry constraints, such as weaker access to finance, services, infrastructure, and institutional support. The insignificant effect in medium-developed municipalities may reflect their intermediate position: constraints are less severe than in highly underdeveloped areas, but local market and institutional capacity may still be insufficient to convert support into new registrations. Overall, these findings support hypothesis 2, which posits that agricultural payment agency grants for women have stronger positive effects in highly underdeveloped municipalities. However, some registrations may reflect the formalization of existing agricultural activities rather than entirely new ventures, so the results should be interpreted as evidence on formal entry into registered agricultural activity.

To facilitate interpretation, Figure 3 presents the graphical representation of the marginal effects reported in Table 4. The figure clearly illustrates that the effect of lagged grants is strongest and positive in highly underdeveloped municipalities, weaker but still positive in underdeveloped

municipalities, statistically insignificant in medium-developed municipalities, and negative in developed municipalities.

Figure 3: Category-specific grant effects across municipal development categories (Model 1)



Source: Author's calculation

The graphical pattern confirms the results from Table 4. It reinforces the conclusion that grant support is more effective in less developed municipalities. This finding provides additional support for H2. It also suggests that the local development context plays an important role in shaping the effectiveness of financial support for women's agricultural entrepreneurship.

Conclusion

This study examined the determinants of the establishment of women-owned agricultural entities in the Republic of Srpska using municipal panel data and Poisson panel-data models. The results show that the effect of agricultural payment agency grants for women depends on the local development context. More specifically, the impact of lagged grants is significantly stronger in highly underdeveloped and underdeveloped municipalities than in developed municipalities, whereas no significant effect is observed in medium-developed municipalities. Female unemployment is negatively associated with the rate of newly registered women-owned agricultural holdings in the preferred Poisson specifications,

indicating that less favorable labor-market conditions may represent an important barrier to women's entrepreneurial entry into agriculture. Overall, the findings confirm that both public support and local structural conditions matter for the establishment of women-owned agricultural entities. At the same time, the broader descriptive evidence shows that the share of total agricultural payment agency support allocated to women increased from 5.45% in 2014 to 7.50% in 2024, suggesting gradual improvement but also indicating that support directed to women still represents a relatively modest share of total agricultural support.

Despite these contributions, the study has several limitations. First, it examines only one institutional setting, which limits generalizability. Second, it focuses on establishing women-owned agricultural entities rather than on their survival or growth. Third, municipal data omit individual and household characteristics influencing women's entrepreneurial entry. Future research could examine other countries or regions to assess comparative policy and institutional contexts. It could also analyze post-entry outcomes and integrate municipal data with micro- or qualitative-level evidence. The study offers theoretical and practical insights, supporting the view that women's entrepreneurship in agriculture depends on institutional measures and local structural conditions. Practically, findings suggest that policies should be more place-sensitive, with greater emphasis on less developed municipalities where support is most effective. Agricultural payment agencies and local policymakers should supplement uniform financial support with targeted interventions, such as removing barriers to training, improving access to networks and resources, and addressing local labor-market and development constraints.

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Appendix

Table A1: Municipalities in the Broader Dataset and Final Fixed-Effects Poisson Estimation Sample

	Municipality / City				
1	City of Banja Luka	22	Kalinovik*	43	Petrovo
2	Berkovići	23	Kneževo	44	City of Prijedor
3	City of Bijeljina	24	Kozarska Dubica	45	Prnjavor
4	Bileća	25	Kostajnica	46	Ribnik
5	Bratunac	26	Kotor Varoš	47	Rogatica
6	Brod	27	Krupa na Uni*	48	Rudo
7	Višegrad	28	Kupres*	49	Sokolac
8	Vlasenica	29	Laktaši	50	Srbac
9	Vukosavlje*	30	Lopare	51	Srebrenica
10	Gacko	31	Ljubinje	52	Teslić
11	City of Gradiška	32	Milići	53	City of Trebinje
12	Derventa	33	Modriča	54	Trnovo*
13	City of Doboj	34	Mrkonjić Grad	55	Ugljevik
14	Donji Žabar*	35	Nevesinje	56	Foča
15	Zvornik	36	Novi Grad	57	Han Pijesak*
16	Istočna Ilidža	37	Novo Goražde*	58	Čajniče
17	Istočni Drvar*	38	Osmaci*	59	Čelinac
18	Istočni Mostar*	39	Oštra Luka*	60	Šamac
19	Istočni Stari Grad*	40	Pale	61	Šekovići
20	Istočno Novo Sarajevo	41	Pelagićevo*	62	Šipovo
21	Jezero*	42	Petrovac*	63	Stanari

Notes: Municipalities marked with an asterisk (*) are not included in the final conditional fixed-effects Poisson estimation sample.

Source: Author's compilation based on the study sample.

Table A2: Negative binomial robustness check of women-owned agricultural holdings

Variables	**Negative binomial robustness check**	**Year indicators**	**Negative binomial robustness check**
Grants allocated to women through the agricultural payment agency	-.050***(.018)	**2016**	-.098(.099)
Municipal development category		**2017**	-.323**(.131)
I	-.504*(.290)	**2018**	-.280*(.146)
II	-.590**(.246)	**2019**	-.725***(.175)
III	-.214(.235)	**2020**	-.645***(.185)
Interaction between municipal development category and grants allocated to women through the agricultural payment agency		**2021**	-.464**(.216)
I	.692***(.147)	**2022**	-.288(.339)
II	.355***(.127)	**2023**	-.261(.434)
III	.038(.045)	**2024**	-.281(.560)
Female unemployment	-.322(.216)	**Exposure**	Estimated female population
Average net wage	-.288(1.115)	Municipality indicators	Yes
Kindergarten attendance rate	.142(.179)	Year indicators	Yes
Road length	-.0008(.0015)	Number of clusters	47
Combined education cycle	.003(.015)	Log pseudolikelihood	-1133.19
Number of observations	434	Pseudo R^2	0.1837
Alpha	.0718		

*Notes: Municipality-clustered robust standard errors are reported in parentheses. Category IV, developed municipalities, is the reference category. Municipality and year indicator variables are included in the specification, with 2015 as the omitted reference year. Estimated female population is used as an exposure term. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*