The Future of Agriculture

The Effects of Government Support for Young Farmers on Youth Participation in Swedish Agriculture

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Degree project/Independent project • 15 credits
Swedish University of Agricultural Sciences, SLU
Faculty of Natural Resources and Agricultural Sciences/Department of Economics
Political Science - Sustainable Development
Degree project/SLU, Department of Economics, 1689 • ISSN 1401-4084
Uppsala 2025

The Future of Agriculture: The Effects of Government Support for Young Farmers on Youth Participation in Swedish Agriculture

Framtidens jordbruk: Effekterna av statligt stöd till unga bönder på ungdomars deltagande i det svenska jordbruket

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Credits:	15 credits
Level:	Bachelor's level, G2E
Course title:	Independent project in Economics, G2E
Course code:	EX0903
Programme/education:	Politices kandidat - hållbar utveckling
Course coordinating dept:	Department of Economics
Place of publication:	Uppsala
Year of publication:	2025
Copyright:	All featured images are used with permission from the copyright owner.
Title of series:	Degree project/SLU, Department of Economics
Part number:	1689
ISSN:	1401-4084

Keywords:	Young Farmers, Support, Sweden, Food Preparedness, VAR Model, Random-Effects GLS

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Abstract

Issues related to food supply and food preparedness are increasingly relevant today due to the importance of maintaining food supply in Sweden during critical situations around the world. In times of war and crisis a stable and continuous domestic food production in Sweden is of the utmost importance. To ensure this, a higher percentage of young people needs to be established in the agricultural sector. There are challenges to achieving this goal due to barriers young farmers are facing, such as lack of capital and access to land. Government support targeted for young farmers may contribute to increasing the interest among young people in engaging in agriculture. This study aims to investigate whether the support for young farmers leads to an increase in the share of young farmers in beef production. To investigate this, panel data is used over all Swedish 21 counties over the period 2016 to 2024. The empirical analysis is based on Panel Vector Autoregression and Random-Effects Generalized Least Square. Results of the analysis indicate that the support for young farmers has a positive effect on the share of young farmers in Sweden. Yet, the findings in this analysis indicate that the youth unemployment rate is a more important factor in driving young people into the agricultural sector searching for employment. Furthermore, the results indicate that the support leads to an increase in beef production. This paper concludes that providing support to young farmers can play a significant role encouraging youth engagement in the agricultural sector. Moreover, such support has the potential to enhance and strengthen domestic food production and contribute to long-term food security.

Keywords: Young Farmers, Support, Sweden, Food Preparedness, VAR Model, Random-Effects GLS

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Abbreviations

VAR	Vector Autoregression
LRF	Federation of Swedish Farmers
WWF	World Wide Fund for Nature
GLS	Generalized Least Square
NUTS2	The Nomenclature for Statistical Territorial Units
NFS	The National Food Strategy

1. Introduction

The following chapter aims to give a background to the subject, information about how support for young farmers works, and an idea of why this study is important including the research question.

1.1 Background

Issues related to food supply and food preparedness are increasingly relevant today due to the importance of maintaining food supply in Sweden during critical situations around the world (The Swedish Board of Agriculture 2025a). Food is a fundamental resource that enables society to function and is recognized as a human right that everyone is entitled to (FN 2008). The food preparedness includes the work to ensure availability of food and water for the population in times of crisis and war (The Swedish Board of Agriculture 2025a). To ensure food supply under such conditions, domestic food production is of utmost importance to be strengthened under times of stability (Ministry of Rural Affairs and Infrastructure 2025; The Swedish Board of Agriculture 2025a). The domestic agriculture- and food production in Sweden is the basis for food preparedness and the flow in the food chain to function (Ministry of Rural Affairs and Infrastructure 2025). According to The Swedish Board of Agriculture (2025a) a long-term sustainability robust food supply with profitable and competitive companies provides a solid foundation for improving preparedness. In 2025, The National Food Strategy 2.0 (NFS) was introduced, which underscores the importance of robust primary production and a well-functioning food security system. Strong and profitable food production companies are required for the country to be prepared when crises such as extreme weather, heightened alerts, and war affect the world. To secure the food chain, it is of great importance that trade is maintained, and agricultural land is secured (Ministry of Rural Affairs and Infrastructure 2025).

Discussing the importance of the domestic food production, The Swedish Board of Agriculture (2022) established that the Swedish food production has added values which include various strengths that have a positive sustainability impact on our food system in an economically, environmentally or/and socially sustainable manner. The concept comprises the need for domestic production for the food supply. To secure food sufficiency, the food system needs to be capable of supplying food to the population during stable times, but also to maintain these services when crisis occurs. Due to national and international crises, such as the drought in Sweden 2018 and Russian's invasion of Ukraine, the preparedness and supply perspective have an important role in society.

Sweden relies on imports for a significant share of its food supply. In addition, many essential inputs for food production, such as fertilizer and fuel, are also imported. This makes the food system in Sweden dependent on international trade to function effectively. Unrest around the world affects Sweden nationally and an increase in domestic production may ensure the food (The Swedish Board of Agriculture 2022).

To summarize and further discuss the self-sufficiency in Sweden, food is a human right and to ensure access to it, it requires global cooperation and/or an increased domestic production. Global unrest and the ongoing climate crisis highlight the need to secure and strengthen food production (European Commission 2025b). Due to this, the self-sufficiency of food is important for Sweden as country. One important issue to ensure future domestic production is succession to increase the share of young farmers in agriculture (Agriculture and rural development 2025), but young farmers face several barriers to entering the market. According to Kerttu et al. (2024), one of the key challenges faced by young farmers is the lack of capital, which places them at a disadvantage when competing with older and more financially established farmers. Only 11 percent of the farmers in the EU are younger than 40 years old. The average age in Sweden is 60 years old (Kerttu et al. 2024). To create a long-term sustainable food supply, a generation renewable in agriculture is essential (Westerberg et al. 2025).

The involvement of young people is essential to securing future food production, and beef production is a part of that (The Swedish Board of Agriculture 2025a). For that, this study takes beef production as its focus. A more profitable beef is important from different perspectives (Holmström 2024), not at least for job opportunities in rural areas and the biodiversity that semi-natural pastures contribute to (The Swedish Board of Agriculture 2023b). Semi-natural pastures in Sweden are species-rich habitats. Cattle grazing is important to avoid overgrowth and to allow several species to interact in the same environment (Swedish Meat 2021). A cultivated landscape with natural pastures in Sweden benefits biodiversity and ecosystem services (The Swedish Board of Agriculture 2023b). Unfortunately, the area of natural pastures in Sweden are decreasing due to development in agriculture, such as large scaled agricultural companies and increased intensification, which leads to a reduce in biodiversity (The Swedish Society for Nature Conservation 2023). According to The Swedish Society for Nature Conservation (2023), a thriving agricultural landscape relies on higher proportion of grazing land, where natural pastures play a significant role. As a result, cows are often fed grains and imported soy which is not considered part of a sustainable agriculture (The Swedish Society for Nature Conservation 2021).

Around 25 percent of the beef produced in Sweden comes from cattle that have not grazed on natural pastures (Hessle et al. 2021). Furthermore, the issue of climate impact that beef production contributes to, remains. In the agriculture sector in Sweden methane and nitrous oxide accounts for large amounts of greenhouse gas emissions (The Swedish Board of Agriculture 2020). Among all food products, beef is associated with the highest overall climate impact, approximately for three-quarters of the agricultural production in Sweden (WWF 2023). Currently consumption of meat is environmentally unsustainable and much of the production are not follows a sustainable production (The Swedish Society for Nature Conservation 2021). However, with more innovative agricultural methods, driven by engaged farmers, beef production can become more sustainable. A shift in how meat is produced is desirable (WWF 2025). Since animal-based food production is a part of a stable food supply (The Swedish Board of Agriculture 2023b) and has an important role in keeping the values of rural and biodiversity, if it can be produced in a sustainable way, this research is a case study based on young farmers in beef production in Sweden.

1.2 Objective and research question

This paper aims to investigate the role of policy support in encouraging generational renewal in agriculture, with a focus on support for young farmers. To inspect the analysis, the beef production sector is used as a case, due to its relevance of ensuring food security. The study includes an analysis of Sweden's 21 counties over several years, 2016 to 2024. This paper aims to answer the question:

Does support for young farmers lead to an increase in the share of young farmers in Swedish beef production?

Several previous studies on problems that young farmers are facing and how the support for young farmers affecting young farmers, relies on questionnaires and interviews with a behavioral approach (e.g. Balazentis et al. 2020; Eistrup et al. 2019; Šimpachová Pechrová et al. 2018). Unlike previous studies, this study is based on statistical data which allows for a more objective analysis of the relationship between support for young farmers and the share of young farmers, strengthening the empirical foundation. Furthermore, few studies discuss and investigates the generation renewal problem in Sweden through a future food sufficiency perspective. This study contributes to fill this gap through link the generation renewal to the long-term ability for domestic food production and highlight its importance for the future in Sweden's agriculture production.

1.3 The support for young farmers

In 2015, the support for young farmers was introduced in Sweden as a supplement to farm support (European Commission 2016). Some changes have been made since the introduction of the support, but this report provides design on its current form. The CAP 2023-2027 includes several interventions for young farmers. All member countries in the EU have their own strategic plan for how the agricultural policy should be run (European Commission 2025a). Sweden's Strategic plan 2023-2027 includes a variety of goals. The support targeted at young farmers in Sweden focuses on the goal; "*attracting and retaining young farmers and other farmers and facilitating sustainable business development in rural areas"* (Ministry of Rural Affairs and Infrastructure 2022).

The support for young farmers aims to promote new generations to get established in agriculture. The criteria for applying are as follows: (1) the applicant must be no older than 40 years of age; (2) the agricultural enterprise must have been in operation for no more than five years and must constitute the farmer's first business; (3) the applicant must hold primary responsibility for the management of the enterprise; (4) the total land area must range between 4 and 200 hectares. Support for young farmers is a yearly support that can be applied for up to five years in a row. In the year 2024 the support was 135 euros per hectare (The Swedish Board of Agriculture 2025b).

1.4 Structure

The structure in this paper is as follows. The first section presents an introduction which includes a background about the subject, an informative section about the support and the purpose of the paper including the research question. The second section presents a review of relevant literature, such as previous research, interviews and articles. Section three discusses the method, data and theoretical framework used in the study. The fourth section presents all the results of the analysis and the fifth and sixth sections discuss and conclude the paper.

2. Literature review

This section presents a literature review discussing the lack of young farmers in agriculture and how the support for young farmers affects the individuals.

In academic literature, numerous studies have examined the declining participation of young individuals in agriculture (e.g. LRF Young Members 2023; Ross 2025), identifying barriers that hinder entry into the sector (e.g. Zagata and Sutherland 2015; Agricultural and Rural Development 2025). Additionally, other studies have studied how support for young farmers contributes to their ability to establish and sustain agricultural enterprises (e.g. Westerberg et al. 2025; Balazentis et al. 2020; Jongeneel 2018).

Several studies have discussed the problem of lack of young people in agriculture (LRF Young Members 2023; Ross 2025) followed by the barriers young farmers are facing (Jennersjö 2025; Zagata and Sutherland 2015). LRF Young Members (2023) discusses the problem of lack of young people in agriculture, concluding an age imbalance followed by a decline of the proportion of young farmers, is a growing problem in the agricultural sector. The problem of a lack of young farmers is further discussed by (Ross 2025). According to Ross (2025), the green industry is often perceived as something one is born into rather than something young people actively choose as a career, which leads to problems in attracting young people into agriculture. Furthermore, several previous studies (Jennersjö 2025; Zagata & Sutherland 2015; Agricultural and Rural Development 2025) have discussed the structural challenges faced by young farmers including limited access to capital and land. Jennersjö (2025) discusses the problem of the aging agricultural sector, arguing that the high requirement of capital assets makes it increasingly difficult for young farmers to get established in the agricultural sector. Further, Zagata and Sutherland (2015) mention some of the barriers to entry into agriculture: access to land; requirement for large capital investment; and education and training for new entrants. The rising value of agricultural land often makes farmers unwilling to sell or pass it on to a new generation. Access to land and credit are cited as the two main constraints for young farmers entering the sector (Agricultural and Rural Development 2025).

When discussing how support for young farmers affects the share of young farmers in the agricultural sector it is two-parted. Westerberg et al. (2025) concluded, on the one hand, that support helps young farmers in Sweden with economic sustainability, but on the other hand it is not enough. The support mainly benefits those farmers with greater access to land.

The report also concluded that the support for young farmers facilitates generational transitions, but there is no evidence that the support attracts young farmers into the sector (Westerberg et al. 2025). Furthermore, Balezentis et al. (2020) conducted a study on support for young farmers in Lithuania and concludes that the support for young farmers has a higher impact on small farmers. Therefore, focus needs to be attained for small farmers to increase their effectiveness (Balazentis et al. 2020). Key factors to ensure a sustainable long-term agricultural sector is young farmers continue receiving support and participating in knowledge transfer (Jongeneel 2018). Helping young people to establish themselves in the agricultural sector can secure the food supply for now and in the future (Agriculture and Rural Development 2025). Girdziute et al. (2022) highlights the problem of the lack of young farmers in agriculture by focusing on identifying the reasons behind the unwillingness to work in agriculture in Lithuania. The reasons behind the unwillingness to work are often gender, where women were less likely to establishing into agricultural sector, area of residence and youths' beliefs that the agricultural sector is not a career-driven sector, which aligns with Ross (2025) discussion about the problem of lack of young farmers in Sweden. Girdziute et al. (2022) concluded that agriculture should be presented as an innovative and technological development sector where it is possible to create its own businesses. The effects of support for young farmers are further discussed by Adamowicz and Szepeluk (2016). The study concluded that the effects of financial support for young farmers are positive.

Through strengthening support for young farmers, generational renewal may be possible and ensuring the agricultural sector's long-term conservation. Young farmers tend to be open-minded to innovation and modern techniques (Agriculture and Rural Development 2025). Furthermore, Adamowicz and Szepeluk (2016) concluded that young farmers are open to innovative changes which can achieve higher production in a sustainable way. With a perspective on the socially and environmentally sustainability The Swedish Board of Agriculture (2023a) outlines the opportunities within' Sweden's agriculture sector to create jobs and be a part of the social sustainability perspective. Further, the report discusses the importance of domestic food production to make sure that food can be delivered for the population and that the agricultural companies are adaptable in times of crisis. To ensure this, the establishment of young farmers plays a significant role.

3. Methodology and data

This section discusses the choice of method and data and finally, the theoretical framework. The first section discusses panel data as the method in this study, including time span and type of entities that are analyzed. Second, the variables and the data sources are presented. The third section presents the theoretical framework. The last section presents the model specification, including the use of Vector Autoregression Model (VAR) and Random-Effects Generalized Least Square (GLS).

3.1 Method

The method used in this paper is a panel data analysis, using the share of young farmers as the dependent variable and the amount of support for young farmers as the independent variable. The study comprises all 21 Swedish counties over a nine-year period, 2016 to 2024, resulting in a total of 189 observations. The purpose is to identify the effect of support for young farmers on the share of young beef farmers in Sweden over time. Two dependent variables will be analyzed, the share of young farmers and beef production, through VAR and GLS which will be described in 3.4 Model specification.

3.2 Data description

The main data in this analysis is gathered from The Swedish Board of Agriculture statistical database. Other data sources that are used is Swedish Public Employment Service, Statistics Sweden and GeoQuery.

The dependent variable of the regression is *the share of young farmers* within the beef sector in Sweden, which is calculated through the total number of young farmers divided by the total number of farmers. Young farmers are defined as ≤ 44 years old. The dependent variable is measured as a percentage of all beef producers in each county and year. The independent variable of the model is *the amount of support for young farmers* which is the amount of support for young farmers in beef production. To isolate the effect of support, several other variables are included. Other important explanatory variables included are *the number of cattle, beef production, youth unemployment rate, precipitation, temperature, disposable income, land price and PPI on beef.* An analysis of the effects of support on beef production will also be done, with beef production as the dependent variable and support as the independent variable. The variables support, beef production, number of cows, disposable income and land price are used in its logarithmic form.

Due to lack of data the variable land price is based on region NUTS2 (The nomenclature for statistical territorial units) which are divided into: Stockholm, Eastern Middle Sweden, Småland with Islands, Southern Sweden, Western Sweden, Northern Middle Sweden, Middle Norrland and Upper Norrland. It would have been beneficial to have this data county based too. All other variables, except PPI on beef are county based. In addition to solving the problem with missing data for youth unemployment rate, disposable income, precipitation and land price for 2024 and temperature for year 2023 and 2024, the previous values are used for these years. The amount of support for year 2021 is missing in Stockholm County and Örebro County and are solved by using the value from 2020. Furthermore, due to the design of the statistics of support for young farmers gathered from The Swedish Board of Agriculture, young farmers are defined as ≤ 44 years old. Since the support only provides young farmers up to 40 years old it would have been beneficial to define young farmers as ≤ 40 years old. A variable that would have been interesting to include is access to agricultural education but since the variable showed out not being significant, this variable is dropped.

3.2.1 Variable description

Table 1. Variable description

Variable	Definition	Unit	Source
Share of young farmers (Share_YF)	Total number of young farmers in beef production in Sweden / Total number of farmers in beef production in Sweden	Percent Per county and year Age group: ≤ 44 years	The Swedish Board of Agriculture
Amount of support (Support)	Amount of support for young farmers in all agricultural sectors in Sweden	SEK Per county and year	The Swedish Board of Agriculture
Number of cattle (Cows)	Total number of cows in Sweden	Per county and year	The Swedish Board of Agriculture
Beef production (Beef prod)	Total beef production in Sweden	Tonnes Per county and year	The Swedish Board of Agriculture
Youth unemployment (Unemp)	Registered unemployment as % of register-based labour force in Sweden	Percent Per county and year Age group: 16-64 (2016-2022) 16-65 (2023)	Swedish Public Employment Service
Precipitation	Yearly mean created by aggregating (mean) the monthly GPM precipitation in Sweden	0.001 millimetres per hour Per county and year	GeoQuery
Temperature (Temp)	Yearly mean created by aggregating (mean) monthly mean daily temperature data from CRUTS in Sweden	Degrees Celsius Per county and year	GeoQuery
Disposable income (Dispinc)	Mean of disposable income for household in Sweden	County and year Age group: 18+	Statistics Sweden
Land price (Landprice)	Price agricultural land, region NUTS2 in Sweden	Price per hectare Per NUT2 Region and year	The Swedish Board of Agriculture
PPI Beef (PPIbeef)	Producer Price Indices of the Food Industry, Agriculturally Regulated Food (PPI-J) year, 2020=100 in Sweden	Index, Price development Per year	The Swedish Board of Agriculture

3.3 Theoretical framework

A theoretical framework is implemented in the study to describe the role of government control measures in the agricultural food system. Hansson et al. (2024) presented a framework as guidance towards a sustainable food system, *Food System Sustainability House.* The framework includes: a *ceiling* of societal objectives that the national food system needs to achieve; a *foundation* that includes environmental conditions to which actors must adapt or respond; and a wall consisting of governance and economic enablers. This study will focus on specific parts of the ceiling and the walls that are relevant for this research paper. Each part consists of themes, sub-themes and indicators. One sub-theme of the ceiling is the Food Availability from Swedish production. This part capture food security and food production perspectives. The indicators associated with this theme helps to ensure food availability at a regional level and Sweden's contribution to global food supply. The walls are divided into two parts, both governance and economic enablers (Hansson et al. 2024). This paper will focus on the governance wall. Governance is necessary to protect common goods affected by large-scale systems, such as the food system (Jagers et al. 2020). And for this, companies that can provide food in the future are necessary, and thus, they need to survive financially. The wall focuses on the need for governance to ensure that social goals are met, while also taking the environmental perspective into account. The Food System Sustainability House gives an insight into how different sustainability perspectives are related to each other (Hansson et al. 2024).

In this study, the ceiling can be related to the importance of food supply and further the importance of generational renewal in agriculture. According to Hansson (2025) the generation issue brings both economic and social challenges, making it relevant within this analytical framework. The wall of governance discussing the governmental role in ensuring social goals and large-scaled system as a threat against common goods. As mentioned in the literature review, access to land and large farms prevents young farmers from establishing the agricultural sector. According to this framework, this problem can be solved by governance and policies.

3.4 Model specification

The Vector Autoregression Model is used in the estimation, with a short-term run to analyse how several variables are affecting each other and change over time. Since the variables are cointegrated, a short-run VAR model is constructed. The dependent variables are a function of their lagged values and the lagged values of other variables in the model, which all have two lags.

There is an importance of using the optimal length of lags, which are chosen through the information criterion: AIC; SC; and HQIC, since too many lags causes statistically insignificance of coefficients and multicollinearity. Too many lags also cause loss of degrees of freedom. The VAR model is estimated by an Ordinary Least Squares (OLS) Regression. The interpretation of the model will be, since OLS, "holding all other things constant"-effect (Baltagi 2011).

3.4.1 Econometric model

First a stationary test is needed to indicate if there are non-stationary in the panels. If there is non-stationary, the first differences of these variables need to be made. The regression is analyzed with the first differences variables. The variables number of cows, precipitation, temperature, disposable income and producer price index were not significant and therefore not used in the analysis. Second, a unit test is used to test for cointegration in the panels, a long-term relationship between the variables.

Panel Generalized Least Squares (GLS) was used to estimate the association between the share of young farmers and the support for young farmers as well as other important explanatory variables. The GLS is suitable because of potential endogeneity and heteroskedasticity in the dataset. The GLS Equation:

$$Share\_YF_{it} = C + \beta_1 lnsupport_{it} + \beta_2 lnbeefprod_{it} + \beta_3 Dlnlandprice_{it} + \beta_4 Dlndispinc_{it} + \beta_5 Dlncows_{it} + \beta_6 Dunemp_{it} + \beta_7 Dppibeef_{it} + \beta_8 Precipitation_{it} + \beta_9 Temp_{it} + \mu_{it}$$

Where *i* denotes county and *t* represent year.

The estimation will require the use of a short-term PVAR Model with a time lag of up to 2 to analyse how the variables affect each other over time. The PVAR Equation:

$$\begin{aligned} Share\_YF_{it} = {} & C + \beta_1 Share\_YF_{it-1} + \beta_2 Share\_YF_{it-2} + \beta_3 lnsupport_{it-1} \\ & + \beta_4 lnsupport_{it-2} + \beta_5 lnbeefprod_{it-1} + \beta_6 lnbeefprod_{it-2} \\ & + \beta_7 Dlnlandprice_{it-1} + \beta_8 Dlnlandprice_{it-2} \\ & + \beta_9 Dlndispinc_{it-1} + \beta_{10} Dlndispinc_{it-2} + \beta_{11} Dlncows_{it-1} \\ & + \beta_{12} Dlncows_{it-2} + \beta_{13} Dunemp_{it-1} + \beta_{14} Dunemp_{it-2} + \varepsilon_{it} \end{aligned}$$

Where *i* denotes county and *t* represent year.

4. Results

This section describes the founding results from the tests in the analysis through the econometric models presented in 3.4.1 Econometric model. The results are presented in different tables with a short conclusion of what is shown in the respective tables. First, a GLS regression is used to investigate how explanatory variables affect the share of young farmers. Second, a PVAR is used to investigate how several variables affect each other over time where all variables are treated as endogenous.

4.1 Test of unit root

In Table 2, an Im–Pesaran–Shin unit-root test is used for testing unit roots and stationary of the panels. If p-value < 0.05 it means that the null hypothesis is rejected, and some panels are stationary. Some of the variables have a p-value > 0.05 which means that the null hypothesis cannot be rejected, and the panels are non-stationary. First differences need to be applied to those variables, which are thereafter noted as "D_...". The variables have a p-value < 0.05 in the first difference, and the null hypothesis can be rejected. The panels are stationary after the first difference. Still, the variable for PPI of beef is non-stationary.

H0: All panels contain unit roots
Ha: Some panels are stationary

Table 2. Im-Peasaran-Shin unit-root test

Variable	**T-statistics (z-t-tilde-bar)**	**P-value**	**Stationary level**	**Stationary in 1st diff**	**P-value in 1st diff**
Share_YF	-1.9672	0.0246	Yes	-	-
Lnsupport	-6.9285	0.0000	Yes	-	-
Lnbeefprod	-2.0137	0.0220	Yes	-	-
Lncows	4.4072	1.0000	No	Yes	0.0001
Unemp	1.5402	0.9382	No	Yes	0.0005
Lndispinc	3.4650	0.9997	No	Yes	0.0000
Lnlandprice	-0.6348	0.2628	No	Yes	0.0000
PPIbeef	14.2832	1.0000	No	No	0.2923
Precipitation	-5.7324	0.0000	Yes	-	-
Temp	-5.3781	0.0000	Yes	-	-

4.2 Test of cointegration

The Kao test for cointegration is estimated to test for cointegration in the panels. The algorithm chose an average of 2 lags across all panels to correct for serial correlation. The test indicated that the null hypothesis of no cointegration is rejected in Dickey-Fuller test, Unadjusted modified Dickey-Fuller test and Unadjusted Dickey-Fuller test since $p<0.05$. The two other tests showed a non-significant result. This is true for three of the test statistics shown in the table. It provides evidence that all panels in the data are cointegrated which indicates a long-term stability relationship between the variables, even though they individually can be non-stationary.

H0: No cointegration
Ha: All panels are cointegrated

Table 3. Kao test

	Statistic	P-value
Modified Dickey-fuller t	1.4938	0.0676
Dickey-Fuller t	-1.6712	0.0473
Augmented Dickey-Fuller t	1.0862	0.1387
Unadjusted modified Dickey–Fuller t	-4.8009	0.0000
Unadjusted Dickey–Fuller t	-6.5517	0.0000

4.3 Summary table

The summary table indicates the *overall*, *between* and *within* results. It is a way to understand the between and within variance for the covariates. The interpretation of the overall results is the summary statistics for the entire dataset and is calculated by N=189. The mean value of share of young farmers is 15.6 percent and varies between 6.3 percent and 24.7 percent. Which means that the mean of young farmers in Swedish agricultural population is 15.6 percent. For support the mean value overall is 6 643 620 SEK, varies between 67 702 SEK and 146 000 000 SEK, and the mean value overall for beef production is 6486.9 tonnes. Beef production varies between 1080 and 25320 tonnes. Between output first estimates unit-level averages for every unit and then calculates the standard deviation for these, calculated by n=21. The counties differ in share of young farmers by 0.027 by average and the support differ by 6 516 395. The beef production differs by 6436.9 between the counties. The land price differs by 19 942.7 SEK between counties, and the overall mean is 34 284 SEK.

The interpretation of the within standard deviation is how much a variable varies within counties over time, calculated by N=189. The share of young farmers varies by 3 percent within counties over time. The support has a within standard deviation of 10 800 000 which indicates that the amount of support varies by 10 800 000 SEK within counties over time. The period in the analysis is from 2016 to 2024.

Table 4. Summary table with overall, between and within results.

Variable		**Mean**	**Std.dev.**	**Min**	**Max**
Share of young farmers	Overall	0.156	0.0403	0.063	0.247
	Between		0.027	0.087	0.194
	Within		0.030	0.071	0.239
Support for young farmers	Overall	6643620	1.25e+07	67702	1.46e+08
	Between		6516395	1691537	2.30e+07
	Within		1.08e+07	-1.47e+07	1.32e+08
Beef production	Overall	6486.931	6306.416	1080	25320
	Between		6436.938	1174.444	24125.56
	Within		316.02	5281.376	7893.598
Land price	Overall	34284.13	21067.25	461650	688800
	Between		19942.7	481827.8	648100
	Within		7939.886	480305.8	556361.4
Disposable income	Overall	515661.4	40186.46	4400	94800
	Between		37955.67	6566.667	76633.33
	Within		15349.98	12750.79	52450.79
Number of cows	Overall	69701.4	64392.26	14808	264637
	Between		65777.44	16023.67	258327.3
	Within		1950.81	62493.06	76400.29
Youth unemployment rate	Overall	0.072	0.016	0.038	0.113
	Between		0.014	0.053	0.0975
	Within		0.008	0.0546	0.089
PPI on beef	Overall	108.298	14.488	93.96	133.57
	Between		1.46e-14	108.298	108.298
	Within		14.488	93.96	133.57
Precipitation	Overall	81.967	14.294	56.898	128.798
	Between		9.637	70.458	108.251
	Within		10.742	49.735	103.083
Temperature	Overall	6.165	2.635	-0.968	9.759
	Between		2.657	-0.236	9.032
	Within		0.431	5.433	7.327

4.4 Scatterplots

In Figure 1, the relationship between support for young farmers and the share of young farmers is estimated. The graph establishes a positive relationship between these two variables. Interpreting these results indicates a one percentage change in support increases the share of young farmers in Swedish beef production. Figure 2 presents the relationship between support and beef production in Sweden. The relationship between these two is also positive. One percentage change in beef production leads to an increase in the share of young farmers.

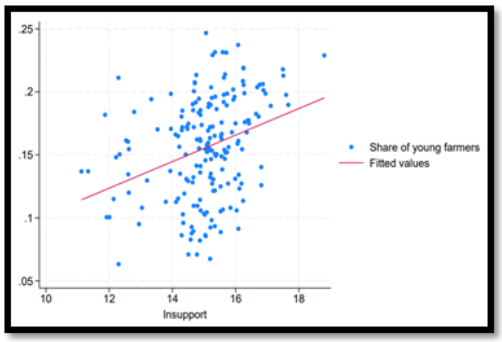

Figure 1. Scatterplot of the support and the share of young farmers

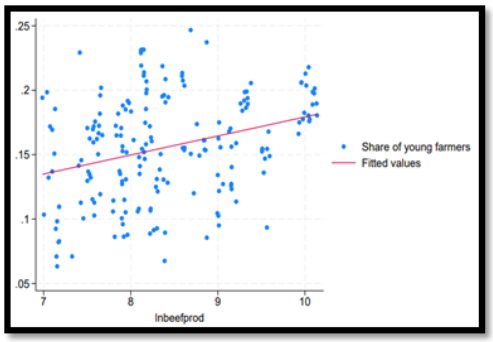

Figure 2. Scatterplot of the beef production and the share of young farmers

4.5 Random-Effects Generalized Least Square regression

The results from Random-Effects GLS regression shows σv is 0.023 and σe is 0.364, assuming that the correlation of v and x is zero. The interpretation of the results is "holding all other constant". Through this table it is possible to discuss the effects of the different variables on the share of young farmers in Sweden. The variable of support is significant at 1 percent level which indicates a strong correlation between support and the share of young farmers. One percentage change in support is associated with an increase by 0.017 percentage point in the share of young farmers. The variable for beef production is not significant but still reasonable to discuss since it is close to zero. One percentage change in beef production will lead to a 0.014 percentage point increase in the share of young farmers. An interesting result to discuss is the results of the youth unemployment rate. The variable is significant at the 5 percent level and has a positive impact on the share of young farmers. One unit increase in unemployment rate leads to an increase in the share of young farmers of 0.88 percentage point.

The variable of temperature is also significant, but unlike the others, negative. One unit increase in temperature leads to a reduction in the share of young farmers within 0.6 percentage point.

Table 5. Random-Effects GLS Regression. The effects of the explanatory variables on the dependent variable.

Share of young farmers	**Variable**	**Coefficient**	**Std.err.**	**P>|z|**
	Lnsupport	0.017***	0.005	0.001
	Lnbeefprod	0.014	0.009	0.122
	D_lnlandprice	-0.019	0.020	0.324
	D_lndispinc	-0.003	1.94e-07	0.910
	D_lncows	0.396 **	0.138	0.004
	D_unemp	0.876 **	0.407	0.032
	D_ppibeef	0.0004	0.0006	0.502
	Precipitation	-9.32e-06	0.0002	0.970
	Temp	-0.006 **	0.003	0.017
	_cons	-0.181	0.077	0.019
	sigma_u	0.023		
	sigma_e	0.030		
	rho	0.364		

*significant at 10% level **significant at 5% level ***significant at 1% level

4.6 Panel Vector Autoregression

The Vector Autoregression displays the short-run relations between the dependent variable, share of young farmers and the explanatory variables, support for young farmers, beef production and land price. The dataset contains data through the years 2016 and 2024. The short-run relations between the dependent variable, beef production, and the explanatory variables are also established. The lag-length used in this regression is two. The PVAR explains a significant positive correlation between the share of young farmers during the last period and this period. For completeness, the full PVAR estimation results can be found in Appendix. As shown in Table 6, one percentage change in the share of young farmers the previous year will increase the share of young farmers in beef production by 0.588 percentage point this year. The result of the effects between beef production and the share of young farmers, shown in Table 6, is significant the second previous year. One percentage change in beef production in the second previous year will increase the share of young farmers by 0.298 percent. The p-value of support for young farmers is not significant.

But the GLS, Table 5, above proves that the variable is significant over the observed period. The variable for land price is significant in the two previous years and shows a positive effect on the share of young farmers. Since the variable of unemployment rate is significant in the second previous year, the results are interpreted as one unit increase in unemployment rate are reducing the share of young farmers. The other variables are not significant and therefore not included in the estimation.

Table 6. Panel Vector Autoregression. The short-run relations between the dependent variable, share of young farmers, and the explanatory variables.

Variable	**Coefficient**	**Std.err**	**P>|z|**
Dependent variable: Share of young farmers (share_YF)			
Share of young farmers (share_YF)			
L1	0.588**	0.295	0.048
L2	0.284	0.210	0.176
Support for young farmers (lnsupport)			
L1	0.017	0.025	0.504
L2	-0.024	0.025	0.332
Beef production (lnbeefprod)			
L1	0.360	0.249	0.148
L2	0.298*	0.171	0.081
Land price (D_lnlandprice)			
L1	0.068*	0.036	0.056
L2	0.054*	0.031	0.087
Youth unemployment (D_unemp)			
L1	-0.228	0.675	0.736
L2	-1.378*	0.708	0.052

Instruments: Lagged (1/2). (share_YF lnbeefprod lnsupport)

*significant at 10% level **significant at 5% level ***significant at 1% level

4.7 Impulse Response Functions

The Impulse Response Functions, Figure 1, describes the evolution of the variable share of young farmers in reaction to a shock in support, youth unemployment rate, beef production and land price. The graph lnbeefprod: lnsupport describes the evolution of beef production in reaction to a shock in support. While the PVAR Model, Table 6, does not show a statistically significant relationship between support for young farmers and the share of young farmers, the impulse response analysis suggests a positive and lasting effect following a policy shock. This indicates that the impact may be long-term and not fully captured by the individual regression coefficients. The results from the analysis indicate a positive effect over time on the share of young farmers in response to a one-unit shock in support. Further, one unit shock in support also has a positive effect on beef production over time. There is a positive relationship between support and the share of young farmers and beef production. The graph for unemployment rate and share of young farmers shows a small effect. In the first years a decrease is indicated and then the line increases before it levels out. There is a clear decrease in the beginning of the land price on share of young farmers. Then the graph shows clear fluctuations. All the graphs are significant since the line is above zero.

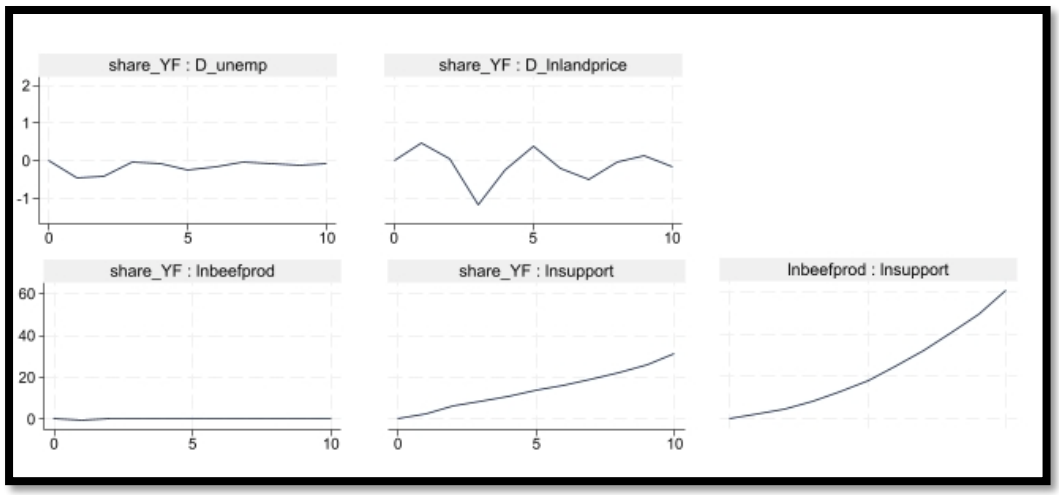

Figure 3. Graphs of Impulse: Response. The effect of a shock in the explanatory variable.

4.8 Stability check

The stability of the model is tested through Eigenvalue stability condition. Because one of the modulus lies above 1 at least one eigenvalue lies outside the circle. This can be shown in the root of the companion matrix. Since two plot lies outside the unit circle, PVAR does not satisfy the stability condition.

Table 7. Stability Check. Test of the stabilization of the model.

Eigenvalue	Real	Imaginary	Modulus
	1.027	-0.225	1.052
	1.027	0.225	1.052
	-0.034	-0.852	0.853
	-0.034	0.852	0.853
	-0.475	0	0.475
	-0.475	0	0.475
	-0.105	0.401	0.414
	-0.105	-0.401	0.414
	-0.286	-0.122	0.311
	-0.286	0.122	0.311

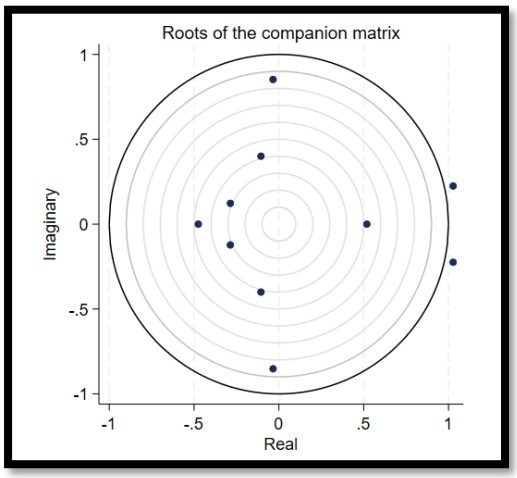

Figure 4. Roots of companion matrix. Test of the stabilization of the model.

5. Discussion

The study has examined whether governance, through supports, are an effective tool for increasing the share of young farmers in Swedish agriculture. The results from the analysis indicated that the support for young farmers has a positive effect on the share of young farmers in Sweden. Self-sufficiency needs to be strengthened due to the importance of domestic food production to create strong sufficiency in times of war and crisis (The Swedish Board of Agriculture 2025a). If Sweden were to move towards a development where the establishment of young farmers is lacking while the older generation gradually leaves the sector, issues arise regarding future food production. The share of young farmers has been declining in Sweden, and the EU. Currently, only 11 percent of the farmers in the EU are younger than 40 years old (Kerttu et al. 2024). In the absence of generation renewal, domestic production risks to be reduced.

The main results derived from this study are the significant relationship between the support for young farmers and the share of young farmers. The results are interpreted as "holding all other constant". The hypothesis was that a higher amount of support will increase the share of young farmers. This was confirmed in the analysis. The results from Table 5, Random-Effects GLS regression, indicate a significant result where one percentage change in support leads to an increase around 0.017 percentage point in the share of young farmers in beef production. Previous literature discussing how support for young farmers helps the young farmers, is two-parted. On the one hand, the support helps young farmers, yet on the other hand it only benefits those farmers with greater access to land (Westerberg et al. 2025). Given this, it would be necessary to design the support differently to help those with less access to land. This study, however, provides evidence suggesting that support may contribute to a higher level of young farmers. It could have been beneficious to include a variable for access to land too, but land price is used instead due to lack of data. The GLS regression indicates that a one percentage change in land price leads to a 0.019 percentage point reduce in the share of young farmers. It can be concluded through the impulse response graphs that one unit shock in support for young farmers will have a positive effect on the share of young farmers. Those results contradict what has been stated in the report by Westerberg et al. (2025) that there is no evidence that support attracts young farmers into the sector. Here it is worth mentioning the uncertainty about the unemployment rate, since it seems to be a factor that drives young people into the agricultural sector. The results of the GLS regression indicated that when youth unemployment rate increases by one unit, the share of young farmers increases by 0.87 percentage point.

This may indicate that the unemployment rate is a more important factor in driving young people to the agricultural sector rather than support targeted at young farmers. This will be further discussed in the next paragraph. Thus, Adamowicz and Szepluk (2016) concluded that the effects of support for young farmers are positive, which is in line with this study. Furthermore, Balazentis et al. (2020) concluded that the support for young farmers has a higher impact on small farmers, but this type of differentiation has not been done in this research. A possible reason for the results not being in line with the previous literature may be that support for young farmers is not enough alone to get young people established in the agricultural sector, although may be a prerequisite for having the opportunity to enter the market. Several previous research established that access to land is a barrier for young people to entry into agriculture (Jennersjö 2025; Zagatha & Sutherland 2015; Agricultural and Rural Development 2025). Here it is possible to discuss the results between land price and the share of young farmers. If the land price is high, it can possibly mean that it is harder to get access to land. Therefore, it is possible to discuss the results from the PVAR align with the literature since it indicates a significant negative relationship between changes in agricultural land price and the share of young farmers. From a generational renewal perspective, rising land prices may contribute to aging in agriculture by limiting young people to entry the sector.

As mentioned, another interesting finding of the GLS regression is the positive and significant effect of youth unemployment on the share of young farmers. This suggests that when labor market conditions are getting worse for young people, agriculture becomes more attractive and higher unemployment pushes youth into farming. Unemployment turns out to be a factor that drives young people to enter the agricultural sector. In previous research it highlights that the reasons behind the unwillingness to work in agriculture are often the youths' beliefs that the agricultural sector is not a career-driven sector (Girdzuite et al. 2022; Ross 2025). The tendency for young people to enter the agricultural sector during periods of labor market instability may reflect a lack of alternative employment opportunities rather than a real interest among young people to establish in agriculture. These kinds of results indicate that something needs to be done by policy makers to encourage young people to get established in the agricultural sector. Girdzuite et al. (2022) means that agriculture needs to be talked about as an innovative and technological development sector where it is possible for individuals to create their own businesses to get young people to enter the sector.

The impulse response graph indicates a positive relationship between support and beef production. The National Food Strategy 2.0 underscores the importance of domestic agriculture- and food production and food security to ensure preparedness in times of uncertainty and potential disruptions to international trade (Ministry of

Rural Affairs and Infrastructure 2025). Since the analysis indicated a positive association between the support and the level of domestic beef production, the support may be a suitable policy to reach the goals of NFS 2.0 and to increase domestic food production. Furthermore, results of this research established that the support for young farmers can contribute to generational renewal in beef production in Sweden. This effect is aligned with food policy objectives, such as NFS 2.0.

A relevant perspective to consider is the conflict between the importance of domestic production and preparedness, and the environmental impact of the agricultural sector. On the one hand beef production contributes to biodiversity and a rich species environment (The Swedish Board of Agriculture 2023b), on the other hand, beef is associated with the highest overall climate impact (WWF 2023). This study shows that the support for young farmers potentially can contribute to increasing the share of young people in the agricultural sector and have a positive effect on production which can help moving forward to a more sustainable agricultural production. Young farmers tend to be open-minded to innovation and modern techniques (Agriculture and Rural Development 2025) and can drive towards more sustainable agriculture. The possible driving force of young people, together with sustainable consumption, can make the impact of food production on the environment manageable.

The theoretical framework used in this research paper is Food System Sustainability House. Discussing the results through this framework can help the understanding of the impact of government interventions in food systems. Through this framework, it is possible to conclude that the government needs to achieve social goals which are in line with the results from this analysis, showing both positive relationship between the support and share of young farmers and the support and beef production. It could have been interesting to include the young farmers' perspective in this framework since it is an important part of the future sustainable food system and to ensure food production in the future as well.

The research is not without any limitations. The analysis covers data from the year 2016 to 2024. To do a more comprehensive analysis it would have been beneficial to use a wider time span which would open for a Before-And-After analysis of the support. Furthermore, the support may interact with other factors not included in the model, such as access to education. The model also has problems with instability, since two of the plots were outside the circle. This means that the impulse response results are not entirely reliable. If more time had been available, a Vector Error Correction Model (VECM) could have been tested instead.

Recommendations for policy implications, given the positive relationship between financial support and the share of young farmers, policy makers should expand support targeted young farmers. Given the positive link between youth unemployment and entry into agriculture, policy should focus on making agriculture an attractive work opportunity through education and innovation. The agriculture sector needs to be presented as an important and attractive sector to increase the willingness among young people to get established.

Another potential limitation of the analysis is the risk of spurious correlation between the level of support for young farmers and their share in the farming population. This refers to a situation where two variables appear to be related, but the relationship is driven by a third, unobserved factor or by parallel time trends. For example, both variables could be influenced by agricultural policies, demographic shifts or economic conditions that are accounted for in the model. If this is the case, the results may overstate the causal impact of support policies.

6. Conclusion

To summarize, this study has investigated the effect of support on the share of young farmers engaging in beef production in Sweden. Due to the significance of the results of support it can be concluded that a higher amount of support will have a positive effect on young people entering the beef production sector. The findings in this research paper underscore the importance of policy support for young farmers to enhance the stability of future food production and resilience in periods of war and crisis, but also in stable times. Targeted support for young farmers can play a role in generational renewal. However, the findings also point out structural barriers, such as land prices and the youth unemployment rate, that influence young people entering the sector.

There is much potential for development in this study. Future research could usefully explore regional differences within Sweden to complement the findings on this study, with particular attention to potential differences between the southern, middle and northern part of Sweden. It could also be interesting to make a comparison between how support for young farmers affects small farmers compared to larger farmers. The future of agriculture and the lack of young farmers is a well-discussed topic with much potential for future studies.

Appendix

The appendix includes additional parts of the PVAR results that are not discussed in detail in the main results section. Although not central to the analysis, they are presented here for the sake of transparency and to provide a complete overview of the model. For the sake of transparency and completeness, the appendix includes full estimation results from the PVAR model for all dependent variables. Each table includes estimated coefficients, standard errors, and p-values for the lagged regressors. As only the most relevant findings are discussed in the results section, the remaining output is made available here without further interpretation.

Table 8. Panel Vector Autoregression, Panel A1. The short-run relations between the dependent variable, support for young farmers, and the explanatory variables.

Variable	Coefficient	Std.err	P>|z|
Dependent variable: Support for young farmers (lnsupport)			
Share of young farmers (share_YF)			
L1	4.591**	2.165	0.034
L2	2.358	2.068	0.254
Support for young farmers (lnsupport)			
L1	0.610***	0.195	0.002
L2	0.046	0.180	0.796
Beef production (lnbeefprod)			
L1	1.630	2.113	0.441
L2	0.829	1.530	0.588
Land price (D_lnlandprice)			
L1	0.100	0.283	0.722
L2	-0.292	0.301	0.332
Youth unemployment (D_unemp)			
L1	-20.960***	4.33	0.000
L2	-15.124***	5.688	0.008

Instruments: Lagged (1/2). (share_YF lnbeefprod lnsupport)

*significant at 10% level **significant at 5% level ***significant at 1% level

Table 9. Panel Vector Autoregression, Panel A2. The short-run relations between the dependent variable, beef production, and the explanatory variables.

Variable	Coefficient	Std.err	P>|z|
Dependent variable: Beef production (lnbeefprod)			
Share of young farmers (share_YF)			
L1	-0.086	0.266	0.747
L2	0.086	0.218	0.692
Support for young farmers (lnsupport)			
L1	-0.010	0.020	0.613
L2	-0.008	0.021	0.687
Beef production (lnbeefprod)			
L1	0.298	0.309	0.335
L2	0.234	0.163	0.150
Land price (D_lnlandprice)			
L1	0.034	0.029	0.244
L2	0.040	0.033	0.218
Youth unemployment (D_unemp)			
L1	-0.002	0.798	0.998
L2	-1.212*	0.625	0.052

Instruments: Lagged (1/2). (share_YF lnbeefprod lnsupport)

*significant at 10% level **significant at 5% level ***significant at 1% level

Table 10. Panel Vector Autoregression, Panel A3. The short-run relations between the dependent variable, land price, and the explanatory variables.

Variable	Coefficient	Std.err	P>|z|
Dependent variable: Land price (D_lnlandprice)			
Share of young farmers (share_YF)			
L1	-0.0331	0.822	0.687
L2	-0.172	0.599	0.774
Support for young farmers (lnsupport)			
L1	0.028	0.066	0.675
L2	-0.026	0.076	0.736
Beef production (lnbeefprod)			
L1	-0.007	1.057	0.995
L2	0.699	0.531	0.187
Land price (D_lnlandprice)			
L1	-0.362***	0.109	0.001
L2	-0.112	0.138	0.414
Youth unemployment (D_unemp)			
L1	0.241	1.955	0.902
L2	2.145	2.282	0.347

Instruments: Lagged (1/2). (share_YF lnbeefprod lnsupport)

*significant at 10% level **significant at 5% level ***significant at 1% level

Table 11. Panel Vector Autoregression, Panel A4. The short-run relations between the dependent variable, youth unemployment, and the explanatory variables.

Variable	Coefficient	Std.err	P>|z|
Dependent variable: Youth unemployment (D_unemp)			
Share of young farmers (share_YF)			
L1	-0.076*	0.041	0.064
L2	-0.021	0.031	0.497
Support for young farmers (lnsupport)			
L1	-0.003	0.0034	0.432
L2	-0.007*	0.004	0.062
Beef production (lnbeefprod)			
L1	-0.040	0.039	0.302
L2	0.015	0.031	0.626
Land price (D_lnlandprice)			
L1	-0.013**	0.006	0.040
L2	0.004	0.005	0.440
Youth unemployment (D_unemp)			
L1	0.119	0.099	0.231
L2	-0.562***	0.101	0.000

Instruments: Lagged (1/2). (share_YF lnbeefprod lnsupport)

*significant at 10% level **significant at 5% level ***significant at 1% level

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