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# The impact of governance on agricultural production as an exclusive factor of the country's food security

**Gelena Pruntseva[a], Nazariy Popadynets[b*], Marta Barna[c], Ihor Stetsiv[d], Iryna Stetsiv[e], Valentyna Yakubiv[f], Lyudmila Shymanovska-Dianych[g], Yana Fedotova[h], Maria Karpiak[b] and Iryna Hryhoruk[f]**

[a]*National Scientific Centre "Institute of agrarian economy", Ukraine*
[b]*SI "Institute of Regional Research named after M. I. Dolishniy of the NAS of Ukraine", Ukraine*
[c]*Lviv University of Trade and Economics, Ukraine*
[d]*Lviv State University of Life Safety, Ukraine*
[e]*Lviv Polytechnic National University, Ukraine*
[f]*Vasyl Stefanyk Precarpathian National University, Ukraine*
[g]*Poltava University of Economics and Trade, Ukraine*
[h]*Military Institute of Taras Shevchenko National University of Kyiv, Ukraine*

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**A B S T R A C T**

The agricultural production, due to the specificity of the functioning of the agricultural industry, is influenced by factors that have significant impacts on agricultural enterprises and determine the importance of state support. The unpredictable factors of agrarian production such as weather, natural disaster, and epidemics increase the risks of agricultural business. That is why farmers need to attract investments. But some farmers do not attract investment because of government subsidies. Besides, using government subsidies could have a negative impact on agrarian business. So, it is necessary to establish the effectiveness of governance for agricultural production and food security in general.



## 1. Introduction

An important factor in maintaining food security is ensuring a high level of agricultural production, which is able to provide the population of the country with food in quantity and sufficient quality for an active and healthy lifestyle. The growth of agricultural production is impossible without investment. At a time when farmers, entrepreneurs, and companies are increasingly rising to the growing demand for more transparent, organic, and locally sourced food, investors have a critical role to play in financing stronger links across local, regional, and global agriculture value chains (Lang et al., 2017). Investors in sustainable food systems are faced with the traditional challenges impact investing, which include a vast array of investment options across asset classes, impact areas, and return profiles, as well as lack of deal flow and a limited track record (Pons et al., 2013). At the

* Corresponding author.
E-mail address: popadynets.n@gmail.com (N. Popadynets)


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same time, according to some scholars, a significant amount of foreign investment increases the dependence of the national economy on foreign investors. This can have a negative impact on food security in times of economic shocks and other crises. It is important to note that agricultural production, due to the specificity of the functioning of the agricultural industry, is influenced by factors that have a significant impact on agricultural enterprises and determine the importance of state support. According to the scholars, some agrarian enterprises do not attract investment because of the possibility of grants and subsidies.

## 2. Literature review

In a globalized world where instability does not respect borders, nontraditional security threats such as food insecurity are poised to play a more central role in global crises. Globally, hunger is on the rise for the first time in over a decade. Right now, 815 million people worldwide — 1 in 9 — will go to bed hungry tonight (Leach & Sova, 2018). The achievement of food security and the eradication of rural poverty is the main goal of the Agenda for Sustainable Development for the period until 2030, and food and agriculture are key elements of the 17 Sustainable Development Goals. Given that global food production needs to be increased by 60% by 2050, investment in food and agriculture is essential to ensure food security. Investment in food and agriculture is also needed to achieve sustainable food security and poverty, while addressing climate issues, preserving natural resources, and facilitating the transition to sustainable production systems (Dankova, 2016). Responsible investment in agriculture and food systems is essential for enhancing food security and nutrition and supporting the progressive realization of the right to adequate food in the context of national food security. The responsible investment makes a significant contribution to enhancing sustainable livelihoods, in particular for smallholders, and members of marginalized and vulnerable groups, creating decent work for all agricultural and food workers, eradicating poverty, fostering social and gender equality, eliminating the worst forms of child labor, promoting social participation and inclusiveness, increasing economic growth, and therefore achieving sustainable development (CFS, 2014). As interest in sustainable food systems and agricultural value chains grows, increasing numbers of investors are beginning to explore high-impact investing opportunities in food, farming, and forestry across asset classes. According to the Global Impact Investing Network's most recent survey of leading impact investors, the largest number of respondents – 63 percent – reported allocating to food and agriculture, more than any other sector. Impact opportunities in sustainable agriculture now extend from real estate investments in sustainably managed farmland and forests to debt investments in farms, cooperatives, and food enterprises, to equity investments – both private and public – in healthy food companies, retailers, and agricultural technologies focused on the efficient use of energy, inputs, and natural resources (Lang et al., 2017; Irtyshcheva et al., 2020). Scale in agribusiness is attained by intensive use of land, water, fossil fuels, pesticides, herbicides, antibiotics, and genetic technology. Such practices reduce the quality of the product; increase the health risks of the consumers, the farmworkers, and the environment; contribute to ecological destruction; and breed wealth inequality. In addition to that, agricultural subsidies have been lasting repercussions on global trade, making it impossible for unregulated countries to bring their products to the market place. The unpredictable aspects of the food system outlined above – weather, agribusiness, policy, consumer behavior – increase the perception of risk and deter impact investors, who instead choose more established impact investment areas – clean energy, green real estate and other conservation economy opportunities (Pons et al., 2013; Yakubiv, 2015; Irtyshcheva et al., 2015). International investments in agriculture have the potential to offer a broad range of social, economic, and environmental impacts. As a development tool, they can create jobs; provide rural infrastructure; connect smallholders to global markets; introduce new productivity-enhancing technologies; and improve access to finance for farmers. However, close partnerships between international investors and national governments are key to ensure that new outside funds sources do not distort local markets or leave local producers and smallholders at a disadvantage (Darby et al., 2018; Kalashnikova et al., 2019). Public investments to improve food security can be placed into five broad categories: social safety nets, such as food stamps and cash transfers, support to farmers, through fertilizers and seeds, research &development, and extensions services, rural development, such as electricity, education, and storage, enabling policies, and nutrition (Bizikova et al., 2017; Panukhnyk et al., 2019). Government investments (subsidies) harm the economy. In most industries, market signals steer investment, businesses balance risks and rewards, and entrepreneurs innovate to reduce costs. Federal programs blunt those market mechanisms in agriculture, causing a range of economic harms, including overproduction, distorted land use, distorted choice of crops, and inadequate cost control (Edwards, 2018; Irtyshcheva et al., 2020). Saving and borrowing are basic financial tools available to all businesses. There are other market-based tools that farmers can use, including insurance and various price hedging products such as futures and options. The existence of farm subsidy programs has replaced or crowded out, greater use of such market-based financial tools (Wright, 2016; Kolomiyets, Popadynets, 2016). The territorial organization of investment activity in agriculture and food industry provides for placement of investments in fixed capital and foreign direct investment in agriculture and food industry, taking into account the investment climate in the state and investment attractiveness in the region; scientifically grounded territorial regulation of investment activity in agro-food production; optimization of the influence of investment activity in agriculture and food industry on the socio-economic development of the territory (Mezentseva & Moroz, 2011). The impact of foreign direct investment on the food security is realized through improving the efficiency of agricultural development, accelerating foreign economic activity in the agricultural sector, improving the level of agricultural production, guaranteeing a balanced quality consumption of the population, provision of affordable and quality consumer goods to the population by forming the required level of income (Markevich, 2017; Shults et al., 2017).

At the same time, international investments can create negative outcomes when not carefully implemented with local input. Some large-scale investment models have raised issues of human rights violations, environmental degradation, and market distortions. In some cases, large-scale, land-based investments that require relocation of people have displaced people and disrupted local value chains. Cultural disruptions are also possible, as unhealthy food consumption patterns, such as higher consumption of processed foods that are less nutritious than traditional diets, may be adopted in developing countries (Darby et al, 2018). With increasing FDI inflows into the country increases dependence on grain imports in the long run, and this effect can be regarded as negative, as the deteriorating food security (Kopnova & Rodionova, 2017). Sometimes expansion of TNCs of developed countries can lead to the absorption of domestic enterprises and monopolization by foreign firms of local food markets (Markevich, 2014; Vasyltsiv et al., 2020).

The main aim of the article is to analyze the impact of governance, in particular government investment, on agricultural production as a component of the country's food security mechanism.

## 3. Materials and Methods

The characteristics of agricultural investment were chosen as “Government expenditure” and “Credit to agricultural, forestry, fishing”. Data presented on government expenditure refers to Core Areas of Government Functions Relevant to the Agriculture Sector based on the Classification of Functions of Government (COFOG). It includes the data of agriculture, forestry and fishing. The research will allow us to find out the impact of the main indicators of investments on the agricultural production. The data for EU countries with the period from 2007 to 2017 were used in the analysis. The indicator “Government expenditure” is available in Food and Agricultural Organization of the United Nations (FAO) from 2007. The indicator “Credit to agricultural, forestry, fishing” is also extracted from FAO. Agricultural output (production value at basic price) is available in Eurostat.

In the study, we will use the Method of Least Squares. The dependent variable (Y) is the index “Agricultural output”. The explanatory variables are “Government expenditure” (X1) and Credit to agricultural, forestry, fishing (X2).

The Method of Least Squares is a procedure to determine the best fit line to data; the proof uses simple calculus and linear algebra (Miller, 2006). The method generalizes to finding the best form

$$Y = b_0 + b_1 \cdot X \quad (1)$$

But for any specific observation, the actual value of Y can deviate from the predicted value. The deviations between the actual and predicted values are called *errors*, or *residuals* (JMP, 2020).

The better the line fits the data, the smaller the residuals (on average). How do we find the line that best fits the data? In other words, how do we determine the values of the intercept and slope for our regression line? Intuitively, if we were to manually fit a line to our data, we would try to find a line that minimizes the model errors, overall. But, when we fit a line through data, some of the errors will be positive and some will be negative. In other words, some of the actual values will be larger than their predicted value (they will fall above the line), and some of the actual values will be less than their predicted values (they will fall below the line) (JMP, 2020). There are two basic categories of least-squares problems:

- Ordinary or linear least squares
- Nonlinear least squares

These depend on linearity or nonlinearity of the residuals. The linear problems are often seen in regression analysis in statistics. On the other hand, the non-linear problems generally used in the iterative method of refinement in which the model is approximated to the linear one with each iteration (BYJU’S, 2020). ARCH Model was used for checking heteroskedasticity. The ARCH or Autoregressive Conditional Heteroskedasticity method provides a way to model a change in variance in a time series that is time dependent, such as increasing or decreasing volatility (Brownlee, 2018). The ARCH model assumes that the conditional mean of the error term in a time series model is constant (zero), unlike the nonstationary series we have discussed so far), but its conditional variance is not. Such a model can be described as in Eqs. (2-4).

$$y_t = \phi + e_t \quad (2)$$

$$e_t | I_{t-1} \sim N(0, h_t) \quad (3)$$

$$h_t = \alpha_0 + \alpha_1 e^2_{t-1}, \ \alpha_0 > 0, \ 0 \leq \alpha_1 < 1 \quad (4)$$

The null hypothesis is that there are no ARCH effects (Colonescu, 2016).

## 4. Results and discussion

We created a model using the Eviews program and studied the correlation between the variables. Next step was to form a correlation matrix. The correlation matrix is shown in Table 1.

**Table 1**
Correlation matrix

| | Y | X1 | X2 |
|---|---|---|---|
| Y | 1 | -0.427149 | 0.775354 |
| X1 | -0.427149 | 1 | -0.172045 |
| X2 | 0.775354 | -0.172045 | 1 |

**Source:** own research

As we can see, the indicator "Y" has a close direct correlation with variable indicator "X2" (0,775354). This means that Credit to agricultural, forestry, fishing has a significant effect on the Agricultural output. However, there is an inverse relationship between Y and X1, the value of which is "-0.427149". This means that the "Government expenditure" has a slight inverse relationship with the production value at basic price. This can be explained by the existing theory regarding the absence of positive effects in case of state financing of agriculture. The relationship between the explained variables (X1 and X2) is low (-0.1720), which indicates the absence of multicollinearity. A multivariate regression model was created and the coefficients of the regression equation were calculated.

$$Y = \beta_0 + \beta_1 \cdot X1 + \beta_2 \cdot X2 \quad (5)$$

The results of regression are shown in Table 2.

**Table 2**
The results of regression (Dependent Variable: Y)

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| X1 | -0.171998 | 0.113523 | -1.515093 | 0.1682 |
| X2 | 0.382924 | 0.105780 | 3.620010 | 0.0068 |
| C | 238439.3 | 67708.03 | 3.521581 | 0.0078 |
| R-squared | 0.690097 | Mean dependent var | | 383511.5 |
| Adjusted R-squared | 0.612621 | S.D. dependent var | | 27754.66 |
| S.E. of regression | 17274.44 | Akaike info criterion | | 22.57884 |
| Sum squared resid | 2.39E+09 | Schwarz criterion | | 22.68736 |
| Log likelihood | -121.1836 | Hannan-Quinn criter. | | 22.51044 |
| F-statistic | 8.907248 | Durbin-Watson stat | | 1.515336 |
| Prob(F-statistic) | 0.009224 | | | |

**Source:** own research

As we can see in the table, R-squared = 0.690097. This means that Y is 69% dependent on variables X1 and X2.

Our multifactor model has the following form:

$Y = 238439.3 – 0.171998X1 + 0.382924X2$

The coefficients of the equation show the quantitative effect of each variables on the dependent indicator. The results obtained mean that "Agricultural output" is reduced by 0.171998 mln Euro with an increase in Government expenditure by 1 mln Euro at a constant level of Credit to agricultural, forestry, fishing. Secondly, the "Agricultural output" is increased by 0,382924 mln Euro with an increase in the Credit to agricultural, forestry, fishing by 1 mln Euro at a constant level of Government expenditure. The data for the presence of autocorrelation were checked.

For these analyses, the indicator of the Durbin-Watson (DW) was taken from the Table 2:

DW=1.515336

According to the Durbin-Watson table with m = 2, we determined the critical points for the significance level of 0,01 and the number of observations n = 10: $d_1 = 0.466$ and $d_2 = 1.333$. The following results were obtained:

$d_1 < DW$, $0.466 < 1.515336$

$d_2 < DW < 4 - d_2$, $1.333 < 1.515336 < 2.667$

To confirm the absence of autocorrelation, we create a graphical model given in Fig. 1.

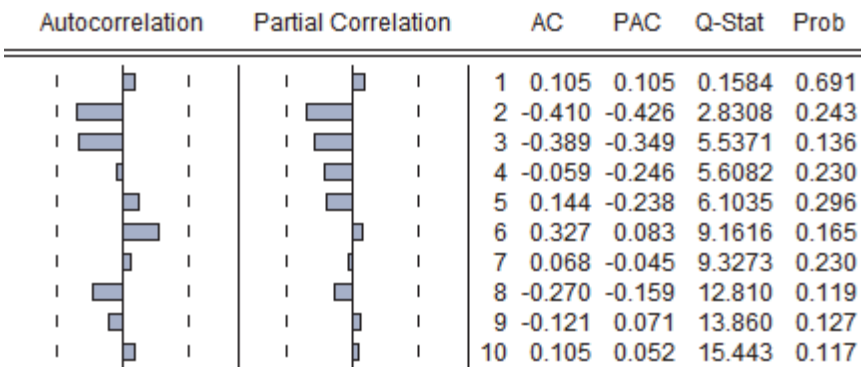


**Fig. 1.** Graphical model

**Table 3**
Heteroskedasticity Test

| Heteroskedasticity Test: ARCH | | | | |
|---|---|---|---|---|
| F-statistic | 0.108407 | Prob. F(2,6) | | 0.8990 |
| Obs*R-squared | 0.313880 | Prob. Chi-Square(2) | | 0.8548 |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C | 2.91E+08 | 1.63E+08 | 1.786029 | 0.1243 |
| RESID^2(-1) | -0.200160 | 0.431109 | -0.464290 | 0.6588 |
| RESID^2(-2) | -0.021195 | 0.429308 | -0.049371 | 0.9622 |
| R-squared | 0.034876 | Mean dependent var | | 2.48E+08 |
| Adjusted R-squared | -0.286833 | S.D. dependent var | | 2.79E+08 |
| S.E. of regression | 3.16E+08 | Akaike info criterion | | 42.24268 |
| Sum squared resid | 6.00E+17 | Schwarz criterion | | 42.30842 |
| Log likelihood | -187.0921 | Hannan-Quinn criter. | | 42.10081 |
| F-statistic | 0.108407 | Durbin-Watson stat | | 0.928071 |
| Prob(F-statistic) | 0.898980 | | | |

In the graphical model, we can see that all values are in the boundary limits of autocorrelation. The results were checked for heteroskedasticity. For these purposes the ARCH test was used. The results obtained of ARCH test are presented in Table 3. Based on the data obtained, we can make conclusion that there is no heteroskedasticity in our model. This is also the confirmation of the high quality of the model.

## 5. Conclusion

As a result of the analysis, it can be concluded that for the development of agriculture and increase the volume of agricultural production, as an element of the food security system, the volume of credits is important. At the same time, there is no positive impact of government expenditure on agricultural production. This may be due to the existing theory that there is no positive impact of public funding on the efficiency of farm activity through blocking market mechanisms, inefficient land use, overproduction, and inappropriate choice of crops for cultivation. The lack of positive impact of public investment on agricultural production may also be due to insufficient effectiveness of existing state support programs, in particular the focus of programs on large agricultural enterprises, lack of access of small and medium agricultural producers to investment resources, underfunding and under fulfillment of state programs. Therefore, to ensure the development of agricultural production, it is important to create an effective investment infrastructure that should increase credits in agriculture and improve existing mechanisms of state support for agricultural enterprises, which should facilitate free access of small and medium agricultural producers to existing programs.

Future work will explore whether government programs could be efficient for small enterprises or farmers.

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