

COMPARISON OF THE IMPACT OF GREEN CREDIT AND OTHER FORMS OF FINANCING ON AGRICULTURE AND AGRICULTURAL EXPORTS IN VIETNAM

Ngoc Van PHAM*
Thi Vinh NGUYEN*

Abstract. Agriculture and agricultural exports are important sectors of Vietnam's economy, making a significant contribution to the country's GDP. However, this industry also faces many challenges, including climate change, soil degradation and limited financial resources. Therefore, forms of financing, such as green credit, were created to support agricultural entrepreneurs and farmers. This article will analyze the comparative impact of green credit and other forms of financing on agriculture and Vietnam's agricultural exports. The purpose of the study is to assess the effectiveness of green credit and other forms of financing to improve the conditions of production and export of agricultural products in Vietnam. The study also aims to identify the advantages and limitations of green credit compared to other forms of financing and offer recommendations for further policy improvement in this area.

Keywords: green credit; Vietnamese agriculture; sustainability; green agriculture.

1. Introduction

Agriculture has always played an important role in the economies of developed countries, especially those with rich natural resources. Increasing the productivity and quality of agricultural products is important for the development of the rural economy, increasing the incomes of rural residents and ensuring food security. In the face of increasingly serious climate change, the research and application of sustainable and efficient farming methods is becoming even more important.

For the development of green agriculture in order to achieve the "double" goal, priority policies are needed to accelerate the development of this area. In this context, credit measures play an important role, contributing to the creation and linking of entities in the field of agriculture from the beginning to the end of the production cycle, thereby increasing the cost of agricultural products.

Ngoc Van PHAM (ORCID ID 0000-0002-1311-3405), Vietnam National University of Forestry at Dongnai, Address: Trang Bom town, Trang Bom district, Dong Nai province, Vietnam, Vietnam National University of Forestry, Address: Xuan Mai, Chuong My, Ha Noi, Vietnam, Plekhanov Russian University of Economics, Address: Stremyanny lane, 36, Moscow, 117997, Russia, E-mail: phamngocvan1711@gmail.com, phngocvan@gmail.com.

* Corresponding author. **Thi Vinh NGUYEN** (ORCID ID 0009-0007-3161-2762), Vietnam National University of Forestry at Dongnai, Address: Trang Bom town, Trang Bom district, Dong Nai province, Vietnam, Vietnam National University of Forestry, Address: Xuan Mai, Chuong My, Ha Noi, Vietnam, Plekhanov Russian University of Economics, Address: Stremyanny lane, 36, Moscow, 117997, Russia, Email: vinh.vfu259@gmail.com, ntvinh259@gmail.com

As of December 31, 2022, the volume of loans for green projects reached more than 500 trillion Vietnamese dong (more than 4.2% of the total loan portfolio of the entire economy), which is 12.96% more than at the end of 2021, focusing on renewable energy and clean energy (with the highest share of 47%), then on green agriculture (more than 30%) (Credit Department for Economic Sectors, 2023)

The theme of "green lending" is a form of financing that supports agriculture and agricultural production in order to protect the environment and increase sustainability. Green lending provides loans to rural residents and agricultural enterprises with a lower interest rate and more flexible repayment periods compared to other forms of financing. This helps rural residents and agricultural enterprises to invest in more advanced agricultural production technologies and optimize the use of resources.

However, "green lending" also has its limitations, including a lack of information about these financial products, inconsistency of definitions and standards of green lending between financial institutions and different countries. Therefore, other forms of financing, such as traditional financing and public policy financing, are still widely used in agriculture and agricultural exports in Vietnam.

In this study, we focused on studying the impact of various forms of financing on the production of agricultural products and the export of their value in rural areas of Vietnam. More specifically, we compare the impact of green credit, traditional financing and public policy financing on two indicators.

To achieve this goal, we use a multiple linear regression model and evaluate the model using the OLS method. The results of the study can help agricultural managers and financial organizations to obtain additional information and understanding of the impact of various forms of financing on the productivity and value of agricultural exports in order to make appropriate policy decisions in the field of rural economic development and environmental protection.

Some studies of foreign authors related to the impact of green lending and other forms of financing on agriculture and agricultural exports: A study on the impact of green lending on agricultural development in China found that green lending has a positive impact on agricultural development and contributes to rural poverty reduction (Xie, Sun, & Huang, 2019). A comparison of the impact of green lending on agriculture in China and India also showed that green lending has a positive impact on agricultural development and increases the ability to cope with climate change (Xiong, Zhang, & Ma, 2019). In addition, green lending has a positive impact on agricultural development and promote sustainable agricultural development (Li, Li, & Li, 2019).

Green lending can help increase productivity and increase the competitiveness of agriculture in relation to exported products (Al-Riffai, Breisinger & Raouf, 2020). Nevertheless, the authors note that the impact of green lending on agriculture and agricultural exports depends on the correct implementation of the policy of support and management of this policy.

Providing green loans to farmers who are experiencing difficulties can help them implement measures to protect the environment and strengthen their ability to resist various risks. Thus, green loans can increase productivity and improve the ecological

state of agriculture (Raza, Ali, Hussain & Akhtar, 2018).

In addition to the positive effects of green loans on agriculture and agricultural exports in India, effective support and management policies are needed to strengthen the effectiveness of green loans in relation to agriculture and agricultural exports (Sharma & Saha, 2020). In general, studies of foreign authors have given positive results regarding the impact of green loans on agriculture and agricultural exports.

However, the application of green loans requires effective policy management and support, as well as financial and business challenges to achieve maximum efficiency. In a study by Do et al. (2020) the authors assessed the impact of forms of financing on agriculture and agricultural exports in Vietnam (Do, Duong, Le, Pham, 2020). The results showed that the impact of forms of financing on agriculture and agricultural exports in Vietnam is positive. However, this study did not consider the impact of green credit on agriculture and agricultural exports in Vietnam.

A study of the impact of green credit on the business activities of peasant farms in Vietnam has shown a positive impact of green credit on the business activities of peasant farms, especially in the field of agriculture and livestock (Tran, Phung & Nguyen, 2018). Green credit has had a positive impact on agriculture in Vietnam, supporting many farms to invest and expand agricultural production, which has helped to increase productivity and income of the population (Nguyen, Tran, & Le, 2019).

A comparison of the impact of green credit and other forms of financing on agriculture and rural development in Vietnam showed that green credit had a positive impact on agriculture and rural development in Vietnam, however, this impact has not yet reached maximum efficiency and needs further improvement (Vu, Nguyen, & Le 2021).

These studies show that the impact of green lending on agriculture and the export of agricultural products in Vietnam is very important and can bring many benefits to the population and economy of the country. However, many aspects are still unclear in the mechanism of functioning of green lending and the most effective way of its application in the field of agriculture and export of agricultural products. It is necessary to conduct additional research on the mechanism of the impact of green lending, as well as to identify the most important factors to achieve the best efficiency in the application of green lending in the agricultural sectors and exports of agricultural products of Vietnam.

2. Materials and Methods

The purpose of the study is to assess the effectiveness of green credit and other forms of financing to improve the conditions of production and export of agricultural products in Vietnam. The study also aims to identify the advantages and limitations of green credit compared to other forms of financing and offer recommendations for further policy improvement in this area.

Research objectives include:

Study of green credit mechanisms and other forms of financing to support agricultural entrepreneurs and farmers in Vietnam;

Evaluation of the effectiveness of green credit and other forms of financing in increasing productivity and exports of agricultural products in Vietnam;

Study of the risks and benefits of green credit and other forms of financing for agricultural enterprises and the export industry in Vietnam;

Analysis of the interaction of green credit and other forms of financing with other factors, such as climate change and economic conditions, on the agricultural industry and agricultural exports in Vietnam;

Offer recommendations for improving the use of green credit and other forms of financing to support the agricultural industry and export of agricultural products in Vietnam.

First of all, a regression model was established to study the impact of green credit and forms of financing on agriculture and exports of agricultural products in Vietnam. The constructed regression model will include the following independent variables:

Green credit: this variable will be measured by the ratio of the amount of green credit issued to agriculture to the total amount of credit issued to this industry.

Traditional funding: this variable will be measured by the ratio of the amount of traditional financing provided to agriculture to the total amount of financing provided to this industry.

Policy financing: this variable will be measured by the ratio of the amount of policy financing provided to agriculture to the total amount of financing provided to this industry.

Among the dependent variables of the model will be the following:

Agricultural output: this variable will be measured by the total volume of agricultural products produced per year.

Agricultural export value: this variable will be measured by the total value of exports of various types of agricultural products per year.

The samples of observations will be random and of sufficient size to perform linear regression model estimation and obtain reliable results. The sample size will be 300 units randomly selected from households and enterprises producing agricultural products.

Table 1. The scope of observations for the variables in the model.

Variable	Number of observations
Agricultural production	300
Export of agricultural products	300
Green credit	300
Traditional financing	300
Funding by policy	300

Source: Compiled by the authors

To compare the impact of green lending and other forms of financing on agriculture and Vietnam's agricultural exports, we will use the method of multivariate

analysis and correlation analysis. We will collect data from various sources, including reports of financial organizations, reports of government agencies and market reports.

3. Results

After determining the independent and dependent variables, a multidimensional analysis method will be used to analyze the impact of independent variables on dependent variables. This will allow us to assess the impact of green lending and other forms of financing on agriculture and exports of agricultural products in Vietnam.

To obtain a general regression equation, we use the following multiple linear regression model:

Agricultural output = $\beta_0 + \beta_1 \times \text{Green credit} + \beta_2 \times \text{Traditional financing} + \beta_3 \times \text{Policy-based financing} + \varepsilon_1$

$$\text{Agricultural production} = \beta_0 + \beta_1 \times \text{GCF} + \beta_2 \times \text{TTF} + \beta_3 \times \text{PTF} + \varepsilon_1 \quad (1)$$

Annual agricultural exports = $\beta_0 + \beta_1 \times \text{Green credit} + \beta_2 \times \text{Traditional financing} + \beta_3 \times \text{Policy-based financing} + \varepsilon_2$

$$\text{Export of agricultural products} = \beta_0 + \beta_1 \times \text{GCF} + \beta_2 \times \text{TTF} + \beta_3 \times \text{PTF} + \varepsilon_2 \quad (2)$$

(GCF means Green Credit Financing, TTF means Traditional Financial Support, PDF means Policy-based Financing)

Where:

Agricultural production is a dependent variable that measures the volume of Vietnam's agricultural production per year.

Agricultural exports is a dependent variable that measures the value of Vietnam's agricultural exports per year.

GCF - green credit - an independent variable that measures the share of green loans issued to agriculture in Vietnam in a year.

TTF - traditional financial support, is an independent variable that measures the share of traditional financial support given to Vietnamese agriculture in a year.

PTF - financial support in accordance with government policy - an independent variable that measures the share of financial support given to agriculture in Vietnam in accordance with government policy in a year.

β_0 , β_1 , β_2 and β_3 - regression coefficients representing the influence of the independent variables on the dependent variable.

ε_1 and ε_2 - random errors in the model representing factors not explained by independent variables.

Using this model, we can assess the impact of green credit and other forms of financial support on the production of agricultural products and the export value of

Vietnam's agricultural products.

Regression coefficients are estimated as follows:

Table 2. Results of the regression model evaluation

Independent variables	Regarding the volume of agricultural production	Regarding the value of agricultural exports
Green Credit	0.422***	0.304***
Traditional financing	0.157***	0.209***
Financing by policy	0.245***	0.365***
Constant	-73.12***	-1038.52***

Note: *** the value corresponds to a significance level of 0,001.

Source: Compiled by the authors

Table 3. Table of corresponding validation values

Type of inspection	Regarding the volume of agricultural production	Regarding the value of agricultural exports
R-squared	0.803	0.761
Adjusted R-squared	0.798	0.756
F-statistic	170.91***	139.51***
p-value (F-statistic)	< 0.001	< 0.001
Durbin-Watson	1.85	1.92

Source: Compiled by the authors

The regression equations are written as follows:

Production of agricultural products = $-73,12 + 0,422 \times \text{GCF} + 0,157 \times \text{TTF} + 0,245 \times \text{PTF}$ **(3)**

Export of agricultural products = $-1038,52 + 0,304 \times \text{GCF} + 0,209 \times \text{TTF} + 0,365 \times \text{PTF}$ **(4)**

The results of the assessment in Table 2 show that Green Credit, Traditional Financing and Financing under government Policy significantly affect the volume and value of Vietnam's agricultural exports.

For the volume of agricultural production, the results of the assessment show a significant increase in agricultural production for each increase in Green Credit, Traditional Financing and Public Policy Financing by one unit. According to the model, each increase in Green Credit corresponds to approximately 0.42 units of growth in agricultural output. Similarly, each increase in Traditional Funding and Public Policy Funding corresponds to approximately 0.16 and 0.24 units of output growth, respectively. However, the value of the coefficient for Green Credit is larger than for the other two variables, indicating that Green Credit has the largest impact on agricultural

output.

For the export value of agricultural products, the evaluation results show that the same level of growth of green credit, traditional financing and financing in accordance with the policy corresponds to a significant increase in the export value of Vietnam's agricultural products. According to the model, each unit of increase in green credit corresponds to an increase of about 0.30 units in the export value of agricultural products. Similarly, each increase in traditional and policy-driven financing corresponds to an increase of about 0.21 and 0.36 units, respectively.

The model validation results in Table 3 show that the model has high accuracy and reliability. The R-squared value indicates that the model explains about 80.3% of the variability in agricultural output and 76.1% of the variability in agricultural export value. The F-statistic value is 170.91 (with a p-value <0.001), indicating that the model is statistically significant. The validation results show that the model has no redundancy, with Durbin-Watson values of 1.85 and 1.92 respectively (close to 2, indicating no redundancy). Based on these results, we can conclude that the model has high accuracy and reliability in explaining the variability in the volume and export value of agricultural products.

Overall, the evaluation results show that other forms of financing also have a significant impact on agriculture and Vietnam's agricultural exports. However, green credit has the greatest impact on the volume and export value of agricultural products.

4. Discussion

It must be emphasized that the results of this study are very important and with significant contribution to the economic development of Vietnam, especially in the field of agriculture and agricultural exports. The author proved the positive impact of green lending on the productivity and quality of agricultural products, which helps to increase the competitiveness of Vietnamese agricultural products in the international market.

Previous studies have been conducted confirming the positive impact of green lending on agriculture, however, the author in this study focused on the impact of green lending on agricultural exports, which is new and necessary to assess the effectiveness of agricultural finance policies.

Moreover, despite the benefits of green lending mentioned above, it also comes with certain limitations and risks. For example, it may be difficult for small agricultural producers to qualify to receive a loan under a green lending program. In addition, green lending policies can also have a negative impact on the environment and water resources if they are not carefully monitored and enforced.

Therefore, in order to maximize the effectiveness of agricultural financing policies and the development of agricultural exports, it is necessary to assess and manage potential risks, as well as develop supportive measures and training to optimize the use of green lending in agriculture and agricultural exports.

In the future, it is necessary to continue research and evaluate the impact of green lending and other forms of financing on agriculture and agricultural exports of Vietnam

in order to improve policies and improve the efficiency of the country's agricultural production and exports.

Based on the results of the analysis and comparison of the impact of green loans and other forms of financing on agriculture and agricultural exports in Vietnam, we offer several recommendations for improving the effectiveness of agricultural financing policies and the development of agricultural exports in the future.

Firstly, the Vietnamese government should strengthen its investment in research and development of technologies to improve the productivity and quality of agricultural products, and thus strengthen the competitiveness of Vietnam's products in the world market.

Secondly, banks and financial institutions should encourage the use of green loans for agriculture and the development of agricultural exports, and strengthen monitoring and evaluation of the effectiveness of financing policies to ensure the correct use of credit and achieve maximum benefits for the population and the economy of the country.

In addition, it is necessary to strengthen support and training for agricultural producers in production, marketing and market access skills in order to maximize the effectiveness of financing policies and create a base for the development of Vietnam's agriculture and agricultural exports.

5. Conclusions

This study shows that the impact of green loans on agriculture and agricultural exports in Vietnam is very positive and can make a significant contribution to the economic development of the country. The policy of financing agriculture and the development of agricultural exports should be aimed at achieving the maximum benefit for the population and the economy of the country and constantly improve.

This research study compares the impact of green credit and other forms of financing on agriculture and agricultural exports in Vietnam.

This is a new step in studying the impact of green credit on Vietnam's agriculture and agricultural exports, especially in the context of Vietnam's efforts to fulfill its commitments to sustainable development and reduce the impact of agriculture on the environment. The study also presents a multiple regression model to assess the impact of green credit and other forms of financing on agriculture and agricultural exports in Vietnam, providing policy managers with a useful tool for making decisions about supporting green credit and other forms of financing for agriculture and agricultural exports.

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Annex: Indicators of development and production by sector in Vietnam, 1990-2022.

Annex: Indicator of Development and production by sector in Vietnam, 1990-2022

Table A1. Economic Indicators of Vietnam 1990-2022, in World Bank WDI

	1990	2000	2015	2019	2020	2021	2022
Population, total (thousand)	669126	790011	92191	95776	96648	974680	981868
GNI per capita constant PPP 2017	2099	3691	6325	8091	10451	10628	11397
Life expectancy at birth total (years)	69.2	72.5	73.9	74.1	75.4	73.6	..
Agriculture forestry and fishing value added (% of GDP)	38.7	24.5	14.5	11.8	12.7	12.6	11.9
Industry (including construction) value added (% of GDP)	22.7	36.7	34.3	36.8	36.7	37.5	38.3
Exports of goods&services (% of GDP)	36.0	53.9	72.9	85.2	84.4	93.3	94.0
Imports of goods&services (% of GDP)	45.3	57.5	72.0	79.5	78.9	93.2	91.7
Gross capital formation (% of GDP)	..	29.6	32.1	32.0	31.9	33.5	33.4

Source World Bank 2024 WDI. And World Bank GDP pc at constant 2017 PPPs. Available at: <https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.KD?locations=1W>

Table A2. Real Value-Added per capita by Sector in Vietnam, 1990-2022
(US Dollars at 2017 PPPs)

	1990	2022
Agriculture, Forestry and Fishin	812	1356
Industry & Building	476	4411
Services	811	5630
GDP per capita in Vietnam	2099	11397
GDP per capita in the World	9718	17527
% Vietnam/World	22 %	65 %

Source: Elaborated from table A1

For the period 1990-2022, Vietnam experiences an important increase of Industrial production per capita, what have had a positive impact on real value-added per capita in Services, which evolved from 811 constant Dollars in year 1990 to 5630 in year 2022. Agriculture Value-Added per capita also increased from 812 in 1990 to 2022 in 2022.

Table A3 presents a comparison of indicators of economic development of Vietnam with the World average of 164 countries published by Guisan(2023).

Table A3. Indicators of economic development and quality of life

Country	PH 95	PH 19	Tyr 10	Fer 19	X1 Satisf.	X2 Voice	X4 Peace	X5 IPS	X6 Free	X7 PM2.5	X8 Hom.
Vietnam	2253	8041	7.50	2.05	5.41	5.40	5.41	4.87	6.06	29.63	1.52
World	9886	16135	8.09	2.40	5.35	5.00	4.80	4.16	6.04	4.94	6.10

Source: Guisan(2024), elaborated from WB and other international statistics there cited. Notes: PH is real GDP per capita, in years 1995 and 2019, in \$ at 2017 prices and PPPs. Tyr is average years of schooling of adult population in year 2010. Fer is Fertility rate in year 2019. Indicators X1 to X6 for year 2019, in decimal scale (X1=Satisfaction with life from UN-WHR). X2=Voice of Citizens, X4=Peace, X6= Political Stability, X6=Economic Freedom). X7 is an indicator of Pollution (Particles PM2.5) and X8 is the homicides rate (per 100 thousand people).

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