# The Impact of Green Credit on Economic Growth in Vietnam

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## Abstract

As one of the fastest-growing economies in the world, Vietnam finds itself at a critical juncture, seeking to strike a harmonious balance between fostering economic growth and maintaining environmental sustainability. In pursuit of this equilibrium, the government has introduced various tools, among which green credit holds prominence. This study employs an Ordinary Least Squares (OLS) regression model to examine the influence of green credit on Vietnam's economic growth. Utilizing data sourced from reports by the State Bank of Vietnam (SBV) and other relevant organizations, the authors discern that while green credit positively influences the country's economic growth, the magnitude of this effect remains relatively modest and statistically insignificant. In response to these findings, the study proceeds to offer practical recommendations to guide the commercial banks and credit institutions in Vietnam toward more effective implementation of green credit initiatives and their potential for fostering sustainable economic development.

**Keywords:** *green credit; green finance; economic growth; regression model; Vietnam*

# 1.   Introduction

## 1.1.   Rationale

Vietnam is amongst the world's top five most vulnerable countries to climate change (USAID, 2023). As the Vietnam Country Climate and Development Report implies, climate change impacts on the Vietnamese economy and national welfare are already significant (Group, 2022). According to a Country Environmental Analysis (CEA) report, in 2020, Vietnam's GDP suffered a $10 billion, or a 3.2 percent decrease, due to climate change impacts (World Bank, 2022). Recognizing the importance of sustainable economic development, in 2021, the Prime Minister issued the National Green Growth Strategy and the National Green Growth Action Plan for 2021-2030 (VietnamPlus, 2023). This strategy's goals are to lower the intensity of greenhouse gas emissions per unit of GDP, along with greenify economic sectors and people's lifestyles and encourage sustainable consumption and the transformation process itself based on the principles of equality, inclusivity, and raising resilience (en.baochinhphu.vn, 2021). Regarding this strategy, the State Bank of Vietnam (SBV) Governor approved Decision No. 1408/QD-NHNN on Promulgating the Banking Industry Action Plan. One of the most crucial goals of this plan is to promote the mobilization of green resources, gradually increasing the proportion of outstanding green credit debt (Đ Khôi, 2023).

Green credit has been developing in many countries worldwide to achieve the goal of global sustainable development and economic growth associated with environmental protection. However, the current state of green credit development in recent years in Vietnam is considered to be relatively modest. As of August 2023, 39/129 credit institutions have outstanding green loans, reaching more than 500,524 billion VND, accounting for 4.2% of the economy's outstanding credit debt. There are 34/129 credit institutions assessing environmental and social risks in credit granting activities with outstanding debt of more than 2.3 million billion VND, accounting for nearly 20% of the total outstanding debt of the entire economy (Nguyễn, 2023). The ratio of outstanding green credit loans in 2018-2022 only fluctuates around 3.2-4.4% of the total outstanding loans of the entire banking industry. This is due to many reasons, including commercial banks' incomplete environmental and social risk assessment framework, limited financial resources to provide green credit, and limited development awareness

(thitruongtaichinhtiente.vn, 2022). Sustainability and corporate governance, according to the ESG (Environmental, Social, and Government) model, are weak and lacking, and incomplete legal corridors are the basic causes (Nguyễn, 2023).

Therefore, green credit is still a new issue worth paying attention to in Vietnam. Along with the task of promoting green credit, a question also arises as to whether this process will have any positive effect on economic growth. Amongst the fastest-growing economies globally, Vietnam needs to balance strategically between environmental protection and vigorous growth (Trọng Huy, 2023). Hence, it is necessary to evaluate and understand the relationship between green credit and economic growth to achieve that goal.

For the above reasons, the authors choose to conduct the research on the topic **"The Impact of Green Credit on Economic Growth in Vietnam"**.

## 1.2. Research Objectives

To determine the impact of green credit on the economic growth of Vietnam, the authors have decided to follow a set of objectives, which will be presented next:

- Develop a conceptual framework to evaluate the relationship between green credit and its impact on economic growth.
- Perform model evaluation and assess each variable's contribution to economic growth, especially the target element green credit.
- Validate the obtained results and provide insights into the underlying factors that may explain them.
- Suggest recommendations to promote green credit appropriately, taking into account economic growth in Vietnam.

# 2. Literature Review

## 2.1. Green Credit

To understand green credit, it is intuitional to approach it from green finance, a broader concept encompassing various financial instruments and practices aimed towards environmental sustainability. To this day, there is still no unique and well-established definition of green finance (Migliorelli & Dessertine, 2019). The Organization for Economic Co-operation and Development (OECD) classifies green finance as finance for achieving economic growth while lowering greenhouse gas emissions and pollution, cutting waste, and increasing the efficiency of natural resource usage (Green Finance and Investment, n.d.). On the other hand, the European Commission sees green finance as taking in environmental, social, and governance (ESG) considerations when making investment decisions in the financial sector, resulting in long-term investments in sustainable economic activities and projects (European Commission, 2022).

In recent years, the rise of green finance has provided opportunities to promote sustainability in financial systems and green the economy (Dikau & Volz, 2021). Fangmin's study shows a positive correlation between the level of investment in green finance and the development of green industry, which will boost the economy (Fangmin & Jun, 2011). By implementing the theory of the environmental Kuznets curve, Zhou et al.'s research indicate that green finance can significantly boost the relationship between economic development and environmental quality (Zhou et al., 2020).

As one of the green finance instruments, green credit is a financing mechanism that allows borrowers to allocate funds exclusively to projects that significantly impact the environment. According to Xing et al., green credit refers to credits obtained through grants, loans, and other credit types that consider environmental sustainability and impact (Xing et al., 2021). In a broader sense, according to the Loan Market Association (LMA), green credit is any kind of loan instrument accessible only to finance or refinance, in whole or in part, suitable green projects that are either new or already existing (Guidance on Green Loan Principles, 2021). Under a more specific context, Luu defines green credit as a specific kind of financial service primarily offered by banks (Luu Anh, 2020). Green credit in this context is classified as credit extended by banks to

meet needs for consumption, investment projects, production, and business ventures while preserving the environment and supporting ecosystem preservation.

In Vietnam, green credit refers to the goal of commercial banks to serve as a conduit for money as the country transitions to a green economic model. Under Article 149 of the Environmental Protection Law No. 17/2020/QH14, passed by the 14th National Assembly on November 17, 2020, and effective from January 1, 2022, green credit is credits granted for the investment of the following specific types of projects: a) Effective use of natural resources; b) Respond to climate change; c) Waste management; d) Treat pollution and improve environmental quality; e) Restore natural ecosystems; f) Conservation of nature and biodiversity; g) Create other environmental benefits (Luật Số 72/2020/QH14 Bảo vệ Môi Trường 2020, 2020). Therefore, most research on green credit in Vietnam approaches the concept of green credit in this definition.

Within the scope of this article, the authors define "green credit" as credit capital flows from banks and credit institutions that are allocated to businesses, projects, and consumption activities that do not harm the environment, lower the risk of climate change, improve adaptation to climate change, and make efficient use of natural resources. This strategy aligns with the Vietnamese financial system's features and the country's viewpoint on capital mobilization to realize green growth objectives.

## 2.2.   Green Credit Development in Vietnam

Regarding green credit development in Vietnam, the State Bank of Vietnam (SBV) has recognized the vital role of the financial system, including banks, in promoting the transition towards a green economy. The banking sector's green credit initiatives in Vietnam are carried out in compliance with Directive No. 03/CT-NHNN, which was issued on March 24, 2015. This Directive requires commercial banks to proactively create green credit policies and programs to progressively raise the share of green credit in the credit portfolio structure and implement social and environmental risk management techniques in their credit-granting activities (Chỉ Thị 03/CT-NHNN 2015 Tăng Trưởng Tín Dụng Xanh Quản Lý Rủi Ro Môi Trường Xã Hội, 2015). Initially, four commercial banks—Vietcombank, BIDV, Agribank, and Sacombank—deployed green credit as a pilot program for small and medium-sized firms (SMEs), with a total sum of VND 2,000 billion ((Bài

đăng trên Tạp chí Tài chính kỳ 2, số tháng 3, 2017). Next, the SBV issued the Industry Action Plan to contribute and support the implementation of the National Green Growth Strategy according to Decision No. 1552/QD-NHNN dated August 6, 2015 (Quyết Định 1552/QĐ-NHNN 2015 Chiến Lược Quốc Gia về Tăng Trưởng Xanh Ngành Ngân Hàng, 2015).

In 2017, the State Bank of Vietnam coordinated with the International Finance Corporation (IFC) to launch an environmental and social assessment handbook to assess risks in ten specific industries: Agriculture, Chemicals, Construction and Infrastructure, Energy, Food Processing, Textiles, Oil and Gas, Waste Treatment, Mining, and Non-Metallic Mineral Products (PTT., 2017). This guide is intended to serve the environmental and social risk management process of credit institutions operating in Vietnam, helping credit officers to effectively appraise production and business projects and ensure green and sustainable development.

According to reports by the SBV, as of June 2023, there have been 43 credit institutions granting green credit with a total outstanding credit of VND 527,947 billion (accounting for more than 4.2% of the total outstanding credit of the entire economy), an increase of 5.48% compared to the end of 2022, mainly focusing on the field of renewable energy, clean energy (accounting for more than 45% of total outstanding green credit), green agriculture (accounting for more than 31% of total outstanding green credit) (Mẫn, 2023). According to the State Bank, credit institutions have also increased environmental and social risk assessment in credit granting activities, with outstanding loans assessed for environmental and social risks reaching more than 2,485 million billion VND (Thời báo Tài chính Việt Nam, 2023).

There are still several shortcomings regarding green credit activities in Vietnam. Firstly, the lack of a legal framework for green credits makes it challenging to assess and allocate credit to green projects (Nguyễn, 2023). A study by Hoai Linh et al. implies the limited number of legal papers about green credit in Vietnam (Do et al., 2021). The lack of regulations on green economic development in current credit granting laws will lead to credit institutions being able to say no to business investment projects that meet green economic development requirements. Furthermore, business investment projects that meet the criteria for green growth have a long capital recovery period and high investment capital requirements (thitruongtaichinhtiente.vn, 2023). As a result, lending organizations frequently seek to concentrate on locating business investment projects that

offer guaranteed capital recovery and quick capital turnover. Secondly, the SBV has not yet provided specific and accurate data and reports on green credit on its website, which makes it challenging to collect information about green credit in Vietnam and to conduct research on this topic.

## 2.3. The Role of Green Credit in Economy Growth

Various economic theories and models link green finance to economic growth. One of them is the Environmental Kuznets Curve (EKC) theory, which suggests that there is an inverted U-shaped relationship between environmental degradation and economic growth (Stern, 2018). According to this theory, environmental degradation increases in the early stages of economic development due to increased industrialization and urbanization but decreases in the later stages due to increased income levels, environmental awareness, regulation, and innovation. Green finance can shape the EKC by accelerating the transition from high to low environmental degradation through supporting green innovation and investment.

Another theory is the Porter Hypothesis, which suggests that there is a positive relationship between environmental regulation and economic performance (Porter, 1991). According to this theory, environmental regulation can stimulate economic growth by inducing innovation and efficiency improvements that can offset compliance costs and enhance the competitiveness of firms. Green finance can support the Porter Hypothesis by providing financing for innovation and efficiency investments that can help firms comply with environmental regulations and gain competitive advantages (OECD, n.d.).

The mechanisms through which green finance can potentially stimulate economic growth include: job creation, increased innovation, improved resource efficiency, reduced environmental costs, enhanced social welfare, and strengthened resilience. For example:

• Job creation: Green finance can create direct and indirect jobs in green sectors, such as renewable energy, energy efficiency, waste management, or green transportation. These jobs can increase income levels, consumption demand, and tax revenues in an economy.

• Increased innovation: Green finance can foster innovation in green technologies, products, or services that can improve productivity, quality, or diversity in an economy. These innovations can increase market opportunities

• Improved resource efficiency: Green finance can improve resource efficiency in terms of energy use

### 2.3.1. The Role of Green Credit in the Economy Growth in the World

At the global level, green credit can contribute to economic growth by facilitating the transition to a green economy, which is defined by the United Nations as "one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities" (Li et al., 2022). Green credit can help mobilize financial resources for green sectors and industries, such as renewable energy, energy efficiency, green transportation, waste management, and eco-tourism, which can create new jobs, increase productivity, and enhance competitiveness. Green credit can also help mitigate the risks and costs associated with environmental degradation and climate change, such as pollution, resource depletion, natural disasters, and health problems, hamper economic growth and social welfare. Green credit can also foster innovation and technological progress by stimulating research and development, diffusion, and adoption of green technologies and practices, which can improve efficiency, quality, and resilience of production and consumption.

According to a report by the International Finance Corporation (IFC), the global market for green finance is estimated to reach $29.4 trillion by 2030 (Chen et al., 2021). The report also identifies 21 emerging markets with the most potential for green investment opportunities across six sectors: renewable energy, green buildings, sustainable transport, water, waste, and climate-smart agriculture. The report suggests that green finance can help these markets achieve their national climate commitments under the Paris Agreement, as well as their sustainable development goals.

## 2.3.2. The Role of Green Credit in the Economy Growth in Vietnam

In Vietnam, green credit can play a vital role in supporting the country's economic growth that is aligned with its environmental and social objectives. Vietnam is one of the most vulnerable countries to the impacts of climate change, such as rising sea levels, extreme weather events, droughts, floods, landslides, and salinization (Li, Lin, et al., 2022). These impacts can pose serious threats to the country's economic sectors, such as agriculture, fisheries, tourism, industry, and infrastructure. At the same time, Vietnam is also facing challenges related to environmental pollution, biodiversity loss, deforestation, urbanization, and industrialization (Chen et al., 2023). These challenges can affect the quality of life and health of the population, as well as the natural resources and ecosystem services that underpin the economy.

Green credit can help Vietnam address these challenges by financing green projects and activities that can reduce greenhouse gas emissions, enhance adaptation and resilience to climate change, improve environmental quality and protection, conserve natural resources and biodiversity, and promote social inclusion and equity. Green credit can also help Vietnam seize the opportunities offered by the global green economy by diversifying its economic structure, upgrading its industrial technology, expanding its export markets, attracting foreign investment, and creating green jobs.

According to a study by Nguyen et al. (2019), green credit in Vietnam has increased significantly in recent years (Li, Ding, et al., 2022). The study estimates that the total outstanding green loans of 21 commercial banks in Vietnam reached 468 trillion VND (about $20 billion) in 2017. The study also finds that green credit has a positive impact on economic growth in Vietnam through two channels: industrial upgrading and environmental regulation. The study suggests that green credit can help improve the efficiency and competitiveness of Vietnamese industries by supporting cleaner production technologies and processes. Green credit can also help enhance the environmental performance of Vietnamese enterprises by complying with environmental laws and standards.

However, the study also points out some challenges and limitations that hinder the development of green credit in Vietnam. These include: (i) the lack of clear definitions and criteria for green projects and sectors; (ii) the lack of incentives and support policies for banks and borrowers to

engage in green lending; (iii) the lack of awareness and capacity of both banks and borrowers on green credit; (iv) the high cost and risk of green projects; (v) the low demand and supply of green credit in the market; (vi) the lack of monitoring and evaluation mechanisms for green credit performance; (vii) the lack of coordination among relevant stakeholders; (viii) the lack of data availability and quality on green finance.

# 3. Methodology

## 3.1. Data and Variables

### 3.1.1. Data

Based on the nature of the research topic, the authors decided to conduct research using primary data collected from reports, articles, and research papers from organizations in Vietnam, in the world, and by previous researchers. The table below lists the variables, their notations in the model, their descriptions, and their predicted effect on the dependent variable.

| Category | Variable name | Description | Data Source |
|---|---|---|---|
| Explained Variable | GDPG | Growth rate of GDP (annual %) | WDI |
| Core Explanatory Variable | GC | Outstanding green credit (% of GDP) | SBV, calculation of the authors |
| Control Variables | FDI | FDI net inflow (% of GDP) | WDI |
| | GE | Government expenditure (billion VND) | MOF |
| | INF | Inflation, consumer price (annual %) | WDI |
| | COV | 1 if the economy is currently affected by COVID, 0 if not | calculation of the authors |

**Table 1: Variables Description and Data Source**

### 3.1.2. Variables

*Explained Variable:*

As for economic growth, the authors take GDP growth as the dependent variable in this research model. Economic growth refers to an increase in the size of a country's economy over a period of time. The size of an economy is typically measured by the total production of goods and services in the economy, which is called gross domestic product (GDP)(Reserve Bank of Australia, 2019).

*Core Explanatory Variables:*

**Green Credit:** As stated previously, Green credit is one of the green tools that has been given top priority by the Vietnamese government in its sustainable development strategy. In this model, the green credit variable represents the proportion of outstanding green credit with respect to the GDP of the same year. The data of this variable is taken from reports of the State Bank of Vietnam.

*Control Variables:*

**Government Expenditure:** Government expenditure refers to the money that the government spends on goods and services, which include public consumption and public investment, and transfer payments consisting of income transfers (pensions, social benefits) and capital transfers (*What Are Government Expenditures? - Definition | Meaning | Example*, 2015). According to the Keynesian theory, an increase in government expenditure leads to an increase in economic growth via an expansionary fiscal policy (Odhiambo, 2015).

**FDI**: Foreign direct investment shows how much foreign capital and influence are in a country's economy. It measures the foreign share of domestic businesses and assets (OECD, 2002). Foreign Direct Investment (FDI) can significantly impact GDP growth. Sikdar's study suggests that FDI can increase GDP by strengthening company balance sheets, increasing profits and labor productivity, and raising per capita income (Sikdar, 2021). There is a positive and significant relationship between FDI and GDP growth (Abbas et al., 2011).

**Inflation**: Inflation measures the general increase in the prices of goods and services in an economy over time. Inflation reduces the purchasing power of money, which means that a unit of currency buys fewer goods and services than before. Inflation is usually expressed as a percentage, which indicates the rate of change in the price level over a period of time. Robert J. Barro's study suggests a negative relationship between inflation rate and GDP growth (Barro, 1995).

**COV**: During the pandemic, many governments implemented fiscal and monetary measures to mitigate the adverse effects on their economies. These measures included stimulus packages,

interest rate adjustments, and support for affected industries, all of which can influence economic growth. According to Vitenu-Sackey et al., COVID-19 has a negative effect on the economy (Asare Vitenu-Sackey & Barfi, 2021). Incorporating COV as a control variable in the research model allows for the account of the unique circumstances and economic shocks associated with the COVID-19 pandemic.

## 3.2. Method

This research aims to assess the influence of green credit on Vietnam's economic growth by employing the Ordinary Least Squares (OLS) regression analysis. Additionally, the correlation between variables will be discussed in order to check for multicollinearity presence. Finally, the authors perform tests for any heteroskedasticity and autocorrelation in the model.

## 3.3. Model

The researchers estimated the following empirical model to investigate the impact of green credit on economic growth: $GDPG_t = \beta_0 + \beta_1 GC_t + \beta_2 FDI_t + \beta_3 GE_t + \beta_4 INF_t + \mu_t$ (1)

where t refers to the time period (year); β0 is the constant intercept; GDPG measures economic growth; GC measures the outstanding green credit in terms of proportion of the GDP; FDI, GE, and INF are control variables of this model; β1–β4 are the coefficients of the function; and μ is the error term.

## 3.4. Hypothesis

Regarding the plethora of positive impacts of green credit on the economic growth of the world and Vietnam, the authors propose the hypothesis that:

**H1: Green credit has a positive relationship with economic growth.**

**H2: FDI has a positive relationship with economic growth.**

**H3: Government expenditure has a positive relationship with economic growth.**

**H4: Inflation has a negative relationship with economic growth.**

**H5: Covid has a negative relationship with economic growth.**

The next section will discuss the analysis result of the previously stated model.

| Variable name | Description | Hypothesis |
|---|---|---|
| **Explained Variable** | | |
| GDPG | Growth rate of GDP (annual %) | |
| **Core Explanatory Variable** | | |
| GC | Outstanding green credit (% of GDP) | + |
| **Control Variables** | | |
| FDI | FDI net inflow (% of GDP) | + |
| GE | Government expenditure (billion VND) | + |
| INF | Inflation, consumer price (annual %) | - |
| COV | 1 if the economy is currently affected by COVID, 0 if not | - |

**Table 2: Research Hypothesis**

# 4. Results and Discussions

## 4.1. Descriptive Statistics

| Variable | Obs | Mean | SD | Min | Median | Max |
|---|---|---|---|---|---|---|
| GDPG | 8 | 6.11 | 2.14 | 2.56 | 6.97 | 8.02 |
| GC | 8 | 3.27 | 1.50 | 1.21 | 3.35 | 5.18 |
| FDI | 8 | 4.74 | 0.27 | 4.30 | 4.85 | 5.00 |

| | | | | | |
|---|---|---|---|---|---|
| GE | 8 | 1621213.88 | 249057.77 | 1355034.00 | 1550670.50 | 2158100.00 |
| INF | 8 | 2.67 | 0.99 | 0.63 | 2.98 | 3.54 |
| COV | 8 | 0.25 | 0.46 | 0 | 0 | 1 |

**Table 3: Descriptive Statistics**

## 4.2.    Correlation Test

| | GC | FDI | GE | INF | COV |
|---|---|---|---|---|---|
| **GC** | 1 | | | | |
| **FDI** | -0.83 | 1 | | | |
| **GE** | 0.64 | -0.81 | 1 | | |
| **INF** | 0.31 | 0.13 | 0.04 | 1 | |
| **COV** | 0.55 | - 0.65 | 0.22 | - 0.09 | 1 |

**Table 4: Correlation Table**

A correlation higher than 0.80 indicates the presence of multicollinearity in the model (Shrestha, 2020). Notably, two correlation values in the model meet this criterion, specifically those between GC and FDI, as well as between GE and FDI. This suggests the existence of multicollinearity issues, implying intricate interactions among these variables that warrant further investigation.

## 4.3.    Empirical Test Results

The authors estimate the model using the OLS regression method:

| Regression Statistics | |
|---|---|
| Multiple R | 0.999 |
| R Square | 0.999 |
| Adjusted R Square | 0.999 |
| Standard Error | 0.041 |
| Observations | 8 |

**Table 5: Results of OLS Regression**

| | Coefficients | Standard Error | t Stat | P-value |
|---|---|---|---|---|
| Intercept | -19.634 | 1.961 | -10.014 | 0.01** |
| Green Credit (%GDP) | 0.563 | 0.035 | 15.968 | 0.004** |
| FDI (%GDP) | 4.462 | 0.345 | 12.917 | 0.006** |
| Gov Expenditure (billion VND) | 2.845E-06 | 1.937E-07 | 14.685 | 0.005** |
| Inflation, consumer prices (annual %) | -0.296 | 0.032 | -9.186 | 0.012* |
| Covid | -4.216 | 0.070 | -60.059 | 0.0003*** |

**Table 6: Coefficients OLS Regression**

*Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

According to the R-squared value, the regression model explained 99.9% of the change in affecting economic growth. As shown in Table 5, all the independent variables are significant at a 1% confidence level, aside from the Inflation variable, which is significant at 5%.

**Intercept:** This is the constant term in the regression equation. In this case, the intercept is -19.634, which is the estimated value of the dependent variable when all independent variables are zero.

**Green Credit (%GDP)**: This variable has a coefficient of 0.563, a standard error of 0.035, a t-statistic of 15.968, and a p-value of 0.004. With one percentage increase in Green Credit (%GDP), there would be a 0.563 percent increase in GDP. With a low p-value (0.004), this variable appears to be statistically significant.

**FDI (%GDP):** This variable has a coefficient of 4.462, a standard error of 0.345, a t-statistic of 12.917, and a p-value of 0.006. Similar to the Green Credit variable, FDI appears to be statistically significant in explaining the variation in the dependent variable. With one percentage increase in FDI (%GDP), there would be a 4.462 percent increase in GDP.

**Gov Expenditure (billion VND):** This variable has a coefficient of 2.84E-06 (which is a very small number), a standard error of 1.937E-07, a t-statistic of 14.685, and a p-value of 0.005. Despite the small coefficient, the low p-value indicates statistical significance. The coefficient explains that if Government Expenditure increases by 1 million (billion VND), GDP increases by 2.937 percent.

**Inflation, consumer prices (annual %):** This variable has a coefficient of -0.296, a standard error of 0.032, a t-statistic of -9.186, and a p-value of 0.012. The negative coefficient suggests that as inflation increases, the dependent variable tends to decrease. The low p-value indicates statistical significance. The coefficient shows that if inflation increases by 1 percent, GDP decreases by 0.296 percent.

**Covid:** This variable has a coefficient of -4.216, a standard error of 0.07, a t-statistic of -60.059, and a p-value of 0. The extremely low p-value indicates strong statistical significance. It appears that the presence of the "Covid" variable has a substantial impact on the dependent variable. The estimated result indicates that if all other variables hold, Vietnam's GDP growth will suffer a 4.216 loss due to the effect of COVID-19.

The authors then employ several robustness tests to determine the existence of heteroskedasticity, autocorrelation, and whether the error term's population is normally distributed in order to assess the model's appropriateness.

The authors first examine the autocorrelation in the model, posing two hypotheses:

H0: There is no autocorrelation phenomenon.

H1: There is an autocorrelation phenomenon.

| H0: no first-order autocorrelation | | |
|---|---|---|
| chisq | = | 2.0006 |
| p-value | = | 0.08066 |

**Table 7: The results of the Durbin-Watson test**

The result shows that the null hypothesis is accepted, meaning that there is no autocorrelation in the model with a p-value = 0.08066 > 0.05. Value chisq close to 2 indicates no significant autocorrelation, implying independence.

The authors secondly use the Breusch-Pagan test with two hypotheses:

H0: The model is homoscedasticity.

H1: The model is heteroscedasticity.

| H0: homoscedasticity | | |
|---|---|---|
| chisq | = | 3.4116 |
| p-value | = | 0.6368 |

**Table 8: The results of the Breusch-Pagan test**

The interpretation of the Breusch-Pagan test for heteroscedasticity is simple. Because the test statistic (BP) is small and the p-value is not significant (0.6368 >0.05), we do not reject the null hypothesis. Therefore, we assume that the residuals are homoscedastic.

The authors now want to check if the model is correct linearly specified by using the Ramsey RESET test with two hypotheses:

H0: The model is correct linearly specified
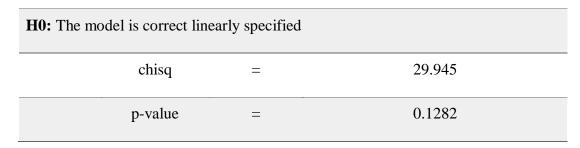
H1: The model is linearly misspecified

| H0: The model is correct linearly specified | | |
| --- | --- | --- |
| chisq | = | 29.945 |
| p-value | = | 0.1282 |

**Table 9: The results of the Ramsey RESET test**

With a statistic of 29.945 and a p-value of ~0.1282 > 0.05, we do not reject H0 Ramsey's RESET test suggests that the linear model is correctly specified.

The authors now use the Jarque-Bera test for residuals with two hypotheses:

H0: The residuals are normally distributed

H1: The residuals are not normally distributed

| H0: The residuals are normally distributed | | |
| --- | --- | --- |
| chisq | = | 1.1097 |
| p-value | = | 0.5741 |

**Table 10: The results of the Jarque-Bera test**

With a statistic of 1.1097 and a p-value of ~0.5741 > 0.05, we do not reject H0 Jarque-Bera test suggests that the residuals are normally distributed.

After all these robustness tests, we conclude the assumptions of this OLS regression are true including:

- The error term's population mean is zero. The error term adheres to a normal distribution pattern.
- There are no correlations between the independent variables and the error term. The error term's variance is constant. In other words, the residuals exhibit homoscedasticity.
- Each observation of the error term is independent of others. In other words, there is no autocorrelation in the model.
- There are no independent variables that are perfect linear functions of other variables, there is no multicollinearity.

## 4.4. Discussions of the Results

| | Coefficient (P-value) | Expected sign | Actual sign | Statistically significant level |
|---|---|---|---|---|
| **GC** | 0.563 (0.039) | + | + | Significant at 1% confidence level |
| **FDI** | 4.462 (0.006) | + | + | Significant at 1% confidence level |
| **GE** | 2.845E-06 (0.005) | + | + | Significant at 1% confidence level |
| **INF** | -0.296 (0.012) | - | - | Significant at 5% confidence level |
| **COV** | -4.216 (0.0003) | - | - | Significant at 1% confidence level |

**Table 10: The comparison of actual and expected signs of variables and its significance**

Table 10 summarizes the result of the effect of the estimated variables on economic growth in the OLS model.

The estimated result suggests that, as predicted, a positive relationship exists between green credit (GC) and economic growth in the sample data. Statistically, this relationship is significant at the conventional significance level of 0.039, implying that, based on the available data and the OLS model used, it can be confidently concluded that green credit has a statistically significant impact on economic growth. Regarding the control variables, the result suggests that all the predicted hypotheses are correct. Therefore, the authors conclude that H1, H2, H3, H4, and H5 are statistically reliable according to the OLS regression model.

In the analysis of the presented model, it is noticeable that the p-values of all the other variables are significant at 1%, except for Inflation at 5%. In statistical analysis, a lower p-value typically

signifies a more robust confidence level in the explanatory ability of variables. Therefore, the significant p-values for all the variables in the model imply that they play a significant role in explaining the variations in the model and have considerable relevance to economic growth in Vietnam.

Similar to our findings, previous research proves that green credit is statistically significant and strongly contributes to economic growth. A study by Hoa et al. shows that green credit issuance increases the financial resources of profit-making and non-profit-making firms, which they utilize to mitigate the polluting influences of their possessions and operations; thus, they contribute to sustainable economic development (Hoa et al., 2022). Ngo and partners also point out that green finance has significantly improved the environmental conditions that ultimately improve the economic conditions (Ngo et al., 2021). In China, several research papers have explored the positive impact of green finance on economic growth (Li, Ding, et al., 2022; Song et al., 2021; Chen, 2023).

In conclusion, the positive impact of green credit on Vietnam's GDP growth is proved through OLS regression model analysis, and the result is consistent with previous research papers.

# 5. Limitations

While the model estimation is significant on a statistical basis, there are still several limitations of this research that need to be assessed.

## 5.1. Data Availability

The lack of data regarding green credit in Vietnam makes it hard to evaluate its impact on economic growth properly. Green credit has only been strongly promoted through the strategic green plan promulgated by the Vietnamese government in 2014. As a result, green credit data readability only spans recent years and is only reported annually by the State Bank of Vietnam. The lack of data in the model compromises the statistical power and reliability of the regression analysis. Limited data points can result in less precise estimates and reduced confidence in the

model's findings. Furthermore, it can hinder the ability to capture long-term trends or fluctuations in the relationship between green credit and economic growth.

## 5.2.    Differences in Green Credit Definition

This research closely follows the definition of green credit according to Vietnam's law, which determines green credit is credit granted to these types of investment projects: a) Effective use of natural resources; b) Response to climate change; c) Waste management; d) Treat pollution and improve environmental quality; e) Restore natural ecosystems; f) Conservation of nature and biodiversity; g) Create other environmental benefits (Nguyen, 2023).

As stated before, there are many approaches to how one defines green credit. Other papers, especially those that have conducted conclusions, drew various ways to define and measure green credit. For example, Hoa et al. use the measurement for green credit as the proportion of credit properly used for pollution prevention in regard to GDP (Hoa et al., 2022). This specification is not consistent with how green credit is addressed in Vietnam and can, therefore, lead to unreliable results. One possible reason behind these papers' methodologies is to bypass the lack of data by replacing green credit with other closely related metrics.

## 5.3.    Potential Overfitting Model

While Ordinary Least Squares (OLS) linear regression serves as a foundational tool for analyzing economic variables, when dealing with economic data evolving over time, Time Series Analysis, specifically models like Autoregressive Integrated Moving Average (ARIMA) or GARCH, becomes highly pertinent. Time series models are adept at capturing trends, seasonality, and autocorrelation present in economic time series data, making them an essential choice for assessing intricate temporal relationships among economic variables and their impacts on economic growth. Our model suggests an extremely high R-squared value at 0.999, implying the potential existence of overfitting and, therefore, can lead to unreliable estimation if one uses the model to predict the future value of GDP growth.

# 6. Conclusions and Recommendations

## 6.1. Conclusions

The research conducted an empirical examination of how green credit influenced Vietnam's economic growth from 2015 to 2022. A basic regression model was employed to analyze this relationship and tests for heteroskedasticity and autocorrelation were conducted to enhance the accuracy of the statistical estimates. The results from the straightforward regression model using real-life data indicate that green credit has a statically significant positive effect on Vietnam's economic growth. In sum, the study offers valuable insights into the influence of green credit on Vietnam's economic growth.

## 6.2. Recommendations

### 6.2.1. Commercial banks

The results indicate that green credit has a significant role in improving the economy. This suggests that banks must be aggressive in pursuing policies and strategies to improve:

Firstly, banks should actively develop and promote green financing products, such as green loans and green bonds, to encourage businesses and individuals to invest in environmentally sustainable projects and initiatives.

Secondly, banks should implement robust credit assessment mechanisms that specifically evaluate the environmental impact and sustainability of projects seeking financing. Consider offering favorable terms and conditions for projects with strong green credentials.

Thirdly, banks should invest in the training and development of bank staff to enhance their understanding of green finance principles and environmental risk assessment. This will help banks make informed decisions regarding green credit applications.

Fourthly, banks should ensure transparency in disclosing the environmental impact of the bank's lending portfolio. In addition, banks should regularly report on their green finance activities, including the amount of green credit extended and its impact on environmental sustainability.

Fifthly, banks should collaborate with environmental organizations, government agencies, and industry associations to share best practices, develop green finance guidelines, and support sustainable initiatives.

### 6.2.2. Policymakers

Firstly, the policy makers should develop and strengthen the regulatory framework for green finance in Vietnam, including clear definitions, standards, and guidelines for green credit and sustainable finance practices.

Secondly, the policy makers should introduce incentives such as tax benefits, subsidies, and grants to encourage banks and financial institutions to provide green credit. Offer support to businesses engaged in green projects.

Thirdly, the policy makers should establish mechanisms for monitoring and reporting on the environmental impact of green credit and sustainable finance activities. Create a database to track the progress of green initiatives in the country.

Fourthly, the policy makers should invest in capacity-building programs for financial regulators to ensure effective oversight of green finance practices and compliance with environmental standards.

Fifthly, the policy makers should promote awareness and education among businesses, financial institutions, and the general public about the benefits of green credit and its role in sustainable development.

Sixthly, the policy makers should develop a vibrant green bond market in Vietnam to attract both domestic and international investors. Encourage companies to issue green bonds to fund environmentally friendly projects.

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