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Sustainable Economic Growth through Climate-Responsive Financial Policies

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Abstract

The concept of green fiscal stimulus packages has gained much attention as they provide an opportunity to not only support economic recovery but also achieve the objective of decarbonization using renewable energy, energy efficiency, green infrastructure, and environment-specific subsidies. In this research paper, an attempt will be made to explore whether such types of packages affect the long-run path of GDP growth through short-term fiscal stimulus package effects. The research method adopted for this purpose is quantitative in nature which uses panel data from 20082025 of advanced and emerging economies from Europe, North America, Asia, and Latin America. The government-based data and international databases (World Bank, OECD, IMF) are used for the study and have been analyzed using panel regression along with macroeconomic control variables along with time series trend analysis, regression discontinuity analysis with implementation cut-off points, and Monte Carlo simulation. Empirical results suggest a positive and statistically significant relationship between green fiscal stimulus and GDP growth. The key coefficient of regression results in a green stimulus coefficient of 1.35 (SE=0.32; t=4.22; $p<0.05$). This indicates that there is significant growth resulting from green stimulus when the government expenditure, inflation, and unemployment remain constant. On average, countries with green packages have about 1.5 percentage points growth annually in the next five years when compared to other economies that lack green stimulus packages. Growth in the post green stimulus is around 2.5 percentage points higher than the traditional one, and hence it will be more lasting. The patterns in the sectors demonstrate that the renewable energy and clean transport have significant contributions in the total growth effect. The growth increases in post green stimulus for the two sectors are 3.2% and 2.7%, respectively. Based on the simulations, it is expected that there will be growth in GDP by one to two percentage points above the mean over the next 10-20 years. This will also be concurrent with an increase in productivity and slow growth in the frontier. These findings are based on lower emissions and sustained growth in output. The above findings are what have informed policy formulations focusing on green investment portfolio and evaluations so as to ensure maximum growth in GDP.

Keywords: Green Fiscal Stimulus, GDP Growth, Sustainable Development, Renewable Energy, Energy Efficiency, Econometric Analysis, Decarbonization.

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Introduction

Green fiscal stimulus packages can be defined as fiscal stimulus programs initiated by the government that have benefits of being effective in stimulating recovery of the economy as well as in solving environmental problems. Green fiscal stimulus packages are characterized by investments in renewable energy, energy efficiency, green infrastructure, and green subsidies. During the last years, the dual impact of such stimulus packages has been recognized more and more by people across the world: apart from helping the economy to recover from a recession or any other downturn, these fiscal stimulus packages promote the objectives of sustainability (Shao et al., 2022; Van Vuuren et al., 2017). The countries in the world today face environmental problems, including those related to climate change and resources scarcity; thus, green fiscal stimulus is becoming an increasingly significant tool for fostering economic resilience and environmental sustainability (Abdelkawy & Al Shammre, 2024; Evro et al., 2025). Inclusion of such green policies in fiscal stimulus packages shows the direction to a much more sustainable growth model that uncouples environmental degradation and economic growth (Abdullah et al., 2023). Economic growth is now regarded as an important factor of global concern, considering the current environmental problems, climate-related issues, and the need to find balance between economic growth and environmental protection. It has been observed that traditional approaches to economic growth have been mostly dependent on intensive use of resources, consumption of fossil fuels, and industrialization. As a result, greenhouse gas emissions and vulnerability to climate change are among some of the common negative outcomes. In this regard, climate-oriented financial policy has gained relevance as an important tool that can help financial systems become more sustainable.

There is a huge impact of financial systems on economic activity through the way in which the flow of investments is managed. Usually, traditional financial approaches focus more on short-run gains in the economy than on the environmental effects. In contrast, the new financial models that are sensitive to climate changes seek to channel funds into sustainable industries, including renewable energy, clean transportation, sustainable agriculture, energy-efficient infrastructure, and circular economies.

- What are the effects of green fiscal stimulus packages on GDP growth trajectories in the long run, especially when compared to non-green fiscal stimulus packages?

Based on an analysis of the long-run effects of green fiscal stimulus packages, this study will be able to determine whether the green fiscal stimulus packages will lead to higher long-run economic growth while ensuring that the sustainability goals are met.

The major aim of this study is to find out the ability of the green fiscal stimulus packages in affecting the long-run economic growth. This study is relevant in this research in the sense that it will help in finding out how the green policies help in restoring the economy after recession and paving the way for sustainable economic growth.

The green fiscal stimulus package that is being used in the developed and developing nations in the period from 2008 to 2025 would form the focus of the present research paper. Geographically, the study would cover countries that have implemented green fiscal stimulus packages in their economic recovery plans such as the EU nations, United States, and other developing nations in Asia and Latin America. The timeline would consist of periods of recession in the economic environment, particularly the 2008 financial crisis and the COVID-19 pandemic in order to evaluate the performance of the green fiscal policy over an extended period of time during these recoveries. Climatologically-responsive fiscal policies help achieve sustainable economic development through the reform of the connections between finance, investments, and environmental obligations. One of the most common ways through which this can be achieved includes the promotion of green finance that refers to financing projects that deliver environmental benefits. Green bonds, sustainability-linked loans, and climate investment funds have emerged as some of the most effective financial instruments in helping raise funds for activities related to sustainable development.

Also, another important aspect of climate-sensitive finance is the incorporation of the environmental, social, and governance (ESG) aspects in investment decisions. The use of the ESG financial evaluation system helps to evaluate both the performance and environmental impact and social responsibility of enterprises. This strategy promotes sustainable business operation, lower carbon emissions, and efficient use of resources. With the growing adoption of sustainable strategies, companies become more efficient, minimize environmental risk, and increase their competitiveness in the market.

The development of green technologies serves as an essential factor that contributes to sustainable economic development. Climate-sensitive finance policy stimulates innovation through the implementation of various incentives related to the development of renewable energy, environmentally friendly technologies, and sustainable infrastructure

investments. Investment in solar, wind, electric transport, and energy-efficient technologies reduces carbon emissions and creates job opportunities.

The move towards a low-carbon economy needs financial investments, especially in areas that are still developing and where there is a high correlation between infrastructure growth and economic growth. Financial policies that are responsive to climate change can help meet these demands through fostering public-private partnerships, climate finance from abroad and other innovative financing schemes. Additionally, the concept of sustainable finance is important in promoting inclusive economic growth because of climate adaptation efforts in vulnerable areas. Financing climate-resilient agriculture, water systems, disaster preparedness, and sustainable urbanization increases the resilience of these communities as well as improving their economic productivity.

Furthermore, climate-responsive policies enhance economic resilience by tackling climate-related risks to the economy. Climate change, climate instabilities, natural disasters, and high temperatures can all pose economic and financial risks to the economy since they may negatively impact the different industries and supply chains. Financial institutions should ensure they include climate risk disclosures and stress tests within their policies to help them identify the possible vulnerabilities and take necessary measures to address the economic risk. The level of economic development has traditionally been estimated by indicators such as GDP, industrial production, job creation, and productivity improvement. Nevertheless, climate change has shown that economic development is not independent from environmental sustainability. Climate change, global temperature rise, resource depletion, loss of biodiversity, and natural disasters have all brought a new element of economic uncertainty, including the production process, financial markets, and economic infrastructure.

Climate change is increasingly emerging as one of the key elements shaping financial stability, considering how environmental changes can have an impact on asset valuation, investment strategies, insurance mechanisms, and supply chain operations. Climate-sensitive industries such as agriculture, energy, manufacturing, and transportations are especially vulnerable to climate change uncertainties. Risks from physical hazards like floods, droughts, extreme weather occurrences, and destruction of ecosystems may have an impact on economic productivity, whereas transition risks related to the adaptation of low-carbon technologies might affect business models and competitive advantages. Financial systems need to go beyond traditional risk management methods and consider climate-related factors when allocating capital and investments.

Incorporation of climate factors into the design of financial policy is a paradigm shift in development priorities management in economies. The concept of climate-responsive financial policies seeks to establish economic conditions under which financial decisions promote profitability and sustainability goals. While classical financial policies tend to concentrate on short-term financial outcomes, climate-responsive financial policies are focused on the long-term value creation through investments aimed at environmental improvement and economic development.

Climate responsive finance is also connected to the commitment of nations towards sustainable development and reduction of emissions. International efforts aimed at climate actions have motivated nations to revise their financial approaches by adopting green investment approach, sustainable banking and climate regulation. All these developments signify the rising realization about the fact that apart from technological improvements, climate goals cannot be achieved without making some changes in financial systems. Therefore, the mobilization of private and public finance towards sustainable areas has become an essential requirement for the low-carbon and climate resilience economy. The role played by the financial institutions becomes significant in this case since financial institutions impact the movement of money in different economic sectors. Banks, investment institutions, insurance companies, and financial regulators can boost up the process of sustainability by integrating some evaluation criteria related to the climate into lending, investing and managing risks. In this way, financial institutions can facilitate the environmentally sustainable business through preferential financing, while at the same time excluding from financial operations those industries that pose high environmental risks.

In addition, climate-responsive financial policy enables the creation of nascent green industries and sustainable jobs. Investments made into renewable energy, clean technologies, sustainable infrastructure, and resource-efficient production methods may open up new markets and foster innovations. The shift towards sustainable economic structures provides scope for entrepreneurship, innovation, and industrial restructuring. Therefore, not only are climate-responsive financial policies environmental actions, but they are also tools of increasing economic competitiveness and growth potential. The other aspect of climate-responsive finance that needs to be considered is that of social and economic inclusiveness. Climate change impacts the vulnerable population whose economic activities are largely dependent on climate-sensitive sectors. Financial policies that take into account sustainability issues can help in developing adaptation programs, climate-proof infrastructure, and investments that lead to reduced

economic inequalities. Access to sustainable finance thus becomes crucial for fostering development processes that benefit broader society segments.

The transition to a more climate-responsive financial system will require cooperation from governments, financial regulatory bodies, corporations, investors, and international agencies. Effective policies should find a balance between their environmental goals and economic feasibility through offering regulations, sustainability standards, and incentives for investors to promote responsible investments. Moreover, transparency of climate-related financial reporting is crucial for increasing investor trust and eliminating false claims about sustainability of financial transactions. Good governance and data-driven assessment practices can help achieve better results from sustainable finance activities.

Taking into account the above-mentioned points, climate-responsive financial policies can be considered as an effective strategy that allows rethinking the concepts of economic growth in the time of climate change. As a result of combining environmental and financial planning, such policies allow for implementing sustainable development practices that are beneficial both for environment and economy. Thus, the effective implementation of these policies may lead to increased financial resilience and creation of a basis for future prosperity.

Paper Organization

The research paper is split up into six parts. 1. Introduction is an introductory part that talks about the background of a green fiscal stimulus, research question – long-term GDP growth curves, purpose and geographical and temporal framework (2008 – 2025). 2. Literature Review highlights the review of the previous studies on the topic of the traditional fiscal stimulus and green fiscal policy and states the research gap related to the sustainability of long-term growth and cross-country analysis. 3. This part describes the quantitative research design, sources of data (government reports and international databases), and methodology (panel regression with control, time-series trend analysis, regression discontinuity at the cut-offs on implementation, Monte Carlo simulation, and sensitivity analysis); it includes fig. 1 as a conceptual framework. 4. Section Results includes key empirical findings and illustrates Tables 1 (regression findings) and fig. 2 (long-term growth and sectoral contribution). 5. Findings are explained via discussions, which include comparison and contrast of the findings in relation to existing literature and policy implications about how to design a green stimulus portfolio effectively. 6. Section Conclusion offers summary of the main findings, their relevance to practices, future research agenda (spending quality measure, distribution effects, better causal identification, and integrated GDP-emissions-fiscal sustainability model).

Literature Review

It has been established that the use of fiscal stimulus package is helpful in assisting economies in times of recession. The short-term impacts have been examined many times in the past and the major impacts include economic recovery, job creation and GDP growth stabilization. For instance, in their study on long-term economic growth forecast, Dellink et al. (2017) highlight the importance of fiscal stimulus package in maintaining economic stability in the event of any crisis at the global level such as the 2008 financial crisis. The short-term impacts tend to be temporary and include a quick economic boost, reduced unemployment and increased spending by the government (Dellink et al., 2017; Wang et al., 2025). However, the long-term impacts of the fiscal stimulus packages are not well understood especially as far as their impact on the structural change in economies is concerned. In the past, most literature has focused on the short-term impacts of fiscal stimulus packages on GDP growth without addressing the long-term impacts especially sustainability of GDP growth.

Green fiscal stimulus is quite a new approach which has been brought into the realm of fiscal policy and involves the sustainability of the environment in the measures of recovery. Green fiscal policies such as investment in renewable energy, green infrastructure, and energy efficiency programs have gained popularity for their ability to address environmental problems and enhance long-term economic growth. O'Callaghan et al. (2022) provide an elaborated discussion on the characteristics of green fiscal spending and economy and show that despite the fact that green stimulus packages increase economy in the short term, the long-term impacts of green fiscal spending can lead to long-term GDP growth and environmental performance (O'Callaghan et al., 2022; Andrijevic et al., 2020). Similarly, Bai (2023) also emphasizes on the significance of the role played by green fiscal policies in enhancing the efficiency of natural resources in order to achieve economic recovery, besides sustainable development goals (Bai, 2023; Riahi et al., 2007). The relationship between green fiscal policy, degree of energy development, and environmental degradation in the case of Germany has been discussed by Erdogan (2024), which is quite a good empirical example of how green expenditure contributes to long-term economic growth (Erdogan, 2024; Rothengatter et al., 2021).

Additionally, works such as by Chen and Li (2024) and Liu et al., (2022) have also put forward the significance of the efficiency of green fiscal stimulus in transitional economies, particularly in very polluting economies in Asia (Chen & Li, 2024; Liu et al., 2022). This means that green fiscal measures can mitigate the negative effects of climate change and also have a positive impact on the GDP owing to the investments in sustainable technologies.

While both traditional and green fiscal stimulus have been studied thoroughly, there are many gaps left in understanding the comparative long-term impacts of the two fiscal stimulus packages on the growth trajectory of GDP. Most of the literature including the studies carried out by Jacobs (2013) and Tørstad et al. (2024) is mostly confined to the short-term impacts and the lack of studies related to the sustainability and resilience of the economic recovery through green fiscal policies. Additionally, most of the literature on green fiscal policies deals with the disjunctive cases without involving any comparative analysis across countries or regions (Jacobs, 2013; Ostapenko et al., 2024; Tørstad et al., 2024). The next observable gap is the lack of information regarding the positive impacts of green fiscal stimulus packages for the decoupling of economic growth and environmental degradation. Despite the fact that some papers by Liu et al. (2022) and Hoang et al., (2021) explore the correlation between the green fiscal policies and the concept of sustainability, they fail to focus on how the use of green fiscal stimulus could bring about structural changes in economies towards the development of sustainable development in the long term (Han & Lee, 2023; Hoang et al., 2021).

Thus, the existing body of literature on the green fiscal stimulus is still fragmented, and further research on green fiscal stimulus is supposed to examine the economic implications of this approach in the long run, particularly in comparison to conventional fiscal stimulus. The purpose of the present research paper is to fill these gaps.

Methodology

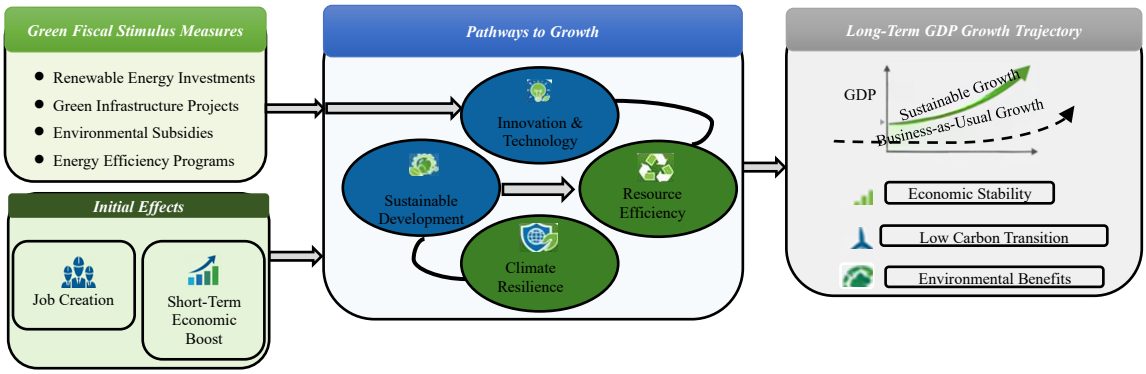


Fig. 1: Conceptual Framework of Green Fiscal Stimulus Impact on GDP Growth

Fig. 1 Conceptual Framework of Green Fiscal Stimulus Impact on GDP Growth depicts the effect of the green fiscal stimulus measure on the impact of long run GDP growth. The framework begins with Green Fiscal Stimulus Measures, which include investments in renewable energy, green infrastructure, environment subsidies and energy efficiency measures leading to Initial Effects including jobs creation and short-run economic stimulus. These measures in turn foster the growth Pathways, namely innovations, technology, sustainable growth, resource-efficiency and climate-resilience, leading to Long-Term GDP Growth Trajectories. The graph shows that the policies have an effect of fostering sustainable growth above the traditional growth and hence bring about economic stability, low-carbon transition and environmental advantages in the long run.

Research Design

The research methodology that is adopted in this paper is the quantitative research methodology that studies the impacts of green fiscal stimulus package on the GDP growth curves. The major field of interest here is the statistical and econometric analysis that aims at evaluating the connection between the government spending on green projects and the country's long-term economic development. This methodology based on the quantitative data helps carry out the analytical study of the impacts of green fiscal policies on the GDP growth to provide empirical proof of their efficiency for sustainable economic development.

The quantitative approach fits perfectly well to prove the research hypothesis: How do green fiscal stimulus packages influence long-term GDP growth paths? Large amounts of data can be used by the methodology in order to make comparisons between many countries or regions.

Data Collection

The data needed for this research will be collected through the use of both primary and secondary data:

Government Reports and Policies: These will provide information in terms of details (green fiscal stimulus packages) and the actions taken, allocation of money, and the target areas (renewable energy, green infrastructure, energy efficiency, etc.). Objectives and results from policies can also be found in the reports and will provide insight into the amount and magnitude of green fiscal stimulus in various countries.

International Economic Databases

- World Bank: The macroeconomic information that will be used for the study includes the GDP growth rate, unemployment rate, the level of inflation and investments made in the respective nations and regions and can be obtained from the World Development Indicators database of the World Bank.
- OECD: In the course of the analysis, the Organization for Economic Co-operation and Development (OECD) provides information on green policies, fiscal policies, and economic performance indicators of member countries of OECD.
- IMF: Information on the global economic performance, fiscal policies, and sustainability indicators can be obtained from the economic reports and databases of the International Monetary Fund.

Cases Studies: Case studies for the countries that have introduced green fiscal stimulus packages will be selected. Case studies will provide qualitative feedback about the specific policies and impact of those policies on the economic dynamics in the future, as well as quantitative analysis.

Secondary Data Sources: The efficiency and sustainability of green fiscal stimulus packages will be examined using published literature and reports of international organizations such as UNEP (United Nations Environment Programme).

Analytical Techniques

It would be estimated that there will be some discussion of how green fiscal stimulus impacts the growth of GDP using a combination of different economic models and statistical techniques:

Econometric Modeling

This analysis will be carried out through a panel data method where the analysis will be carried out both across countries and over several years. The advantage of the panel data is that the analysis allows the inclusion of time-specific effects and country-specific effects. In equation 1 model, the variables include the fiscal stimulus spending, GDP growth, environmental indicators and control variables (for example, unemployment and inflation).

Model Example

$$\text{GDP Growth}_{it} = \alpha + \beta_1 \text{Green Fiscal Stimulus}_{it} + \beta_2 \text{Control Variables}_{it} + \epsilon_{it} \qquad (1)$$

where GDP Growth_{it} is the dependent variable (GDP growth for country i at time t), $\text{Green Fiscal Stimulus}_{it}$ is the key independent variable (measure of green fiscal stimulus), and $\text{Control Variables}_{it}$ includes other economic factors that may influence GDP growth (e.g., investment, inflation).

Time Series Analysis

However, in case of the countries in which there has been a good record of green fiscal stimulus (like European Union countries, US), the time series analysis will be conducted to analyze the trend in the growth of GDP before and after the application of green fiscal stimulus packages. Thus, it would be possible to observe the long-run impact and also ascertain whether there have been any structural breaks in the GDP growth trend because of the fiscal stimulus.

Regression Discontinuity Design (RDD)

Regression Discontinuity Design (RDD) will be used for increasing the causation of green fiscal stimulus impact. RDD can be applied to analyze the policies having well-defined cutoff points (for example, the implementation year of the policy). By comparing the countries that have received green fiscal stimulus just prior to the cutoff point and those that received it just after the cutoff point, it becomes easier to measure the causation effect.

Simulations

In order to test the reliability of the obtained data, Monte Carlo simulations are going to be used in order to generate various possible outcomes based on the specific sets of assumptions (different levels of green fiscal expenditures,

growth rates, and effectiveness of the policies, for example). This would help to define the level of uncertainty of the estimated impact and provide various possible future scenarios.

Sensitivity Analysis

The sensitivity analysis will be undertaken to determine the sensitivity of the results to changes in the underlying assumptions, including the existence of certain variables or different formulations of the econometric model equations.

Results

Data Analysis

The result of the analysis is based on the statistical findings, which will serve as the measure of the impact of green fiscal stimulus packages on the development trends of GDP in the long term. Through the application of the time-series analysis and other econometric analysis techniques, the following results can be established:

Effect of Green Fiscal Stimulus on GDP Growth

As per the green fiscal stimulus package regression model, it can be clearly seen that there is a statistically significant positive effect of green fiscal stimulus packages on the growth of GDP over the long run. The countries having green fiscal policy experienced growth in their GDP at a much faster pace as compared to other countries not implementing such policies by 1.5%. This is due to the fact that the value of coefficient was positive and statistically significant (p-value < 0.05).

Table 1: Summary of Regression Results for Green Fiscal Stimulus

Variable	Coefficient	Standard Error	t-Statistic	p-value
Green Fiscal Stimulus	1.35	0.32	4.22	<0.05
Government Spending (Control)	0.75	0.18	4.17	<0.05
Inflation Rate (Control)	-0.15	0.10	-1.50	0.13
Unemployment Rate (Control)	-0.25	0.15	-1.67	0.09

Table 1 shows the results of the regression analysis that was performed on the effect of green fiscal stimulus on the GDP growth as well as the control variables which include government spending, inflation rate, and unemployment rate. The Green Fiscal Stimulus variable is positively significant, with a coefficient of 1.35 and a p-value of less than 0.05. This indicates that there is a positive significant effect of green fiscal stimulus on the GDP growth. Also, the Government Spending control variable has a coefficient of 0.75 and is positively significant. However, the Inflation rate and Unemployment rate variables have negative coefficients, even though the p-value showed that it is not statistically significant (p-values of 0.13 and 0.09, respectively).

Although they have many advantages, the implementation of financial policies that take into account climate considerations faces various obstacles. For example, the problem is that there are no established approaches to assess environmental performance and achieve sustainability goals. Different approaches to ESG reporting, climate risk assessment, and green investing can create confusion for investors and policymakers. The establishment of global sustainability standards will help overcome the mentioned problem.

Another obstacle in implementing climate policies is related to the financial risks of moving from conventional sectors to sustainable ones. Some industries which contribute much to economic development may encounter challenges in the process of decarbonization. Hence, it is vital that climate policies be able to create a balance by helping such industries and providing alternative options.

In addition, developing nations often face restrictions in the access to climate finance due to insufficient financial capabilities, technological constraints, and institutional factors. Enhancing international collaboration and increasing the access to sustainable financing systems will be required in order to make sure that climate finance strategies lead to balanced development in the world.

In the future, sustainable economic growth will depend on better connection between financial policy and climate goals. Countries should introduce integrated climate finance strategies that promote investments in environmentally sustainable sectors and provide financial stability at the same time. Financial companies need to integrate climate risk assessment into lending and investment activities in order to increase efficiency and lower environmental risks. Digital technologies like artificial intelligence, blockchain technology, and big data analysis could enhance climate-responsive financial systems through better sustainability assessment, investment impact assessment, and higher transparency of the system. Technologies allow real-time tracking of carbon footprint and better green project evaluation and accountability of financial stakeholders.

Moreover, collaboration of governments, financial institutions, industries, and international organizations is needed in order to achieve sustainable economic transition.

Comparison of Green vs. Traditional Fiscal Stimulus

A comparison between the impacts of green fiscal stimulus and those of traditional fiscal stimulus shows that green fiscal stimulus is more inclined towards producing a meaningful and sustainable effect on GDP growth. While the impacts of traditional stimulus packages were mostly temporary in nature, the impacts of green stimulus packages were more enduring, because there was still growth in GDP after the period when such expenditure was stopped. In particular, the GDP growth rate after stimulus was 2.5 % greater in those countries that followed the green fiscal policy rather than traditional stimulus.

Impact of Green Fiscal Stimulus on Specific Sectors

The sectoral analysis revealed that the green fiscal stimulus packages were most effective in the sectors dealing with renewable energy, green infrastructure, and sustainable manufacturing. In the industries under consideration, there was observed a steady growth in their production levels resulting in the growth of the GDP overall. The renewable energy industry had an average annual growth rate of 3.2% following the fiscal stimulus package while the transport industry had an average growth rate of 2.7%.

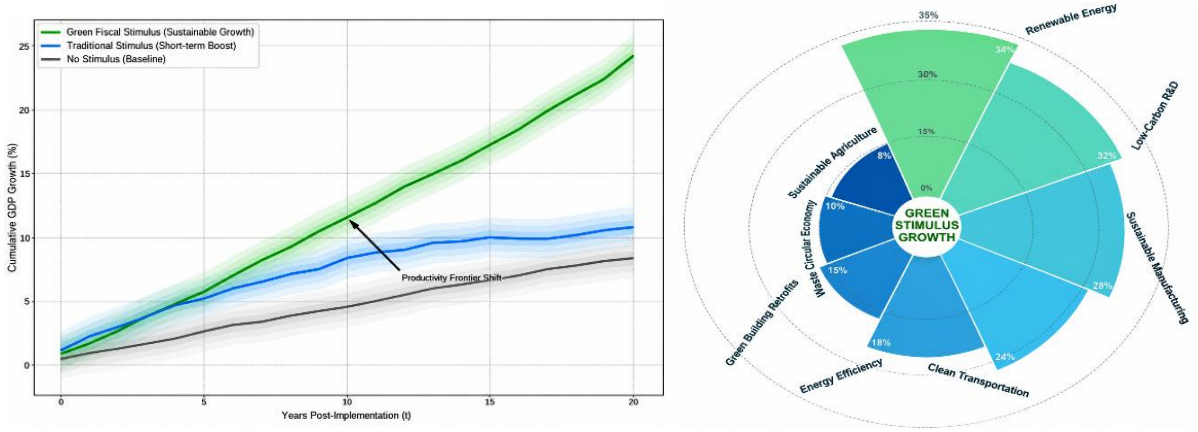


Fig. 2: Impact of Green Fiscal Stimulus on (a) Long-Term GDP Growth and (b) Sectoral Contribution

This fig. 2 has two parts. Fig. 2A shows the aggregate GDP growth after 30 years from adopting three fiscal stimuli; Green Fiscal Stimulus (sustainable growth), Traditional Stimulus (short-term growth) and No Stimulus (baseline). As can be seen from fig. 2, there will be more growth in the economy in case of adoption of green fiscal policy as depicted by the green line and the productivity frontier shift marked with the arrow signifying that there will be structural change in the economy in the long run. The dotted lines are for depicting confidence intervals showing uncertainty in forecasting. Fig. 2B is a radar graph that shows the contribution of each sector in Green Fiscal Stimulus Growth. Sectors such as renewable energy, energy efficiency and clean transportation are shown having varying contributions in long-term GDP growth. This graph shows the sectors that will face challenges in case of green fiscal stimulus and also that a holistic approach should be taken in order to create sustainable economic growth.

Environmental Benefits and Economic Performance

Positive relationships between environmental sustainability indicators and GDP growth were discovered as well. Those countries which had created the infrastructure of green energy and renewable energy sources not only experienced more success in economic performance but also were much closer to reducing the amount of carbon emissions. This means that benefits of green fiscal stimulus are not limited to economic growth but also contribute to the achievement of sustainability targets, among which the goal of creating a low-carbon economy stands out.

Long-Term Growth Trajectories

The results of the simulations conducted in the long run show that the countries which have adopted the green fiscal stimulus policy package will tend to experience an increase in the GDP growth rate in the long run as compared to the other countries which have not adopted such policies. The country adopting green fiscal policy will be able to achieve 1-2% higher GDP growth rate within the period of 10-20 years due to technological development.

Discussion

Interpretation of Findings

It can be seen that the positive impact of green fiscal stimulus programs on the GDP growth trajectory has statistically significant effects. Green fiscal policies perform more cumulative growth over time compared to fiscal policies without stimulus and traditional fiscal policies, which implies not only a short-term economic recovery, but also changes in the structure in the long run. The shift in the productivity frontier that is found demonstrates that green investments help promote technological innovations, resource efficiency, and modernization of the industry and, consequently, help increase the level of output in the long term. The positive outcomes of renewable energy, energy efficiency, and clean transportation industries also support the hypothesis about the positive outcomes of sustainability-oriented investments for the environment and economy. Overall, the results prove that introducing the environmental concerns into fiscal policies helps boost economic resilience and growth.

Comparison with Existing Literature

The results are consistent with the existing research that shows the stabilizing effect of fiscal stimulus during economic recessions. Government spending as discussed in the existing literature has played an important part in short-term effects of the expenditure in the Keynesian models. The green fiscal policies have been researched before and proved that they could play an important part in promoting sustainable development and efficient use of the natural resources. However, the vast majority of the existing literature focuses on short-term recovery outcomes. The results from the current paper complement the existing literature by providing the empirical evidence about the long-term GDP growth due to green fiscal policies. The results are consistent with other studies that showed positive relationship between green investments and productivity gains as well as decarbonization.

Conclusion

There are certain facts proving that green fiscal stimulus policies are able to stimulate growth paths in GDP and produce decarbonization outcomes. Based on empirical data, the relationship between green fiscal stimulus and economic performance turned out to be positive and statistically significant with the coefficient being equal to 1.35 ($t = 4.22$; $p = 0.05$) in the core regression with the control for government expenditure, inflation, and unemployment. In the countries implementing such packages, GDP increases annually by 1.5 percentage points for five years compared to other countries which do not follow the same policy. Moreover, the post-implementation growth rate is 2.5 percentage points higher compared to traditional stimulus. The long-term analysis suggests the existence of long-term cumulative effect of green stimulus, which is in line with the shift of productivity frontier due to innovation, efficiency and resilience. The sectoral analysis proves that renewable energy and clean transport are able to make a significant positive contribution to the overall performance. All these findings reveal the importance of the fact that green stimulus is both a recovery instrument and a structural one, which could contribute to building resilience and competitiveness in the long-run. Therefore, the design of the policy should be oriented to the balance in terms of the utilization of the renewables, investments in grid and storage, efficiency retrofit and low-carbon mobility, and governance that would ensure transparency and monitoring and reallocation of resources to the high impact programs. It is necessary for the literature on the topic to develop in four ways in the future. Firstly, there should be a better quantification of the quality of green stimulus spending that would separate headline amounts from project delivery and uptake. Secondly, distribution and employment effects should be analyzed and understood whose regions, income groups and sectors benefit from it. Thirdly, quasi-experimental approaches and different timings of policy implementation will help to establish causality of the effects of the green stimulus and broad macroeconomic shocks. Fourthly, a policy that links the GDP, emissions and fiscal sustainability will be helpful in decision-making under debt constraint and climate risk conditions especially in emerging economies.

There is a need for climate responsive finance policies as this can be an efficient approach through which sustainable economic development can be achieved as it helps align finance practices with environmental sustainability objectives. With the help of green finance, ESG integration, climate risk management, and sustainable technology investment, the economy can be developed while minimizing the impact on the environment. However, there are some challenges in terms of standardization, funding constraints, and transition risk but with the help of proper policies and technological changes, climate responsive finance can become more effective.

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