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FINANCE FOR SUSTAINABILITY: EXAMINING THE ROLE OF FINANCIAL DEVELOPMENT IN SUSTAINABLE DEVELOPMENT GOALS

Sürdürülebilirlik İçin Finans: Sürdürülebilir Kalkınma Amaçlarında Finansal Gelişmenin Rolünün İncelenmesi

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Keywords:
Financial Development, Sustainable Development, Renewable Energy, Trade Openness.

JEL Codes:
O16, Q01, G20, F18.

Abstract

The role of financial systems in achieving the Sustainable Development Goals and addressing global challenges such as climate change and inequality is increasingly important. However, studies examining this relationship using comprehensive indices and macro-level panel data remain limited. This study aims to examine the relationship between financial development and sustainable development using a large panel dataset covering 132 countries from 2000 to 2021. The analysis employs the International Monetary Fund's multidimensional Financial Development Index and the United Nations' Sustainable Development Goals Index, applying the Augmented Mean Group estimator to account for cross-sectional dependence and slope heterogeneity. Empirical results indicate that financial development, economic growth, and renewable energy consumption positively affect sustainable development. In contrast, trade openness and gross capital formation exhibit a negative relationship with sustainability. These findings emphasize the need to strengthen financial systems and promote environmentally friendly investments to achieve the Sustainable Development Goals. Moreover, they provide a crucial warning that, without supporting environmental policies, expanded trade and capital investments may have adverse effects on sustainability, such as the creation of pollution havens.

Anahtar Kelimeler:
Finansal Gelişme, Sürdürülebilir Kalkınma, Yenilenebilir Enerji, Ticari Açıklık.

JEL Kodları:
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Öz

Finansal sistemlerin Sürdürülebilir Kalkınma Amaçlarına ulaşmadaki ve iklim değişikliği ile eşitsizlik gibi küresel sorunlarla mücadeledeki rolü giderek daha fazla önem kazanmaktadır. Bununla birlikte, kapsamlı endeksler ve makro düzeydeki panel verilerini kullanarak bu ilişkiyi inceleyen çalışmalar sınırlı kalmıştır. Bu çalışma, 2000-2021 yılları arasında 132 ülkeyi kapsayan geniş bir panel veri setini kullanarak finansal gelişme ile sürdürülebilir kalkınma arasındaki ilişkiyi incelemeyi amaçlamaktadır. Analizde, Uluslararası Para Fonu'nun çok boyutlu Finansal Gelişmişlik Endeksi ve Birleşmiş Milletler'in Sürdürülebilir Kalkınma Amaçları Endeksi kullanılmış; yatay kesit bağımlılığını ve eğim heterojenliğini dikkate alan Genişletilmiş Ortalama Grup (Augmented Mean Group) tahmincisi uygulanmıştır. Ampirik sonuçlar, finansal gelişmişliğin, ekonomik büyümenin ve yenilenebilir enerji tüketiminin sürdürülebilir kalkınmayı olumlu yönde etkilediğini göstermektedir. Buna karşılık, ticaretin açıklığı ve brüt sermaye oluşumu sürdürülebilirlikle negatif bir ilişki sergilemektedir. Bu bulgular, Sürdürülebilir Kalkınma Amaçlarına ulaşmak için finansal sistemlerin güçlendirilmesi ve çevre dostu yatırımların teşvik edilmesi gerektiğini vurgulamaktadır. Ayrıca, bu bulgular çevre politikaları desteklenmeden ticaretin ve sermaye yatırımlarının genişletilmesinin, kirlilik cennetleri gibi sürdürülebilirlik üzerinde olumsuz etkileri olabileceği konusunda önemli bir uyarı niteliği taşımaktadır.

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1. Introduction

A strong financial system is widely acknowledged as a crucial catalyst for economic growth (Beck et al., 2000; Beck and Levine, 2003). The financial sector supports capital accumulation and technological progress by aggregating savings, providing investment-related information, efficiently allocating capital, and facilitating domestic transactions and foreign capital inflows. Economies with more developed financial systems generally experience faster long-term growth, and evidence suggests that this relationship is causal rather than merely correlational. Beyond promoting growth, financial development broadens access to finance for poor and vulnerable groups, strengthens risk management, enhances resilience to shocks, and boosts productivity. This contributes to higher incomes, reduced poverty, and less inequality (Demirguc-Kunt and Klapper, 2012; World Bank, 2015; World Bank, 2018).

The literature mainly emphasizes the link between finance and growth. Some more recent research also examines the influence of financial development on sustainability. This trend reflects a growing awareness that economic growth alone will not suffice in a world facing challenges such as environmental degradation and inequalities. (Houda and Lamia, 2016).

A turning point was the Brundtland Report that defined sustainable development as a "development which meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987). The notion of identifying national trends according to international indicators is generalized in the adoption by the United Nations (UN), in 2015, a list of 17 Sustainable Development Goals (SDGs) that proposes a framework for public policies structured around poverty reduction, inequality, and climate change, among other factors. SDGs represent a worldwide initiative aimed at addressing global challenges such as poverty, climate change, and inequality by 2030 (UN, 2015). This initiative demonstrates the need to monitor the long-term sustainability of economic growth, even when supported by financial development.

Thus, research has shifted from simply looking at growth outcomes to a more comprehensive framework that also considers environmental and social issues. This shift has highlighted the importance of evaluating the financial system not only in terms of its ability to support economic growth but also in terms of its environmental and social impacts.

Given the central role of financial markets, a key question is how financial development influences sustainable development. Although the finance-growth relationship is well established, the broader sustainability implications remain uncertain, leaving a clear research gap (Dutta and Saha, 2022).

This study addresses that gap by examining the relationship between sustainable development and financial development across countries. It employs cross-country data on the Financial Development Index (FDI) and the SDG Index, while accounting for Gross Domestic Product (GDP) per capita, trade openness, renewable energy consumption, and capital formation. To capture heterogeneous country experiences and address cross-sectional dependence, the study applies the Augmented Mean Group (AMG) estimator.

This study contributes to the literature in three main ways. First, in this study, the SDG Index was used as a comprehensive measure of sustainability, capturing economic, social, and environmental dimensions. Second, the International Monetary Fund's (IMF) FDI was used, allowing for a broader evaluation of financial systems beyond conventional single indicators.

Third, an analysis was performed on a large sample of 132 countries, and second-generation panel estimators (AMG estimator and Common Correlated Effects Mean Group estimator) were used. This method provides efficient results even in panels with cross-sectional dependence and heterogeneity problems. By providing more robust and globally comparable evidence, this study expands previous studies.

The remainder of the article is structured as follows. Section 2 reviews the existing literature on financial development and sustainability. Section 3 presents the data, model specification, empirical methodology and empirical results. Section 4 concludes with a summary.

2. Literature Review

Several studies highlight the critical role of financial development in promoting economic and sustainable development. Guru and Yadav (2019) emphasize that economic development requires financing, with financial institutions playing a crucial role not only in the growth of financial markets but also in poverty reduction. Similarly, Acemoglu et al. (2005) underscore the positive impact of financial intermediaries on economic growth, noting that they encourage savings accumulation, multiply resources through asset management, and channel surpluses toward development financing.

The financial system is of great importance as it serves as the primary conduit for the mobilization and allocation of the massive resources required to address global challenges such as poverty, inequality, and climate change (Akhtar and Rashid, 2024). Furthermore, it is observed that financial development has important effects on the SDGs through a variety of specific transmission channels. In view of the above findings, it can be interpreted that these mechanisms transform financial variables into social, economic, and environmental impacts.

In traditional theory, it is assumed that the framework developed by King and Levine (1993) and Levine (2005) reveals the causal relationships between financial development and economic growth. The economic transmission channel of financial development relies on the capacity of financial systems to mobilize savings and direct them to the most efficient investment projects. This mechanism not only leads to an increase in the total amount of investment but also improves the quality and efficiency of these investments. This has important effects on supporting sustainable economic growth and industrialization (Al-Smadi, 2025). Similarly, according to the study conducted by Emara and El Said (2021) in Middle East and North Africa (MENA) countries, it is seen that financial inclusion has important effects on economic growth in the case of a strong institutional structure. These findings, which support the approaches emphasizing the benefits of financial development, are consistent with earlier studies.

The environmental transmission channel of financial development operates by correcting market failures and directing capital to environmentally friendly and low-emission projects (Li and Deng, 2025). In a study conducted by Shahbaz et al. (2013) on South Africa, it is seen that economic expansion leads to an increase in CO2 emissions, while financial development has important effects on reducing carbon emissions. Furthermore, an analysis was performed on China by Ma et al. (2025) to examine the impact of green finance as a dimension of financial development on carbon emissions. At the end of the analysis, it has been observed that there is an inverted U-shaped relationship between green finance and carbon emissions, and this effect shows spatial spillover characteristics. Based on these findings, it can be concluded that green finance

has important effects on environmental sustainability through the channels of energy structure transformation and technological advancement. However, some studies also show that financial growth does not always lead to environmental benefits. According to Guo and Naseer (2025), it is assumed that excessive credit expansion in upper-middle-income countries leads to an increase in energy-intensive consumption, and thus has important effects on overshadowing sustainability gains.

The social impacts of financial development are generally associated with reducing poverty, eliminating income inequality, and raising living standards. Zhang and Naceur (2019) performed an analysis on 143 countries. It was observed that, excluding market liberalization, all dimensions of financial development (depth, access, efficiency and stability) significantly contribute to social sustainability by reducing inequality and poverty. Furthermore, Beck et al. (2007) found that financial development disproportionately increases the incomes of the poorest in society, reducing income inequality and lowering extreme poverty. Considering these findings, it can be interpreted that these effects operate both through inequality reduction and overall economic growth.

Empirical research using panel data across countries has consistently confirmed the positive link between financial development and sustainable development. Hunjra et al. (2022) analyzed 50 low-income and middle-income countries (1991-2020) using fixed effects, feasible generalized least squares, and bootstrap panel quantile regression, finding that financial development positively affects sustainable economic development, with additional positive effects from natural resource abundance, international tourism, trade openness, and foreign direct investments. Dutta and Saha (2023) applied panel vector autoregression on 143 countries (1990-2020) and found that financial development generally drives sustainable development, with bidirectional causality observed between the financial market index and adjusted net savings. Koirala and Pradhan (2020) used panel data for 12 Asian countries (1990-2014), showing that per capita income and financial development positively affect sustainable development, while inflation, natural resource rents, and time have negative effects. Ntarmah et al. (2019) examined 37 developing countries (2000-2016), concluding that banking system stability promotes economic sustainability, although the effects of regulatory capital, bank credit, and other indicators vary across BRICS vs. non-BRICS and Asian vs. non-Asian countries.

Financial inclusion and digital finance have also been shown to influence sustainable development. Nguyen Van and Le Quoc (2024) applied threshold and Bayesian regression to 117 countries (2004-2022), finding that digital financial inclusion positively affects sustainable development in countries with low and medium financial development but negatively affects it in countries with high financial development. Oanh and Dinh (2024) applied quantile-on-quantile regression, Granger tests, and wavelet coherence on Vietnam (2004-2022), reporting that both digital financial inclusion and financial stability positively affect sustainable development across different quantiles and frequencies.

Regional and sectoral studies also illustrate the nuanced relationship between finance, trade, and sustainability. Zioło et al. (2023) used a synthetic indicator of sustainable development and fuzzy logic for European countries, finding that sustainable development varies across regions, with Sweden, Finland, and Denmark performing the highest, and Lithuania, Cyprus, and Bulgaria the lowest; higher sustainable development was associated with higher financial development. Pho et al. (2025) applied a two-step system generalized method of moments (GMM)

to 151 countries (2004-2021), showing that financial market development, technological innovation, and green trade positively contribute to sustainable development, while financial institutional development and urbanization negatively affect it, with institutional quality strengthening the positive role of finance and trade.

The role of energy and technological innovation is also emphasized in recent studies. Yang et al. (2022) applied bootstrapped autoregressive distributed lag (ARDL) cointegration and Granger causality on China (1980-2019), finding that financial development and green technology innovation positively contribute to long-run environmental protection, whereas energy consumption and employment hinder it. Tan (2022) analyzed private investments in the sustainable development conceptually and from a regulatory perspective, noting that increasing private finance for SDGs reshapes governance, accountability, and regulatory mechanisms. Using private markets and corporate regulatory regimes as tools to achieve development goals. Güney (2021) used instrumental variables and two-step GMM on 35 countries (2005-2018), finding that solar energy positively affects sustainable development, while non-renewable energy reduces it. Li et al. (2023) applied cross-sectional ARDL to G20 data (1992-2018), showing that renewable energy reduces ecological footprints, whereas capital formation, non-renewable energy, and natural resource use negatively affect sustainable development. Pan et al. (2023) conducted a bibliometric review on the energy-sustainable development nexus, noting rapid research growth, diverse methodological approaches, and evidence that low-carbon energy supports SDGs while creating trade-offs with some goals.

Trade and investment dynamics also influence sustainability outcomes. Sheikh et al. (2021) applied a dynamic panel ARDL on BRICS countries, finding that while economic growth supports sustainability, trade openness, energy consumption, and foreign direct investment negatively affect it in both the short and long run. Hao et al. (2025) applied social network analysis on 54 Belt and Road countries (2007-2021) to construct the renewable energy products trade network, finding that higher trade intensity and centrality positively affect SDG performance, particularly for import trade in low- and middle-income countries, whereas renewable energy technology shows a negative mediation effect.

Although there is a wide range of literature on this topic, it is observed that important gaps remain. It is seen that most studies use partial indicators of sustainability rather than comprehensive measures such as the SDG Index, and often rely on limited proxies of financial development. Furthermore, evidence based on large cross-country panels that consider cross-sectional dependence and heterogeneity problems is still limited. The aim of this study is to contribute to the literature by analyzing these gaps. In this study, a comprehensive sustainability measure, a multidimensional FDI, and second-generation panel methods were used. This method provides efficient results even in panels with cross-sectional dependence and heterogeneity problems.

3. Empirical Analysis

This section presents the empirical framework used to examine the relationship between financial development and sustainable development. It describes the dataset, variables, and model specification, reports preliminary diagnostic tests, presents baseline estimations, and includes robustness checks as well as a panel causality analysis to assess the direction of the relationship.

3.1. Data and Methodology

This study investigates the effect of financial development on sustainable development using a comprehensive cross-country panel dataset. Financial development is measured by the FDI compiled by the IMF, while sustainable development is proxied by the SDG Index produced by the UN.

To account for other factors that may influence sustainable development, the analysis includes several control variables: trade openness (as a percentage of GDP), GDP per capita (constant 2015 US dollars), renewable energy consumption (as a percentage of total final energy consumption), and gross capital formation (as a percentage of GDP). All control variables are obtained from the World Bank (WB) database. The analysis utilizes a panel dataset covering 132 countries over the period 2000-2021.

To determine the effect of financial development on sustainable development across countries, the following empirical model is specified:

$$SDG_{it} = f(FDI_{it}, TO_{it}, GDPpc_{it}, REC_{it}, GCF_{it}, v_i) \quad (1)$$

where SDG_{it} represents the Sustainable Development Goals Index, FDI_{it} is the Financial Development Index, TO_{it} denotes trade openness, $GDPpc_{it}$ is GDP per capita, REC_{it} is renewable energy consumption, GCF_{it} is gross capital formation, and v_i captures unobserved country-specific effects. All variables in the equation, except for GDP per capita, are included in their original form. GDP per capita is transformed into its natural logarithm, leading to the following estimation equation:

$$SDG_{it} = \beta_0 + \beta_1 FDI_{it} + \beta_2 TO_{it} + \beta_3\, ln\,(GDPpc_{it)} + \beta_4\, REC_{it} + \beta_5\, GCF_{it} + v_i + u_{it} \quad (2)$$

Table 1 presents the descriptive statistics, providing an overview of the data distribution across the sampled countries and years.

Table 1. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max
SDG	65.484	10.794	38.582	86.869
FDI	0.345	0.243	0.026	0.997
TO	81.381	44.681	4.128	437.327
REC	32.301	28.422	0.000	98.300
GCF	24.165	7.372	1.097	76.782
lnGDPpc	8.635	1.440	5.661	11.438
GDPpc	13765.3	17698.08	287.3906	92757.23

3.2. Preliminary Tests

Before estimating the model, we assess the properties of the data by testing for cross-sectional dependence (CSD) and slope homogeneity. These are essential diagnostics, as neglecting CSD can lead to biased estimates in panel data models. We apply the Cross-sectional Dependence (CD) test proposed by Pesaran (2004) and the Delta (Δ) test of Pesaran and Yamagata (2008).

The results in Table 2 reject the null hypothesis of cross-sectional independence at the 1% level for all variables, implying that shocks in one country may spill over rapidly to others in the

sample. Similarly, the slope homogeneity test (Table 3) rejects the null hypothesis, indicating substantial heterogeneity in slope coefficients across countries.

Table 2. Cross-sectional Dependence (CD) Test Results

Variable	CD-test
SDG	397.303***
FDI	127.887***
TO	56.741***
REC	31.85***
GCF	2.868***
lnGDPpc	260.365***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Table 3. Slope Homogeneity Test Results

Delta ($\tilde{\Delta}$)	Adj. ($\tilde{\Delta}_{adj}$)
43.865 ***	53.123***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Given the presence of CSD and slope heterogeneity, we proceed with unit root testing using the Cross-sectional Augmented Dickey-Fuller (CADF) test of Pesaran (2007), which accounts for CSD. As shown in Table 4, the FDI variable is stationary at level (I(0)), while all other variables are integrated of order one (I(1)).

Table 4. Panel Unit Root Test (CADF) Results.

Variable	t-bar (Level)	Z(t-bar) (Level)	t-bar (1st Diff)	Z(t-bar) (1st Diff)	Order of Integration
SDG	-2.302	0.225	-3.365***	-12.908***	I(1)
FDI	-2.640***	-3.948***	-	-	I(0)
TO	-2.225	1.169	-2.828***	-6.270***	I(1)
REC	-1.946	4.626	-3.162***	-10.396***	I(1)
GCF	-2.354	-0.422	-3.107***	-9.723***	I(1)
lnGDPpc	-1.919	4.958	-2.552***	-2.866***	I(1)

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Following the unit root identification, the long-run cointegration relationship is examined using the Cross-Sectionally Augmented Error Correction Model (CS-ECM) (Chudik and Pesaran, 2015). This framework is particularly suitable as it addresses CSD through cross-sectional averages and accounts for slope heterogeneity. Furthermore, it produces consistent estimates even with a mixture of I(0) and I(1) processes. Table 5 reports the CS-ECM results, where the error correction term (ECT) is negative and statistically significant, confirming a stable long-run equilibrium between sustainable development and its determinants.

Table 5. Cointegration Test (CS-ECM)

Adjustment Term	Coefficient
ECT (L.SDG)	-1.031***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

3.3. Baseline Estimation

Given the presence of CSD and heterogeneous slope coefficients, the AMG estimator of Eberhardt and Bond (2009), Eberhardt and Teal (2010), and Bond and Eberhardt (2013) is employed. AMG is chosen because it accounts for CSD, allows for heterogeneous slope coefficients across countries, and provides robust long-run estimates, making it well-suited for panels with diverse country characteristics. However, since the baseline AMG may not fully capture potential endogeneity issues, the results are initially interpreted as strong associations.

Table 6 reports the results from the AMG estimator. The findings indicate a strong positive association between financial development and sustainable development. Specifically, the coefficient on the FDI is 1.840025 and statistically significant at the 5% level. Findings are consistent with previous cross-country evidence suggesting that robust financial institutions and markets are essential for mobilizing the massive resources required to address global challenges.

Table 6. Augmented Mean Group (AMG) Estimations

Variable	Coefficient
FDI	1.840025**
TO	-0.0057176*
REC	0.0448263***
GCF	-0.0229697***
lnGDPpc	1.285448**
Common Dynamic Process	0.8699908***
Constant	50.62488***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Economic prosperity, captured by the logarithm of GDP per capita, also shows a positive association with sustainable development. The coefficient of 1.285 indicates that a 1% increase in GDP per capita is associated with a 0.01285-unit increase in the SDG Index. This finding is consistent with the view that economic growth, when channeled effectively, enables the allocation of resources toward human capital development and green infrastructure.

Among the control variables, REC has a positive coefficient of 0.045, significant at the 1% level, underscoring the importance of clean energy in achieving sustainable development. This suggests that improvements in financial development are systematically linked with higher SDG Index scores, highlighting the role of financial systems in supporting progress toward sustainability (Guru and Yadav, 2019; Gao et al., 2022). Similarly, economic growth and renewable energy use also contribute to achieving these SDGs. On the other hand, research also shows that a narrow “growth at any cost” approach can hinder progress (Coscieme et al., 2020; Marti and Cervelló-Royo, 2023; Guillamón et al., 2025). Effective policies are essential to direct financial and economic resources toward sustainability goals (Dutta and Saha, 2023; Aslam et al., 2023).

In contrast, GCF is negatively associated with the SDG Index, with a coefficient of -0.023 significant at the 1% level. Similarly, TO exhibits a small but significant negative association (-0.0057 at the 10% level). In the absence of effective environmental policies, the growth of global trade and expanding supply chains can have deeper impacts on environmental degradation. Failure to direct increasing capital accumulation towards environmentally friendly investments

may increase the impacts of resource-intensive sectors (Rahman and Ahmad, 2019; Adedoyin et al., 2020; Qamruzzaman et al., 2024).

The AMG estimates indicate a consistent link between financial development, income growth, and renewable energy use and enhanced sustainability outcomes. However, the relationship with trade openness and capital formation is more nuanced and potentially context-dependent.

3.4. Robustness Check

To validate the stability of these findings, the Common Correlated Effects Mean Group (CCEMG) estimator (Pesaran, 2006) is applied. While AMG uses a common dynamic multiplier, CCEMG addresses unobserved common factors and cross-sectional dependence by augmenting the regression with cross-sectional averages of the dependent and independent variables.

Furthermore, a Fixed-Effects Instrumental Variable (FE-IV) regression is conducted to mitigate potential endogeneity and simultaneity bias. In this specification, FDI is instrumented using its first lag (L.FDI). Table 7 presents a comparative summary of these estimators.

Table 7. Robustness Check: CCEMG and FE-IV Estimations

Variable	AMG (Baseline)	CCEMG (Robust)	FE-IV (Endogeneity)
FDI	1.840025**	2.4082**	8.1220***
TO	-0.0057176*	-0.0047	-0.0005
REC	0.0448263***	0.0454***	-0.0092
GCF	-0.0229697***	-0.0305***	0.0041
lnGDPpc	1.285448**	1.3949*	9.4959***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The comparative analysis reveals that the positive impact of FDI and lnGDPpc on SDG remains statistically significant across all specifications. It is seen that the direction and significance of these core variables are consistent in the AMG, CCEMG, and FE-IV models. Notably, the FE-IV estimator yields higher coefficients; in view of the above findings, it can be interpreted that the positive role of financial development persists once endogeneity is addressed. While the significance of some control variables varies across models, the primary relationship between financial development and SDGs remains structurally firm.

3.5. Panel Causality Analysis

Finally, to examine the direction of these relationships, the Dumitrescu and Hurlin (2012) heterogeneous panel causality test is employed. As reported in Table 8, the results indicate bidirectional causality between financial development and the SDG Index. This establishes a feedback mechanism where financial improvements promote sustainability, and advancements in SDGs, in turn, drive further financial development. Similarly, renewable energy consumption, trade openness, gross capital formation, and income levels exhibit bidirectional causal relationships with the SDG Index. This indicates that these macroeconomic and environmental determinants act as multidimensional drivers of sustainable development, while the realization of SDGs concurrently fosters improvements across these dimensions.

Table 8. Dumitrescu-Hurlin Panel Causality Test

Null Hypothesis	W-stat	Zbar-stat	Z-tilde
FDI does not Granger-cause SDG Index	3.7063	9.8020***	5.9629***
SDG Index does not Granger-cause FDI	3.8502	10.6289***	6.5766***
REC does not Granger-cause SDG Index	3.4883	8.4847***	4.9952***
SDG Index does not Granger-cause REC	4.8661	16.3393***	10.8247***
TO does not Granger-cause SDG Index	3.0988	6.3124***	3.3730***
SDG Index does not Granger-cause TO	5.7985	21.8208***	14.8829***
GCF does not Granger-cause SDG Index	3.7072	9.8070***	5.9666***
SDG Index does not Granger-cause GCF	3.3170	7.5656***	4.3031***
lnGDPpc does not Granger-cause SDG Index	4.9516	16.9557***	11.2722***
SDG Index does not Granger-cause lnGDPpc	4.0956	12.0382***	7.6226***

Note: ***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively

4. Conclusion

This study empirically examines the relationship between financial development and sustainable development using a panel data set covering 132 countries for the period 2000-2021. The findings reveal that financial development has a statistically significant and positive impact on SDGs performance. The development of financial institutions and markets supports the sustainable development process by contributing to the more efficient allocation of resources, the financing of innovative projects, and the achievement of economic stability. Furthermore, the causality analysis confirms the existence of a bidirectional relationship, indicating that financial development and advances in sustainability support each other in a feedback mechanism.

The empirical results also highlight the nuanced and sometimes contradictory nature of sustainability drivers. While economic prosperity and renewable energy use positively impact the SDG Index, the negative coefficients for trade openness and gross capital formation reveal critical trade-offs. Specifically, the negative impact of trade expansion supports the pollution haven hypothesis in contexts with weak institutional oversight, while the results for capital formation suggest that global investment flows remain predominantly directed toward resource-intensive traditional sectors rather than green infrastructure.

These findings have important implications for policymakers, indicating the need to shift from general financial expansion to targeted sustainable finance frameworks. In this context, it is assumed that making Environmental, Social, and Governance (ESG) disclosure requirements and green credit guarantees a part of the institutional framework has important effects on ensuring that market efficiency translates into social and environmental gains. Furthermore, implementing fiscal incentives such as green investment tax credits and integrating rigorous environmental protocols into international trade agreements are of great importance to address the adverse effects of capital formation and trade. This will mitigate the risk of carbon leakage and the pollution haven effect. Moreover, leveraging financial systems to scale up renewable energy infrastructure through the issuance of green bonds will lead to an increase in the effective alignment of long-term capital with the energy transition. It can be concluded that aligning financial, energy and trade policies is crucial to ensuring that economic development supports the 2030 Agenda.

Future research could expand this analysis by examining the SDGs in detail to identify which goals are most responsive to financial development. This study provides a global perspective covering 132 countries. However, analyses of different regions or income groups

could reveal how the relationship between financial development and sustainable development varies.

Declaration of Research and Publication Ethics
This study, which does not require ethics committee approval and/or legal/specific permission complies with the research and publication ethics.

Researcher's Contribution Rate Statement
I am the sole author of this paper. My contribution is 100%.

Declaration of Researcher's Conflict of Interest
There are no potential conflicts of interest in this study.

Declaration of Generative AI Usage
During the preparation of this work, the author used Gemini and ChatGPT for the purposes of language editing, grammatical correction, and ensuring the consistency of the bibliographic reference style. After using these services, the author reviewed and edited the content as necessary and takes full responsibility for the integrity and accuracy of the final published article.

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