

The Mitigating Role in Financial Depth on the Remittances-ESG Nexus: How Financial Development Offsets the Negative Impact in OECD Countries

Cansu Çilingir Kara¹

Melek Özlem Ayas Cin²

Abstract

This manuscript examines the influence of remittance inflows and financial development on Environmental, Social, and Governance (ESG) performance utilizing annual panel data from 35 OECD nations spanning 2000-2023. The dependent variable is the national-level ESG score, whereas remittance inflows (expressed as a percentage of GDP) and financial depth, quantified by domestic credit to the private sector, function as the principal independent variables. The model incorporates an interaction term between financial depth and remittances to encapsulate the moderating function of financial development. GDP per capita, inflation, and trade openness are included as control variables to account for economic progression, macroeconomic stability, and international trade exposure. The Augmented Mean Group (AMG) estimator, selected for its resilience to cross-sectional dependence, heteroscedasticity, and parameter heterogeneity, discloses that remittances exert a statistically significant negative direct effect on ESG performance ($\beta = -0.24$, $p < 0.05$). Nevertheless, the interaction term between financial depth and remittances is positive and marginally significant ($\beta = 0.05$, $p < 0.10$), indicating that financial depth alleviates the detrimental impact of remittance inflows on ESG outcomes. Among control variables, GDP ($\beta = 0.04$, $p < 0.01$) and trade openness ($\beta = 0.01$, $p < 0.01$) exhibit significant positive correlations with ESG performance. The Dumitrescu-Hurlin panel causality

1 Asst. Prof. Dr., Istanbul Beykent University, cansukara@beykent.edu.tr, ORCID ID:0000-0001-5923-9700

2 Asst. Prof. Dr., Istanbul Beykent University, ozlemayas@beykent.edu.tr, ORCID ID: 0000-0002-4594-5011

test corroborates unidirectional causality from remittances to ESG scores ($z = 2.95, p < 0.01$), reinforcing the credibility of the findings. Overall, the results elucidate that financial depth assumes a pivotal moderating role, transforming the remittance-ESG nexus and enhancing nations' sustainability performance through well-developed financial infrastructure.

1. Introduction

The performance of an entity regarding its environment, society, and governance is defined by ESG factors, which involve a multidimensional approach for the assessment of the sustainability of such entities, including countries, by extending the focus beyond the typical key indicators of performance (Verhoeven, 2024). The key factors mentioned above impinge upon the responsibility of countries regarding the management of their environment, which has a bearing on their capacity for securing the welfare of the next generations based on their governance functions (Diaye et al., 2021).

There is a level of complexity in the evaluation process in ESG because there is no global accepted standard. However, there is a rigorous process in designing a Sovereign ESG Index, which includes the following steps, as described in the sources:

1) **Data Collection** The process of evaluation has, as its first step, compiling a large set of indicators, usually between 40 and 71, from credible sources such as the World Bank Sovereign ESG Database, OECD, among others.

2) **Normalization**: Since the indicators were given in different units (for instance, metric tons CO₂ compared to the percentage population with access to electricity), it is essential to normalize the given indicators to have a standard scale. The standard scale is always 0 to 1, and techniques such as Min-Max normalization are used.

3) **Weighting**: The indicators are assigned a weightage based on the contribution they make to the final score. Weightage is often done through statistical tools like Principal Component Analysis (PCA), which determines which indicators explain the highest amount of variance, or methods based on entropy, which estimate the variability in data.

4) **Index Calculation**: The final ESG score can be calculated by combining the weighted, standardized indicators in an equation to form an index which gives an overall measure of the ESG performance for the country.

ESG data can actually be thought of as the overall health check of a nation. Instead of looking at the gross domestic product as the only way to measure value, the health check includes data about the environment (like the amount

of cholesterol and lung functionality), social data (based off of relationships and the level of education), as well as data concerning governance or honesty. The overall score for ESG comes from the aggregation of these pieces of data into one report.

1.1. The Role of Financial Depth for ESG Evaluation

Financial depth constitutes a critical aspect of financial development, with the ratio of private credit to GDP acting as its principal metric in cross-national evaluations. Scholars often utilize measures of financial depth in a manner that is synonymous with indicators of financial development, especially in the context of analyzing the progression of credit markets (Kerimov, 2021).

The function of financial depth, quantified via domestic credit to the private sector, in influencing ESG performance operates through intricate mechanisms encompassing credit allocation, institutional caliber, and the efficacy of financial intermediation. Financial depth can be conceptualized as the capability of a nation's financial system to mobilize resources and direct them towards productive investments, which has direct ramifications for all three ESG dimensions (Ng et al., 2020). The correlation between financial depth and environmental sustainability is particularly intricate, exhibiting both beneficial and detrimental effects contingent upon the sectoral distribution of credit. While more profound financial systems can mobilize capital for green technologies and sustainable infrastructure initiatives (Ng et al., 2020; Hassani et al., 2024), several investigations have documented that increases in domestic credit to the private sector are associated with elevated CO2 emissions and larger ecological footprints, especially when lending supports carbon-intensive sectors (Elsayed & Albeltagy, 2024). This duality suggests that financial depth acts as a "double-edged sword," where the environmental outcome critically depends on whether credit flows are directed towards green investments or pollution-intensive endeavors.

The influence of financial depth on governance quality and social outcomes is generally more favorable, though still contingent on institutional context and the nature of financial development. Country-level metrics of financial sector advancement have been found to enhance the governance component of ESG in global analyses, indicating enhancements in corporate oversight, disclosure incentives, and public accountability as finance deepens (Ng et al., 2020). More profound credit markets expand monitoring capacity through increased analyst coverage and transparency, which fortifies board practices and amplifies governance outcomes (Obiora et al., 2020). However, the governance advancements are more pronounced where financial accessibility,

market development, and institutional caliber permit markets to effectively price governance attributes (Ng et al., 2020).

The mechanism connecting financial depth to ESG performance operates primarily through the alleviation of financing constraints, enabling firms to engage in corporate social responsibility and environmental initiatives that might otherwise be financially unfeasible (Obiora et al., 2020). This implies that policy interventions should concentrate not only on augmenting credit availability but also on enhancing financial efficiency, implementing conditionalities for green lending, and amplifying disclosure requirements to ensure that financial depth translates into substantive ESG enhancements rather than merely financing unsustainable growth (Ganda, 2019; Majeed & Mazhar, 2019).

1.2. The Role of Remittance for ESG Evaluation

The role of remittance receipt and financial developments on environmental sustainability and political processes is described by a variety of interactions involving domestic households, the quality of institutions, as well as levels of civic participation. Remittances may be viewed as a positive source of sustainable funding within developing regions (Giuliano & Ruiz-Arranz, 2009), yet such remittance contributions towards environmental sustainability can often be mediated by the levels of host-country developments involving political processes.

The link between remittances and the environment primarily involves the consumption-oriented growth hypothesis and the mediating impact of financial systems. The arrival of remittances has, in various instances, had a negative effect on the quality of the environment. Various studies have shown that the remittances that the economies of the OECD countries receive have led to an increase in the household income of the affected economies and have, as a result, led to the promotion of the consumption of energy-intensive goods (Sadorsky, 2010; Zhang, Liu & Bae, 2017). The negative impact of remittances on the environment can be moderated by an advanced financial system. An advanced financial system can act as an “ESG filter,” channeling these money flows from consumption to investments such as green bond markets, energy-saving projects, and social impact bonds.

Compared with normal private credit investments, “green finance” in the forms of budget allocations dedicated to meeting climate-related objectives has been a substantial enabler of good environmental practices in the ESG context (OECD, 2017; UNEP, 2021).

Remittances have an impact on the political sustainability because they shape the behavior of the citizenry vis-à-vis their governments. There is some suggestive evidence of a “resource curse” role of remittances, which can insulate beneficiaries against local economic conditions and, in turn, reduce government performance-linkages with individual well-being outcomes (Kpodar & Le Goff, 2011). This can lead to beneficiaries of remittances, in any region across either sub-Saharan Africa or Mexico, becoming less likely voters.

Though they vote less actively, remittance recipients tend to show higher political engagement (Careja & Emmenegger, 2012). In Africa, for example, remittance receivers tend to personally contact the state administrative body in regard to a problem or take part in a demonstration or protest. The remittance helps the receiver overcome the costs associated with such political engagement. Remittances might weaken the household’s reliance on state patronage, and as such, the cost of maintaining a political opposition might decrease. In other autocratic states, the remittances might fuel the corrupt machinery or enable the incumbent to maintain power through the existence of a private welfare safety net that decreases the pressure on the state to deliver public goods.

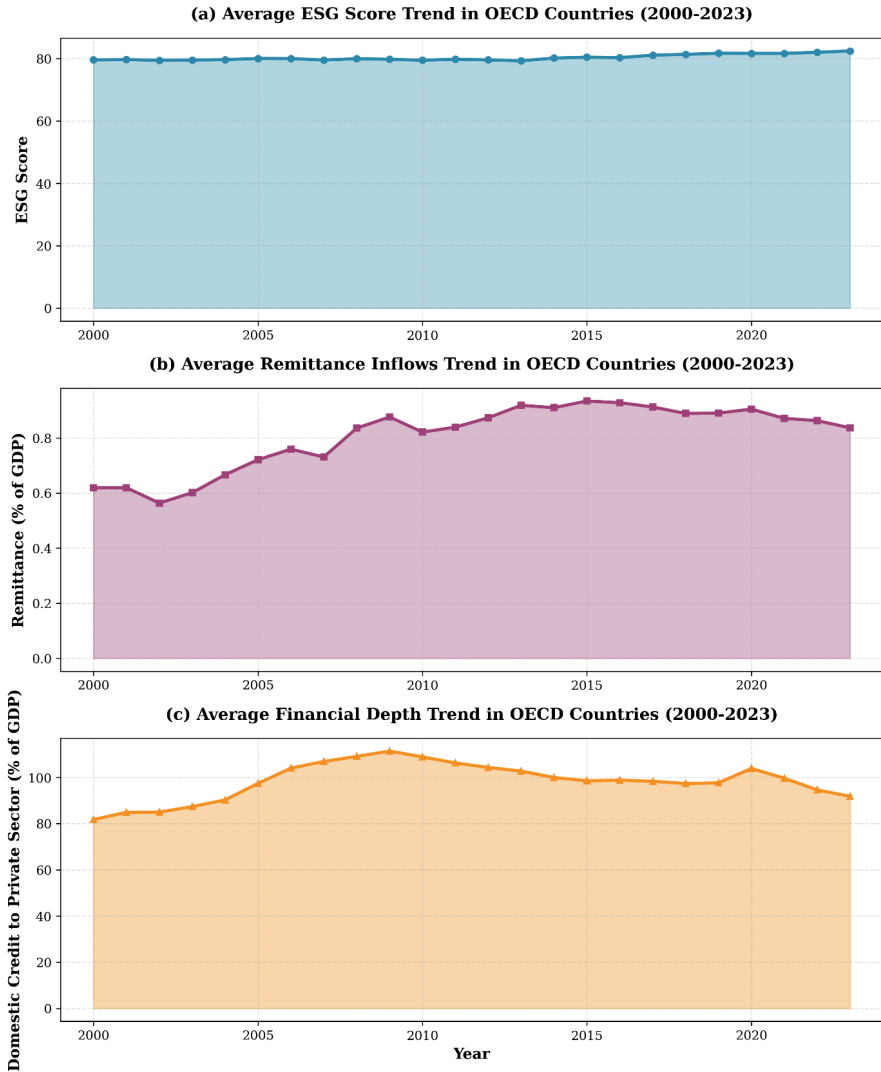


Figure 1. Temporal trends of (a) ESG performance, (b) remittance inflows, and (c) financial depth in OECD countries, 2000-2023.

Note. The graphs show average values across 35 OECD member states. ESG scores range from 0 to 100, while remittance and financial depth are expressed as percentages of GDP.

Figure 1 illustrates the temporal patterns of the principal variables investigated in this research across 35 OECD nations over the timeframe 2000-2023. Panel (a) reveals a consistent enhancement in ESG performance, particularly accelerating post-2015, indicating heightened sustainability commitments among OECD countries. Panels (b) and (c) indicate that while

remittance inflows remained relatively stable around 0,8% of GDP, financial depth displayed significant fluctuations, reaching a peak in 2009-2010 before stabilizing at roughly 95% of GDP.

2. Literature

The conversation around remittance inflows has shifted from seeing these as extra income for households to seeing these as significant factors that interact with ESG, remittance and financial development. Following differences between our variable set and the table in the literature are what make our study unique and address the gaps in the literature:

1. Direct and Comprehensive Assessment of the Remittance-ESG Connection: This manuscript illustrates that remittances adversely influence ESG performance in OECD nations, unless financial systems are sufficiently developed to convert remittance flows into sustainable investments, resulting in a conditional remittance-ESG model predicated on financial depth. To elucidate this assertion, while previous literature has explored the association between remittances and economic development, environmental degradation, and sustainability; this paper is among the initial efforts to directly quantify the impact of remittances on a nation's ESG performance, extending beyond CO₂ emissions or growth. It shifts the focus of the discourse from a solely environmental standpoint to a more comprehensive perspective of sustainability, characterized by the ESG framework (E, S, and G).

2. Theoretical Confirmation of Financial Development as a Moderating Factor: Another significant contribution to theory is the introduction and validation of the moderating influence of the interplay between remittances and financial development. Indeed, it is shown that financial depth functions as a conditional institutional conduit, rather than merely as a supplementary variable or parallel growth catalyst. Financial depth serves, fundamentally, as an "ESG filter." Remittances can detrimentally impact ESG performance, particularly concerning consumption-driven disparities, yet the existence of a sophisticated financial sector can channel remittances toward more sustainable investments, thereby mitigating the adverse externalities of remittances. This study represents a crucial contribution to the understanding of the relationship between remittances and sustainability, especially as it demonstrates that the institutional framework of the home nation is pivotal in determining the influence of international capital on ESG performance.

3. Empirical Insights from Developed Economies with High-Quality Data: Empirically, this investigation is conducted on 35 OECD nations from 2000 to 2023, broadening the geographical scope beyond the conventional examination of developing regions. In contrast to earlier studies that concentrate on emerging or low-income nations, this research analyzes the most institutionally sophisticated

and financially advanced economies, illustrating that the remittance-sustainability dilemma is universal and not restricted to developing countries. The utilization of high-quality, standardized ESG data for sovereign nations guarantees measurement reliability and cross-country comparability, addressing data quality issues prevalent in prior research. This furnishes robust empirical evidence that even in advanced economies, the sustainability implications of remittances critically hinge on the depth and caliber of the financial system.

Empirically, the research is conducted on 35 OECD countries between 2000 and 2023, widening the geographical scope beyond the traditional analysis of developing regions. In fact, it is conducted on the most institutionalized and financially advanced countries, thanks to the use of high-quality ESG data for sovereign countries. Given the contributions of this study to the existing literature, this section aims to identify and explore concepts and their relationships with regard to the theoretical framework.

2.1. The Nexus of ESG, Remittance and Financial Development

As stated by Gajurel and Chindengwike (2025), remittance impacts economic growth through the financial development of the hosting country. Topxhiu and Krasniqi (2025) pointed out that there are two ways its impacts may occur: either with complementarity hypothesis or substitution hypothesis. In a financially advanced country, the financial structure enables remittance to support economic growth, thus raising GDP. In a financially underdeveloped country, remittance acts as a substitute for the underdeveloped financial system, enabling entrepreneurs to bypass the system. Recent research focuses on the impact of the flow of funds on ESG performance.

Dauvergne (2020) and Linnenluecke (2022) define the environmental (E) dimension of ESG as a phenomenon with evaluates activities related to minimizing ecological footprints and the management of natural resources. This category includes factors such as energy management/energy security, climate change resilience, waste management, and biodiversity conservation.

Dmytriyev, Freeman and Hörisch (2021) and Serafeim (2020) explain social (S) category by its focus on interactions with stakeholders, which include employees, citizens, and society at large. It looks at the ability of a country to respond to the needs of its citizens, relieve poverty, invest in human resources, and provide health and nutrition.

Gillan, Koch, and Starks (2021) and Kaufmann, Kraay and Mastruzzi (2011) state the governance (G) dimension looks at the ability of institutions and leadership for governance and the strength of governance arrangements

and legal systems. It also considers factors like transparency and accountability to limit corruption.

The stability of the funds from remittances may have a negative impact on the ESG score of a country, as it follows the consumption-oriented growth path, thus increasing energy consumption and, in turn, emissions (the E in ESG).

Financial development acts as an ESG filter. A well-developed financial system can redirect funds from household consumption to sustainable investments in the environment, such as green bonds, energy-saving projects, and social projects.

In terms of corporate and institutional governance, or the ‘G’ in ESG analysis, advanced financial systems promote sustainability through the imposition of transparency and accountability. Utilization of fintech and electronic payment transactions further improves governance in terms of tracking financial transactions as proved by Arner, Barberis and Buckley (2017) and Ozili (2021). In summary according to Giuliano and Ruiz-Arranz (2009) and Hassani, Mushtaq and Bahini (2024), financial development will enhance the link between remittances and sustainability as a means of optimizing the use of these remittances. Without a strong financial system, the preference of remittances will be towards current consumption as opposed to sustainability and environmental conservation. With a strong financial system in place, they will be channelled to support sustainable development. The addition of fintech and electronic remittance systems can increase the Governance (G) component by ensuring traceability and transparency, thus curbing the misuse of funds.

The inflow of remittance funds often has a direct negative effect on the overall ESG performance and environment of a country; nevertheless, it also depends on the development status of the financial system of the nation. In financially developed economies, a kind of “ESG filter” exists in the financial system. Yang et al. (2021) say that the advanced financial infrastructure structures, such as the green bonds market, ESG loan markets in the SME sector, etc., help in effective management of the remittance flows.

As argued by Galeone, Rinaldo and Fusco (2024), remittances received by a country with a less developed financial system mainly contribute to consumption expenditure, resulting in a higher ecological footprint and fast depletion of natural resources. The presence of a strong banking sector and complex financial systems allows for the allocation of remittances to investment opportunities in sustainable development projects as opposed to consumption.

Foster et al. (2021) revealed that the implementation of fintech and remittance options improves the traceability and transparency of these financial

transactions. It reinforces the Governance (G) factor of the ESG to avert the likelihood of inefficient and unscrupulous uses of funds.

Drago et al. (2025) highlight evidence can be found in the literature regarding regions at OECD Countries. This research utilizing the Augmented Mean Group estimator suggests that the direct effect of remittances on ESG scores is negative, but the interaction term of remittances and domestic credit (or financial development) is significant and positively related to ESG scores. This provides additional support to the inference that financial development helps offset the negative effect of remittances.

Institutional factors, such as the rule of law, economic freedom, and the quality of regulation, influence organizational and economic activities in a country. As suggested by Tanchangya et al. (2025) in terms of sustainable finance, financial institutions are not just intermediaries but also catalytic instruments that can steer financial flows towards sustainability. A financial system aligned with sustainable development incorporates environment, social, and governance (ESG) risks into its processes. In the case of the OECD advanced economies, effective institutions facilitate transparency and represent the needed drivers for aligning remittance flows with green and social priorities. Financial inclusion, facilitated by good governance, is the vehicle that drives the process of institutional transformation. Financial institutions that practice ESG screening on their credits and investments can channel the financial liquidity of remitting households into the productive sectors that follow ESG principles. This highlights the role of financial development as an important moderating factor in the empirical model that we construct.

2.2. How to Define Inflation and Trade Openness within Remittance and GDP

Ghosh Dastidar (2017) points out that remittances and development depend on the wider macro environment, with inflation and trade openness as the main constraints. In this regard, inflation is a main indicator of stability in the macro environment. Growth and openness are advantageous below this level, but the benefits decrease and are dissuasive for long-term contracts as inflation increases beyond this level. With inflation, trade openness appears. Trade openness is a measure of the country's integration into the world economy. Wergthemmi, Mtiraoui and Lassoued (2026) emphasize OECD countries, this has been associated with higher GDP and sustainability, but can have negative environmental impacts without regulations in place. Remittances have emerged as a key macroeconomic driver, reconfiguring the developmental trajectory of LMICs in the face of portfolio flows and FDI volatility. The

present analysis has moved away from the traditional dichotomy of optimism/pessimism in favor of a conditional assessment of remittance impacts in terms of the absorptive capacity of the remittance-receiving countries. The developmental impact of remittances is conditioned upon the presence of the following factors: remittance impacts on economic growth are mediated by the presence of Financial Development, ESG performance, and Macroeconomic Stability (inflation and trade openness).

The pessimistic perspective on remittance inflows employs the Corden-Neary Dutch Disease model, which posits that large injections of foreign exchange may destabilize the host economy's structure. This is done via the spending effect; remittance inflows increase income in the host economy, which in turn increases demand for non-tradable goods like real estate and services. Lartey, Mandelman and Acosta (2012) noted that given that tradable goods are priced in global markets, this causes a rise in the real exchange rate (RER) and appreciation. ESG-wise, this causes a social imbalance in that it increases the cost of living for non-recipients and causes asset bubbles, which undermines the Social pillar in sustainable development.

The Resource Movement Effect makes the imbalances more severe as the economy attracts more labor and capital to the booming non-tradable sector, leading to a process of de-industrialization and a loss of international competitiveness in the agricultural and manufacturing sectors. This directly impacts the objectives of the Financial Development as the focus of the banks, preoccupied with serving consumption and real estate, is not to support the development of high-value green industries. As observed by Hasan et al. (2024) without a sophisticated financial system to act as a "stabilizing filter" to guide the inflows towards ESG investments in green infrastructure or renewable energy, the economy will continue to grow in a consumption-intensive, environmentally taxing, and institutionally fragile manner.

In conclusion, the literature indicates that the transition from a remittance-driven economy to a sustainable and ESG-compliant one calls for a holistic approach. While remittances can provide liquidity to alleviate poverty and ensure stability in income, the impact on long-run GDP growth is contingent on the presence of a well-developed financial development system to manage inflation and leverage trade openness to drive sustainable growth. Literature summary shown in Table 1.

Table 1. Summary of Literature

Author(s) & Year	Scope & Time Period	Methodology	Variables	Main Findings
Giuliano & Ruiz-Arranz (2009)	Developing Countries (1970- 2005)	GMM (Generalized Method of Moments)	Dependent: Sustainability; Independent: Remittances, Fin. Development	Financial Development ↑ → Remittance Optimization ↑ → Sustainability ↑
Kaufmann et al. (2011)	Theoretical / Review	Theoretical / Review	Dependent: Corruption; Independent: Governance (G), Transparency	Transparency & Accountability ↑ → Corruption ↓
Lartey et al. (2012)	Developing and Transition Countries	System GMM, DSGE Model	Dependent: Real Exchange Rate; Independent: Remittances	Remittances ↑ → Demand ↑ → Real Exchange Rate ↑ (Dutch Disease)
Ghosh Dastidar (2017)	Not specified	Panel Data Model	Dependent: Development; Independent: Remittances, Inflation, Trade	Inflation & Trade Openness → Limits the effect of remittances on development
Arner et al. (2017)	Theoretical / Review	Theoretical / Review	Dependent: Governance (G); Independent: Fintech, Electronic Payments	Fintech & E-Payment ↑ → Financial Monitoring ↑ → Governance (G) ↑
Dauvergne (2020)	Theoretical / Review	Theoretical / Review	Dependent: Ecological Footprint; Independent: Environmental Management (E)	Environmental Management ↑ → Ecological Footprint ↓
Serafeim (2020)	Theoretical / Review	Theoretical / Review	Dependent: Poverty, Human Resources; Independent: Social (S) Interaction	Stakeholder Engagement ↑ → Poverty ↓; Human Resources ↑
Foster et al. (2021)	Theoretical / Review	Theoretical / Review	Dependent: Governance (G); Independent: Fintech	Fintech ↑ → Transparency & Traceability ↑ → Governance (G) ↑
Dmytriyev et al. (2021)	Theoretical / Review	Theoretical / Review	Dependent: Poverty, Human Resources; Independent: Social (S) Interaction	Stakeholder Engagement ↑ → Poverty ↓; Human Resources ↑
Gillan et al. (2021)	Theoretical / Review	Theoretical / Review	Dependent: Corruption; Independent: Governance (G), Transparency	Transparency & Accountability ↑ → Corruption ↓
Ozili (2021)	Theoretical / Review	Theoretical / Review	Dependent: Governance (G); Independent: Fintech, Electronic Payments	Fintech & E-Payment ↑ → Financial Monitoring ↑ → Governance (G) ↑

Yang et al. (2021)	BICS Countries (1990- 2016)	CS-ARDL, FMOLS Estimator	Dependent: Remittance Management; Independent: Financial Infrastructure	Financial Infrastructure (Green Bond) ↑ → Remittance Management ↑
Linnenluecke (2022)	Theoretical / Review	Theoretical / Review	Dependent: Ecological Footprint; Independent: Environmental Management (E)	Environmental Management ↑ → Ecological Footprint ↓
Galeone et al. (2024)	Developing Countries	Panel Data Analysis	Dependent: Ecological Footprint; Independent: Remittances, Financial Development	Financial Development ↓ + Remittances ↑ → Consumption ↑ → Ecological Footprint ↑
Gajurel & Chindengwike (2025)	Nepal and Tanzania (1995- 2023)	ARDL	Dependent: Econ. Growth; Independent: Remittances, Financial Development	Financial Development ↑ → (Remittances → Economic Growth ↑)
Topxhiu & Krasniqi (2025)	Western Balkan Countries (2002- 2022)	Dynamic Panel Data Approach	Dependent: GDP; Independent: Remittances, Financial System	Financial Development ↑ → (Remittances → GDP ↑); Financial Development ↓ → Remittances (Substitute for Fin. System)
Drago et al. (2025)	35 OECD Countries (2000- 2023)	AMG Estimator, Dumitrescu-Hurlin Test	Dependent: ESG; Independent: Remittances, Domestic Credit	Remittances ↑ → ESG ↓; (Remittances + Domestic Credit) ↑ → ESG ↑
Wergthemmi et al. (2026)	24 OECD Countries (2005- 2022)	Panel Data Regression	Dependent: GDP, Environment; Independent: Trade Openness	Trade Openness ↑ → GDP ↑ & Sustainability ↑; Lack of Regulation + Openness ↑ → Environmental Impact ↓

3.Methodology, Analysis and Findings

The Classic Mean Group (MG) Model, proposed by Pesaran and Smith (1995) offers a consistent methodology in dynamic panels where there exists heterogeneity in coefficients across groups. The MG estimator pools the dynamic regression equations across each group in the dataset and obtains the average long-run effect by simply averaging the coefficients. Unlike other models, the MG estimator is robust and has a consistency property in both the sample dimension and time dimension, provided the coefficients are randomly distributed across the heterogenous units. Therefore, the MG estimator has

become a widely adopted model in the field of panel data studies, particularly in macroeconomic studies, because it handles the issue of heterogeneity explicitly, reducing the bias that arises in dynamic models due to serial correlation Pesaran and Smith (1995).

β_{MG} : Mean Group (MG) estimator; General coefficient, average across all units in the cross-sectional entities.

N : The total number of countries or segments involved in the analysis.

i : Section unit index.

β_i : Estimates of coefficients from the time series studies conducted in each country.

$\sum_{i=1}^N \beta_i$: The sum of the estimated coefficients on all units in the section.

$\frac{1}{N}$: The average is arrived at by dividing the sum by the total number of units.

The MG estimator does not consider cross-section dependence (CD), which can be pervasive. In macroeconomic analysis, where globalization and global shocks have importance, it is important to recognize CD, which can cause bias in estimation. This gave birth to the Augmented Mean Groups (AMG) estimator, which was developed taking into account heterogeneity (Eberhardt & Bond, 2009; Eberhardt & Teal, 2010). AMG incorporates the MG estimator and includes an error term for cross-section dependence (CDE).

Calculation of the CDEs: The CDEs are first obtained through the computation of the coefficients on the time dummies in a first-difference regression.

Group Regression: $\hat{\mu}_t^*$ this variable is included in the dynamic regression equation designed for the country in order to generate coefficients that are country-specific.

Averaging: The final long-term coefficient $\hat{\beta}_{AMG}$ the amount is derived by calculating the average of the coefficients in the typical MG approach.

AMG Predictor Formulation: The mean coefficient for the AMG predictor $\hat{\beta}_{AMG}$ the equation keeps the form of equation (1) and is calculated by the mean of the coefficients in the prediction equation, illustrated below.

$$\hat{\beta}_{AMG} = \frac{1}{N} \sum_{i=1}^N \hat{\beta}_i^{AMG}$$

Thus, the basic formula concerning the basic averaging process, namely the arithmetic mean, and the adopted notation, in the N and $\hat{\beta}_i$. Also applies in the case of the AMG algorithm, and the only difference has to do with the process of augmentation in the equation that yields the $\hat{\beta}_i^{AMG}$ coefficient.

This study analyzes the impact of remittance inflows and financial development on Environmental, Social, and Governance (ESG) performance in 35 countries between 2000 and 2023. The independent variables include remittance inflows (remittance) and domestic credit to private sector (financial depth), while the moderating effect of financial development is captured via an interaction term (financial depth_remittance). The dependent variable is the logarithm of the ESG score (ESG). Control variables represent economic development (GDP), price stability (inflation), and trade openness (trade). All financial flow variables are expressed as a percentage of GDP (World Bank, 2025), and ESG scores are sourced from a leading global rating agency (Refinitiv, 2025). Since ESG scores for countries have been measured since 2000, the analysis begins in 2000.

The objective of this research is to investigate the effects of remittances and financial development (financial depth), proxied by private sector credit, on the ESG sustainability performance of 35 countries in the OECD. The research will consider the direct effects of remittances and financial development, as well as the moderating effects of financial system depth. The research hypothesis is that remittances have effects on ESG sustainability, but the extent of the effects is moderated by financial system depth. To achieve this objective, the research will use the interaction term financial depth_remittance. The research will also consider two pathways: 1) the direct effects of remittances and financial system depth on ESG sustainability, and 2) the moderating effects of financial system depth on the relationship between remittances and ESG sustainability. The rationale for the research is that financial system depth moderates the effects of remittances, with the implication that remittances will have more desirable effects in more financially developed systems (Afridi et al 2024). The results of the research will be discussed in the next section.

OECD countries have been selected because of their homogeneous institutional environment and their position as global leaders in ESG disclosure standards, which provide high-quality data for complex econometric analysis (Wu & Chen, 2024). Moreover, being global leaders in financial innovation, they provide a mature environment to test the role of financial depth, which may be less developed in emerging economies. The inclusion of OECD countries is vital since these countries are the benchmark for sustainable policy

implementation globally, where financial infrastructure and environmental goals are most aligned (OECD, 2024). This allows for an in-depth analysis of how developed financial systems can catalyze the use of external capital for sustainable development.

To address cross-sectional heterogeneity and cross-sectional dependency inherent in the macroeconomic panel data, the Augmented Mean Group (AMG) estimator (Eberhardt & Bond, 2009; Eberhardt & Teal, 2010) was employed. Building upon the foundation of the Classic Mean Group (MG) estimator (Pesaran & Smith, 1995), the AMG estimator preserves parameter heterogeneity across panel units by performing separate regressions for each country. Crucially, the AMG estimator overcomes a key limitation of the MG estimator by incorporating a Common Dynamic Effect (CDE), a latent factor that accounts for the influence of unobserved common shocks and cross-sectional dependence.

Prior to estimation, the series were tested for stationarity using the Pesaran (2007) CIPS unit root test, and the model was specified in first differences to ensure robust inference. Furthermore, Pesaran and Yamagata's (2008) slope homogeneity test and Pesaran's (2004) CD test were conducted to verify the suitability of the chosen estimator. All analyses within this methodological framework were performed using Stata 14 software.

Table 2. Variable Definitions and Descriptions

Variable Type	Variable Abbreviation	Full Variable Name & Description
Independent Variable	remittance	Remittance Inflows: Personal transfers and compensation of employees received (% of GDP).
Independent Variable	financial depth	Domestic Credit to Private Sector: Financial resources provided to the private sector by financial corporations (% of GDP).
Moderating Variable	financial depth_ remittance	Interaction Term: Financial Depth × Remittance: Captures the moderating effect of financial development on the remittance–ESG relationship.
Dependent Variable	ESG	ESG Score: Environmental, Social, and Governance performance score of countries.
Control Variable	GDP	GDP per capita (constant US\$): controlling for economic development.
Control Variable	inflation	Inflation, Consumer Prices (Annual %): Controls for macroeconomic stability and price levels.
Control Variable	trade	Trade Openness: The sum of exports and imports of goods and services (% of GDP).

Table 2 lists all the dependent and independent variables used in the model. The major independent variables are remittance inflows and financial depth, and their interaction effect. The dependent variable is the ESG performance score. The major macroeconomic variables, GDP per capita, inflation, and trade openness, are used as controls. All the variables related to financial flows, namely remittances and financial depth, are converted into percentage GDP terms in order to make them comparable across countries. Naturally, all variables except the inflation variable are converted into their logarithmic forms in order to make them stationary and reduce heteroskedasticity problems. The inflation variable has negative observations in the dataset and hence retained in its level form.

Table 3. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
remittance	840	-0.91	1.28	-4.44	1.82
financial depth	840	4.46	0.54	2.50	5.71
GDP	840	10.29	0.71	8.02	11.81
inflation	840	3.17	5.06	-4.44	72.30
trade	840	4.42	0.52	2.97	6.02
ESG	840	4.38	0.09	4.07	4.60

The descriptive statistics in Table 3 above provide insights into the basic characteristics of the panel data. The negative mean value and high standard deviation of the remittance variable of -0.92 and 1.28 respectively indicate large variations in the foreign exchange inflows of the various nations studied. The financial depth variable confirms the non-linear relationship in the model, and the extreme outlier form of the inflation variable (with a maximum of 72.31) captures the macroeconomic instability of the data. Lastly, since the ESG scores only range from a minimum of 4.07 to a maximum of 4.61, there is an understanding about the performance of sustainability in the nations studied being at a similar level.

Table 4. Cross-sectional Dependency Test Results

Test Statistic	Value	p-value
Pesaran CD	34.76***	0.00

The strongly negative and significant result of the CD test 0.00 on unit roots from Pesaran (2004) strongly rejects the null hypothesis suggested in Table 4 above, which indicates the existence of strong interdependencies between

the units observed in the cross-section. This revelation of the existence of interdependencies inspires us to employ the CIPS unit root tests developed by Pesaran (2007). This method has been termed second-generation because this method takes care of interdependencies through the aid of cross-sectionally augmented regression.

Table 5. CIPS Unit Root Test Result

Variable Name	Constant	Trend
ESG	-1.86	-2.58
remittance	-2.29***	-2.91***
financial depth	-1.75	-2.73***
GDP	-1.91	-2.49
inflation	-3.32***	-3.51***
trade	-1.74	-1.97
Critical Values %10	-2.04	-2.54
Critical Values %5	-2.11	-2.61
Critical Values %1	-2.23	-2.73

The unit root test results of the CIPS model are vital findings in establishing the nature of the stationarity of the involved variables. In the Table 5, remittance and inflation series confirm the existence of a stationarity pattern because the hypothesis of the unit root in the series can be rejected at the significance levels of both 10 %, 5% and 1% in the models with and without trends. The financial depth series follows the same pattern because it shows stationarity in the trend model, while the ESG, GDP, and trade series confirm the existence of a unit root in both models. This confirms that in the context of panel data modeling, the different levels of stationarity of the involved variables must be considered. As a result, the first-order difference of the ESG, GDP, and trade series will be taken.

Table 6. The result of values with a first-degree difference (CIPS Test)

Variable Name	Constant	Trend
ESG	-4.00***	-4.11***
GDP	-3.76***	-3.72***
trade	-3.62***	-3.79***
Critical Values %10	-2.04	-2.54
Critical Values %5	-2.11	-2.61
Critical Values %1	-2.23	-2.73

To confirm the stationarity of the variables, the first differences of the series were calculated. As shown in Table 6, the test statistics of the CIPS test for each of the series when estimated under models allowing and disallowing trend components exceeded the critical levels at the significance levels of the ESG, GDP, and trade series. The findings confirm the stationarity of the first differences of the said series.

Table 7. Panel Diagnostic Test Results

Test	Null Hypothesis (H ₀)	Statistic	p-value
Heterogeneity	Slope coefficients are homogeneous	$\Delta = 3.23^{***}$ $\Delta_{adj} = 4.00^{***}$	0.00
Heteroskedasticity	$\sigma_1^2 = \sigma^2$ (homoskedasticity)	$\chi^2(35) = 1039.05^{***}$	0.00
Autocorrelation	No first-order autocorrelation	$F(1.34) = 157.29^{***}$	0.00

The three simple tests of diagnosis are presented in Table 7. The result reveals that the model rejects homoscedasticity ($p=0.00$) and suggests significance of heteroscedasticity through the Breusch-Pagan (1979) and Cook-Weisberg (1983). Wooldridge (2010) method suggests the model has serial correlation as the hypothesis of no autocorrelation can be rejected at ($p=0.00$). Pesaran & Yamagata (2008) homogeneity test also rejects homogeneity.

Table 8. Augmented Mean Group Estimator Result

Variable	Coef.	p-value
remittance	-0.24**	0.05
financial depth	0.04	0.29
financial depth_remittance	0.05**	0.05
GDP	0.04***	0.00
inflation	-0.00	0.13
trade	0.01***	0.00
Common dynamic process	1.02***	0.00
Constant	-0.22	0.28
Number of observations	805	
Number of groups (N)	35	
Wald χ^2 (6)	124.29***	
Prob > χ^2	0.00	
RMSE (sigma)	0.00	

The findings related to the Augmented Mean Group (AMG) test, examining the moderating effect of financial development on the association between remittances and ESG performance among OECD members, are presented in Table 8. The findings reveal that the arrival of remittances has a negative and statistically significant impact on ESG performance in the long run (-0.24 , $p < 0.05$). The financial depth variable has a positive impact, but the coefficient is statistically insignificant, suggesting that increases in private sector financial depth do not have a direct impact on ESG performance.

One major finding has to do with the role of the interaction term financial depth \times remittance. In other words, although the coefficient on remittance is negative, and significant, the interaction term has a positive coefficient and a marginal significance level ($\beta = 0.05$, $p < 0.10$), implying that the moderating effect, and indeed the role, of financial development cannot be ignored. This means, therefore, that countries with advanced financial structures are able, through these structures, to mitigate the negative effects that the flow of remittances has on ESG performance. The implication here, therefore, is that the effect on ESG performance in each country depends on the extent of the financial development in the respective country. That means, consequently, financial development has an indirect effect on ESG performance.

Concerning the control variables, GDP ($\beta = 0.04$, $p < 0.01$) and trade openness ($\beta = 0.01$, $p < 0.05$) have significant and positive long-run relations with the ESG performance in OECD countries. In addition, the high significance level of the Common Dynamic Process ($\beta = 1.02$, $p < 0.01$) also confirms the implication that there exists a common long-run process in the ESG performance in the panel. In sum, the evidence confirms that the net role of remittance in sustainable development has a critical relation with the development stage of the financial system, and the development role of the financial system becomes imperative in the sustainability effect of remittance.

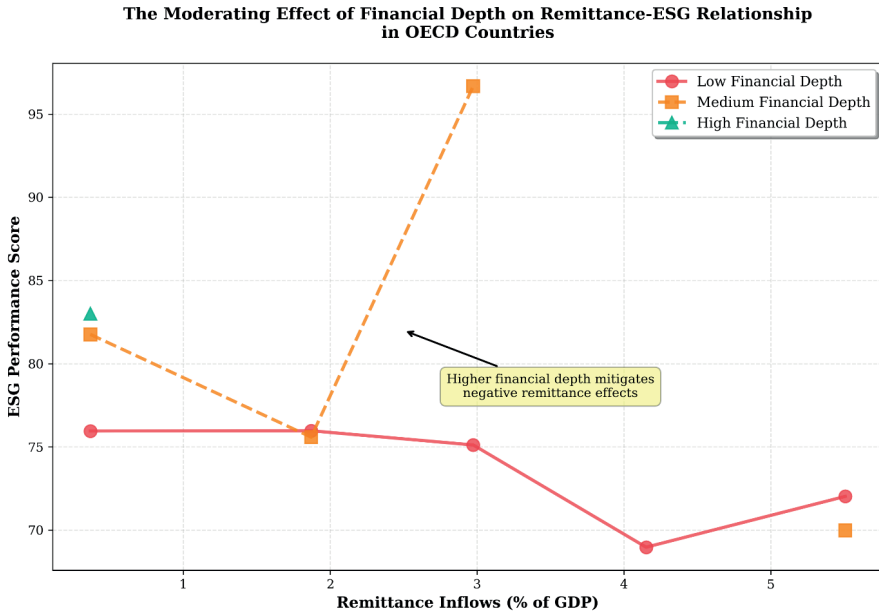


Figure 2. The Moderating Effect of Financial Depth on the Remittance-ESG Correlation in OECD Nations.

Note. The chart illustrates that elevated levels of financial development alleviate the adverse effect of remittance inflows on ESG performance. Nations are classified into three categories based on their financial depth levels (domestic credit to the private sector as a percentage of GDP): low (bottom tertile), medium (middle tertile), and high (top tertile).

Figure 2 offers empirical illustration of the moderating influence of financial depth on the remittance-ESG association, validating the significant positive interaction term identified in Table 8 ($\beta = 0.05$, $p < 0.10$). The divergent trajectories across the three financial depth categories reveal a distinct threshold effect: in low financial depth environments (red line), increasing remittance inflows are linked to declining ESG scores, whereas in high financial depth settings (green line), the same remittance increases correspond to enhanced or stable ESG performance. This trend affirms that well-established financial systems facilitate remittances to be directed toward sustainable investments, thereby transforming their impact from potentially harmful to advantageous for ESG outcomes.

Table 9. Dumitrescu–Hurlin Panel Causality Test Results (Robustness Test)

Direction of Causality	Z	p-value	Conclusion
remittance \Rightarrow ESG	2.95***	0.00	Causality Exists
ESG \nRightarrow remittance	-0.83	0.40	Failure to Establish Causality

Robustness check were conducted using Dumitrescu & Hurlin panel causality test (2012). The results of the Dumitrescu & Hurlin panel causality test (2012) indicate the existence of the asymmetric causality link from remittances to ESG performance. The results of the test indicate the existence of the statistically significant one-way causality link from remittances to ESG performance ($z\text{-bar} = 2.95$, $p = 0.00$). However, the absence of the causal link from ESG performance to remittances was found ($z\text{-bar} = -0.83$, $p = 0.40$). This reinforces the viewpoint that remittances play a crucial role in the determination of ESG performance in OECD nations and do not support the hypothesis of the reverse impact. This causality finding is particularly supportive of the significant negative effect of remittances on ESG performance identified in the main AMG model. The fact that causality emerges unidirectionally from remittances to ESG leaves no room for doubt regarding the direction of the relationship in the main model and further reinforces the reliability of financial development and its moderating effect on this relationship.

4. Conclusion, Policy Implications, and Limitations

This study examines the relationship between remittance flows and ESG scores in 35 OECD countries, along with the moderating role played by the level of financial development in this relationship, through a comprehensive econometric analysis based on a 24-year time series covering the period 2000-2023. The Augmented Mean Group (AMG) estimator was chosen for its ability to simultaneously and effectively control for multiple econometric issues identified in the panel data set, such as cross-sectional dependence, autocorrelation, heteroscedasticity, and parameter heterogeneity. The empirical findings reveal that an increase in the share of remittances in gross domestic product has a statistically significant and negative direct effect on ESG performance when the financial development interaction is excluded. This indicates that uncontrolled or poorly directed remittance inflows can temporarily weaken a country's sustainable development indicators through mechanisms such as prioritizing consumption growth or diverting resources to unsustainable sectors. The direct negative impact could arise from either "Dutch Disease" or the consumption-smoothing motive, in which case the

inflows would be used for non-productive consumption rather than long-run sustainable investments.

However, the research indicates that high financial development offsets this negative effect. This is because the significant interaction between the remittances and the level of financial development confirms this. This result shows a “threshold effect”, which implies that there is a minimum level of financial infrastructure that is necessary in order for remittances to make a net positive contribution to the ESG structure. In developed countries, the financial sector facilitates the remittances efficiently; hence, the remittances become effective opportunities for sustainable growth. This is because of the well-developed banking infrastructure that assists remittances to become systematically beneficial for the governance-conscious environment, society, and the business world.

The findings of the Dumitrescu & Hurlin panel causality test, used to remove uncertainties about the nature of this relationship and to confirm the results’ validity, revealed the existence of the same statistically significant and one-way causality from remittances to ESG performance. This firmly confirms our basic hypothesis about the existence of the causal effect of changes in remittances on ESG performance rather than the contrary and constitutes strong proof of the model’s correctness.

Taking the results of the study at hand into account, the first recommendation that should be presented to policymakers revolves around the importance of developing financial channels through which the remittance trend can be aligned with the principles of financial development. In this regard, financial regulations must be developed that can promote the flow of remittances towards the green bond market, sustainable investment fund, and ESG factors-based loans to SMEs. In addition, policymakers should also focus on the quality of financial depth, which can be achieved by implementing mandatory ESG-linked reporting for financial institutions in order to ensure that remittance money goes into responsible projects.

Additionally, financial literacy initiatives must be increased in order to sensitize the recipients of remittances about the financial development opportunities available through sustainable investments. By utilizing blockchain-based remittance systems, transparency and cost savings can be achieved, which in turn can be beneficial for the ESG Governance pillar. Finally, fintech methodologies such as tax benefits and electronic remittance channels supporting the same must be used widely. In this way, the trend of remittances can be used as a revolutionizing factor improving the ESG performance of

the recipients as opposed to being limited to supplying foreign exchange to the economy of the recipients.

This investigation possesses several limitations. First, the examination is confined to OECD nations, which may restrict the generalizability to emerging economies. Second, the ESG data sourced from Refinitiv may exhibit measurement constraints. Third, we concentrate on aggregate ESG indices rather than distinct E, S, and G constituents. Subsequent inquiries could disaggregate ESG into its elements to ascertain differential impacts of remittances on environmental, social, and governance performance independently.

Future research could broaden this examination in numerous avenues: (1) scrutinizing the disparate influences of remittances on individual Environmental, Social, and Governance components; (2) exploring threshold impacts of financial advancement employing panel threshold regression; (3) contrasting OECD and non-OECD nations; (4) investigating the significance of remittance modalities (formal versus informal channels); and (5) evaluating the ramifications of digital financial innovations on the remittance-ESG interconnection.

References

- Afridi, M. A., Khan, I., Rahman, H. U., & Khan, M. R. (2024). Remittances as a driver of economic growth: The moderating impact of financial development in developing economies. *Journal of Economic and Administrative Sciences*. <https://doi.org/10.1108/JEAS-05-2024-0143>
- Arner, D. W., Barberis, J., & Buckley, R. P. (2017). FinTech and RegTech in a nutshell, and the future in a sandbox. *CEA Institute Research Foundation*, 3(4), 1-20. <http://dx.doi.org/10.2139/ssrn.3088303>
- Breusch, T. S., & Pagan, A. R. (1979). A simple test for heteroscedasticity and random coefficient variation. *Econometrica*, 47(5), 1287-1294. <https://doi.org/10.2307/1911963>
- Careja, R., & Emmenegger, P. (2012). Making democratic citizens: The effects of migration experience on political attitudes in Central and Eastern Europe. *Comparative Political Studies*, 45(7), 875-902. <https://doi.org/10.1177/0010414011428587>
- Cook, R. D., & Weisberg, S. (1983). Diagnostics for heteroscedasticity in regression. *Biometrika*, 70(1), 1-10. <https://doi.org/10.1093/biomet/70.1.1>
- Dauvergne, P. (2020). *AI in the wild: Sustainability in the age of artificial intelligence*. MIT Press. <https://doi.org/10.7551/mitpress/12458.001.0001>
- Diaye, M., Ho, S., & Oueghlissi, R. (2021). ESG performance and economic growth: A panel co-integration analysis. *Empirica*, 49(1), 99-122. <https://doi.org/10.1007/s10663-021-09508-7>
- Dmytriiev, S. D., Freeman, R. E., & Hörisch, J. (2021). The relationship between stakeholder theory and corporate social responsibility: Differences, similarities, and implications for social issues in management. *Journal of Management Studies*, 58(6), 1441-1470. <https://doi.org/10.1111/joms.12684>
- Drago, C., Costantiello, A., Arnone, M., & Leogrande, A. (2025). Bridging sustainability and inclusion: Financial access in the environmental, social, and governance landscape. *Journal of Risk and Financial Management*, 18(7), 375. <https://doi.org/10.3390/jrfm18070375>
- Eberhardt, M., & Bond, S. (2009). *Cross-section dependence in nonstationary panel models: A novel estimator* (University of Oxford Discussion Paper No. 17692). University of Oxford. <https://ora.ox.ac.uk/objects/uuid:9165b83f-d5f4-4c9c-a5e0-2d3c3e63b5e2>
- Eberhardt, M., & Teal, F. (2010). *Productivity analysis in global manufacturing production* (Discussion Paper Series No. 515). University of Oxford, Department of Economics. <https://www.economics.ox.ac.uk/materials/papers/4729/paper515.pdf>
- Elsayed, M., & Albeltagy, W. A. A. (2024). Exploring the linkage between financial development and ecological footprint in Egypt: Evidence from AVECM

- analysis. *International Journal of Energy Economics and Policy*, 14(6), 14-23. <https://doi.org/10.32479/ijecp.17852>
- Foster, K., Blakstad, S., Bos, M., & Gazi, S. (2021). *BigFintechs and their impacts on sustainable development*. The Dialogue on Global Finance Digital Finance Governance Project. <https://www.cigionline.org/static/documents/BigFintechs%20and%20their%20Impacts%20on%20Sustainable%20Development.pdf>
- Gajurel, R. P., & Chindengwike, J. D. (2025). Remittance-growth nexus: Does financial development mediate? Evidence from Nepal and Tanzania. *African Development Finance Journal*, 8(9), 213-238.
- Galeone, G., Ranaldo, S., & Fusco, A. (2024). ESG and FinTech: Are they connected? *Research in International Business and Finance*, 69, 102225. <https://doi.org/10.1016/j.ribaf.2023.102225>
- Ganda, F. (2019). The environmental impacts of financial development in OECD countries: A panel GMM approach. *Environmental Science and Pollution Research*, 26(7), 6758-6772. <https://doi.org/10.1007/S11356-019-04143-Z>
- Ghosh Dastidar, S. (2017). Impact of remittances on economic growth in developing countries: The role of openness. *Global Economy Journal*, 13(1), 20160066. <https://doi.org/10.1515/gej-2016-0066>
- Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance*, 66, 101889. <https://doi.org/10.1016/j.jcorpfin.2021.101889>
- Giuliano, P., & Ruiz-Arranz, M. (2009). Remittances, financial development, and growth. *Journal of Development Economics*, 90(1), 144-152. <https://doi.org/10.1016/j.jdeveco.2008.10.005>
- Hasan, M. H., Hossain, M. Z., Hasan, L., & Dewan, M. A. (2024). FinTech and sustainable finance: How is FinTech shaping the future of sustainable finance? *European Journal of Management, Economics and Business*, 1(3), 100-115. <https://doi.org/10.59992/EJMEB.2024.v1n3p7>
- Hassani, B. K., Mushtaq, R., & Bahini, Y. (2024). ESG (Environment, Social, and Governance) development: What is the role of financial development at the global level? *Bankers, Markets & Investors*, 177, 14-28. <https://doi.org/10.54695/bmi.177.0014>
- Kaufmann, D., Kraay, A., & Mastruzzi, M. (2011). The worldwide governance indicators: Methodology and analytical issues. *Hague Journal on the Rule of Law*, 3(2), 220-246. <https://doi.org/10.1017/S1876404511200046>
- Kerimov, P. (2021). Financial depth-economic growth nexus: Implications for the Ukrainian banking sector. *Banks and Bank Systems*, 16(4), 72-82. [http://dx.doi.org/10.21511/bbs.16\(4\).2021.07](http://dx.doi.org/10.21511/bbs.16(4).2021.07)

- Kpodar, M. K., & Le Goff, M. M. (2011). *Do remittances reduce aid dependency?* (IMF Working Paper No. 11/246). International Monetary Fund. <https://doi.org/10.5089/9781463922979.001>
- Lartey, E. K., Mandelman, F. S., & Acosta, P. A. (2012). Remittances, exchange rate regimes and the Dutch disease: A panel data analysis. *Review of International Economics*, 20(2), 377-395. <https://doi.org/10.1111/j.1467-9396.2012.01028.x>
- Linnenluecke, M. K. (2022). Environmental, social and governance (ESG) performance in the context of multinational business research. *Multinational Business Review*, 30(1), 1-16. <https://doi.org/10.1108/MBR-11-2021-0148>
- Majeed, M. T., & Mazhar, M. (2019). Financial development and ecological footprint: A global panel data analysis. *Pakistan Journal of Commerce and Social Sciences*, 13(2), 487-514.
- Ng, T. H., Lye, C. T., Chan, K. H., Lim, Y. Z., & Lim, Y. S. (2020). Sustainability in Asia: The roles of financial development in environmental, social and governance (ESG) performance. *Social Indicators Research*, 150(1), 17-44. <https://doi.org/10.1007/S11205-020-02288-W>
- Obiora, S., Bamisile, O., Opoku-Mensah, E., Tochukwu, O., Nwagwu, U., & Chukwuma, A. (2020). Impact of banking and financial systems on environmental sustainability: An overarching study of developing, emerging, and developed economies. *Sustainability*, 12(19), 8074. <https://doi.org/10.3390/SU12198074>
- OECD. (2017). *Investing in climate, investing in growth*. OECD Publishing. <https://doi.org/10.1787/9789264273528-en>
- OECD/CAF Development Bank of Latin America and the Caribbean. (2024). *Latin American economic outlook 2024: Financing sustainable development*. OECD Publishing. <https://doi.org/10.1787/c437947f-en>
- Ozili, P. K. (2021). Digital finance, green finance and social finance: Is there a link? *Financial Internet Quarterly*, 17(1), 1-7. <https://doi.org/10.2478/fiqf-2021-0001>
- Pesaran, M. H. (2004). *General diagnostic tests for cross section dependence in panels* (Cambridge Working Papers in Economics No. 0435). University of Cambridge. <https://doi.org/10.17863/CAM.5113>
- Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2), 265-312. <https://doi.org/10.1002/jae.951>
- Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics*, 68(1), 79-113. [https://doi.org/10.1016/0304-4076\(94\)01644-F](https://doi.org/10.1016/0304-4076(94)01644-F)

- Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. *Journal of Econometrics*, *142*(1), 50-93. <https://doi.org/10.1016/j.jeconom.2007.05.010>
- Refinitiv. (2025). *Country ESG scores (annual)* [Data set]. Refinitiv Eikon Database.
- Sadorsky, P. (2010). The impact of financial development on energy consumption in emerging economies. *Energy Policy*, *38*(5), 2528-2535. <https://doi.org/10.1016/j.enpol.2009.12.048>
- Serafeim, G. (2020). Public sentiment and the price of corporate sustainability. *Financial Analysts Journal*, *76*(2), 26-46. <https://doi.org/10.1080/0015198X.2020.1723380>
- Tanchangya, T., Islam, N., Naher, K., Mia, M. R., Chowdhury, S., Sarker, S. R., & Rashid, F. (2025). Financial technology-enabled sustainable finance for small-and medium-sized enterprises. *Environment, Innovation and Management*, *1*, 2550006. <https://doi.org/10.1142/S2972335125500069>
- Topxhiu, R., & Krasniqi, F. (2025). Remittances, financial development and economic growth: A dynamic panel data approach. *Contemporary Economics*, *19*(2), 208-229. <https://doi.org/10.5709/ce.1897-9254.562>
- UNEP. (2021). *State of finance for nature 2021*. United Nations Environment Programme. <https://www.unep.org/resources/state-finance-nature>
- Verhoeven, G. (2024). *The influence of ESG performance on corporate debt maturity: Evidence from European listed companies* [Master's thesis, Erasmus University Rotterdam]. EUR Thesis Repository. <https://thesis.eur.nl/pub/72785/>
- Wergthemmi, N., Mtiraoui, A., & Lassoued, M. (2026). Assessing the economic, social and environmental effects of trade openness: An OECD analysis. *Science*, *2*, 35-43.
- Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). MIT Press.
- World Bank. (2025). *World development indicators* [Data set]. <https://databank.worldbank.org/source/world-development-indicators>
- Wu, Z., & Chen, S. (2024). Does environmental, social, and governance (ESG) performance improve financial institutions' efficiency? Evidence from China. *Mathematics*, *12*(9), 1369. <https://doi.org/10.3390/math12091369>
- Yang, B., Jahanger, A., & Ali, M. (2021). Remittance inflows affect the ecological footprint in BICS countries: Do technological innovation and financial development matter? *Environmental Science and Pollution Research*, *28*(18), 23482-23500. <https://doi.org/10.1007/s11356-021-12400-3>
- Zhang, S., Liu, X., & Bae, J. (2017). Does trade openness affect CO2 emissions: Evidence from ten newly industrialized countries? *Environmental Science and Pollution Research*, *24*(21), 17616-17625. <https://doi.org/10.1007/s11356-017-9392-8>