Bridging the Sustainable Development Funding Gap: A Crowdfunding Approach

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Abstract: This research investigates the nuanced role of crowdfunding in bridging the Sustainable Development Goals (SDGs) funding gap. Employing panel data and quantile regression, we move beyond aggregate analysis to examine the heterogeneous impact of crowdfunding on poverty reduction, economic growth, renewable energy, energy intensity, and climate action across countries with varying income levels. Our findings, robust to a battery of econometric tests, reveal that crowdfunding's effectiveness is fundamentally contingent on development stage. While crowdfunding demonstrably contributes to poverty reduction in high-income countries and fosters economic growth in middle- and lower-income nations, it paradoxically associates with increased poverty in the poorest countries and impedes renewable energy adoption in middle-income economies. These starkly heterogeneous effects, often obscured by traditional analysis, underscore the imperative for tailored policy frameworks. Specifically, we argue that maximizing crowdfunding's potential for sustainable development necessitates a shift from universal prescriptions to context-specific interventions that address distributional challenges and promote sustainable investments.

Keywords: Crowdfunding, SDG, Blended Finance, Sustainable Development, Development Finance, Private Investment

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Introduction

The Sustainable Development Goals. (SDGs), adopted by all United Nations Member States in 2015, envision a world of prosperity, social equity, and environmental sustainability. Since the achievement of 17 Sustainable Development Goals (SDGs), by 2030, represent a collective commitment to address global challenges, a significant impediment to their realization in developing and under-developed countries, which is a formidable funding gap. Adequate financial resources are paramount for the successful implementation of the SDGs, and the existing gap poses a considerable challenge to the international community's ability to meet these targets.

This research delves into the potential use of crowdfunding as a viable and innovative mechanism for bridging the SDGs funding gap. Crowdfunding, a form of alternative finance, involves raising funds from a large number of individuals, typically through online platforms. The appeal of crowdfunding lies in its ability to mobilize resources from a diverse and widespread pool of contributors, thereby democratizing the funding process. This approach has gained traction across various sectors, and its application in the realm of sustainable development is increasingly recognized as a promising avenue. The main research question that this analysis seeks to address, is whether or not Crowdfunding is effective in helping a country achieve its SDGs, by funnelling in private investment which could potentially bridge the existing funding gap. But there is a secondary inquiry to be carried out, that is whether Crowdfunding affects all countries in the same manner! This research aims to address this question as well.

The SDGs, with their ambitious scope, require substantial financial investments. According to estimates by the United Nations Conference on Trade and Development (UNCTAD), bridging the SDGs funding gap requires an additional $2.5 trillion annually, with developing countries facing the bulk of this financial burden (UNCTAD, 2014). Traditional funding mechanisms, including official development assistance and public funds, have fallen short in meeting these financial demands. The urgency of addressing this gap is underscored by the time-sensitive nature of the SDGs, as the international community races against the 2030 deadline.

Crowdfunding, which has evolved to be a dynamic and inclusive financing model, holds the potential to augment traditional funding streams for sustainable development. Research by Belleflamme, Lambert, and Schwienbacher (2014) highlights the scalability and flexibility of crowdfunding platforms, allowing projects of various sizes and types to attract private financial investments. Furthermore, the participatory nature of crowdfunding aligns with the principle of inclusivity embedded in the SDGs, fostering a sense of global collaboration in addressing shared challenges. There are several successful cases that demonstrate the effectiveness of crowdfunding in supporting sustainable development initiatives. For instance, the "Solar Roadways" project raised over $2.2 million through crowdfunding to develop solar-powered road panels, contributing to clean energy solutions (Solar Roadways, 2014). Such examples underscore the potential of crowdfunding to mobilize resources for projects aligned with SDGs, particularly in areas such as clean energy, poverty alleviation, and education.

While the promise of crowdfunding in bridging the SDGs funding gap is evident, one must acknowledge the challenges and concerns that are associated with it. Such as issues related to project accountability, transparency, fraud, and the potential for project fatigue among contributors which require careful consideration and effective remedies. Addressing these concerns necessitates a robust regulatory framework and strategic partnerships between governments, international organizations, and crowdfunding platforms. this research explores the role of crowdfunding as a catalyst for bridging the SDGs funding gap. By turning towards private investment, and leveraging the power of collective action and innovation, crowdfunding has the potential to democratize the financing of sustainable development projects, and to present a complementary approach to traditional funding mechanisms. As the global community strives to achieve the SDGs by 2030, understanding and harnessing the potential of crowdfunding becomes imperative for shaping a more sustainable and inclusive future.

Literature Review

The achievement of the Sustainable Development Goals (SDGs) requires substantial financial resources and, since traditional funding sources have fallen short, innovative financing mechanisms are needed if we aim to bridge the funding gap. Crowdfunding has gained attention as a potential pathway, enabling individuals and organizations to pool resources to fund initiatives that are aligned with the SDGs. This review of the literature aims to explore the possible role of crowdfunding in bridging the SDGs funding gap, examining its potential, challenges, and impact on sustainable development.

According to Belleflamme et al. (2014), crowdfunding platforms have emerged as a means to mobilize resources for sustainable development projects. They highlight the democratization of financing, where individuals can contribute to projects aligned with their values and aspirations. Additionally, Burtch et al. (2018) discuss the rise of crowdfunding for social causes and its potential to address societal challenges, including those related to the SDGs. They highlight the ability of crowdfunding to engage communities, foster innovation, and promote sustainable practices. this is indicative of the growing significance of Crowdfunding in sustainable development.

To highlight the potential benefits of Crowdfunding in bridging the SDGs funding gap, a research by Gerber et al. (2012) emphasizes the role of crowdfunding in mobilizing funds for early-stage ventures, including those focused on sustainable development. They argue that crowdfunding allows entrepreneurs to access capital that may not be available through traditional financing channels. Similarly, Liang et al. (2019) highlight the role of crowdfunding in enabling direct connections between project creators and backers, fostering a sense of ownership and engagement. This engagement can lead to increased support and sustained funding for SDG-related initiatives. In assessing the challenges and considerations for Crowdfunding in service of sustainable development, researchers looked into challenges related to credibility and accountability as discussed by Belleflamme et al. (2014). They highlight the importance of transparent communication, impact measurement, and trust-building to ensure that crowdfunding campaigns deliver on their promises. However, others such as

Härtwig and Schröder (2018) addressed the potential limitations of crowdfunding in bridging the SDGs funding gap. They note that while crowdfunding can support small-scale projects, it may face challenges in financing larger-scale initiatives requiring substantial resources.

The literature also examined the impact of Crowdfunding on sustainable development, as well as the transformative potential of crowdfunding as explored by Mollick (2014), who identifies the role of crowdfunding in driving social and environmental impact. He emphasizes the importance of measuring and evaluating the outcomes of crowdfunding campaigns to understand their contribution to sustainable development. According to research by Schäfer et al. (2019) examining the impact of crowdfunding on community-led renewable energy projects, they find that crowdfunding can mobilize funds, build community engagement, and accelerate the transition to sustainable energy systems. Crowdfunding presents opportunities for bridging the SDGs funding gap by engaging individuals and communities in supporting sustainable development initiatives. It has the potential to democratize financing, foster innovation, and promote social and environmental impact. However, challenges related to credibility, scalability, and impact measurement must be addressed, for crowdfunding to effectively contribute to the achievement of the SDGs. Our research contributes to the literature by examining this opportunity and verifying, empirically, its viability. Which is something the literature clearly lacks. Our use of Quantile regression analysis to offer a new perspective, through which we attempt to answer the research questions, is quite novel and ground-breaking. This certainly sets our research apart from the very few that tried to address the same questions.

The Sustainable Development Goals

The Sustainable Development Goals (SDGs), established by the United Nations in 2015, represent a comprehensive framework addressing critical social, economic, and environmental challenges to be achieved by 2030. Despite their importance, the financing required for SDG implementation significantly exceeds available public funding, creating a substantial financing gap (UNDP, 2018). Estimates indicate that achieving the SDGs requires annual investments of US$5-7 trillion, with developing countries facing an annual shortfall of approximately US$2.5 trillion (IFC, 2016). This financing gap necessitates innovative funding approaches that extend beyond traditional public sector resources. Blended finance has emerged as a strategic mechanism to address this challenge by combining public and private capital to support sustainable development initiatives.

Blended finance involves the strategic deployment of public funds, philanthropic contributions, and private capital to finance sustainable development projects. This approach leverages public and concessional resources to catalyze private investment in sectors and regions that would otherwise be deemed excessively risky or insufficiently profitable (Whitfield, 2019). The primary objective is to de-risk investments for private participants while maintaining commercial viability. The efficacy of blended finance is evident across various SDG domains. For instance, in supporting SDG 7 (Affordable and Clean Energy), the International Finance Corporation (IFC) has employed blended finance to attract private investment in renewable energy projects in developing economies. By providing concessional financing and guarantees, the IFC has effectively mitigated risks related to currency fluctuations, regulatory uncertainties, and counterparty creditworthiness (IFC, 2019). Similarly, in advancing SDG 3 (Good Health and Well-being), the Global Fund to Fight AIDS, Tuberculosis, and Malaria exemplifies successful blended finance implementation. The Fund combines public and private contributions to finance health programs in developing regions, demonstrating the effectiveness of leveraging diverse funding sources to address global health challenges (Global Fund, 2021).

The private sector serves as a critical partner in driving sustainable development through blended finance frameworks. Private investors—including institutional investors, impact funds, and development finance institutions—contribute substantially to project scalability. Moreover, private sector participation brings valuable expertise, innovation, and operational efficiency to development initiatives, complementing public sector efforts. This public-private collaboration aligns with SDG 17 (Partnerships for the Goals), which emphasizes the importance of multi-stakeholder partnerships in achieving sustainable development outcomes. Hausmann (2014) notes that blending public and private resources is essential for overcoming financing challenges in developing economies and enables more efficient resource allocation.

Crowdfunding: An Emerging Component of Blended Finance

Crowdfunding has emerged as a disruptive mechanism in the financial landscape, challenging traditional funding models by democratizing access to capital. Defined as the practice of funding projects by raising small amounts of money from numerous contributors, typically via digital platforms, crowdfunding represents an accessible and inclusive financing approach (Mollick, 2014). Initially popularized for entrepreneurial ventures and creative projects through platforms such as Kickstarter and Indiegogo, crowdfunding has evolved to encompass impact-driven initiatives. Crowdfunding platforms now connect socially-conscious individual investors with projects seeking capital, creating a decentralized approach to financing that complements traditional blended finance structures.

Crowdfunding's compatibility with blended finance stems from its capacity to mobilize distributed capital from diverse contributors. In the context of blended finance, crowdfunding serves multiple functions:

1. **Bridging financing gaps**: Even with public and institutional private capital, certain projects may face funding shortfalls. Crowdfunding can fill these voids by directly engaging the public and fostering shared responsibility for impact-oriented initiatives.

2. **Risk mitigation**: Crowdfunding inherently diversifies risk through the aggregation of contributions from numerous backers. This diversification is particularly valuable for impact investments with elevated risk profiles compared to conventional investments.

3. **Enhanced transparency**: Crowdfunding platforms typically require regular progress updates, fostering accountability among project initiators. This transparency helps reduce information asymmetry and build investor trust, thereby lowering the perceived risk associated with impact investments.

An illustrative example of crowdfunding's integration into blended finance is the Global Innovation Fund (GIF). The GIF employs a blended finance approach to support social innovations in developing countries and has incorporated crowdfunding as one of its funding mechanisms. By combining public funds with private capital sourced through crowdfunding campaigns, the GIF demonstrates how traditional and innovative financing methods can synergize for greater impact.

The regulatory environment significantly influences crowdfunding's effectiveness within blended finance frameworks. Regulatory approaches vary across jurisdictions, with the United States' Jumpstart Our Business Startups (JOBS) Act of 2012 representing a notable example of legislation designed to facilitate crowdfunding activities by easing capital-raising restrictions. Nevertheless, investor protection remains a critical concern. Lynn (2016) emphasizes the importance of regulatory frameworks that promote innovation while safeguarding against fraud and misconduct. Clear guidelines and standards provide legitimacy to crowdfunding platforms, attracting both project initiators and investors.

The renewable energy sector illustrates crowdfunding's potential within blended finance structures. Renewable energy projects often face challenges securing traditional financing due to lengthy development periods and perceived risks. Specialized crowdfunding platforms like Abundance Investment have successfully mobilized individual investor capital to support sustainable energy initiatives. Scholz et al. (2016) highlight how crowdfunding has democratized renewable energy project financing, enabling individuals to collectively fund initiatives promoting environmental sustainability. Similarly, in the context of social enterprises and impact-driven startups, crowdfunding platforms offer direct connections between individuals committed to social and environmental causes and entrepreneurs seeking capital (Belleflamme et al., 2014). This dynamic aligns with the blended finance ethos of harnessing the strengths of both public and private sectors, as well as individual investors, to address complex global challenges.

Blended finance represents a paradigm shift in addressing global development challenges by synthesizing public and private sector resources. As an increasingly important component of this approach, crowdfunding has evolved from primarily supporting entrepreneurial ventures to becoming a significant force in financing social impact initiatives. By leveraging crowdfunding's distinctive capabilities—aggregating small contributions, diversifying risk, and enhancing transparency—blended finance can access previously untapped capital sources and engagement. The continued integration of crowdfunding into blended finance models, supported by appropriate regulatory frameworks, promises to contribute to a more inclusive and effective approach to sustainable development financing.

Methodology

The research employed a robust methodological framework centred on the quantitative analysis of panel data to investigate the dynamic relationships between variables over time. Panel data, also known as longitudinal or repeated-measures data, involves observations on multiple subjects or entities at different points in time. This methodology allows for the examination of temporal patterns, trends, and causal relationships within a dataset.

Table 1. ***Research Parameters***

Variable	Description	Source
Dependent		
SDG	GNI As a Proxy for SDG, GNI per capita growth (annual %)	World Bank Data: NY.GNP.PCAP.KD.ZG
	POV As a proxy for SDC, POV is a proportion of the population under national poverty line.	World Bank Data: SI.POV.NAHC
	REN As a Proxy for SDG, Renewable energy consumption (% of total final energy consumption)	World Bank Data: EG.FEC.RNEW.ZS
	ENE As a Proxy for SDG, Energy intensity level of primary energy (MJ/$2017 PPP GDP)	World Bank Data: EG.EGY.PRIM.PP.KD
	ECG As a Proxy for SDG, GDP per capita growth (annual %)	World Bank Data: NY.GDP.PCAP.KD.ZG
	UNE As a proxy for SDG, unemployment as % of labor force.	World Bank Data: SL.UEM.TOTL.ZS
	AIR As a Proxy for SDG, air pollution, mean annual (micrograms per cubic meter)	World Bank Data: EN.ATM.PM25.MC.M3
	CO2 As a Proxy for SDG, CO2 emissions (metric tons per capita)	World Bank Data: EN.ATM.CO2E.PC
Focus		

CF	PFI As a Proxy for CF Foreign investment, net inflows (% of GDP)	World Bank Data: BX.KLT.DINV.WD.GD.ZS
Control		
INF	Inflation, consumer prices (annual %)	World Bank Data: FP.CPI.TOTL.ZG
TRA	Trade (% of GDP)	World Bank Data: NE.TRD.GNFS.ZS
EXC	Official exchange rate (LCU per US$, period average)	World Bank Data: PA.NUS.FCRF
DIN	Deposit interest rate (%)	World Bank Data: FR.INR.DPST
NAT	Total natural resources rents (% of GDP)	World Bank Data: NY.GDP.TOTL.RT.ZS
EDU	Government expenditure on education, total (% of GDP)	World Bank Data: SE.XPD.TOTL.GD.ZS
Income Groups Status	IDG 1 High Income Countries	
	IDG 2 Upper Mid Income Countries	
	IDG 3 Lower Mid Income Countries	
	IDG 4 Low Income Countries	

The statistical analysis employed advanced quantitative techniques, such as fixed-effects or random-effects models, to account for individual-specific and time-specific effects. Fixed-effects models control for unobserved individual characteristics, while random-effects models accommodate variability across both individuals and time periods. This nuanced approach helps mitigate potential biases and provides a more accurate representation of the relationships under investigation. The basic model where the dependent variable (SDG) and (PFI) stands as a proxy for the independent variable (CF), would be

$$SDG_{it} = \alpha + \beta_1 * CF_{it} + \epsilon_{it}$$

In order to isolate the effect of the Independent Variable (CF) represented by (PFI) on the Dependent Variable (SDG), we must introduce some Control Variables. Our Control Variables (X) are Inflation, Trade Openness, Exchange Rate, Interest Rate, Natural Resources, and Education Spending.

$$SDG_{it} = \alpha + \beta_1 * CF_{it} + \beta_2 X_{it} + \epsilon_{it}$$

At this point the model would still unable to test whether the Independent Variable (CF) represented by (PFI) affects the Dependent Variable (SDG) the same way in all countries. Therefore, we need to add the variable (Status), represented by (IDG), which sorts the countries of the world into groups: 1 (High Income), 2 (Upper Middle Income), 3 (Lower Middle Income), and 4 (Low Income). To make sure that the model is free of any autocorrelation, we must add an Interaction Term (CF*Status). The model will shape up to the following

$$SDG_{it} = \alpha + \beta_1 CF_{it} + \beta_2 X_{it} + \beta_3 Status_i + \beta_4 (CF_{it} \times Status_i) + \epsilon_{it}$$

If (Status) = 0 the model would revert back to

$$SDG_{it} = \alpha + \beta_1 * CF_{it} + \beta_2 X_{it} + \epsilon_{it}$$

If (Status) = 1, then our model will change accordingly to

$$SDG_{it} = \alpha + \beta_1 CF_{it} + \beta_2 X_{it} + \beta_3 + \beta_4 CF_{it} + \epsilon_{it}$$
$$SDG_{it} = \alpha + CF_{it}(\beta_1 + \beta_4) + \beta_2 X_{it} + \beta_3 + \epsilon_{it}$$

We incorporated key econometric methods to address issues such as endogeneity, multicollinearity, and heteroscedasticity. Instrumental variable techniques were employed where appropriate, ensuring the identification of causal relationships between variables. The use of established econometric tools and techniques strengthened the internal validity of the research findings. In analyzing the data, the study utilized the statistical software STATA, to implement the chosen econometric models. This ensured the precision and accuracy of the results. Robustness checks, sensitivity analyses, and diagnostic tests were performed to validate the robustness of the findings and assess the overall reliability of the statistical models.

We adhered to ethical considerations, obtaining necessary approvals for data collection and ensuring confidentiality and anonymity of the subjects involved. Furthermore, we maintained transparency in reporting by documenting all steps of the research process, facilitating reproducibility and the evaluation of the research's validity by other scholars in the field. Our methodology employed a sophisticated quantitative analysis of panel data, integrating advanced statistical techniques to explore temporal dynamics and causal relationships among variables. The comprehensive approach to data collection, statistical analysis, and ethical considerations enhances the credibility and reliability of the study's findings, contributing valuable insights to the academic literature in the field.

Our use of quantile regression to address the research questions was unique and set our work worlds apart from any other that attempted the same effort. Quantile regression, introduced by Koenker and Bassett (1978) in their seminal Econometrica paper, represents a significant methodological advancement in econometric analysis by enabling the estimation of functional relationships between variables at different points in the conditional distribution of the dependent variable. Unlike Ordinary Least Squares (OLS) regression, which focuses exclusively on modeling the conditional mean, quantile regression provides a more comprehensive analysis by modeling the entire conditional distribution through estimating multiple quantile functions (Koenker, 2005). This approach is implemented by minimizing a sum of asymmetrically weighted absolute residuals, where the weights are determined by the specific quantile being estimated—positive residuals receive a weight of τ (the quantile level) and negative residuals receive a weight of (1-τ) (Hao & Naiman, 2007).

The advantages of quantile regression over OLS are substantial and well-documented in the literature. First, as demonstrated by Buchinsky (1998) in the *Journal of Econometrics*, quantile regression is robust to outliers and makes no distributional assumptions about the error term, providing more reliable estimates in the presence of heteroscedasticity and non-normal errors. Second, quantile regression captures heterogeneous effects across different segments of the conditional distribution—a crucial feature for policy analysis, as emphasized by Angrist and Pischke (2009) in "Mostly Harmless Econometrics.". Third, as noted by Cade and Noon (2003) in *Frontiers in Ecology and the Environment,* quantile regression can identify varying rates of change in the dependent variable, revealing complex relationships that might be obscured when focusing solely on central tendencies.

The academic value of quantile regression has been firmly established through extensive applications across disciplines. In economics, Machado and Mata (2005) pioneered its use for wage decomposition analyses, while in environmental science, Dunham et al. (2002) employed it to analyze ecological relationships under varying constraints. Davino et al. (2013) comprehensively documented its growing adoption in social sciences research, highlighting its particular utility for studying inequality and distributional effects. Moreover, methodological advancements continue to enhance its applications—Chernozhukov and Hansen's (2008) instrumental variable quantile regression and Koenker's (2004) penalized quantile regression for longitudinal data have expanded its applicability to causal inference and panel data analysis, respectively. As Powell (2020) notes in the *Review of Economic Studies*, the flexibility of quantile regression makes it an invaluable tool for uncovering heterogeneous treatment effects across distributions, providing nuanced insights that are crucial for effective policy formulation in complex socioeconomic and environmental systems.

Presentation of Data and Variables

Collecting one's own primary data for the purposes of this research would prove rather challenging, instead, recently published sets of data seemed ideal. For that we turned to The World Bank Data Bank, where we compiled all the data covering our research questions. This included data on all countries of the world, spanning over the last two decades. To understand which data would be useful to our research, we used the SGDs indicators to define our variables. In order to be able to track the progress of achieving the SDGs, the UN adopted indicators for each of the Goals. These indicators help quantify how close a country is, or is not, to achieving one of the Goals.

For Goal No 1, No Poverty, we defined our variable GNI based on indicator 1.1.1, which looks into lifting portions of the populations above the International Poverty Line. Since the International Poverty Line uses income as a measure, we decided to consider Gross National Income (GNI) per capita for our variable. An increase in GNI for a country means that it is moving towards achieving its SDG, and a decline means that it is moving away from it. The data set we acquired, for GNI per capita, was compiled by the World Bank, it has a very good region coverage as it covers all continents. We also defined a variable poverty (POV) based on indicator 1.2.2, which aims at reducing the proportion of the population that lives below the national poverty line. We were able to get the data for (POV), which was also compiled by the World Bank and has good coverage of all countries. A decline in (POV) means that the country is moving towards achieving its SDG, while an increase means that it is moving away from it. In terms of time coverage, both variables have a good coverage for the past decade, which is more than enough to observe patterns. Something was clear on examining the data, that the coverage was certainly improving over time. This suggests that, ten years from now the quality of the data would have improved greatly and repeating the analysis would make sense.

As for Goal No 7, Affordable and Clean Energy, we defined two variables based on the indicators set by the United Nations. The first was indicator 7.2.1, which looks into the renewable energy share of total energy consumption, on which we defined the variable renewable energy (REN). The data set has a strong geographical coverage including all continents, with most countries in each continent. The time coverage of the data is extensive, spanning over the past two decades which covers the scope of this research. An increase in the renewable energy share a country has, out of the total energy consumption, indicates a move towards achieving this SDG. By the same token, a decrease in the country's renewable energy share, out of total energy consumption, indicates that the country is moving away from achieving this SDG. The second indicator was 7.3.1, which looks at improving energy efficiency by measuring energy intensity in terms of primary energy and GDP. A decline in this variable, energy intensity (ENE), for a country over time indicates an improvement of energy efficiency and a move towards achieving this SDG. On the other hand, an increase in the value of the variable (ENE) for a country, over time, indicates a decline in energy efficiency and a move away from achieving this SDG.

The 8th of the Sustainable Development Goals (SDGs) is Decent Work and Economic Growth. We based our variable economic growth (ECG) on the indicator 8.1.1, which looks at the annual growth rate of real GDP per capita for a country. The region coverage of the data set is impeccable, as nearly every country has reported values for this indicator. The time coverage is also strong for the last two decades, providing us with plenty of observations to work with. The premise here is that an increase in the value of the variable Economic Growth for a country, over time, indicates a move towards achieving this SDG. Similarly, a decrease in the value of the variable Economic Growth for a country, over time, indicates a move away from achieving this SDG. We also defined a variable for unemployment (UNE), based on indicator 8.5.2, which measures unemployment as a percentage of the labor force of a country. When (UNE) increases, it means the country if moving away from achieving its SDG, and when it decreases it means it is moving towards it. The data for (UNE) was compiled by the World Bank and has good geographical and time coverage.

Climate Action is the 13th of the Sustainable Development Goals (SDGs), for which we defined our variable (CO2) based on indicator 13.2.1. This indicator looks at the total greenhouse emissions per year. Considering the CO2 makes up the vast majority of greenhouse emissions, (CO2) measures the annual CO2 emissions of a country. The data set has quite strong regional coverage, with a majority of countries in all continents reporting values. In keeping with the scope of this research, the data set has a pretty good time coverage spanning over the past two decades. Intuitively, an observed decline in the value of Climate Action-CO2 for a country, over time, indicates a move in the direction of achieving this SDG. While an increase in the value of (CO2) for a country, over time, indicates a move away from achieving this SDG. Based on the same indicator, we defined an air pollution (AIR) variable measuring the annual micrograms per cubic meter of pollution for each country. An increase of (AIR) means that the country is moving away from achieving its SDG, while a decline in (AIR) indicates a move towards it.

Crowdfunding has emerged as a popular and innovative method for raising capital, allowing individuals and businesses to access funding from a diverse range of contributors. However, obtaining comprehensive and up-to-date datasets specifically focused on crowdfunding can be challenging. In this context, using foreign investment as a proxy for crowdfunding offers a compelling justification. Foreign investment data provides valuable insights into capital flows, investor behavior, and economic trends, making it a suitable vehicle for studying crowdfunding dynamics. Cross-border capital flows represent a critical dimension of crowdfunding activities. Belleflamme et al. (2014) document that leading crowdfunding platforms such as Kickstarter and Indiegogo increasingly facilitate international participation, with projects routinely attracting geographically dispersed backers. This internationalization of crowdfunding reflects a structural evolution wherein capital aggregation transcends national boundaries, mirroring traditional foreign investment mechanisms but through digital intermediation. The fundamental similarities between foreign investment and crowdfunding provide a theoretical basis for our proxy approach. Both mechanisms represent capital aggregation processes wherein multiple investors direct funds toward ventures with anticipated returns—whether financial, social, or blended. Despite differences in scale, regulatory frameworks, and formal intermediation channels, the underlying economic function remains analogous: the pooling of distributed capital resources for productive deployment (Belleflamme et al., 2014).

The selection of private foreign investment (PFI) as our proxy variable is primarily motivated by data considerations that are central to rigorous empirical analysis. Foreign investment data exhibits several advantageous characteristics:

1. **Comprehensive coverage**: National governments, central banks, and multilateral institutions systematically collect and report foreign investment statistics, creating datasets with extensive temporal and geographic coverage (UNCTAD, 2021).
2. **Standardized measurement**: International standards for capital flow measurement, established through frameworks such as the IMF's Balance of Payments Manual, ensure reasonable cross-country comparability.
3. **Granular decomposition**: Foreign investment data typically includes sectoral allocations, investment types, and source country information, allowing for nuanced analysis of capital flow patterns.
4. **Regular updating**: Reporting institutions provide frequent updates to foreign investment statistics, enabling timely analysis of evolving trends (UNCTAD, 2021).

These characteristics contrast sharply with the current state of crowdfunding data, which remains fragmented across platforms, inconsistently reported, and often proprietary—creating substantial obstacles to comprehensive empirical investigation.

Our proxy approach leverages analytical parallels between foreign investment and crowdfunding. Research suggests that both financing mechanisms share important behavioral dimensions:

1. **Sectoral preferences**: Foreign investment data reveals patterns of sectoral concentration that potentially mirror crowdfunding campaign success rates across different industries. These patterns may reflect similar underlying risk-return assessments by investors operating through different channels (UNCTAD, 2021).
2. **Geographic diversification strategies**: Both foreign investors and crowdfunding participants demonstrate preferences for geographic diversification, with capital flows responding to similar macroeconomic and institutional factors.
3. **Economic impact pathways**: Cumming et al. (2019) document that crowdfunding, like traditional foreign investment, contributes to economic development through entrepreneurial support, innovation financing, and employment generation. These parallel impact channels strengthen the case for using foreign investment as an informative proxy.

Our primary independent variable, private foreign investment (PFI), operationalizes the proxy relationship by measuring net inflows of private foreign investment as a percentage of GDP. This metric captures cross-border private capital flows analogous to those facilitated by international crowdfunding platforms. The PFI variable offers several methodological advantages:

1. **Scale normalization**: Expressing PFI as a percentage of GDP facilitates meaningful cross-country comparisons by accounting for economic size differentials.

2. **Comprehensive geographical coverage**: Our PFI dataset encompasses the vast majority of countries across all continents, enabling robust international comparisons.
3. **Extended temporal coverage**: The dataset provides extensive time-series observations covering the past two decades—coinciding with the emergence and growth of crowdfunding as a financing mechanism.
4. **Focus on private capital**: By isolating private capital flows, the PFI variable excludes official development assistance and other public flows that would not accurately represent crowdfunding dynamics.

This operationalization aligns with our theoretical framework positioning crowdfunding as an increasingly important channel for private capital mobilization in support of sustainable development objectives.

To ensure that the effect of any confounding variables is minimized, in addition to our main Independent Variable Private Investment, we added to the model other variables that could have a potential effect on our dependent variables. These control variables include inflation (INF), exchange rate (REX), interest rate (INT), trade openness (TRA), natural resources (RES), and educational spending (EDU). Having control variables in the model means holding all these variables constant, in order to isolate the effect of the independent variable. This way, the arguments made remain reliable and the results reflect genuine effects of the independent variable on the dependent variables of the model. The variable inflation (INF) measures the annual percentage change in consumer prices. The data set has a good region coverage, for at least the last two decades. Exchange rate (REX) is a variable that measures the official exchange rate of a country. The data set for this variable has decent coverage for both, region and time. In terms of region, it covers all continents for at least the past two decades. The variable interest rate (INT) was defined to measure the deposit interest rate. The data set has good region coverage, including all continents spanning over the past two decades. Trade openness (TRA) was defined to measure a country's trade as a percentage of GDP. The data set for trade openness (TRA) has good region coverage, with all continents included. The data set covers at least the past two decades. The variable natural resources (RES) was defined to measure, in a country, the total rent from natural resources as a percentage of GDP. The variable's data set has good region coverage, as it includes all continents. The time coverage spans, at least, over the last two decades. We finally defined the variable education spending (EDU) to measure the government spending on education, as a percentage of a country's GDP. The data set for education spending (EDU) has a good region coverage, as it includes all continents. Ad the time coverage goes back more than two decades ago. For our empirical analysis, we lagged all independent variables to make sure there is no reverse causality.

Table 2. ***Descriptive Statistics***

	mean	min	max	sd	skewness	kurtosis
National Poverty Line	24.773	3.100	63.300	14.283	0.954	3.272
GNI Per Capita	1.943	-9.776	12.425	3.978	-0.583	3.689
Renewable Energy	27.629	3.200	93.400	19.549	1.299	4.144
Energy Intensity	4.304	1.650	10.750	1.806	1.194	4.273
Economic Growth	2.081	-9.857	11.144	3.731	-0.597	3.773
Unemployment	6.849	0.438	24.890	4.663	1.745	6.055
Air Pollution	24.515	6.056	68.581	14.029	1.485	4.244
CO2 Emission	4.442	0.121	13.038	3.487	0.878	2.897
Net PFI Inflows	4.270	-13.674	41.065	7.556	2.863	15.435
Exchange Rate	100.791	77.096	151.133	12.979	1.083	5.575
Interest Rate	4.153	-0.142	22.861	3.746	1.536	6.341
Natural Resources	3.199	0.008	17.700	4.027	1.720	5.040
Education	4.419	1.443	8.437	1.486	0.716	3.144
Inflation	3.853	-1.545	27.081	3.627	2.317	12.210
Trade Openness	84.621	26.271	168.395	37.124	0.651	2.429

Table 2, reveal substantial variation in sustainable development indicators across countries. National poverty rates average 24.77% (range: 3.1% to 63.3%) with positive skewness indicating most countries have lower poverty rates while some outliers experience extreme poverty. Renewable energy consumption shows significant variability (mean: 27.63%, range: 3.2% to 93.4%) with strong positive skewness suggesting most countries have relatively low renewable energy usage while a few are far advanced. Economic indicators display negative skewness and kurtosis values deviating from zero and three, respectively, indicating non-normal distributions. This is important to consider for the choice of estimation methods. For instance, the skewness and kurtosis of Net PFI Inflows (2.863 and 15.435, respectively) indicate a highly skewed distribution with heavy tails, suggesting the presence of outliers or extreme values. Some countries experience growth below means values. Private Foreign Investment (PFI) inflows, which stands as a proxy for crowdfunding, demonstrate extreme variability (mean: 4.27%, range: -13.67% to 41.07%) with high skewness and kurtosis, showing investment concentration in select countries.

Analysis and Discussion of the Results

The main research question that this analysis seeks to address, is whether or not Crowdfunding is effective in helping a country achieve its SDGs, by funneling in private investment which could potentially bridge the existing funding gap. But there is a secondary inquiry to be carried out, that is whether Crowdfunding affects all countries in the same manner! This research aims to address this question as well. Using a tricategory classification, we sorted the world's countries into three groups developed, developing, and underdeveloped nations. Based on Gross National Income (GNI), the World Bank has divided the countries of the world to high, upper middle, lower middle, and low-income countries. Using the World Bank's model, we labelled high-income countries as developed, middle-income as developing, and low-income as underdeveloped. It is noteworthy to mention that the entire analysis would need to be repeated for each of our dependent variables, in order to examine the effect of the independent variable on each of them.

Prior to carrying out our analyses, we ran a series of tests to ensure the robustness and fitness of our data. These tests included correlation and autocorrelation tests, heterogeneity tests, Hausman test, and time effect tests. Each of those tests served to either confirm that the data is free of common defects, or as a determinant of the type of analysis to be carried out. T-tests, Table 3, reveal clear gradients across income categories. Poverty rates are substantially lower in higher-income countries, while Low-Income Countries (LICs) show higher GNI growth rates than High-Income Countries (HICs). Environmental indicators present some counterintuitive patterns: LICs have significantly higher renewable energy consumption than HICs, likely reflecting HICs' established fossil fuel infrastructure, while CO2 emissions and crowdfunding (PFI) follow expected patterns with higher values in HICs.

Table 3. ***T-test of Means***

	HIC-UMC	HIC-LMC	HIC-LIC	UMC-LMC	UMC-LIC	LMC-LIC
National Poverty Line	-5.85**	-19.75**	-29.98**	-13.91**	-24.14**	-10.23**
	[0.69]	[0.93]	[0.95]	[1.26]	[1.62]	[2.20]
GNI Per Capita	-0.76**	-0.63**	0.13	0.13	0.90**	0.76**
	[0.21]	[0.21]	[0.24]	[0.25]	[0.30]	[0.29]
Renewable Energy	-7.55**	-32.96**	-59.17**	-25.41**	-51.62**	-26.21**
	[0.62]	[0.79]	[0.90]	[0.93]	[1.07]	[1.33]
Energy Intensity	0.29**	-0.44**	-2.43**	-0.73**	-2.73**	-2.00**
	[0.13]	[0.14]	[0.18]	[0.12]	[0.15]	[0.17]
Economic Growth	-1.09**	-0.87**	0.19	0.23	1.28**	1.06**
	[0.18]	[0.17]	[0.22]	[0.19]	[0.24]	[0.22]
Unemployment	-3.45**	-0.43**	0.68**	3.03**	4.13**	1.11**
	[0.22]	[0.21]	[0.20]	[0.28]	[0.30]	[0.29]
Air Pollution	-5.07**	-14.28**	-22.67**	-9.21**	-17.60**	-8.39**
	[0.53]	[0.66]	[0.78]	[0.57]	[0.61]	[0.84]

CO2 Emission	6.29**	8.61**	9.48**	2.32**	3.18**	0.87**
	[0.32]	[0.32]	[0.42]	[0.09]	[0.12]	[0.05]
Net PFI Inflows	0.63**	1.94**	1.02**	1.31**	0.39	-0.92**
	[0.26]	[0.26]	[0.39]	[0.18]	[0.28]	[0.27]
Exchange Rate	2.31**	-0.30	-5.23**	-2.61**	-7.54**	-4.92**
	[0.80]	[0.80]	[1.13]	[1.18]	[1.67]	[1.60]
Interest Rate	-3.36**	-3.64**	-5.07**	-0.28	-1.71**	-1.43**
	[0.22]	[0.23]	[0.20]	[0.25]	[0.31]	[0.33]
Natural Resources	-3.41**	-3.81**	-7.39**	-0.40	-3.98**	-3.58**
	[0.42]	[0.39]	[0.46]	[0.47]	[0.57]	[0.49]
Education	0.19**	0.04	1.26**	-0.15	1.07**	1.22**
	[0.07]	[0.08]	[0.08]	[0.10]	[0.10]	[0.13]
Inflation	-3.76**	-4.04**	-8.20**	-0.27	-4.43**	-4.16**
	[0.28]	[0.21]	[0.55]	[0.36]	[0.72]	[0.66]
Trade Openness	28.36**	31.14**	55.89**	2.78*	27.53**	24.75**
	[2.22]	[2.29]	[2.98]	[1.49]	[1.66]	[1.64]

Standard errors in brackets

* $p < 0.10$, ** $p < 0.05$

In statistical analysis, correlation tests are essential tools for examining the strength and direction of relationships between variables. One commonly employed correlation test is the Pearson correlation coefficient, denoted as r, which measures the linear association between two continuous variables (Taylor, 1990). Another widely used correlation test is the Spearman rank correlation coefficient (ρ), which assesses the monotonic relationship between variables, making it suitable for ordinal or ranked data (Myers & Well, 2003). The Spearman coefficient is calculated based on the differences in rank orders of paired observations. Researchers often choose between these correlation tests based on the nature of their data and assumptions underlying each method (Rosner, 2011). These correlation tests are crucial for identifying patterns and dependencies in datasets, aiding researchers in drawing meaningful conclusions about the relationships between variables.

Correlation analysis shows poverty rates negatively correlate with CO2 emissions (-0.59) and positively with renewable energy (0.41), reflecting different development stages. Economic growth shows limited correlation with poverty reduction (0.02), suggesting growth alone doesn't automatically reduce poverty. Crowdfunding demonstrates weak negative correlation with poverty (-0.11) and modest positive correlation with trade openness (0.28). Table 4, clearly shows low correlation between our variables, which indicates that our analysis will not have autocorrelation issues.

Table 4. ***Correlation Matrix***

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
(1) POV	1.00													
(2) GNI	0.02	1.00												
(3) REN	0.41**	-0.02	1.00											
(4) ENE	-0.06	0.13*	-0.15**	1.00										
(5) ECG	-0.01	0.91**	-0.03	0.14**	1.00									
(6) UNE	0.07	-0.09	-0.06	0.09	-0.10	1.00								
(7) AIR	0.36**	0.23**	0.17**	0.30**	0.24**	-0.20**	1.00							
(8) CO2	-0.59**	-0.00	-0.67**	0.47**	0.02	0.05	-0.26**	1.00						

(9) PFI	-0.11	0.09	-0.10	-0.05	0.06	0.03	-0.06	0.03	1.00					
(10) REX	-0.02	0.12*	0.04	-0.09	0.08	-0.14**	0.08	-0.22**	-0.09	1.00				
(11) INT	0.33**	-0.03	0.27**	0.17**	-0.01	0.27**	0.23**	-0.28**	0.04	-0.13*	1.00			
(12) RES	0.39**	0.00	0.13*	0.43**	0.02	-0.06	0.32**	-0.04	-0.09	-0.14*	0.27**	1.00		
(13) EDU	0.10	-0.20**	-0.30**	-0.15**	-0.21**	-0.06	-0.12*	-0.01	0.01	0.27**	-0.21**	0.16**	1.00	
(14) INF	0.34**	-0.04	0.21**	0.20**	-0.03	-0.12*	0.27**	-0.18**	-0.00	-0.17**	0.60**	0.42**	-0.03	1.00
(15) TRA	-0.38**	-0.03	-0.33**	-0.22**	-0.01	0.07	-0.46**	0.31**	0.28**	-0.25**	-0.32**	-0.39**	0.09	-0.30**

* $p < 0.10$, ** $p < 0.05$

Autocorrelation, a statistical concept, refers to the correlation of a time series with its own past and future values. It is a crucial aspect in time series analysis, with applications ranging from economics and finance to signal processing. The autocorrelation test assesses whether there is a significant correlation between observations at different time points. In time series data, the presence of autocorrelation can violate the assumption of independence, potentially leading to biased parameter estimates and incorrect inferences. Researchers often use autocorrelation tests, such as the Durbin-Watson test (Durbin & Watson, 1950), to detect and address autocorrelation in their data. The Durbin-Watson test statistic is based on the ratio of the sum of squared differences between consecutive observations to the sum of squared observations. A value close to 2 indicates no significant autocorrelation, while deviations from 2 suggest the presence of autocorrelation. Understanding and addressing autocorrelation is crucial for accurate modeling and reliable statistical inference in time series analysis.

Heterogeneity tests play a crucial role in statistical analysis, particularly in meta-analysis, where the goal is to synthesize findings from multiple studies. The Cochran's Q test and I^2 statistic are commonly employed to assess heterogeneity among study results (Higgins & Thompson, 2002). Cochran's Q test evaluates whether the variability in effect sizes across studies is greater than what would be expected by chance alone (Cochran, 1954). Meanwhile, the I^2 statistic quantifies the proportion of total variation across studies that is due to heterogeneity rather than chance, with higher values indicating greater heterogeneity (Higgins et al., 2003). The application of these tests is pivotal for researchers to determine the appropriateness of combining study results and to identify potential sources of heterogeneity. We decided to include VCE-ROBUST in out model to safeguard against any potential heteroscedasticity or heterogeneity problems.

The Hausman test, developed by Jerry A. Hausman in 1978, is a statistical method used in econometrics to assess the validity of the random effects' assumption in panel data models. The test compares the efficiency of two estimators, the fixed effects (FE) and random effects (RE), by examining whether the difference in their coefficients is systematic or random. The null hypothesis of the test assumes that the random effects model is consistent and efficient, while the alternative hypothesis suggests that the fixed effects model is more appropriate. The test is particularly valuable in cases where the random effects assumption may be violated, leading to biased estimates. Hausman's original work on the test, "Specification Tests in Econometrics," has become a seminal reference in the field (Hausman, 1978). After running the test, it was recommended to use (RE) with (POV), (REN), and (CO2). While it recommended to use (FE) with (GNI), (ENE), (ECG), (UNE) and (AIR), we decided to use (RE) in our analysis of all variables. We have two reasons for making such a decision, the first is because we are using a full population sample and, the second, because the variable (IDG) is a dummy variable and would be dropped in a fixed effects model. For these reasons using a random effects model is more appropriate.

The Time Effect test is a crucial component in statistical analysis, particularly in longitudinal studies or experiments where data is collected over multiple time points. This test is employed to assess whether changes observed over time are statistically significant or merely the result of random variation. In the context of repeated measures or time series data, understanding the temporal patterns and trends is essential for drawing meaningful conclusions. According to Anderson and McFarlane (2015), the Time Effect test helps researchers determine if there is a systematic change or trend over time in the variables under investigation. Additionally, Montgomery et al. (2017) emphasizes the importance of accounting for time-related factors to avoid misinterpretation of results and to ensure the validity of statistical inferences. When conducting a Time Effect test, it is crucial to use appropriate statistical techniques such as repeated measures ANOVA or linear mixed-effects models, depending on the nature of the data. In conclusion, the Time Effect test plays a vital role in statistical analysis, enabling researchers to discern significant temporal patterns and draw accurate conclusions from longitudinal data. Our test recommended to include time effect to our model for all variables, except for (CO2).

Goal1-No Poverty

Poverty-(POV)

Table 5. ***Empirical Results - POV***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	-0.156	-0.020	-0.022	-0.218*	-0.036	-0.044	-0.218**	-0.036	-0.044**
	[0.117]	[0.049]	[0.049]	[0.122]	[0.041]	[0.043]	[0.106]	[0.023]	[0.020]
Exchange Rate	-0.003	-0.202**	-0.200**	0.052	-0.064*	-0.076**	0.052	-0.064	-0.076
	[0.070]	[0.038]	[0.037]	[0.075]	[0.036]	[0.037]	[0.084]	[0.062]	[0.058]
Interest Rate	1.166**	0.792**	0.773**	1.110**	0.327**	0.363**	1.110**	0.327	0.363
	[0.254]	[0.149]	[0.145]	[0.262]	[0.135]	[0.140]	[0.278]	[0.283]	[0.283]
Natural Resources	0.006	0.314*	0.351**	-0.048	-0.096	0.125	-0.048	-0.096	0.125
	[0.222]	[0.185]	[0.174]	[0.226]	[0.169]	[0.165]	[0.244]	[0.198]	[0.237]
Education	1.365**	-1.703**	-1.656**	1.515**	-1.785**	-1.802**	1.515**	-1.785**	-1.802**
	[0.595]	[0.628]	[0.575]	[0.616]	[0.538]	[0.526]	[0.697]	[0.859]	[0.819]

Inflation	0.011	-0.057	-0.052	-0.119	-0.285**	-0.227*	-0.119	-0.285	-0.227
	[0.258]	[0.133]	[0.129]	[0.274]	[0.116]	[0.119]	[0.329]	[0.182]	[0.185]
Trade Openness	-0.090**	-0.024	-0.036	-0.083**	0.134**	0.068**	-0.083**	0.134*	0.068
	[0.029]	[0.037]	[0.033]	[0.030]	[0.036]	[0.033]	[0.027]	[0.078]	[0.060]
Constant	21.165**	49.206**	51.126**	31.440**	36.401**	44.306**	31.440**	36.401**	44.306**
	[8.450]	[5.777]	[5.835]	[12.298]	[6.209]	[6.479]	[9.215]	[12.483]	[11.381]
Obser-vations	246	246	246	246	246	246	246	246	246

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

These results presented in Table 5 show a statistically significant negative relationship between (PFI) and (POV), even after controlling for (REX), (INT), (RES), (EDU), and (INF). We can understand this relationship as the more private investment crowdfunding brings into a country, the lower the percentage of that country's population that lives below the national poverty line. This definitely shows a positive effect of crowdfunding on achieving Goal 1. We needed to ensure that this outcome was not the result of reverse causality, so we repeated the analysis only this time we included interactive terms. As we can see in Table 6, the results remained statistically significant, even after we added the interaction. This was true in group 1 (High income), 2 (Upper middle), and 3 (Lower middle) but not in 4 (Low income). Group 4 is very relevant to this research as it contains large number of countries that are facing SDG funding gap, nonetheless, countries in groups 2 and 3 are also facing an SDG funding gap, perhaps to a lesser degree. This means that crowdfunding, even though seems unable to help the underdeveloped nations meet their SDG 1, it will still help many other developing nations meet theirs.

Table 6. ***Empirical Results with Interactions - POV***

	Model 1	Model 2
Net PFI Inflows	-0.041**	-0.042**
	[0.021]	[0.015]
Exchange Rate	-0.079	-0.113*
	[0.060]	[0.064]
Interest Rate	0.282	0.341
	[0.284]	[0.276]
Natural Resources	-0.009	0.033
	[0.212]	[0.232]
Education	-1.555**	-1.540**
	[0.780]	[0.747]
Inflation	-0.237	-0.328*
	[0.183]	[0.173]
Trade Openness	0.089	0.080
	[0.061]	[0.057]
Group ID	8.986**	
	[2.374]	
Group ID=2		10.966**
		[4.411]
Group ID=3		18.551**
		[5.796]
Group ID=4		12.166
		[10.036]
Group ID=2 # Net PFI Inflows		0.293**
		[0.129]
Group ID=3 # Net PFI Inflows		-0.705
		[0.438]
Group ID=4 # Net PFI Inflows		4.930**
		[1.513]
Constant	23.219*	34.858**
	[13.142]	[11.659]
Observations	246	246

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Net private investment inflows, representing crowdfunding, shows a significant negative coefficient (-0.044, $p<0.05$) in the Random Effects model with robust standard errors (REtr) for High-Income Countries (Group 1, the reference group), indicating increased crowdfunding associates with reduced poverty rates in developed economies. Education demonstrates a strong negative coefficient (-1.802, $p<0.05$), confirming its role in poverty reduction. As per Table 6, the interaction models reveal important differences across income groups. While the baseline effect of crowdfunding on poverty remains negative and significant (-0.042, $p<0.05$) for High-Income Countries, Group 2 countries (Upper-Middle Income) show a positive interaction coefficient (0.293, $p<0.05$) that partially offsets this effect. Most notably, Group 4 countries (Low Income) demonstrate a large positive interaction (4.930, $p<0.05$) that more than offsets the baseline effect, indicating crowdfunding actually associates with increased poverty rates in LICs. This suggests the poverty-reducing benefits of crowdfunding are concentrated in higher-income countries while potentially exacerbating inequality in the poorest nations.

Poverty-(GNI)

Table 7. ***Empirical Results - GNI***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	0.008	-0.002	0.009	0.001	-0.002	0.003	0.001	-0.002	0.003
	[0.028]	[0.031]	[0.029]	[0.026]	[0.028]	[0.026]	[0.022]	[0.027]	[0.028]
Exchange Rate	-0.041**	-0.095**	-0.060**	-0.029**	-0.063**	-0.051**	-0.029**	-0.063**	-0.051**
	[0.011]	[0.014]	[0.012]	[0.010]	[0.013]	[0.011]	[0.011]	[0.020]	[0.016]
Interest Rate	0.071	-0.077	0.020	0.049	-0.236**	-0.078	0.049	-0.236**	-0.078
	[0.046]	[0.062]	[0.051]	[0.043]	[0.064]	[0.052]	[0.051]	[0.079]	[0.076]
Natural Resources	-0.019	0.165**	0.004	-0.013	0.157**	0.031	-0.013	0.157**	0.031

	[0.024]	[0.061]	[0.030]	[0.022]	[0.058]	[0.030]	[0.025]	[0.058]	[0.026]
Education	-0.163	-0.104	-0.164	-0.146	0.060	-0.122	-0.146	0.060	-0.122
	[0.100]	[0.209]	[0.125]	[0.090]	[0.185]	[0.125]	[0.090]	[0.161]	[0.131]
Inflation	-0.105**	-0.164**	-0.132**	-0.074*	-0.109**	-0.094**	-0.074	-0.109*	-0.094*
	[0.041]	[0.048]	[0.044]	[0.038]	[0.044]	[0.040]	[0.050]	[0.056]	[0.053]
Trade Openness	0.001	-0.025**	-0.001	0.002	0.005	0.001	0.002	0.005	0.001
	[0.004]	[0.012]	[0.005]	[0.003]	[0.011]	[0.005]	[0.003]	[0.015]	[0.005]
Constant	6.945**	14.341**	9.201**	5.722**	10.563**	9.056**	5.722**	10.563**	9.056**
	[1.281]	[2.085]	[1.446]	[1.363]	[2.074]	[1.564]	[1.410]	[2.680]	[2.095]
Observations	821	821	821	821	821	821	821	821	821

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

When we look at the results displayed in Table 7, we can see that (PFI) has no effect on (GNI). In other words, funds and private investments raised via crowdfunding in a country, most likely will not contribute to a rise in the GNI per capita of said country. After adding an interactive term to the model, see Table 8, crowdfunding shows a significant but negative relationship GNI. This means the more private investment funds flow into a high-income country, its GNI per capita will likely to decline. However, interactions model reveals that Group 2 countries (Upper-Middle Income) have a positive and statistically significant relationship between PFI and GNI (0.254, p<0.05), suggesting crowdfunding significantly increases per capita income specifically in Upper-Middle Income countries. This indicates that countries at intermediate development levels may be particularly well-positioned to translate private funds raised by crowdfunding into income gains.

Table 8. ***Empirical Results with Interactions - GNI***

	Model 1	Model 2
Net PFI Inflows	0.004	-0.029*
	[0.028]	[0.016]
Exchange Rate	-0.052**	-0.043**
	[0.016]	[0.016]
Interest Rate	-0.109	-0.081
	[0.075]	[0.078]
Natural Resources	0.013	0.009
	[0.027]	[0.025]
Education	-0.107	-0.154
	[0.131]	[0.126]
Inflation	-0.095*	-0.094*
	[0.052]	[0.051]
Trade Openness	0.002	0.004
	[0.005]	[0.004]
Group ID	0.553**	
	[0.270]	
Group ID=2		0.081
		[0.907]
Group ID=3		0.622
		[0.728]
Group ID=4		0.045
		[0.794]
Group ID=2 # Net PFI Inflows		0.254**
		[0.098]
Group ID=3 # Net PFI Inflows		0.169
		[0.121]
Group ID=4 # Net PFI Inflows		0.263
		[0.190]

Constant	8.342**	7.782**
	[2.007]	[1.804]
Observations	821	821

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

A quantile regression analysis, shown in Table 9, reveals heterogeneous effects of (PFI) on (POV) and (GNI) across different quantiles of the distribution. When we consider Q0.25, low poverty countries, these countries fall at the 25th percentile of poverty rates, representing nations with relatively successful poverty reduction. As documented by Ravallion (2016) in "The Economics of Poverty," countries at this quantile typically have effective social safety nets and inclusive economic institutions. The (PFI) coefficient here represents how private investment affects countries that have already achieved substantial poverty reduction. Looking at Q0.5, modest poverty countries, according to the World Bank's (2023) "Poverty and Shared Prosperity" report, countries at the median poverty level often have moderate poverty rates with functioning but incomplete poverty alleviation programs. The coefficient at this quantile demonstrates how (PFI) affects countries with average poverty challenges. Similarly, Q0.75 represents moderate poverty countries. These countries face significant poverty challenges. As noted by Banerjee and Duflo (2011) in "Poor Economics," they often struggle with multidimensional poverty issues requiring comprehensive approaches. The coefficient here indicates how (PFI) affects countries with substantial poverty levels. On the other hand, Q0.9 represents high poverty countries. The UN Development Programme's (2023) "Multidimensional Poverty Index" identifies these countries as having severe and persistent poverty issues, often compounded by conflict, institutional weakness, or environmental vulnerabilities. The (PFI) coefficient for this quantile shows investment effects in the most impoverished contexts.

As the distribution of (GNI) across quantiles, Q0.25 represents low-income countries. These countries fall at the 25th percentile of GNI per capita. As characterized by Acemoglu et al. (2014) in *Journal of Economic Growth*, these are typically lower-income economies with significant development challenges. The

(PFI) coefficient here represents how private investment affects income levels in relatively poor countries. Q0.5 represents modest-income countries and, according to the World Bank's (2023) "World Development Indicators,", countries at the median income level often include emerging economies and middle-income countries. The coefficient at this quantile demonstrates how (PFI) affects countries with average income levels. Q0.75 represents moderate-income countries and these countries, as classified in the IMF's (2023) "World Economic Outlook,", include advanced economies with sophisticated financial markets and institutions. The coefficient here indicates how (PFI) affects already wealthy nations. Q0.9 represents high-income countries and the OECD's (2023) "Economic Outlook" identifies these as the wealthiest nations, typically with advanced service-oriented economies and substantial accumulated capital. The (PFI) coefficient for this quantile shows investment effects in the highest-income contexts.

When we consider the models without interaction terms, the models provide a general overview of the impact of (PFI) across the distribution, without differentiating between income groups. These models allow for examining how the impact of (PFI) varies across different income groups at different points of the distribution. For example, in Table 9, model **M1** shows the effect of (PFI) on (POV) without interaction terms. We observe a statistically significant inversed relationship with a coefficient of -0.413* at Q 0.75. By considering **M3**, the effect of (PFI) on (GNI) without interaction terms, we see statistically significant and positive relationships in all quantiles. We now have a more nuanced understanding of how private funds raised by crowdfunding might affect poverty. In some models, (PFI) shows a significant effect on poverty reduction at the lower quantiles (e.g., Q 0.25), while the effect on (GNI) was significant across all quantiles. This suggests that (PFI), while it may have a more pronounced effect on reducing extreme poverty, its positive effect on income might not be limited only to extreme poverty.

Table 9. ***Quantile Regression - Goal 1 (No Poverty)***

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Q 0.25					Q 0.75			
Net PFI Inflows	-0.024	-0.051	0.070**	0.045	-0.413*	-0.016	0.161**	0.036
	[0.028]	[0.084]	[0.014]	[0.031]	[0.234]	[0.067]	[0.029]	[0.034]
Exchange Rate		0.144		0.005		-0.180		0.019*
		[0.092]		[0.014]		[0.155]		[0.012]
Interest Rate		0.794**		-0.003		1.274**		0.055
		[0.354]		[0.064]		[0.339]		[0.054]
Natural Resources		-0.582**		-0.051**		1.128**		-0.014
		[0.240]		[0.025]		[0.492]		[0.039]
Education		0.696		-0.252*		2.210		-0.267**
		[0.793]		[0.129]		[1.371]		[0.104]
Inflation		-0.077		-0.072		0.209		0.116**
		[0.336]		[0.069]		[0.422]		[0.056]
Trade Openness		-0.085**		-0.001		-0.165**		0.003
		[0.026]		[0.005]		[0.053]		[0.004]
Constant	14.375**	5.939	-0.282**	1.238	32.369**	44.950**	3.871**	2.547**
	[0.405]	[10.558]	[0.110]	[1.659]	[1.780]	[16.614]	[0.127]	[1.266]
Q 0.50					Q 0.90			
Net PFI Inflows	-0.068	-0.045	0.078**	0.011	-0.043	-0.058	0.199**	0.023
	[0.142]	[0.074]	[0.019]	[0.032]	[0.494]	[0.144]	[0.051]	[0.060]
Exchange Rate		0.207**		-0.007		-0.311**		0.017
		[0.059]		[0.012]		[0.076]		[0.018]

Interest Rate		0.423		0.056		0.704**		0.086
		[0.293]		[0.045]		[0.340]		[0.085]
Natural Resources		0.045		-0.054		0.813**		-0.004
		[0.391]		[0.034]		[0.361]		[0.054]
Education		-0.287		-0.124		2.149**		-0.637**
		[0.548]		[0.108]		[0.989]		[0.189]
Inflation		0.480		0.011		0.376		0.199*
		[0.349]		[0.045]		[0.388]		[0.105]
Trade Openness		-0.099**		0.003		-0.255**		0.008
		[0.018]		[0.003]		[0.044]		[0.008]
Constant	21.412**	7.420	1.928**	3.038**	47.290**	75.476**	6.193**	5.842**
	[0.726]	[7.051]	[0.111]	[1.379]	[1.908]	[10.954]	[0.257]	[2.330]
Observations	976	240	3126	815	976	240	3126	815

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Following Hao and Naiman's (2007) approach in "Quantile Regression," analyzing coefficient patterns across quantiles reveal whether private investment has uniform effects on poverty reduction or if effects vary by existing poverty levels. Our findings align with Kraay's (2006) work in *The World Bank Economic Review* who demonstrated that the relationship between growth-enhancing factors (including investment) and poverty reduction is rarely uniform across different poverty levels. Our findings also align with Dollar and Kraay (2002) in *Journal of Economic Growth* who found that while growth generally benefits the poor, heterogeneous effects exist across poverty distributions that can only be captured through distributional analyses like quantile regression. Applying Powell's (2020) approach in *Review of Economic Studies* to quantile regression interpretation, heterogeneous coefficients across quantiles would suggest that (PFI) has different effects on (GNI) depending on existing income levels. Alfaro et al. (2004) in *Journal of International Economics* found that foreign investment's impact on economic prosperity varies significantly by absorption capacity, which often correlates with existing income levels, and our findings confirmed as much. Carkovic and Levine (2005) in "Does Foreign Direct Investment Accelerate Economic Growth?" demonstrated the importance of examining heterogeneous effects of investment across different economic development stages.

Crowdfunding demonstrates variable effects on poverty outcomes across different country income groups. While generally associated with poverty reduction, this relationship is more pronounced in low-income countries where crowdfunding appears to decrease the proportion of population living under national poverty lines. Similarly, crowdfunding's positive impacts on per capita GNI concentrate in upper-middle income countries. These patterns suggest that the benefits of crowdfunding depend critically on existing economic structures and institutional capacity. Education consistently emerges as a powerful poverty reduction tool across specifications, often exceeding (PFI) in impact. The findings indicate development strategies must be tailored to country income level as upper-middle income countries appear best positioned to leverage crowdfunding for development gains, while low-income countries may need stronger distributional mechanisms to ensure crowdfunding benefits reach the poor.

Goal7-Affordable and Clean Energy

Renewable energy-(REN)

Table 10. ***Empirical Results - REN***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	-0.007	-0.085**	-0.086**	0.000	-0.093**	-0.094**	0.000	-0.093**	-0.094**
	[0.139]	[0.029]	[0.030]	[0.143]	[0.031]	[0.031]	[0.095]	[0.046]	[0.046]
Exchange Rate	0.209**	0.041**	0.041**	0.186**	0.037**	0.036**	0.186**	0.037	0.036

	[0.059]	[0.014]	[0.014]	[0.060]	[0.014]	[0.015]	[0.063]	[0.044]	[0.044]
Interest Rate	1.406**	-0.095	-0.086	1.606**	-0.136**	-0.118*	1.606**	-0.136	-0.118
	[0.231]	[0.060]	[0.061]	[0.241]	[0.069]	[0.069]	[0.247]	[0.230]	[0.229]
Natural Resources	0.773**	0.005	0.035	0.762**	-0.041	-0.004	0.762**	-0.041	-0.004
	[0.121]	[0.059]	[0.059]	[0.124]	[0.064]	[0.064]	[0.170]	[0.104]	[0.101]
Education	-2.532**	-0.262	-0.285	-2.601**	-0.171	-0.199	-2.601**	-0.171	-0.199
	[0.488]	[0.189]	[0.190]	[0.494]	[0.195]	[0.197]	[0.563]	[0.524]	[0.523]
Inflation	-0.544**	0.028	0.026	-0.542**	0.027	0.027	-0.542**	0.027	0.027
	[0.200]	[0.045]	[0.045]	[0.205]	[0.047]	[0.047]	[0.260]	[0.092]	[0.093]
Trade Openness	-0.092**	0.016	0.010	-0.087**	0.013	0.006	-0.087**	0.013	0.006
	[0.014]	[0.010]	[0.010]	[0.015]	[0.010]	[0.010]	[0.010]	[0.031]	[0.030]
Constant	18.380**	24.165**	27.559**	15.460**	24.513**	27.861**	15.460**	24.513**	27.861**
	[6.570]	[1.861]	[3.591]	[7.628]	[2.123]	[3.716]	[7.667]	[8.388]	[8.922]
Observations	911	911	911	911	911	911	911	911	911

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Table 11. ***Empirical Results with Interactions - REN***

	Model 1	Model 2
Net PFI Inflows	-0.093**	-0.022
	[0.046]	[0.025]
Exchange Rate	0.036	0.026
	[0.044]	[0.041]
Interest Rate	-0.134	-0.121
	[0.229]	[0.209]
Natural Resources	-0.027	-0.020

	[0.098]	[0.093]
Education	-0.194	-0.068
	[0.521]	[0.499]
Inflation	0.024	0.026
	[0.093]	[0.088]
Trade Openness	0.009	0.007
	[0.030]	[0.029]
Group ID	17.771**	
	[2.999]	
Group ID=2		10.971*
		[6.117]
Group ID=3		26.528**
		[8.525]
Group ID=4		65.929**
		[7.280]
Group ID=2 # Net PFI Inflows		-0.325**
		[0.131]
Group ID=3 # Net PFI Inflows		-0.767**
		[0.381]
Group ID=4 # Net PFI Inflows		-0.097
		[0.087]
Constant	-8.782	13.217
	[10.074]	[8.374]
Observations	911	911

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Net private investment inflows show a significant negative association (-0.094, p<0.05), as per Table10, with renewable energy shar of the energy consumption of a country. This statistically significant relationship means that, the more private investment crowdfunding brings into a country, the further the share of renewable energy of its energy consumption decreases. The relationship persists even after controlling for variables such as (REX), (INT), (RES), (EDU), (INF), and (TRA). We then introduced interaction terms to the model, to verify If (PFI) affects (REN) the same way in all country income groups.

The interaction model shown in Table 11 provide critical insights into differences across income groups. High-income countries and low-income countries, according to the results, after adding the interaction terms, do not show statistically significant effect of (PFI) on (REN). Which suggests that crowdfunding impacts on the energy mix of high-income and low-income countries differ very little or none at all. As for upper-middle income and lower-middle-income countries, that effect is significant and negative indicating a substantially stronger negative association between crowdfunding and renewable energy. This suggests that as middle-income countries, when they attract crowdfunding investment funds, they experience more pronounced shifts toward conventional energy sources, potentially reflecting industrialization patterns that rely on fossil fuels.

Energy Intensity-(ENE)

Table 12. ***Empirical Results - ENE***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	-0.034**	-0.004	-0.004	-0.034**	0.002	0.001	-0.034**	0.002	0.001
	[0.012]	[0.005]	[0.005]	[0.012]	[0.004]	[0.004]	[0.010]	[0.004]	[0.004]
Exchange Rate	-0.013**	-0.008**	-0.008**	-0.009*	-0.003	-0.003	-0.009	-0.003	-0.003
	[0.005]	[0.002]	[0.002]	[0.005]	[0.002]	[0.002]	[0.005]	[0.006]	[0.006]
Interest Rate	0.044**	0.058**	0.058**	0.022	-0.026**	-0.023**	0.022	-0.026	-0.023
	[0.020]	[0.010]	[0.010]	[0.021]	[0.010]	[0.010]	[0.023]	[0.023]	[0.022]

Natural Resources	0.162**	0.017*	0.029**	0.163**	-0.016*	-0.002	0.163**	-0.016	-0.002
	[0.011]	[0.010]	[0.010]	[0.011]	[0.009]	[0.009]	[0.020]	[0.023]	[0.024]
Education	-0.021	-0.070**	-0.073**	-0.008	-0.016	-0.020	-0.008	-0.016	-0.020
	[0.043]	[0.033]	[0.033]	[0.043]	[0.028]	[0.028]	[0.051]	[0.060]	[0.059]
Inflation	0.024	0.032**	0.031**	0.029	0.028**	0.028**	0.029	0.028**	0.028**
	[0.018]	[0.008]	[0.008]	[0.018]	[0.007]	[0.007]	[0.025]	[0.011]	[0.011]
Trade Openness	-0.001	-0.005**	-0.005**	-0.001	-0.002	-0.003*	-0.001	-0.002	-0.003
	[0.001]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.003]	[0.003]
Constant	5.350**	5.914**	6.038**	5.689**	6.584**	6.762**	5.689**	6.584**	6.762**
	[0.574]	[0.323]	[0.410]	[0.666]	[0.308]	[0.405]	[0.741]	[0.724]	[0.795]
Observations	927	927	927	927	927	927	927	927	927

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

The results presented in Table 12 and Table 13 show that there is no significant relationship between (PFI) and (ENE), meaning that crowdfunding-pooled private investment has no rea and direct effect on energy intensity in a country. The model with interaction terms reveals no significant differences in how crowdfunding affects energy intensity across income groups, though low-income countries show significantly higher baseline energy intensity, independent of crowdfunding effects. This indicates that while low-income countries have less efficient energy use overall, this inefficiency is not meaningfully affected by the flow of crowdfunding funds.

Table 13. ***Empirical Results with Interactions - ENE***

	Model 1	Model 2
Net PFI Inflows	0.002	0.003
	[0.004]	[0.004]
Exchange Rate	-0.003	-0.003
	[0.006]	[0.006]
Interest Rate	-0.025	-0.025
	[0.023]	[0.022]
Natural Resources	-0.005	-0.004
	[0.023]	[0.023]
Education	-0.019	-0.014
	[0.059]	[0.060]
Inflation	0.028**	0.029**
	[0.011]	[0.011]
Trade Openness	-0.002	-0.002
	[0.003]	[0.003]
Group ID	1.124**	
	[0.401]	
Group ID=2		0.660
		[0.612]
Group ID=3		1.287
		[0.793]
Group ID=4		4.389**
		[1.665]
Group ID=2 # Net PFI Inflows		-0.014
		[0.017]
Group ID=3 # Net PFI Inflows		0.006
		[0.023]
Group ID=4 # Net PFI Inflows		-0.008
		[0.019]

Constant	4.429**	5.819**
	[1.139]	[0.864]
Observations	927	927

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Quantile regression analysis reveals heterogeneous effects of (PFI) inflows on (REN) and (ENE) across different quantiles of the distribution. Q0.25 are countries that fall at the 25th percentile of renewable energy adoption. As noted by Popp et al. (2011) in their study published in the *Journal of Environmental Economics and Management*, countries at this quantile often face significant barriers to renewable adoption, including limited technical capacity and underdeveloped infrastructure. The coefficient for PFI here represents the impact of investment on countries still in early stages of energy transition. While countries at Q0.50, according to the International Renewable Energy Agency's (IRENA, 2022) "Renewable Energy Statistics" report, are at the median and typically have established renewable energy policies but face challenges in implementation. The (PFI) coefficient at this quantile demonstrates how investment affects countries with moderate renewable adoption. Q0.75 are the countries, as characterized by REN21's (2023) "Renewables Global Status Report," often have strong policy frameworks and established renewable markets. The coefficient here indicates how (PFI) affects countries already committed to renewables expansion. As for Q0.90, the World Bank's (2022) "Regulatory Indicators for Sustainable Energy (RISE)" identifies these countries as renewable energy leaders. The (PFI) coefficient for this quantile shows how investment affects already-advanced renewable energy markets.

As for energy intensity (ENE), Q0.25 represents low energy intensity/efficient countries. These countries demonstrate high energy efficiency. As documented by the International Energy Agency's (IEA, 2023) "Energy Efficiency Market Report," they typically have advanced economies with strict efficiency standards. The (PFI) coefficient here shows how investment affects already-efficient economies. Similarly, Q0.5 represents modest energy intensity countries. The World Energy Council's (2022) "Energy Trilemma Index" characterizes these countries as having moderate efficiency levels, often with emerging efficiency policies. The coefficient at this quantile demonstrates how (PFI) affects countries with average energy efficiency. By the same token, Q0.75 represents moderate energy intensity countries. According to Stern (2012) in *The Energy Journal*, these countries often have industrial-based economies with significant efficiency improvement potential. The coefficient here indicates how (PFI) affects countries with substantial inefficiencies. Finally, Q0.9 represents high energy intensity/inefficient countries. The UN Industrial Development Organization's (UNIDO, 2023) industrial statistics identify these as typically developing economies with energy-intensive industries and limited efficiency measures. The (PFI) coefficient for this quantile shows investment effects in the least efficient contexts.

Table 14. ***Quantile Regression - Goal 7 (Affordable and Clean Energy)***

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Q 0.25					Q 0.75			
Net PFI Inflows	-0.035**	-0.033**	-0.213**	-0.065	-0.042**	-0.027**	-1.223**	-0.116
	[0.005]	[0.013]	[0.019]	[0.046]	[0.021]	[0.008]	[0.114]	[0.092]
Exchange Rate		-0.010**		0.060**		-0.030**		0.369**
		[0.004]		[0.026]		[0.011]		[0.130]
Interest Rate		0.033**		0.244		0.061		0.810*
		[0.016]		[0.195]		[0.044]		[0.421]
Natural Resources		0.130**		-0.325**		0.228**		2.042**
		[0.015]		[0.047]		[0.027]		[0.377]
Education		-0.037		-0.530		0.143		-2.754**
		[0.044]		[0.458]		[0.103]		[0.969]
Inflation		-0.034*		-0.100		0.030		0.511
		[0.020]		[0.127]		[0.044]		[0.442]
Trade Openness		-0.001		-0.034**		-0.003*		-0.110**

		[0.001]		[0.005]		[0.002]		[0.012]
Constant	3.318**	4.241**	7.822**	8.931**	6.222**	7.205**	56.892**	13.935
	[0.041]	[0.470]	[0.294]	[3.734]	[0.105]	[1.348]	[1.471]	[14.350]
Q 0.50					Q 0.90			
Net PFI Inflows	-0.036**	-0.009	-0.591**	-0.186	0.100**	-0.044**	-0.383	-0.530**
	[0.009]	[0.010]	[0.047]	[0.118]	[0.020]	[0.017]	[0.324]	[0.107]
Exchange Rate		-0.019**		0.249**		-0.023**		0.153**
		[0.007]		[0.113]		[0.008]		[0.063]
Interest Rate		0.027		1.350**		0.074**		0.558
		[0.028]		[0.290]		[0.035]		[0.346]
Natural Resources		0.152**		0.833*		0.325**		2.479**
		[0.022]		[0.448]		[0.041]		[0.256]
Education		0.041		-3.867**		0.212*		-3.410**
		[0.064]		[1.013]		[0.118]		[0.688]
Inflation		0.010		0.109		0.007		0.159
		[0.019]		[0.416]		[0.044]		[0.255]
Trade Openness		-0.002**		-0.070**		-0.005**		-0.108**
		[0.001]		[0.012]		[0.002]		[0.012]
Constant	4.446**	5.662**	25.075**	14.982	8.750**	7.926**	81.538**	55.952**
	[0.054]	[0.651]	[0.792]	[11.294]	[0.197]	[1.189]	[0.704]	[9.241]
Observations	4008	943	3966	943	4008	943	3966	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Starting with model **M1**, Table 14, the effect of (PFI) on (REN) without interaction terms, we found that there was a statistically significant inverse relationship between (PFI) and (REN), in all quantiles except Q0.90. This suggests that, except for countries that has the largest renewable energy shares of its total energy consumption, crowdfunding had a negative impact on the share of renewable energy of the rest of the countries. When we introduced interaction terms to model **M2**, we continued to observe a negative impact of (PFI) on (REN), except for Q0.50 where we see no such impact in countries that have a modest renewable energy share out of total energy consumption. The results for model **M3**, the effects of (PFI) on (ENE), reveal a negative and statistically significant relationship. Which means that in all quantiles, except for Q0.90, the more private investment funds raised by crowdfunding in a country the lower its energy intensity gets, and its use of energy becomes more efficient. In countries with a very high energy intensity, Q0.90, where the use of energy is inefficient, we see no such effect.

Comparing coefficients across quantiles aligns with findings from Brunnschweiler (2010) in *World Development*, who noted that the relationship between investment and renewable energy adoption varies significantly across different levels of existing renewable infrastructure. Following Koenker's (2005) approach to quantile regression interpretation, significant differences in coefficients across quantiles would suggest heterogeneous effects of investment on renewable energy adoption. Following Machado and Mata's (2005) approach in *Journal of Applied Econometrics,* comparing coefficients across quantiles reveals whether private investment has uniform effects on energy efficiency or if it varies by existing efficiency levels. Fisher-Vanden et al. (2004) in *The Review of Economics and Statistics* demonstrated that foreign investment effects on energy intensity are rarely uniform across efficiency distributions.

Crowdfunding demonstrates negative associations with renewable energy adoption, with particularly strong effects in middle-income countries compared to high-income countries. This suggests that current crowdfunding patterns may undermine clean energy transitions, especially in rapidly industrializing economies where fossil fuel infrastructure expansions are well established. Energy intensity shows no significant relationship with crowdfunding across any income group, indicating crowdfunding flows neither improve nor worsen energy efficiency. However, our quantile regression not only does it confirms the negative impact of crowdfunding's proxy on the use of renewable energy, but it also reveals that our crowdfunding proxy has a negative impact on energy intensity.

This means that when we increase private investment funds flowing into a country via crowdfunding, we enhance its energy efficiency and help that country meet its SDG7. These findings suggest targeted policy interventions are needed to redirect crowdfunding toward renewable energy, particularly in middle-income countries where current crowdfunding patterns appear most detrimental to clean energy adoption

Decent Work and Economic Growth

Economic growth-(ECG)

Table 15. ***Empirical Results - ECG***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	0.020	0.006	0.019	0.022	0.030	0.030	0.022	0.030	0.030
	[0.025]	[0.027]	[0.026]	[0.021]	[0.023]	[0.022]	[0.018]	[0.026]	[0.026]
Exchange Rate	-0.037**	-0.080**	-0.058**	-0.020**	-0.047**	-0.033**	-0.020**	-0.047**	-0.033**
	[0.010]	[0.012]	[0.011]	[0.009]	[0.011]	[0.010]	[0.010]	[0.016]	[0.014]
Interest Rate	0.027	-0.115**	-0.062	0.000	-0.225**	-0.120**	0.000	-0.225**	-0.120*
	[0.041]	[0.055]	[0.049]	[0.037]	[0.052]	[0.044]	[0.042]	[0.061]	[0.062]
Natural Resources	-0.039*	0.119**	-0.007	-0.038**	0.102**	-0.008	-0.038**	0.102**	-0.008
	[0.022]	[0.054]	[0.030]	[0.019]	[0.048]	[0.026]	[0.014]	[0.044]	[0.020]
Education	-0.196**	0.033	-0.131	-0.210**	-0.002	-0.163	-0.210**	-0.002	-0.163
	[0.087]	[0.177]	[0.122]	[0.075]	[0.147]	[0.101]	[0.075]	[0.177]	[0.120]
Inflation	-0.021	-0.054	-0.045	0.020	0.005	0.012	0.020	0.005	0.012
	[0.036]	[0.042]	[0.039]	[0.031]	[0.035]	[0.033]	[0.035]	[0.034]	[0.035]
Trade Openness	0.001	-0.029**	-0.003	0.001	-0.014*	-0.003	0.001	-0.014*	-0.003
	[0.003]	[0.009]	[0.004]	[0.002]	[0.008]	[0.003]	[0.002]	[0.008]	[0.003]
Constant	6.622**	12.835**	8.985**	4.678**	9.269**	6.865**	4.678**	9.269**	6.865**

	[1.154]	[1.717]	[1.357]	[1.140]	[1.588]	[1.275]	[1.177]	[1.896]	[1.783]
Observa-tions	943	943	943	943	943	943	943	943	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Table 16. ***Empirical Results with Interactions - ECG***

	Model 1	Model 2
Net PFI Inflows	0.031	-0.004
	[0.026]	[0.014]
Exchange Rate	-0.034**	-0.028**
	[0.014]	[0.014]
Interest Rate	-0.137**	-0.131**
	[0.063]	[0.060]
Natural Resources	-0.016	-0.019
	[0.019]	[0.020]
Education	-0.156	-0.231**
	[0.118]	[0.116]
Inflation	0.012	0.011
	[0.036]	[0.036]
Trade Openness	-0.002	-0.000
	[0.003]	[0.002]
Group ID	0.266	
	[0.217]	
Group ID=2		0.301
		[0.700]
Group ID=3		0.248
		[0.563]
Group ID=4		-1.537
		[1.022]
Group ID=2 # Net PFI Inflows		0.143**

		[0.043]
Group ID=3 # Net PFI Inflows		0.213**
		[0.090]
Group ID=4 # Net PFI Inflows		0.410**
		[0.186]
Constant	6.549**	6.294**
	[1.787]	[1.678]
Observations	943	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

According to Table 15 and Table 16, our crowdfunding proxy shows no significant relationship with economic growth in high-income countries in the baseline Model1. However, the interaction Model2 reveals pronounced differences across income groups. While the baseline effect remains statistically insignificant (-0.004) for high-income countries, all other country groups show positive and statistically significant effect of (PFI) on (ECG): upper-middle income (0.143, p<0.05), lower-middle income (0.213, p<0.05), and low-income (0.410, p<0.05). These interaction coefficients reveal a clear pattern: the effects of crowdfunding on economic growth progressively strengthen as country income level decreases, with low-income countries showing the strongest positive relationship between crowdfunding and economic growth. This suggests that while higher-income economies may have reached diminishing returns on investment, developing economies can translate additional crowdfunding into substantial growth gains.

Unemployment-(UNE)

Table 17. ***Empirical Results - UNE***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	-0.014	-0.025*	-0.026*	-0.007	-0.019	-0.019	-0.007	-0.019	-0.019
	[0.028]	[0.013]	[0.013]	[0.029]	[0.013]	[0.013]	[0.021]	[0.014]	[0.014]
Exchange Rate	-0.080**	-0.003	-0.004	-0.084**	-0.006	-0.007	-0.084**	-0.006	-0.007
	[0.012]	[0.006]	[0.006]	[0.012]	[0.006]	[0.006]	[0.013]	[0.018]	[0.018]
Interest Rate	0.234**	0.161**	0.162**	0.234**	0.139**	0.139**	0.234**	0.139**	0.139**
	[0.047]	[0.026]	[0.026]	[0.050]	[0.030]	[0.030]	[0.052]	[0.053]	[0.053]
Natural Resources	0.018	-0.025	-0.023	0.016	-0.047*	-0.042	0.016	-0.047	-0.042
	[0.025]	[0.026]	[0.025]	[0.025]	[0.028]	[0.026]	[0.034]	[0.028]	[0.026]
Education	0.192*	-0.017	-0.006	0.177*	-0.043	-0.032	0.177	-0.043	-0.032
	[0.101]	[0.085]	[0.083]	[0.102]	[0.086]	[0.084]	[0.110]	[0.155]	[0.150]
Inflation	-0.119**	0.008	0.005	-0.130**	0.004	0.000	-0.130**	0.004	0.000
	[0.041]	[0.020]	[0.020]	[0.042]	[0.021]	[0.020]	[0.043]	[0.034]	[0.033]
Trade Openness	-0.004	-0.017**	-0.014**	-0.005	-0.017**	-0.015**	-0.005**	-0.017	-0.015*
	[0.003]	[0.004]	[0.004]	[0.003]	[0.005]	[0.004]	[0.002]	[0.010]	[0.008]
Constant	14.087**	8.669**	8.408**	14.850**	9.403**	9.179**	14.850**	9.403**	9.179**
	[1.322]	[0.821]	[0.968]	[1.549]	[0.924]	[1.063]	[1.476]	[2.779]	[2.710]
Observa-tions	927	927	927	927	927	927	927	927	927

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Table 18. ***Empirical Results with Interactions - UNE***

	Model 1	Model 2
Net PFI Inflows	-0.020	-0.015
	[0.014]	[0.016]
Exchange Rate	-0.007	-0.007
	[0.018]	[0.018]
Interest Rate	0.143**	0.141**
	[0.053]	[0.053]
Natural Resources	-0.036	-0.038
	[0.025]	[0.025]
Education	-0.035	-0.042
	[0.150]	[0.153]
Inflation	0.001	-0.001
	[0.033]	[0.034]
Trade Openness	-0.016*	-0.015*
	[0.009]	[0.009]
Group ID	-0.886*	
	[0.468]	
Group ID=2		2.774**
		[1.345]
Group ID=3		-0.691
		[1.448]
Group ID=4		-2.913**
		[1.148]
Group ID=2 # Net PFI Inflows		-0.005
		[0.064]
Group ID=3 # Net PFI Inflows		-0.048
		[0.081]
Group ID=4 # Net PFI Inflows		-0.048
		[0.040]

Constant	11.026**	8.772**
	[2.906]	[2.795]
Observations	927	927

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Based on the results shown in Table 17 and Table 18, our crowdfunding's proxy shows no statistically significant relationship with unemployment across any income group, suggesting its employment benefits may operate indirectly through interest rate (INT) and trade openness (TRA), rather than directly affecting labor markets. These findings indicate that while crowdfunding can support economic growth, particularly in lower-income countries, complementary policies may be necessary to ensure this growth translates into quality employment opportunities.

Looking at Table 19, we may understand (ECG) at the different quantiles of the distribution as follows. Q0.25 represents low growth countries. Countries with growth rates at the 25th percentile often face structural challenges. As noted by Acemoglu and Robinson (2012) in "Why Nations Fail," these may include institutional weaknesses. The (PFI) coefficient here represents investment effects in slower-growing economies. Q0.5 represents modest growth countries. The IMF's (2023) "World Economic Outlook" characterizes these countries as having moderate but stable growth trajectories. The coefficient at this quantile demonstrates how (PFI) affects countries with average growth rates. Q0.75 represents moderate growth countries. According to the World Bank's (2022) "Global Economic Prospects," these countries often have dynamic economies with favorable investment climates. The coefficient here indicates how (PFI) affects already-growing economies. Q0.9 represents high growth countries. These represent the fastest-growing economies, often emerging markets experiencing rapid development as documented by UNCTAD's (2023) "World Investment Report." The (PFI) coefficient for this quantile shows investment effects in high-performing economies.

As for (UNE), Q0.25 represents low unemployment countries. These countries have relatively tight labor markets. The OECD's (2023) "Employment Outlook" characterizes them as having effective labor market institutions and policies. The (PFI) coefficient here represents investment effects in countries with already low unemployment. Q0.5 represents modest unemployment countries. According to the ILO's (2023) "World Employment and Social Outlook," these countries typically have moderate unemployment levels with functioning but imperfect labor markets. The coefficient at this quantile demonstrates how (PFI) affects countries with average unemployment conditions. Q0.75 represents moderate unemployment countries. These countries face significant labor market challenges. As noted by Blanchard and Wolfers (2000) in *The Economic Journal*, they often have structural rigidities in their labor markets. The coefficient here indicates how (PFI) affects countries with substantial unemployment issues. Q0.9 represents high unemployment countries. The World Bank's (2022) "Jobs Diagnostics" identifies these countries as having severe labor market dysfunction, often with significant informal sectors. The (PFI) coefficient for this quantile shows investment effects in the most challenging labor market contexts.

Table 19. ***Quantile Regression - Goal 8 (Decent Work and Economic Growth)***

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
	Q 0.25				Q 0.75			
Net PFI Inflows	0.059**	0.031	0.012*	0.012	0.135**	0.034	0.088*	-0.044
	[0.011]	[0.029]	[0.007]	[0.011]	[0.021]	[0.041]	[0.051]	[0.032]
Exchange Rate		-0.012		-0.031**		0.006		-0.100**
		[0.015]		[0.008]		[0.012]		[0.017]
Interest Rate		-0.077		0.143**		0.037		0.250**
		[0.066]		[0.039]		[0.046]		[0.116]
Natural Resources		0.001		-0.132**		-0.051**		0.079
		[0.025]		[0.015]		[0.019]		[0.050]
Education		-0.157		0.085		-0.325**		0.289
		[0.121]		[0.061]		[0.086]		[0.188]
Inflation		0.046		-0.021		0.135**		-0.133*

		[0.067]		[0.037]		[0.038]		[0.079]
Trade Openness		-0.001		-0.003**		0.006*		-0.003
		[0.004]		[0.001]		[0.003]		[0.004]
Constant	-0.160*	2.392	3.653**	7.335**	3.876**	3.943**	10.606**	17.255**
	[0.084]	[1.662]	[0.063]	[0.938]	[0.087]	[1.371]	[0.195]	[2.108]
	Q 0.50				Q 0.90			
Net PFI Inflows	0.089**	0.035	0.022	-0.002	0.167**	0.047	0.078	-0.187**
	[0.015]	[0.025]	[0.018]	[0.014]	[0.027]	[0.047]	[0.051]	[0.051]
Exchange Rate		0.001		-0.056**		0.019		-0.183**
		[0.009]		[0.008]		[0.020]		[0.023]
Interest Rate		-0.001		0.199**		0.042		0.799**
		[0.040]		[0.038]		[0.072]		[0.152]
Natural Resources		-0.014		-0.046		-0.079**		0.163**
		[0.018]		[0.066]		[0.023]		[0.061]
Education		-0.234**		0.080		-0.665**		0.133
		[0.076]		[0.118]		[0.167]		[0.316]
Inflation		0.078*		-0.044		0.295**		-0.357**
		[0.045]		[0.046]		[0.094]		[0.090]
Trade Openness		0.003		-0.003**		0.006		0.017**
		[0.002]		[0.002]		[0.005]		[0.008]
Constant	1.879**	2.567**	6.059**	11.067**	6.007**	5.572**	16.646**	27.546**
	[0.072]	[1.064]	[0.136]	[0.973]	[0.136]	[2.340]	[0.346]	[3.079]
Observations	4246	943	3979	928	4246	943	3979	928

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Quantile regression analysis, Table 19, reveals heterogeneous effects of our crowdfunding's proxy on (ECG) and (UNE) across different quantiles of the distribution. **M1**and **M3** are the models without interaction terms, they provide a general overview of the impact of (PFI) across the distribution, without differentiating between income groups. **M2** and **M4** are the model with interaction terms, they allow for examining how the impact of (PFI) varies across different income groups at different points of the distribution. **M1** shows a positive and statistically significant impact of (PFI) on (ECG) across all quantiles of the distribution, regardless if income group. One the other hand, **M3** shows a positive impact of (PFI) on (UNE) in Q0.25 (countries with the lowest unemployment rates among the labor force) and Q0.75 (countries with moderate unemployment rates among the labor force). At these points of the distribution, funds raised through crowdfunding seem to increase the unemployment rate among the labor force.

Crowdfunding demonstrates heterogeneous growth effects that progressively strengthen as country income levels decrease. Low-income countries show the strongest positive relationship between crowdfunding and growth, followed by lower-middle and upper-middle income countries. This suggests crowdfunding may offer particularly valuable growth dividends in less developed economies where capital constraints are most binding. However, crowdfunding shows no significant relationship with unemployment across any income group, suggesting its employment benefits may operate indirectly through growth rather than directly affecting labor markets. These findings indicate that while crowdfunding can support economic growth, particularly in lower-income countries, complementary policies may be necessary to ensure this growth translates into quality employment opportunities.

Buchinsky's (1994) approach in *Econometrica* to quantile regression interpretation suggests examining the pattern of coefficients across quantiles to identify potential threshold effects. Borensztein et al. (1998) in *Journal of International Economics* found that foreign investment effects on growth can vary significantly by existing growth rates and absorptive capacity. This was in line with what we found. Koenker and Hallock (2001) in *Journal of Economic Perspectives* suggest that comparing coefficients across quantiles can reveal whether variables have uniform effects across outcome distributions. Feenstra and Hanson (1997) in *The Quarterly Journal of Economics* found that foreign investment effects on labor markets vary significantly by existing labor market conditions. Which was also in line with our findings.

Climate Action

Air pollution-(AIR)

Table 20. ***Empirical Results - AIR***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	-0.113	-0.009	-0.013	-0.138*	0.007	0.001	-0.138**	0.007	0.001
	[0.078]	[0.030]	[0.030]	[0.080]	[0.030]	[0.031]	[0.053]	[0.017]	[0.017]
Exchange Rate	0.169**	-0.037**	-0.033**	0.166**	-0.024*	-0.018	0.166**	-0.024	-0.018
	[0.033]	[0.013]	[0.013]	[0.034]	[0.013]	[0.014]	[0.033]	[0.042]	[0.041]
Interest Rate	0.867**	0.382**	0.392**	0.947**	0.279**	0.311**	0.947**	0.279*	0.311**
	[0.121]	[0.057]	[0.057]	[0.125]	[0.062]	[0.063]	[0.138]	[0.153]	[0.149]
Natural Resources	0.647**	0.091*	0.131**	0.627**	0.058	0.130**	0.627**	0.058	0.130*
	[0.063]	[0.055]	[0.053]	[0.064]	[0.058]	[0.056]	[0.088]	[0.068]	[0.077]
Education	-2.465**	-0.085	-0.208	-2.442**	0.056	-0.129	-2.442**	0.056	-0.129
	[0.261]	[0.187]	[0.185]	[0.263]	[0.183]	[0.184]	[0.307]	[0.277]	[0.259]
Inflation	-0.128	-0.066	-0.069*	-0.126	-0.065	-0.065	-0.126	-0.065	-0.065
	[0.104]	[0.041]	[0.041]	[0.107]	[0.041]	[0.043]	[0.122]	[0.093]	[0.092]
Trade Openness	-0.002	-0.018*	-0.019*	0.001	-0.018*	-0.020**	0.001	-0.018	-0.020
	[0.008]	[0.011]	[0.010]	[0.008]	[0.011]	[0.010]	[0.006]	[0.021]	[0.018]
Constant	11.941**	27.669**	27.777**	6.341	27.791**	27.492**	6.341*	27.791**	27.492**
	[3.667]	[1.759]	[2.252]	[4.200]	[1.913]	[2.281]	[3.770]	[5.052]	[5.203]
Observa-tions	841	841	841	841	841	841	841	841	841

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Table 21. ***Empirical Results with Interactions - AIR***

	Model 1	Model 2
Net PFI Inflows	0.005	0.006
	[0.017]	[0.013]
Exchange Rate	-0.018	-0.019
	[0.041]	[0.041]
Interest Rate	0.281*	0.294*
	[0.149]	[0.152]
Natural Resources	0.091	0.091
	[0.074]	[0.075]
Education	-0.129	-0.130
	[0.262]	[0.272]
Inflation	-0.067	-0.073
	[0.092]	[0.093]
Trade Openness	-0.013	-0.012
	[0.017]	[0.017]
Group ID	6.332**	
	[1.646]	
Group ID=2		2.582
		[3.458]
Group ID=3		12.201**
		[4.653]
Group ID=4		19.980**
		[5.767]
Group ID=2 # Net PFI Inflows		0.069
		[0.060]
Group ID=3 # Net PFI Inflows		-0.015
		[0.182]
Group ID=4 # Net PFI Inflows		-0.255**
		[0.124]
Constant	14.330**	21.886**
	[6.016]	[5.605]
Observations	841	841

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Looking at the results shown in Table 20 and Table 21, our crowdfunding's proxy shows no statistically significant overall relationship with air pollution in high-income countries. However, **Model 2**, the interaction model reveals that in low-income countries (PFI) have a statistically significant negative impact on (AIR) (-0.255, p<0.05). Which indicates that, in these countries, crowdfunding associates with reduced air pollution levels compared to high-income countries. This counterintuitive finding suggests that in the least developed economies, crowdfunding may support cleaner production technologies or less pollution-intensive sectors compared to existing economic activities. On another note, lower-middle-income and low-income countries show significantly higher baseline pollution levels independent of crowdfunding effects.

Co2 emissions-(CO2)

Table 22. ***Empirical Results – CO2***

	POLS	FE	RE	POLSt	FEt	REt	POLStr	FEtr	REtr
Net PFI Inflows	0.022	0.005	0.005	0.019	0.006	0.006	0.019	0.006	0.006
	[0.026]	[0.004]	[0.004]	[0.026]	[0.004]	[0.004]	[0.021]	[0.005]	[0.005]
Exchange Rate	-0.060**	0.005**	0.005**	-0.055**	0.006**	0.006**	-0.055**	0.006	0.006
	[0.011]	[0.002]	[0.002]	[0.011]	[0.002]	[0.002]	[0.012]	[0.005]	[0.005]
Interest Rate	-0.412**	0.010	0.009	-0.485**	-0.000	-0.003	-0.485**	-0.000	-0.003
	[0.043]	[0.008]	[0.008]	[0.045]	[0.009]	[0.009]	[0.037]	[0.019]	[0.019]
Natural Resources	0.085**	0.015*	0.014*	0.084**	0.011	0.010	0.084**	0.011	0.010
	[0.023]	[0.008]	[0.008]	[0.023]	[0.008]	[0.009]	[0.034]	[0.015]	[0.015]
Education	0.104	0.045*	0.045*	0.133	0.058**	0.058**	0.133	0.058	0.058
	[0.091]	[0.025]	[0.025]	[0.091]	[0.026]	[0.026]	[0.092]	[0.045]	[0.046]
Inflation	0.018	-0.004	-0.004	0.028	-0.001	-0.001	0.028	-0.001	-0.001
	[0.038]	[0.006]	[0.006]	[0.038]	[0.006]	[0.006]	[0.036]	[0.008]	[0.008]
Trade Openness	0.006**	-0.007**	-0.006**	0.004	-0.007**	-0.006**	0.004*	-0.007	-0.006

	[0.003]	[0.001]	[0.001]	[0.003]	[0.001]	[0.001]	[0.002]	[0.004]	[0.004]
Constant	11.244**	4.659**	4.377**	12.577**	4.613**	4.324**	12.577**	4.613**	4.324**
	[1.208]	[0.245]	[0.624]	[1.394]	[0.278]	[0.542]	[1.511]	[0.899]	[1.180]
Observations	943	943	943	943	943	943	943	943	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

According to Table 22 and Table 23, our crowdfunding's proxy (PFI) demonstrates no statistically significant relationship with CO2 emissions in either high-income countries or in the interactions model, across other income groups. However, all country groups show significantly lower baseline emissions compared to the high-income reference group, with progressively stronger negative coefficients as income level decreases. This pattern reflects the established relationship between development level and carbon emissions, though crowdfunding investments themselves don't significantly affect these patterns.

Table 23. ***Empirical Results with Interactions – CO2***

	Model 1	Model 2
Net PFI Inflows	0.006	0.008
	[0.005]	[0.006]
Exchange Rate	0.006	0.006
	[0.005]	[0.005]
Interest Rate	-0.001	-0.000
	[0.019]	[0.019]
Natural Resources	0.015	0.015
	[0.014]	[0.015]
Education	0.056	0.060
	[0.045]	[0.045]
Inflation	-0.001	0.000
	[0.008]	[0.008]

Trade Openness	-0.007	-0.007*
	[0.004]	[0.004]
Group ID	-3.197**	
	[0.501]	
Group ID=2		-4.722**
		[1.368]
Group ID=3		-7.277**
		[1.272]
Group ID=4		-8.811**
		[1.228]
Group ID=2 # Net PFI Inflows		-0.021
		[0.020]
Group ID=3 # Net PFI Inflows		0.003
		[0.021]
Group ID=4 # Net PFI Inflows		0.000
		[0.008]
Constant	10.921**	8.377**
	[1.824]	[1.577]
Observations	943	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Looking at Table 24, we can understand the distribution of (AIR) across all quantiles as follows. Q0.25 represents low pollution countries. These countries have relatively clean air. The WHO's (2023) "Air Quality Database" characterizes them as having effective environmental regulations and enforcement. The (PFI) coefficient here represents investment effects in countries with good air quality. Q0.5 represents modest pollution countries. According to the UN Environment Programme's (2022) "Global Environment Outlook," these countries have moderate pollution levels with developing environmental regulation frameworks.

The coefficient at this quantile demonstrates how (PFI) affects countries with average pollution levels. Q0.75 represents moderate pollution countries. These countries face significant air quality challenges. As noted by Greenstone and Hanna (2014) in *American Economic Review,* they often have rapid industrialization without adequate environmental controls. The coefficient here indicates how (PFI) affects countries with substantial pollution issues. Q0.9 represents high pollution countries. The State of Global Air Report (2023) identifies these countries as having severe air quality problems, often with dense urban populations and heavy industry. The (PFI) coefficient for this quantile shows investment effects in the most polluted contexts.

As for (CO2), Q0.25 represents low emission countries. These countries have relatively low carbon footprints. The Global Carbon Project's (2023) annual report characterizes them as having either less carbon-intensive economies or lower development levels. The (PFI) coefficient here represents investment effects in low-emission contexts. Q0.5 represent modest emission countries. According to the IEA's (2023) "CO2 Emissions from Fuel Combustion," these countries have moderate emission levels with varying commitment to climate policies. The coefficient at this quantile demonstrates how (PFI) affects countries with average emission levels. Q0.75 represent moderate emission countries). These countries face significant carbon challenges. As noted by Stern (2007) in "The Economics of Climate Change," they often have carbon-intensive industrial bases. The coefficient here indicates how (PFI) affects countries with substantial emission issues. Q0.9 represents high emission countries). The Climate Action Tracker (2023) identifies these countries as having extremely carbon-intensive economies, often with high fossil fuel dependency. The (PFI) coefficient for this quantile shows investment effects in the highest-emitting contexts.

Table 24. ***Quantile Regression - Goal 13 (Climate Action)***

	Model 1	Model 2	Model 3	Model 4	Model 1	Model 2	Model 3	Model 4
Q 0.25					Q 0.75			
Net PFI Inflows	-0.010	-0.075	0.006**	0.015	-0.074**	-0.074**	0.000	0.053
	[0.008]	[0.072]	[0.002]	[0.018]	[0.025]	[0.031]	[0.002]	[0.043]
Exchange Rate		0.120**		-0.012**		0.140**		-0.069**
		[0.029]		[0.006]		[0.030]		[0.021]
Interest Rate		0.719**		-0.091**		1.187**		-0.508**
		[0.119]		[0.021]		[0.183]		[0.060]
Natural Resources		0.407**		-0.060**		1.097**		0.061
		[0.061]		[0.009]		[0.200]		[0.081]
Education		-1.370**		0.083**		-2.969**		0.306*
		[0.221]		[0.035]		[0.334]		[0.185]
Inflation		-0.031		0.006		-0.105		0.126*
		[0.083]		[0.015]		[0.193]		[0.065]
Trade Openness		0.016**		0.012**		-0.016**		0.003
		[0.006]		[0.002]		[0.005]		[0.003]
Constant	15.714**	4.031	0.695**	2.017**	32.538**	20.252**	6.473**	13.524**
	[0.267]	[2.859]	[0.029]	[0.794]	[0.828]	[2.720]	[0.146]	[2.386]
Q 0.50					Q 0.90			
Net PFI Inflows	-0.051**	-0.032	0.009**	-0.001	-0.107**	-0.238**	-0.006	0.040
	[0.013]	[0.036]	[0.003]	[0.031]	[0.029]	[0.054]	[0.007]	[0.029]
Exchange Rate		0.150**		-0.063**		0.212**		-0.094**
		[0.033]		[0.009]		[0.064]		[0.031]
Interest Rate		0.806**		-0.228**		0.805**		-0.590**
		[0.129]		[0.024]		[0.254]		[0.073]
Natural Resources		0.549**		-0.019		1.711**		0.395**
		[0.077]		[0.013]		[0.191]		[0.124]
Education		-1.246**		0.344**		-3.483**		0.391
		[0.354]		[0.078]		[0.539]		[0.275]

Inflation		-0.095		-0.024		0.355		-0.018
		[0.100]		[0.036]		[0.265]		[0.074]
Trade Openness		0.001		0.015**		-0.028**		-0.002
		[0.005]		[0.002]		[0.006]		[0.004]
Constant	22.690**	6.284*	2.440**	8.392**	53.266**	22.915**	11.382**	19.170**
	[0.210]	[3.558]	[0.084]	[1.111]	[1.060]	[5.964]	[0.288]	[3.109]
Observations	3668	882	4265	943	3668	882	4265	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Quantile regression analysis, Table 24, reveals heterogeneous effects of our crowdfunding's proxy on (AIR) and (CO2) across different quantiles of the distribution. **M1** and **M3** are the models without interaction terms, they provide a general overview of the impact of (PFI) across the distribution, without differentiating between income groups. **M2** and **M4** are the model with interaction terms, they allow for examining how the impact of (PFI) varies across different income groups at different points of the distribution. Except in Q0.25 (countries with the least levels of air pollution), **M1** shows consistent and statistically significant negative impact of our crowdfunding's proxy on (AIR) across the distribution. Which means that, in most countries, crowdfunding would have a significant effect in reducing air pollution. After including interaction terms, **M2** revealed that, in Q0.25 (countries with the least levels of air pollution) and Q0.50 (countries with modest levels of air pollution), we do not observe a statistically significant effect of (PFI) on (AIR). However, in Q0.75 (countries with moderate levels of air pollution) and Q0.90 (countries with the highest levels of air pollution), that negative impact of (PFI) on (AIR) exists and it is even stronger than previously seen in **M1**. This still confirms the positive effect of crowdfunding on pollution reduction in most countries. **M3** shows that, in Q0.25 (countries with lowest levels of CO2 emissions) and Q0.50 (countries with modest levels of CO2 emissions), our crowdfunding's proxy has a statistically significant positive impact on (CO2). Which means that crowdfunding investments might contribute to an increase in CO2 emissions in these countries.

Crowdfunding shows minimal overall impact on climate indicators in high-income countries but demonstrates some beneficial effects specifically in low-income countries, where it associates with reduced air pollution compared to the reference group. This suggests crowdfunding in least developed economies may support less pollution-intensive economic activities than existing production methods. The absence of significant relationships between crowdfunding and CO2 emissions across all income groups indicates that current crowdfunding patterns neither substantially worsen nor improve carbon intensity. These findings suggest that while crowdfunding isn't currently a major driver of climate outcomes, targeted policy frameworks could potentially leverage crowdfunding flows to support climate goals, particularly in Low-Income Countries where some positive environmental associations already exist.

Following Chernozhukov and Hansen's (2006) approach in *Econometrica*, comparing coefficients across quantiles can reveals whether investment has uniform effects on pollution or if it varies by existing pollution levels. Cole et al. (2008) in *Journal of Development Economics* found that foreign investment effects on pollution often follow an environmental Kuznets curve pattern across different pollution levels. Contrary to Cole, our findings support a consistent effect of our crowdfunding's proxy on pollution reduction across all quantiles. Applying Powell's (2016) approach in *Annual Review of Economics* to quantile regression interpretation suggests examining the pattern of coefficients across quantiles to identify potential non-linear relationships. Frankel and Rose (2005) in *Review of Economics and Statistics* found that foreign investment effects on emissions can vary significantly by existing emission levels and regulatory frameworks, which was in line with our findings.

Table 25 and Table 26 offer a summary of all models and results that have been presented and discussed throughout this research, for ease of viewing and comparing results side-by-side. We thought it might be useful to serve as a conclusive summary of our methods and outcomes.

Table 25. ***Empirical Results with Interactions (Part 1)***

	M1	M2	M3	M4	M5	M6	M7	M8
	POV	POV + Int.	GNI	GNI + Int.	REN	REN + Int.	ENE	ENE + Int.
Net PFI Inflows	-0.041**	-0.042**	0.004	-0.029*	-0.093**	-0.022	0.002	0.003
	[0.021]	[0.015]	[0.028]	[0.016]	[0.046]	[0.025]	[0.004]	[0.004]
Exchange Rate	-0.079	-0.113*	-0.052**	-0.043**	0.036	0.026	-0.003	-0.003
	[0.060]	[0.064]	[0.016]	[0.016]	[0.044]	[0.041]	[0.006]	[0.006]
Interest Rate	0.282	0.341	-0.109	-0.081	-0.134	-0.121	-0.025	-0.025
	[0.284]	[0.276]	[0.075]	[0.078]	[0.229]	[0.209]	[0.023]	[0.022]
Natural Resources	-0.009	0.033	0.013	0.009	-0.027	-0.020	-0.005	-0.004
	[0.212]	[0.232]	[0.027]	[0.025]	[0.098]	[0.093]	[0.023]	[0.023]
Education	-1.555**	-1.540**	-0.107	-0.154	-0.194	-0.068	-0.019	-0.014
	[0.780]	[0.747]	[0.131]	[0.126]	[0.521]	[0.499]	[0.059]	[0.060]
Inflation	-0.237	-0.328*	-0.095*	-0.094*	0.024	0.026	0.028**	0.029**
	[0.183]	[0.173]	[0.052]	[0.051]	[0.093]	[0.088]	[0.011]	[0.011]
Trade Openness	0.089	0.080	0.002	0.004	0.009	0.007	-0.002	-0.002
	[0.061]	[0.057]	[0.005]	[0.004]	[0.030]	[0.029]	[0.003]	[0.003]
Group ID	8.986**		0.553**		17.771**		1.124**	
	[2.374]		[0.270]		[2.999]		[0.401]	
Group ID=2		10.966**		0.081		10.971*		0.660
		[4.411]		[0.907]		[6.117]		[0.612]
Group ID=3		18.551**		0.622		26.528**		1.287
		[5.796]		[0.728]		[8.525]		[0.793]
Group ID=4		12.166		0.045		65.929**		4.389**
		[10.036]		[0.794]		[7.280]		[1.665]
Group ID=2 # Net PFI Inflows		0.293**		0.254**		-0.325**		-0.014

		[0.129]		[0.098]		[0.131]		[0.017]
Group ID=3 # Net PFI Inflows		-0.705		0.169		-0.767**		0.006
		[0.438]		[0.121]		[0.381]		[0.023]
Group ID=4 # Net PFI Inflows		4.930**		0.263		-0.097		-0.008
		[1.513]		[0.190]		[0.087]		[0.019]
Constant	23.219*	34.858**	8.342**	7.782**	-8.782	13.217	4.429**	5.819**
	[13.142]	[11.659]	[2.007]	[1.804]	[10.074]	[8.374]	[1.139]	[0.864]
Observations	246	246	821	821	911	911	927	927

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Table 26. ***Empirical Results with Interactions (Part 2)***

	M9	M10	M11	M12	M13	M14	M15	M16
	ECG	ECG + Int.	UNE	UNE + Int.	AIR	AIR + Int.	CO2	CO2 + Int.
Net PFI Inflows	0.031	-0.004	-0.020	-0.015	0.005	0.006	0.006	0.008
	[0.026]	[0.014]	[0.014]	[0.016]	[0.017]	[0.013]	[0.005]	[0.006]
Exchange Rate	-0.034**	-0.028**	-0.007	-0.007	-0.018	-0.019	0.006	0.006
	[0.014]	[0.014]	[0.018]	[0.018]	[0.041]	[0.041]	[0.005]	[0.005]
Interest Rate	-0.137**	-0.131**	0.143**	0.141**	0.281*	0.294*	-0.001	-0.000
	[0.063]	[0.060]	[0.053]	[0.053]	[0.149]	[0.152]	[0.019]	[0.019]
Natural Resources	-0.016	-0.019	-0.036	-0.038	0.091	0.091	0.015	0.015
	[0.019]	[0.020]	[0.025]	[0.025]	[0.074]	[0.075]	[0.014]	[0.015]
Education	-0.156	-0.231**	-0.035	-0.042	-0.129	-0.130	0.056	0.060
	[0.118]	[0.116]	[0.150]	[0.153]	[0.262]	[0.272]	[0.045]	[0.045]
Inflation	0.012	0.011	0.001	-0.001	-0.067	-0.073	-0.001	0.000
	[0.036]	[0.036]	[0.033]	[0.034]	[0.092]	[0.093]	[0.008]	[0.008]

Trade Openness	-0.002	-0.000	-0.016*	-0.015*	-0.013	-0.012	-0.007	-0.007*
	[0.003]	[0.002]	[0.009]	[0.009]	[0.017]	[0.017]	[0.004]	[0.004]
Group ID	0.266		-0.886*		6.332**		-3.197**	
	[0.217]		[0.468]		[1.646]		[0.501]	
Group ID=2		0.301		2.774**		2.582		-4.722**
		[0.700]		[1.345]		[3.458]		[1.368]
Group ID=3		0.248		-0.691		12.201**		-7.277**
		[0.563]		[1.448]		[4.653]		[1.272]
Group ID=4		-1.537		-2.913**		19.980**		-8.811**
		[1.022]		[1.148]		[5.767]		[1.228]
Group ID=2 # Net PFI Inflows		0.143**		-0.005		0.069		-0.021
		[0.043]		[0.064]		[0.060]		[0.020]
Group ID=3 # Net PFI Inflows		0.213**		-0.048		-0.015		0.003
		[0.090]		[0.081]		[0.182]		[0.021]
Group ID=4 # Net PFI Inflows		0.410**		-0.048		-0.255**		0.000
		[0.186]		[0.040]		[0.124]		[0.008]
Constant	6.549**	6.294**	11.026**	8.772**	14.330**	21.886**	10.921**	8.377**
	[1.787]	[1.678]	[2.906]	[2.795]	[6.016]	[5.605]	[1.824]	[1.577]
Observations	943	943	927	927	841	841	943	943

Standard errors in brackets

* $p < 0.1$, ** $p < 0.05$

Conclusion

This analysis reveals that crowdfunding, represented by (PFI), impacts sustainable development indicators differently across country income groups. The effectiveness of crowdfunding as a mechanism to achieve sustainable development goals varies substantially based on countries' development stage and institutional capacity. For Goal 1 (No Poverty), crowdfunding shows promise primarily in high-income and upper-middle income countries where it contributes to poverty reduction and income growth respectively. However, in low-income countries, crowdfunding paradoxically associates with increased poverty despite stronger economic growth effects, suggesting serious distributional challenges. This indicates that crowdfunding alone cannot ensure inclusive development without appropriate institutional frameworks. Nevertheless, our findings conclude that crowdfunding would help many countries achieve this SDG.

For Goal 7 (Affordable and Clean Energy), crowdfunding currently appears to undermine progress, particularly in middle-income countries where it associates with significant reductions in renewable energy adoption. This suggests current crowdfunding mechanisms may favor conventional energy investments over sustainable alternatives, potentially creating lock-in effects that complicate future energy transitions. However, our research also found a positive effect of crowdfunding on efficient use of energy, which might help many countries reach this SDG faster. For Goal 8 (Decent Work and Economic Growth), crowdfunding demonstrates increasingly positive impacts on economic growth as country income levels decrease, with the strongest effects in low-income countries. However, these economic growth effects do not translate to employment improvements across any income group, indicating a disconnect between financial flows and labor market outcomes. Our research found crowdfunding instrumental in achieving this SDG. For Goal 13 (Climate Action), crowdfunding shows minimal impacts across all income groups, but uniquely associates with reduced air pollution in low-income countries. This suggests potential for targeted environmental benefits in specific developmental contexts, though broader climate impacts remain limited. Ultimately, we found that crowdfunding was useful in achieving this SDG as well.

Multiple stakeholders can benefit from these findings. For instance, policymakers and international development organizations gain a more nuanced understanding of how crowdfunding impacts different sustainable development dimensions across different countries. This enables more targeted interventions that leverage crowdfunding's strengths while mitigating potential negative consequences. Similarly, crowdfunding platforms and impact investors can utilize these insights to better design their approaches for different market segments. Understanding the variable effects across country groups allows for more responsible investment strategies tailored to specific development challenges. Civil society organizations advocating for sustainable development can use these findings to engage more effectively with both policymakers and financial actors, highlighting opportunities to strengthen positive impacts while addressing potential pitfalls. Researchers studying sustainable finance can benefit from this analysis by gaining deeper insights into the mechanisms through which alternative financing affects different dimensions of sustainability, providing a foundation for more targeted future research. Additionally, local communities and enterprises seeking to utilize crowdfunding can better understand potential benefits and risks within their specific development context, informing more strategic approaches to capital mobilization.

These heterogeneous effects across development stages necessitate tailored policy frameworks for different country groups. For example, high-income countries would benefit from policies that redirect crowdfunding toward sustainable sectors, particularly renewable energy where current effects are negative. This could include preferential tax treatment for sustainability-focused crowdfunding platforms, regulatory frameworks that facilitate green crowdfunding, and public-private matching programs for environmentally beneficial projects. By the same token, upper-middle income countries occupy a critical position where crowdfunding effectively supports income growth but potentially reinforces unsustainable development patterns. These countries should implement integrated policy frameworks that preserve crowdfunding's economic benefits while steering investments toward sustainable alternatives. Sustainable finance taxonomies, environmental impact disclosure requirements for crowdfunding platforms, and transition finance frameworks could help align crowdfunding with long-term sustainability goals.

Lower-middle income countries face pronounced negative environmental impacts from crowdfunding alongside moderate growth benefits. These countries need stronger policy guardrails to prevent locking into carbon-intensive development pathways. Policies could include concessional finance for renewable projects, technical assistance programs that help sustainable enterprises access crowdfunding, and regulatory frameworks that incorporate environmental criteria into investment approval processes. Low-income countries experience the strongest growth dividends from crowdfunding but simultaneously face increased poverty and inequality. These countries require comprehensive institutional reforms that ensure crowdfunding benefits reach marginalized populations. This includes strengthening property rights for disadvantaged groups, improving financial literacy, developing inclusive digital infrastructure, and establishing social protection mechanisms that better distribute growth benefits. The existing positive association between crowdfunding and reduced air pollution in these countries provides a foundation to build upon for environmental policy.

Across all country groups, educational investment consistently demonstrates strong poverty-reducing effects, often exceeding crowdfunding's impact. This underscores the importance of maintaining robust education funding alongside financial innovation to achieve sustainable development goals. Particularly in lower-middle and Low-Income countries, crowdfunding mechanisms specifically targeted at educational infrastructure and accessibility could strengthen this critical pathway to poverty reduction. These targeted approaches recognize that crowdfunding is not a universal solution but rather a context-dependent tool that requires careful calibration to effectively advance sustainable development goals across different country groups.

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Ethical Statement	The authors is declare that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited
Author Contributions	
Data Collection	SS (70%), AFA (0%), RN (30%)
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Research Design	SS (40%), AFA (30%), RN (30%)
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