RESEARCH AND REVIEWS IN SUSTAINABILITY
Volume 2 (2026) · ISSN 2977-8441

TECHNICAL ARTICLE

Tracking Climate Finance Flows in India: The UNFCCC $100 Billion Goal

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RECEIVED 8 April 2026 · REVISED 26 April 2026 · ACCEPTED 26 May 2026 · PUBLISHED 27 May 2026

ABSTRACT

Considering the larger crisis of climate change that the world is currently facing, the Conference of the Parties meets under the framework of the United Nations Framework Convention on Climate Change (UNFCCC)'s Paris Agreement. This economic research focuses on a critical aspect of climate finance in India. Beginning with the evaluation of project funding, which can be referred to as climate finance, a concept that remains evolving and without an exact definition, this study tracks major projects that form part of climate finance flows in India. Specifically, this is examined in the context of tracking the USD 100 billion goal. This goal refers to the commitment by developed countries to mobilise USD 100 billion annually by 2020, which was later extended to 2025 and has now transitioned into the New Collective Quantified Goal (NCQG). In the context of climate finance, data availability remains a major challenge due to its highly fragmented nature. There is no single platform that provides a comprehensive record of all internationally funded climate projects in India, including both the number of projects and the total financial disbursements. Therefore, the methodology adopted in this study follows a mixed-method quantitative approach based on project-level data compilation. Within the limits of the available data and analysis, the aggregate climate finance received by India over the period 2010 to 2024 is estimated at approximately USD 1.5 billion. When considered as a proportion of the USD 100 billion annual global target, this accounts for roughly 1.51 percent over the study period, with an average annual inflow of about USD 100.4 million. While this appears limited in proportional terms, this comparison must be interpreted cautiously, as the USD 100 billion goal applies collectively to more than 150 developing countries and was not consistently achieved until 2022.

KEYWORDS Climate Finance, Finance, Inflows, Adaptation, India

1. Identification of Research Problem

Climate finance systems have developed within global frameworks and institutions; however, India continues to face a fundamental funding shortfall. Despite its high vulnerability to climate change, the country receives climate finance that does not adequately match its actual needs. Its status as a developing economy creates expectations of greater self-reliance, while historical resource pressures continue to influence its current capacity. At the same time, there remains limited public understanding of the full scale and urgency of the climate challenge.

This research examines the patterns of climate finance inflows to India and evaluates their relationship with international climate agreements.

2. Climate Finance: India

2.1. What is Climate Finance?

Climate-related risks are increasing both in scale and frequency. According to the COP 30 Scientific Committee (2025), climate-related disasters resulted in global economic losses of approximately USD

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Published by Caravel Press.

doi.org/10.65582/rrs.2026.013

320 billion in 2024, continuing an upward trend. Without stronger climate action, global temperatures are projected to rise by 2.6–3.1 °C by 2100, leading to severe consequences such as flooding, extreme heat, and ecosystem disruption. These projections highlight the growing urgency of transitioning toward sustainable pathways.

Such a transition requires substantial financial resources. Climate finance therefore becomes central to enabling mitigation and adaptation efforts. According to the UNFCCC Standing Committee on Finance, climate finance includes local, national, and transnational funding from public, private, and alternative sources that support climate-related actions. While this definition is widely used, there is still no universally accepted interpretation, as the concept continues to evolve across different institutional and policy contexts. Differences in stakeholder priorities, regional needs, and emerging challenges contribute to these variations. Nevertheless, the core idea remains consistent: financial flows directed toward activities that reduce emissions, support adaptation, and enable climate-resilient development.

2.2. Existing Climate Finance Goals

Global climate finance goals have been developed to support such transitions across countries. Over time, multiple commitments have emerged to mobilise financial resources for climate-related activities, including renewable energy and sustainability-focused projects. However, there is limited clarity at the country level regarding how much finance has been directed to individual economies. In this study, an attempt is made to track these financial inflows in India through sources such as official development assistance, bilateral and multilateral funding, and private investments.

2.2.1. Between 2010 – 2012 (USD 30 billion)

Under the 2009 Copenhagen Accord (UNFCCC 2010) and subsequently reaffirmed through the Cancun Decision (UNFCCC 2011) and the Durban Platform (UNFCCC 2012), developed nations committed to mobilizing close to USD 30 billion in financing for the years 2010 to 2012. By the conclusion of the fast start finance period, contributing countries reported that they had exceeded these pledged amounts (Nakhooda 2013).

The India Solar Power Guarantee Facility received funding of USD 150 million during this period as one of the major projects which India funded. The ADB board approved the project in 2011 to provide solar energy projects with lower financing expenses and extended loan repayment periods. The program offers loan guarantees which cover up to 50 percent of default risk for commercial bank loans that last up to fifteen years which small private developers use to fund their solar power projects. The UK Government provided ADB with a USD 10 million untied grant which ADB used to pay for guarantee costs while decreasing financial risks and project expenses. (IMF 2014).

2.2.2. The USD 100 Billion Commitment under the Paris Agreement

The Paris Agreement (UNFCCC 2015), adopted in 2015, restated the responsibility of developed countries to remain at the forefront of mobilising and delivering climate finance through diverse sources, financial instruments, and channels, with an explicit expectation that these efforts would demonstrate advancement beyond earlier undertakings. The accompanying Conference of the Parties decision reaffirmed the commitment first articulated in Copenhagen, which set a collective target of mobilising USD 100 billion annually by the year 2020. (UNFCCC 2016).

The Standing Committee on Finance needs to start its biennial assessments in 2028 which will measure the progress of all parts of the USD 100 billion commitment. The COP which serves as the Paris Agreement country meeting will assess these evaluations using all relevant and available data. (Standing Committee on Finance 2022)

Since 2009 when the goal first appeared, people have raised concerns about the failure to meet the USD 100 billion target which needed to be reached by 2020. The evolution of the commitment through past COPs shows key decisions which were made during earlier conferences. The COP16 agreement

stated that developed countries must mobilize between $100 billion and $100 billion for annual funding which should reach $100 billion by 2020. The COP17 agreement established a system which required countries to report their progress every two years while also defining the USD 100 billion target as including both public and private financial contributions.

The COP18 meeting established a new climate finance framework which required countries to use public and private funding sources together with established international funding channels to achieve their goal of raising $100 billion every year until 2020. The COP21 conference established the USD 100 billion target to continue until 2025 because it required developed nations to prove their ongoing efforts to generate climate finance. (UNFCCC 2016)

The USD 100 billion commitment is commonly understood along three core dimensions. The first requirement states that nations must work together to reach an annual funding target of USD 100 billion which begins in 2020 and lasts until 2025. The commitment requires developing countries to establish their unique needs which must be met through the dedication of international resources. The goal requires organizations to show progress through actual emission reductions and transparent reporting which tracks their climate actions and emissions. The elements create an analytical framework that enables assessment of progress towards achieving the USD 100 billion climate finance target in the international climate governance system.

Note: In the coming sections, we will track this finance goal itself with special emphasis on India.

2.2.3. The New Collective Quantified Goal on Climate Finance and the Baku to Belém Framework (From USD 300 Billion to 1.3T)

Discussions on the New Collective Quantified Goal (NCQG) began at COP26 in Glasgow in 2021, aiming to expand climate finance in line with scientific requirements and the needs of developing countries. After extended negotiations, a last-minute agreement was reached at COP29 in Baku in 2024 (Carvalho 2025). A major divide persisted, with developing countries advocating for equity-based commitments under the UNFCCC and stronger public finance obligations from developed nations, while developed countries framed the NCQG as a broader mobilisation goal under the Paris Agreement, with shared but not exclusive responsibility.

The final decision sets a minimum target of USD 300 billion annually by 2035 for developing countries, led by developed nations (Watson *et al.* 2025). It also calls for scaling total climate finance to at least USD 1.3 trillion per year by 2035 through public and private sources. Despite this, uncertainties remain, particularly regarding the inclusion of loss and damage finance.

3. Research Questions & Objectives

3.1. To quantify, track, and analyse climate finance inflows to India

The objective of this research requires the development of a standardized method which will enable us to measure and monitor climate finance inflows that have entered India since 2010 while we assess their global standing. The complete financial inflows will be monitored through all international funding organization websites. The UNFCCC maintains climate finance databases which contain complete information but Indian climate finance information exists as incomplete data with missing components. The research results show that India lacks a complete system for reporting all climate finance inflows which come into the country. The research will evaluate multilateral and bilateral funding organization websites together with project documentation and execution reports to determine the total financial assistance which these funding sources provide.

3.2. To assess the factors affecting these climate finance inflows in India

To check the impact of factors affecting climate finance inflows in India. The raw data shows three types of data issues because of its volatility and structural breaks and years with no incoming data. We model the climate finance inflows by using their annual growth rate. The method provides better

results than traditional regression because it reduces spurious regression problems which occur in project-based approval systems that operate over brief periods.

4. Tracking the $100 Billion Goal and Flows in India

The USD 100 billion climate finance target required annual mobilization starting from 2020 but extended its deadline until 2025 so this section investigates climate funding for Indian projects during this time frame. The research investigates climate finance projects that received funding from all financial sources which were previously mentioned in the study.

4.1. Process

The research uses a bottom up method because there is no centralized dataset which tracks climate finance that countries mobilize jointly. The research traces climate finance flows to India by compiling data from specific global financial facilities and Indian government sources which received international funding and foreign government support instead of using worldwide financial data. The international climate finance research enables researchers to study India environmental funding through project assessment while demonstrating the deficiencies which exist in funding organizations and financing systems regarding their transparency and reporting methods.

4.2. The GCF Facility

Under the GCF, India has accessed both implementation finance and readiness support. The approval of 15 projects with total GCF financing of USD 1.0 billion reflects direct investment in mitigation and adaptation activities with expected measurable climate outcomes. The approved five readiness activities will use USD 5.6 million to develop institutional capacity and policy frameworks and project preparation capabilities.

Table 1. GCF in India.

Category	Indicator	Value	Interpretation
Project based finance	Number of approved projects	15	Direct mitigation and adaptation interventions
Project based finance	Total GCF financing	USD 1.0 billion	Commitments for on ground climate action[1]
Readiness support	Number of readiness activities	5	Capacity building and preparatory support
Readiness support	Readiness funding approved	USD 5.6 million	Grant based support for institutional strengthening

The low volume of readiness finance compared to project finance demonstrates its function as an enabling tool which supports project execution. Readiness activities serve as essential components which help organizations secure climate financing while improving their capacity to execute major investment projects. The two categories need to be separated because they provide essential information which enables proper evaluation of GCF finance effects on India and assessment of progress toward international climate finance obligations.

4.3. Adaptation Finance

NABARD received its National Implementing Entity accreditation in July 2012 to obtain funds from the Adaptation Fund for India. The organization carries out its duties by executing complete project evaluation together with funding distribution activities which it conducts for all Adaptation Fund Board-backed initiatives in the nation. NABARD has established six specific adaptation projects which received total funding of USD 9.853 million according to the graph below which shows that all

available funds for the country reached their maximum limit of USD 10 million which the Adaptation Fund Board had established. The projects work together to enhance adaptation capabilities while developing resilient systems which result in measurable success for improving adaptive abilities and benefiting people who take part in the project. NABARD uses Adaptation Fund resources to develop adaptation abilities while safeguarding essential ecosystems and vulnerable communities throughout India.

4.4. Global Environment Facility & India

The portfolio data presented below shows that India maintains a strong relationship with the GEF Trust Fund. The country currently has 46 national projects under the GEF Trust Fund with total financing amounting to USD 412.97 million. India supports 18 additional regional and global projects which receive funding from the identical trust fund and these projects have a total financial backing of USD 250.98 million. National projects demonstrate a high co-financing ratio of 12.65 which shows how projects use both domestic and international funds together with GEF grants. Regional and global projects show a lower co financing ratio of 1.42 which occurs because their funding system includes multiple countries and shared financial resources.

India maintains no active LDCF or SCCF projects because these funding sources exist to assist least developed nations and specific adaptation initiatives. The data demonstrates that the GEF Trust Fund serves as the primary source of environmental funding for India while functioning as a vital multilateral tool that enables both national and regional environmental initiatives.

Table 2. Active GEF Project Portfolio of India by Trust Fund

Fund	Type of Projects	No. of Projects	Total Financing (USD)	Co-financing Ratio
GEF Trust Fund	National	46	412,970,676	12.65
GEF Trust Fund	Regional / Global	18	250,982,885	1.42
LDCF	National / Regional	0	0	0.00
SCCF	National / Regional	0	0	0.00

Source: https://www.thegef.org/

5. Research Design & Methodology

This study adopts a mixed-method quantitative approach to analyse climate finance inflows to India. Due to the absence of a centralised and comprehensive dataset, the analysis follows a bottom-up methodology, compiling project-level data from major multilateral climate finance institutions. These include the Green Climate Fund, Global Environment Facility, Adaptation Fund, Special Climate Change Fund, and selected additional sources.

The dataset is constructed using annual observations from 2010 to 2024. Given the nature of climate finance, which is largely project-driven rather than continuously disbursed, the data exhibits significant volatility, discontinuities, and years with zero inflows. These characteristics require careful treatment in the empirical framework. To address these issues, the study models climate finance inflows using growth rates rather than absolute levels. This approach reduces the risk of spurious regression and allows for a more meaningful interpretation of short-run variations in inflows.

Given the small sample size, results are interpreted as indicative rather than causal.

5.1. Dependent Variable $\Delta \ln(\text{Total}_{CFt} + 1)$

$$\Delta \ln \left(Total_{CFt} + 1 \right) \tag{1}$$

$Total_{CFt}$ represents the total climate finance commitments received by India in year t, based on approved project-level funding across selected multilateral sources. These include the Green Climate Fund, Global Environment Facility, Adaptation Fund, and Special Climate Change Fund.

A logarithmic transformation is applied in the form $\ln(Total_{CFt} + 1)$ to account for years with zero inflows while retaining all observations in the dataset. The addition of 1 ensures that the transformation remains defined even when no funding is recorded.

The first difference of the logged series, $\Delta ln(Total_{CFt} + 1)$, is used as the dependent variable. This captures the annual growth rate of climate finance inflows rather than their absolute magnitude. The focus on growth rates is appropriate given the discontinuous and project-based nature of climate finance, where large approvals in specific years drive observed fluctuations. This transformation also helps mitigate non-stationarity concerns and allows the analysis to focus on factors influencing changes in inflows over time rather than their levels.

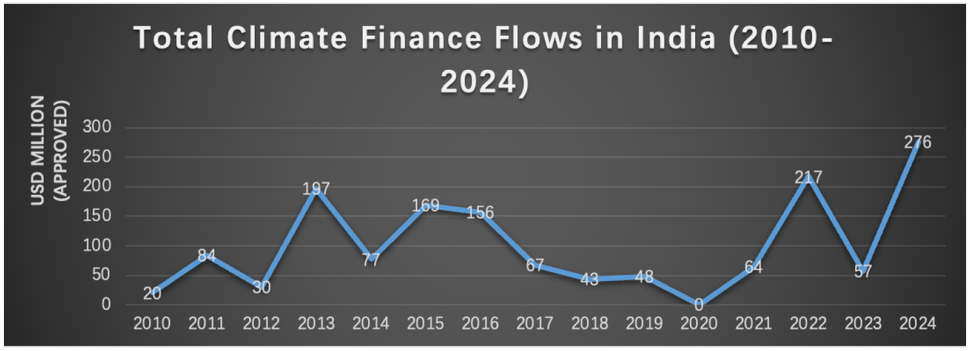

Figure 1. Variable-1 $(Total_{CF} + 1)$. Source: Author's compilation based on project-level data from the Green Climate Fund, Global Environment Facility, Adaptation Fund, and Special Climate Change Fund, Clean Technology Fund and Few Miscellaneous Funds.

The series below displays substantial annual fluctuations according to figure 1, indicating discontinuous patterns as they are funding specific projects in a cycle. The GEF is the main source of inflows from 2010-2012, specifically in 2013, high rise in inflows was observed from CTF project approvals. The Green Climate Fund becomes a primary funding source starting from 2018. The Green Climate Fund approved USD 200 million and USD 215.6 million in 2022 and 2024, which resulted in total inflows of approximately USD 217.0 million in 2022 and USD 275.9 million in 2024. These represent the highest values in the sample.

The annual funding distribution shows its separate components through Figure 2. The initial funding period shows GEF dominance according to the composition, while the mid-period funding spikes show CTF approval influence, and the following years demonstrate growing GCF funding availability. The Adaptation Fund and SCCF together with other grants contribute to the sample through their limited and infrequent funding throughout the study period. The data shows that multilateral climate finance inflows to India experience both fluctuating patterns and different funding sources during the research period.

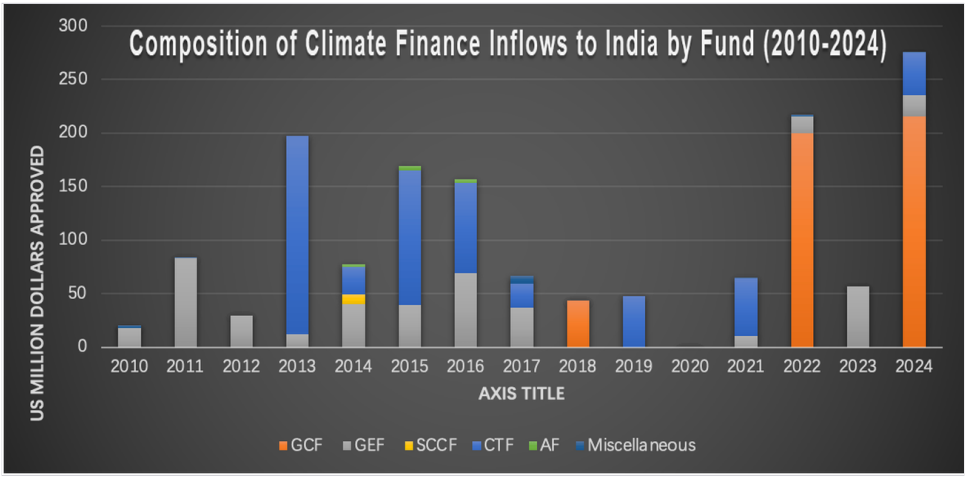

Figure 2. Composition of CF in India. Source: Author's compilation based on project-level data from the Green Climate Fund, Global Environment Facility, Adaptation Fund, and Special Climate Change Fund, Clean Technology Funds.

Table 3. Total Multilateral Climate Finance in India (2010 - 2024). Yearly Climate Finance Inflows in India.

Year	GCF	GEF	SCCF	CTF	AF	Miscellaneous	$Total_{CF}$
2010	0	17588500	0	0	0	28,20,000	2,04,08,500
2011	0	83460554	0	0	0	3,29,000	8,37,89,554
2012	0	29650778	0	0	0	0	2,96,50,778
2013	0	12168182	0	18,49,60,000	0	0	19,71,28,182
2014	0	39850203	9818182	2,50,00,000	2510854	0	7,71,79,239
2015	0	39753508	0	12,50,00,000	4104225	0	16,88,57,733
2016	0	68846448	0	8,50,00,000	2556093	0	15,64,02,541
2017	0	36721300	0	2,21,93,000	0	80,00,000	6,69,14,300
2018	43420000	0	0	0	0	0	4,34,20,000
2019	0	0	0	4,80,00,000	0	0	4,80,00,000
2020	0	0	0	0	0	0	0
2021	0	10824700	0	5,33,00,000	0	2,00,000	6,43,24,700
2022	200000000	15683600	0	0	0	13,50,000	21,70,33,600
2023	0	56650000	0	0	0	0	5,66,50,000
2024	215600000	19500000	0	4,00,00,000	0	8,70,000	27,59,70,000
Total							1,50,57,29,127

Note: For the Global Environment Facility, only project-level grant commitments under Full-sized and Medium-sized Projects in the climate change focal area are included. Project preparation grants and replenishment-level commitments are excluded to avoid double counting and ensure comparability with other climate finance mechanisms.

5.2. Augmented Dickey–Fuller Test Results

Table 4. Results of the Augmented Dickey–Fuller (ADF) stationarity test.

Variable	Dickey–Fuller statistic	Lag order	p-value	Interpretation
log_cf	−1.8264	2	0.6385	Non-stationary
d_log_cf	−2.3512	2	0.4386	Non-stationary

Before estimating the time-series model, the stationarity properties of the dependent variable are examined. The Augmented Dickey–Fuller test is applied to the log-transformed series $\ln(Total_{CF} + 1)$.

For the level specification:

- Dickey–Fuller statistic = −1.8264
- p-value = 0.6385

The null hypothesis of a unit root cannot be rejected, indicating that the log-transformed series is non-stationary in levels.

For the first-differenced series:

- Dickey–Fuller statistic = −2.3512
- p-value = 0.4386

The null hypothesis of non-stationarity again cannot be rejected.

The limited sample size of 15 annual observations, the presence of discrete approval spikes, and structural shifts across years reduce the power of unit root tests in this context. To minimise the risk of spurious regression and to focus on year-to-year variation, the empirical analysis proceeds using the first difference of the log-transformed series, $\Delta\ln(\text{Total}_{CF} + 1)$, as the dependent variable. This is evident due to the following data limitations:

1. Very small sample: we effectively have data from 2010-2024, only 14 observations.
2. Structural breaks: Climate finance inflows are not smooth macro aggregates. They are project driven. Large spikes in approval years, especially from Green Climate Fund & Global Environment Facility.
3. Discrete Sources: As the data has already been compiled from different sources, it is bound to be non-stationary.

5.2.1. Summary of Climate Finance Trends

Within the limits of this analysis and the data constraints, the aggregate climate finance received by India from the selected major multilateral funds between 2010 and 2024 amounts, as listed in Table-3 above, to: USD 1,505,729,127.

The USD 100 billion commitment refers to a collective annual mobilisation target by developed countries for developing nations as a group. When India's cumulative receipt of USD 1,505,729,127 over the fifteen-year period from 2010 to 2024 is compared with the annual benchmark of USD 100 billion, the proportional magnitude is as follows:

$$\frac{1,\ 505,\ 729,\ 127}{100,\ 000,\ 000,\ 000} * 100 = 1.51\% \tag{2}$$

If the annualised average is considered:

(1,505,729,127) / 15 ≈ USD 100.4 million per year.

This cumulative inflow reflects India's quantified receipts from the multilateral channels examined in this study. Over the fifteen-year period, the total amount received corresponds to an annualised average of approximately USD 100 million per year.

When the total inflow of USD 1.51 billion from 2010–2024 is contextualised, it may appear proportionally small; however, it is important to note that the USD 100 billion goal applies to more than 150 developing countries collectively, and as one of the fastest-growing economies, India needs to explore additional avenues of finance for its climate requirements.

In 2022, the OECD reported that total mobilised climate finance reached approximately USD 115.9 billion. Prior to that year, aggregate mobilisation remained below the stated annual target, reflecting structural and political constraints in scaling finance flows.

India receives about USD 100 million each year from selected multilateral funds, which represents only a small portion of total global public climate finance. The Indian economy faces substantial costs related to emission reduction, climate adaptation, and resilience. However, current multilateral funding through concessional mechanisms provides only limited financial support relative to the country's estimated domestic investment requirements. The evidence suggests that India has financed a large part of its climate transition through domestic resources and government-led investment initiatives, along with additional financing channels.

The period after 2022 shows an increase in financial inflows, coinciding with the achievement of the collective climate finance target and renewed efforts to scale finance until 2025. This trend may enable India to access greater international climate finance, supporting its energy transition and broader sustainable development objectives.

5.3. Empirical modelling

Our baseline specification is:

$$\Delta\ln\left(Total_{CFt}+1\right)=\beta0+\beta1\Delta\ln\left(GLOBAL_{CFt}\right)+\beta2\Delta\ln(GDPt)+\beta3PATt+\beta4\Delta\ln(OILt)+\beta5\Delta\ln(CO2t)+\varepsilon t \quad (3)$$

Where we have:

1. Global Climate Finance Growth as: $\Delta ln(GLOBAL_CFt)$
2. Domestic Economic Growth as: $\Delta ln(GDPt)$
3. Policy Dummy: PAT as: $PATt$
4. International Oil Price Growth as: $\Delta ln(OILt)$
5. Emissions Growth as : $\Delta ln(CO2t)$

5.4. Independent Variable $\Delta\ln(Global_{CFt})$

The official climate finance data becomes accessible to after a predetermined time which affects their ability to conduct empirical studies. The table demonstrates that different components of global climate finance become available to the public at different times because each reporting institution and dataset follows its own schedule. Bilateral public climate finance, reported under the framework of the United Nations Framework Convention on Climate Change, typically becomes available several years after the reference year. For instance, flows corresponding to 2021 and 2022 are only finalised in the first quarter of 2025, while data for 2023 will not be available until the first quarter of 2027. In contrast, multilateral public climate finance reported through the OECD Development Assistance Committee exhibits a comparatively shorter lag, generally becoming available within two to three years after the reporting year. Similar reporting delays affect export credits and mobilised private finance data. These staggered release timelines reflect the complexity of national reporting cycles, verification procedures, and harmonisation requirements across institutions. For this study, the presence of such lags necessitates careful consideration of the terminal year included in the time series, as the most recent observations may be provisional or subject to revision. Consequently, interpretations of recent trends in global climate finance must account for the institutional reporting structure that governs data availability.

Table 5. Overview of time lags in availability of official climate finance data.

Dataset	Source	2019	2020	2021	2022	2023	2024	2025
Bilateral public	UNFCCC	Q1 2022	Q1 2022	Q1 2025	Q1 2025	Q1 2027	Q1 2027	Q1 2029
Multilateral public	OECD DAC	Q1 2021		Q1 2023	Q1 2024	Q1 2025	Q1 2026	Q1 2027
Export credits	OECD ECG							
Mobilised private	OECD DAC							

Source: https://www.oecd.org/en/publications/climate-finance-provided-and-mobilised-by-developed-countries-in-2013-2022_19150727-en/full-report/component-3.html#title-dea34e73bf.

Table 6 report annual global climate finance flows from 2010 to 2024. The first column presents values in million US dollars, followed by the same figures in absolute US dollar terms for consistency with our India level data. We then compute the natural logarithm of global climate finance and its first difference. The logarithmic transformation reduces scale variation and allows changes to be interpreted proportionally. Taking the first difference of the logged series converts the data into annual growth rates and helps address non stationarity concerns. Since our empirical framework focuses on how changes in global finance influence changes in India's inflows, modelling growth rather than levels is both econometrically and conceptually appropriate.

Table 6. Global Climate Finance { ΔIn(GLOBALCFt) }.

Year	$Global_{CF}$ (Million Dollars)	$Global_{CFt}$ (USD)	$Log(Global_{CFt})$	$\Delta ln(GLOBAL_{CFt})$
2010	1094.39	1094390000	20.81346297	
2011	1086.058378	1086058378	20.80582081	-0.0076422
2012	1423.874034	1423874034	21.07664719	0.27082637
2013	1801.73	1801730000	21.31201315	0.23536596
2014	1836.85	1836850000	21.33131798	0.01930483
2015	1290.724459	1290724459	20.97846949	-0.3528485
2016	2415.628434	2415628434	21.60522531	0.62675582
2017	2016.471368	2016471368	21.42461497	-0.1806103
2018	3221.776658	3221776658	21.8931988	0.46858383
2019	2887.728266	2887728266	21.78373596	-0.1094628
2020	3637.935918	3637935918	22.0146823	0.23094634
2021	4194.342554	4194342554	22.15700244	0.14232014
2022	2222.538146	2222538146	21.52191569	-0.6350868
2023	2899.147113	2899147113	21.78768243	0.26576674
2024	3417.797058	3417797058	21.95226205	0.16457961

Source: https://climatefundsupdate.org/data-dashboard/#1541245664232-8e27b692-05c8 – raw data but the yearly calculations & compilation is by author.

Figure 3. Climate finance provided and mobilised in 2013-2022 (USD billion). Source: Adapted from OECD (2023) https://www.oecd.org/en/publications/climate-finance-provided-and-mobilised-by-developed-countries-in-2013-2022_19150727-en/full-report/component-2.html#title-a4ccb8e632.

5.5. ΔIn(GDPt)

Table 7. GDP measured in constant 2015 US dollars.

Year	GDP (constant 2015 US$)	Log(GDP)	ΔIn(GDPt)
2010	1.5359E+12	28.06014	
2011	1.6164E+12	28.11122	0.051086
2012	1.7046E+12	28.16435	0.053127
2013	1.81345E+12	28.22625	0.061905
2014	1.94783E+12	28.29774	0.071485
2015	2.10359E+12	28.37467	0.076926
2016	2.27727E+12	28.454	0.079331
2017	2.43202E+12	28.51974	0.065745
2018	2.58897E+12	28.58228	0.062541
2019	2.68921E+12	28.62027	0.037984
2020	2.53383E+12	28.56075	-0.05951
2021	2.77935E+12	28.65324	0.092484
2022	2.99084E+12	28.72658	0.073337
2023	3.26572E+12	28.8145	0.087926
2024	3.47782E+12	28.87743	0.062926

Source: World Bank | https://data.worldbank.org/indicator/NY.GDP.MKTP.KD?locations=IN.

The GDP series here is from the World Bank's World Development Indicators, the GDP measured in constant 2015 US dollars removing the effects of inflation to capture real economic growth over time.

5.6. Independent Variable Δ(n(OILt)

We have employed international crude oil prices, the annual average Brent benchmark price, rather than domestic fuel prices in India as India is a net importer of crude oil and cannot determine international oil prices. Consequently, domestic fuel price movements largely reflect fluctuations in global crude markets, subject to taxes and policy adjustments. For the purposes of our empirical model, we are not attempting to capture domestic fuel pricing policy, but rather broader global energy market conditions.

Table 8. Brent Benchmark Oil Price

observation_date	POILBREUSDA	Log(OILt)	ΔIn(OILt)
2010-01-01	79.80700834431270	4.379611	
2011-01-01	111.53922643359000	4.714376	0.334765
2012-01-01	112.01167269747200	4.718603	0.004227
2013-01-01	108.96172547681800	4.690997	-0.02761
2014-01-01	99.34544580117950	4.598603	-0.09239
2015-01-01	53.02271240353850	3.97072	-0.62788
2016-01-01	45.07907624380450	3.808418	-0.1623
2017-01-01	54.88691608632910	4.005275	0.196857
2018-01-01	71.61259298732670	4.271271	0.265996
2019-01-01	64.19847398676200	4.161979	-0.10929
2020-01-01	43.33384282263630	3.768934	-0.39305
2021-01-01	70.83149958435280	4.260304	0.49137
2022-01-01	98.99632757701230	4.595083	0.334779
2023-01-01	82.32124302810710	4.410629	-0.18445
2024-01-01	79.91173940491880	4.380923	-0.02971

Source: https://fred.stlouisfed.org/series/POILBREUSDA.

5.7. Independent Variable Δln(CO_2t)

We use annual total carbon dioxide emissions data for India which Our World in Data obtained from the Global Carbon Project dataset to measure the environmental pressure variable. The series captures territorial CO_2 emissions from fossil fuel combustion and industrial processes on an annual basis. The study uses total emissions data because the researchers want to determine whether climate finance responds to national-level environmental pressure and mitigation requirements. Total emissions act as the better metric because climate finance allocations depend on both the total emissions and the potential for emissions reduction. The emissions series undergoes a natural logarithm transformation which the model uses to handle other macroeconomic variables within its framework. This method enables growth-based analysis of the variable while it also assists in resolving non stationarity issues present in the level series.

Table 9. Annual CO2 Emissions in India

Year	Annual CO_2, emissions	Log(CO_2t)	ΔIn(OILt)
2010	1678529500	21.24118	
2011	1765694800	21.29181	0.050626
2012	1926986400	21.37922	0.087413
2013	1995337200	21.41408	0.034856
2014	2148052000	21.48783	0.073748
2015	2231817500	21.52608	0.038255
2016	2352540200	21.57876	0.052679
2017	2425721900	21.6094	0.030633
2018	2595227100	21.67694	0.067545
2019	2611174700	21.68307	0.006126
2020	2422732000	21.60816	-0.0749
2021	2675778000	21.70751	0.099344
2022	2831131600	21.76394	0.056436
2023	3062756400	21.84258	0.078639

Table 9. (continued)

Year	Annual CO_2, emissions	Log(CO_2t)	ΔIn(OILt)
2024	3193478100	21.88438	0.041795

Source: https://ourworldindata.org/co2-and-greenhouse-gas-emissions#explore-data-on-co2-and-greenhouse-gas-emissions.

5.8. Dummy Variable PAT

The PAT variable is constructed as a binary indicator equal to one for years 2013 onward, corresponding to the operational phase of the Perform Achieve Trade mechanism, and zero otherwise. The dummy variable captures potential policy signalling effects associated with the introduction of a market based energy efficiency instrument. By distinguishing between pre and post implementation periods, the variable allows us to test whether the presence of a formal mitigation mechanism is associated with changes in climate finance inflows, controlling for global financial conditions and macroeconomic factors.

Table 10. Final Regression Data Table.

Year	ΔIn(Total$_{CFt}$ + 1)	ΔIn(GLOBAL$_{CFt}$)	ΔIn(GDPt)	ΔIn(OILt)	PAT	ΔIn(CO_2t)
2010					0	
2011	1.412356828	-0.007642155	0.051085777	0.051086	0	0.050626
2012	-1.038819959	0.270826375	0.053127293	0.002042	0	0.087413
2013	1.894365794	0.235365965	0.061904803	0.008778	1	0.034856
2014	-0.937723683	0.019304834	0.071485221	0.00958	1	0.073748
2015	0.782926041	-0.352848491	0.076926353	0.005441	1	0.038255
2016	-0.076623469	0.626755818	0.079331429	0.002405	1	0.052679
2017	-0.84902037	-0.180610338	0.065744513	-0.01359	1	0.030633
2018	-0.432492524	0.468583828	0.062541385	-0.0032	1	0.067545
2019	0.100280844	-0.109462839	0.037983765	-0.02456	1	0.006126
2020	-17.68671159	0.230946339	-0.059513564	-0.0975	1	-0.0749
2021	17.97945427	0.142320141	0.092484304	0.151998	1	0.099344
2022	1.216108475	-0.635086755	0.073337493	-0.01915	1	0.056436
2023	-1.34316018	0.265766743	0.087926212	0.014589	1	0.078639
2024	1.583400163	0.164579614	0.062925648	-0.025	1	0.041795

6. Empirical Results & Hypothesis

6.1. Model 1

$$d_{cf} = \beta_0 + \beta_1 d_{global} + \varepsilon \tag{4}$$

6.1.1. Hypothesis 1: Global Supply Effect

H1: Growth in global climate finance is positively associated with growth in climate finance inflows to India. This hypothesis tests whether expansions in aggregate global climate finance translate into higher inflows to India. A positive and statistically significant coefficient on $\Delta\ln(GLOBAL_{CF})$ would support the existence of a global supply transmission mechanism. The expected sign is positive.

Table 11. H1 global supply effect results.

Variable	Coefficient (β)	Std. Error	t-value	p-value
Constant	0.3528	2.0229	0.174	0.864
ΔGlobal	-2.0502	6.2106	-0.330	0.747

6.1.2. Coefficient on d_{global}

Estimate: -2.0502. p-value: 0.747. Interpretation: A 1 unit increase in global climate finance growth is associated with a 2.05 unit decrease in India's climate finance growth.

However:

- The sign is negative
- The coefficient is statistically insignificant
- The p-value is extremely high.

This means we cannot reject the null hypothesis that $\beta_1 = 0$, hence global climate finance growth does not indicate any growth in financial inflows in India for climate change.

6.1.3. R-squared

$R^2 = 0.009$. Only 0.9 percent of variation is explained, zero explanatory power.

6.1.4. Residual Standard Error = 7.329

Comparatively, this is larger than the mean of d_{cf} because of the extreme 2020–2021 shock. Global supply conditions do not explain India's inflow dynamics alone.

6.2. Model 2

$$d_{cf} = \beta_0 + \beta_1 d_{global} + \beta_2 d_{gdp} + \varepsilon \tag{5}$$

6.2.1. Hypothesis 2: Domestic Absorptive Capacity

H2: Higher economic growth rates in India leads to higher climate finance inflows. Expected sign: Positive

Table 12. H2 domestic absorptive capacity result.

Variable	Coefficient (β)	Std. Error	t-value	p-value
Constant	-8.567	2.482	-3.452	0.00541
ΔGlobal	-0.523	4.021	-0.130	0.899
ΔGDP	150.665	35.655	4.226	0.00142

6.2.2. GDP Growth (d_{gdp})

Estimate: 150.665. p-value: 0.00142. This is statistically significant at the 1 percent level. The magnitude looks large because:

- d_{cf} is extremely volatile
- GDP growth variation is small, around 0.05–0.09
- So scaling mechanically inflates coefficient size

But economically, the sign is positive and strongly significant suggesting that India's climate finance inflows are strongly pro-cyclical with domestic economic growth. That is consistent with absorptive capacity argument.

6.2.3. Global Climate Finance (d_{global})

Estimate: -0.523. p-value: 0.898. Still completely insignificant. So global supply growth does not explain variation once GDP is controlled for.

6.2.4. R-squared

R^2 = 0.622. Adjusted R^2 = 0.553. Now 62 percent of variation is explained, that is a dramatic increase from Model 1. So domestic macroeconomic conditions appear much more relevant than global financial trends.

6.2.5. Intercept: Negative and significant.

This is not substantively meaningful; it simply reflects baseline mean shifts.

6.2.6. Important Observation

Notice residual max is now 12.68 instead of 17.9 and adding GDP absorbs part of the 2020–2021 volatility.

Hence, preliminary evidence suggests:

- Domestic GDP growth plays a dominant role
- Global climate finance growth does not transmit strongly to India.

6.3. Model 3

$$d_{cf} = \beta_0 + \beta_1 d_{global} + \beta_2 d_{gdp} + \beta_3 d_{oil} + \varepsilon \quad (6)$$

6.3.1. Hypothesis 3: Energy Price Channel

H3: Growth in international oil prices is positively associated with growth in climate finance inflows to India.

Table 13. H3 energy price channel result.

Variable	Coefficient (β)	Std. Error	t-value	p-value
Constant	-3.537	1.697	-2.084	0.063741
ΔGlobal	-2.220	2.257	-0.984	0.348478
ΔGDP	59.688	26.709	2.235	0.049441
ΔOil	93.278	18.393	5.071	0.000484

6.3.2. Oil Price Growth (d_{oil})

Estimate: 93.278. p-value: 0.000484. Highly statistically significant. Positive sign. Interpretation: An increase in global oil price growth is associated with higher growth in climate finance inflows to India. The positive and statistically significant coefficient on oil price growth in Model 3 is economically consistent with the role of global energy price dynamics in shaping investment incentives.

6.3.3. GDP Growth (d_{gdp})

Estimate: 59.688. p-value: 0.049. Still positive and statistically significant at 5 percent. Magnitude has reduced from Model 2.

6.3.4. Global Climate Finance (d_{global}): Still insignificant.

p-value: 0.348. No evidence of global supply pass-through.

6.3.5. Model Fit

R^2 = 0.894. Adjusted R^2 = 0.862. This is very high. Residual standard error dropped dramatically to 2.62, indicating oil and GDP together explain most of the variation. However, caution is to be maintained because we have taken a small sample. High R^2 can occur mechanically.

So far our preliminary narrative indicates that India's climate finance growth appears to be driven by:

- Domestic economic growth
- Global energy price shocks

Rather than: Aggregate global climate finance expansion

6.4. Model 4

$$d_{cf} = \beta_0 + \beta_1 d_{global} + \beta_2 d_{gdp} + \beta_3 d_{oil} + \beta_4 d_{co_2} + \varepsilon \tag{7}$$

6.4.1. Hypothesis 4: India's CO_2 emissions

H4: Growth in India's CO_2 emissions is positively associated with growth in climate finance inflows.

Table 14. H4 India's CO2 emissions result.

Variable	Coefficient (β)	Std. Error	t-value	p-value
Constant	-3.697	1.761	-2.100	0.0652
ΔGlobal	-1.719	2.435	-0.706	0.4980
ΔGDP	84.200	45.445	1.853	0.0969
ΔOil	99.024	20.730	4.777	0.0010
ΔCO_2	-29.110	42.999	-0.677	0.5154

6.4.2. Key Insights So Far

- Oil price growth is robust and strongly significant.
- GDP growth is positive but becomes weaker when CO2 is added.
- CO_2 growth has no statistical effect.
- Global climate finance growth has no detectable influence.

Econometric Interpretation: At this stage, climate finance inflows to India appear more responsive to: Global energy price shocks and Domestic macroeconomic growth; rather than: Aggregate global climate finance expansion and Domestic emissions growth

6.5. Model 5 : Base Line model

$$d_{cf} = \beta_0 + \beta_1 d_{global} + \beta_2 d_{gdp} + \beta_3 d_{oil} + \beta_4 d_{co_2} + \beta_5 PAT + \varepsilon \quad (8)$$

6.5.1. Hypothesis 5: Policy Signalling Effect

H5: The implementation of the Perform Achieve Trade mechanism is associated with higher growth in climate finance inflows to India. This hypothesis tests whether the introduction of a market based energy efficiency mechanism enhanced institutional credibility and attracted additional climate finance. Expected sign: Positive

6.5.2. Oil Price Growth (d_{oil})

Estimate: 99.666. p-value: 0.00166. Still highly significant and positive. This result is stable across specifications.

6.5.3. GDP Growth (d_{gdp})

Estimate: 60.730. p-value: 0.338. Now statistically insignificant and standard error has increased sharply. This suggests:

- Multicollinearity between GDP and other variables
- Small sample inflation of variance
- PAT dummy absorbing part of post-2013 variation

GDP loses significance in the full model.

6.5.4. CO_2 Growth (d_{co2})

Estimate: -8.158. p-value: 0.886. Completely insignificant. No evidence that emissions growth influences inflows. Mitigation need responsiveness hypothesis not supported in this sample.

6.5.5. Global Climate Finance (d_{global})

Still insignificant. No pass-through effect.

6.5.6. PAT Dummy

Estimate: 1.781. p-value: 0.539. Positive but statistically insignificant. Interpretation: No statistical evidence that the introduction of PAT is associated with a structural shift in climate finance inflow growth. Given only two pre-policy years, this is not surprising. The dummy has very limited variation.

6.5.7. Model Fit

$R^2 = 0.904$. Adjusted $R^2 = 0.844$. High explanatory power. Residual standard error: 2.79. However:

- Degrees of freedom = 8
- Small sample caution remains critical.

6.6. Heteroskedasticity Robust Results for Model-5

Table 15. Heteroskedasticity robust results for model-5.

Variable	Coefficient (β)	Std. Error	t-value	p-value
Constant	-4.7923	2.1028	-2.2790	0.0522
ΔGlobal	-2.0497	1.4656	-1.3985	0.1995
ΔGDP	60.7300	42.9965	1.4124	0.1955
ΔOil	99.6657	16.9545	5.8784	0.0004
ΔCO_2	-8.1582	43.3751	-0.1881	0.8555
PAT	1.7811	2.1553	0.8264	0.4325

The heteroskedasticity robust estimates confirm that oil price growth remains positive and statistically significant across specifications which include the 2020 outlier exclusion. The energy price channel maintains its permanent strength because of this outcome. The results therefore suggest that climate finance inflows to India over 2011 to 2024 are more closely associated with global energy market conditions than with aggregate global climate finance expansions or domestic emissions growth. The organization of inflows shows higher responsiveness to shifts in energy economics and transition incentives than to indicators of required mitigation efforts and total global funding resources. The actual versus fitted values plot in Figure 4 illustrates the predictive performance of Model 5. The model successfully captures most climate finance growth patterns because most observations remain close to the 45 degree reference line. The line shows residual volatility which increases during years with significant inflow changes. The visual alignment demonstrates that the regression results show high explanatory ability.

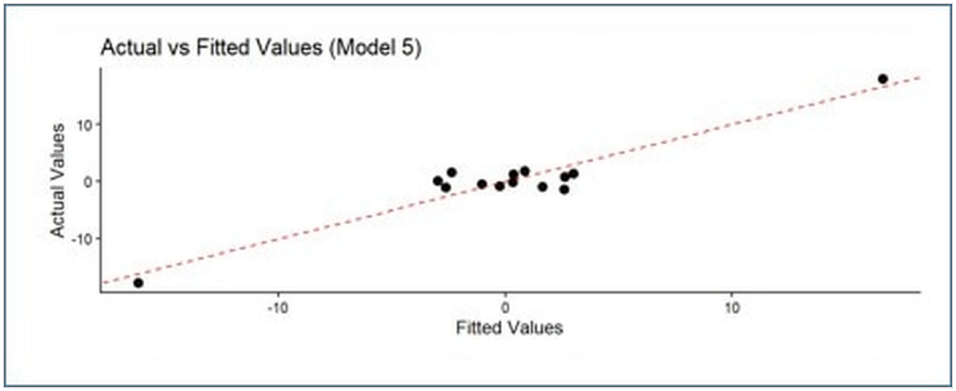

Figure 4. Actual vs Fitted Plot. Source: Author's computation.

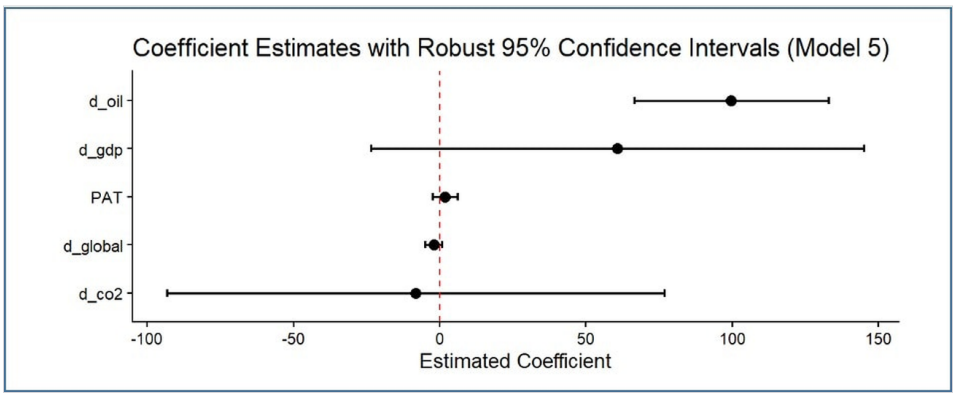

Figure 5. Coefficient Plot. Source: Author's computation.

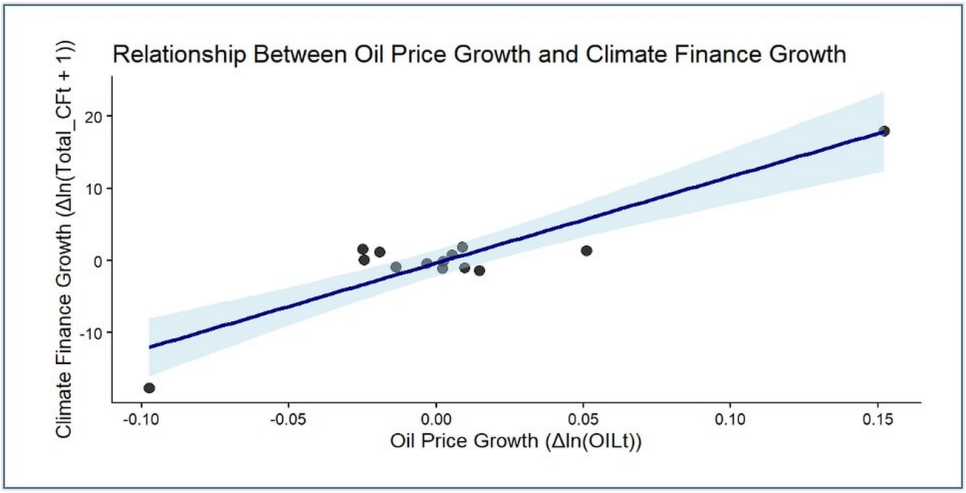

Figure 6. Oil Price Growth and Climate Finance Growth. Source: Author's computation.

7. Discussion

From a theoretical perspective, these findings are consistent with existing literature on climate finance allocation, which suggests that international climate finance flows are influenced not only by aggregate global commitments but also by domestic economic conditions, institutional capacity, and investment environments (OECD 2023; World Bank 2015; Buchner *et al.* 2019). The absence of a statistically significant relationship between global climate finance growth and India's inflows indicates that global supply-side expansion does not necessarily translate into proportional country-level disbursements. Instead, the significance of variables such as oil price growth highlights the role of global energy market dynamics in shaping investment incentives and financing patterns within the climate sector.

These results also reflect the broader political economy of climate finance, where allocation is often driven by project readiness, policy frameworks, and the ability to absorb and deploy funds effectively, rather than solely by need-based criteria. This helps explain the observed volatility in India's inflows, which are largely tied to discrete project approvals rather than continuous financial commitments which is consistent with project-based disbursement structures highlighted in existing climate finance literature.

At the same time, the findings underline the growing importance of strengthening domestic climate finance mechanisms. Given the limitations of external funding, there is increasing relevance of domestic instruments such as green taxonomy frameworks and carbon market mechanisms in India. A well-defined green taxonomy can improve clarity and standardisation in sustainable investment classification, thereby facilitating capital mobilisation, while carbon markets can generate price signals that incentivise low-carbon investments and emissions reduction pathways (Reserve Bank of India 2023; International Energy Agency 2022).

Future research can further examine how these domestic financial structures interact with international climate finance flows, and whether strengthening domestic frameworks can enhance both the scale and stability of climate finance in India over the long term.

8. Conclusion

For modelling and the overall data analysis of the regression, logarithmic transformations were applied and 1 was added to the variables to account for years with zero flows, without dropping observations. The first difference was then taken to capture the annual growth in inflows rather than their levels, in order to understand what drives the expansion or contraction of climate finance in India.

Using this methodology, the dataset was constructed with the dependent variable defined as the annual growth rate of total climate finance inflows in India. The independent variables included global climate finance growth, India's GDP growth, CO_2 emissions, oil prices, renewable energy capacity, and policy indicators such as the Perform, Achieve and Trade (PAT) mechanism.

Statistical tools for stationarity testing, including Augmented Dickey-Fuller, Phillips-Perron, and KPSS tests, were applied. Regression diagnostics such as autocorrelation, multicollinearity, and model specification were also examined.

The initial assumption of the study was that an increase in global climate finance would lead to higher inflows into India, implying a positive relationship between the two. However, the regression results do not support this expectation. The findings indicate that climate finance inflows in India are highly volatile and largely driven by discrete project approvals rather than stable annual commitments.

Within the limits of the available data and analysis, the aggregate climate finance received by India over the period 2010 to 2024 amounts to approximately USD 1.5 billion. When considered as a proportion of the USD 100 billion global annual target, this corresponds to about 1.51 percent over the fifteen-year period, with an average annual inflow of approximately USD 100.4 million. While this appears proportionally small, this comparison must be interpreted cautiously, as the USD 100 billion goal applies collectively to more than 150 developing countries and was not consistently achieved until 2022.

The coefficient plot in the analysis reflects model estimates with 95 percent confidence intervals. Among the selected variables, oil price growth shows a large positive coefficient with confidence intervals that do not cross zero, indicating statistical significance and economic relevance. This suggests that global crude oil prices are associated with changes in climate finance inflows to India. In contrast, carbon dioxide emissions are not statistically significant, and no evidence is found to support the mitigation-responsive hypothesis that higher climate finance inflows are associated with reductions in emissions.

The policy variable, represented by the dummy for the Perform, Achieve and Trade (PAT) scheme, shows a positive but statistically insignificant coefficient. This may be explained by the limited variation in the data, as the sample covers only fourteen years and the policy was implemented in 2013, resulting in very few pre-policy observations. This remains an area for further research, particularly in evaluating the long-term policy impact on climate finance flows.

As the study evaluates financial flows under the USD 100 billion commitment for the period 2010 to 2024, the analysis is constrained by the limited number of observations. The results should therefore be interpreted with caution. However, the time period remains relevant, as it corresponds to the duration of the climate finance commitment.

To assess robustness, the model was re-estimated after excluding 2020 as an exceptional pandemic year. The results remain consistent, with oil price growth continuing to show strong statistical significance, while the PAT variable becomes marginally significant and other variables remain insignificant.

Overall, the findings suggest that short-run variations in climate finance inflows to India are more closely associated with global energy market conditions than with aggregate global climate finance availability or domestic mitigation indicators.

Declarations

Author contributions. Vaishnavi Verma: conceived the study, designed the research framework, compiled and analysed the data, conducted the empirical analysis, interpreted the findings, and wrote and revised the manuscript, read and approved the final version of the manuscript.

Conflicts of interest. The author declares no competing interests.

Data availability. The data used in this study are compiled from publicly available sources, including the Green Climate Fund, Global Environment Facility, Adaptation Fund, OECD climate

finance database, World Bank World Development Indicators, Our World in Data, and Federal Reserve Economic Data (FRED). All datasets are accessible through the respective official websites. The compiled dataset used for analysis is available from the author upon reasonable request.

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HOW TO CITE THIS ARTICLE

Verma, V. (2026). Tracking Climate Finance Flows in India: The UNFCCC $100 Billion Goal. Research and Reviews in Sustainability, 2, 232-253. https://doi.org/10.65582/rrs.2026.013

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