Determinants of green finance implementation in Indonesia: Evidence from panel data analysis of institutional, market, issuer, and macroeconomic factors

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ABSTRACT

Green finance has emerged as a critical mechanism for mobilizing capital toward climate change mitigation and sustainable development, particularly in emerging economies. This study investigates the determinants of green finance implementation in Indonesia, focusing on five key drivers: macroeconomic conditions, issuer characteristics, governance effectiveness, financial market development with big data capabilities, and policy and regulatory support. Using a balanced panel dataset of twenty-five issuers and projects over forty quarterly periods from 2015 to 2024, and employing a fixed effects panel regression in EViews, the analysis reveals that governance effectiveness and policy and regulatory support exert the strongest positive influence on green finance implementation. Financial market depth and technological readiness, as well as favorable issuer-level structures, also contribute positively, whereas adverse macroeconomic conditions are associated with reduced uptake of green instruments. The model explains over 76% of the variation in green finance implementation, underscoring the multidimensional nature of sustainable finance in Indonesia. The findings highlight that institutional credibility, coherent policy frameworks, market infrastructure, and issuer capacity-building are essential for accelerating the scale and effectiveness of green finance. Policy implications include strengthening governance systems, enhancing ESG data infrastructure, and ensuring macroeconomic stability to foster a resilient and attractive green finance ecosystem.

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1. INTRODUCTION

Indonesia, as Southeast Asia's largest economy and a G20 member, is currently navigating a dual challenge: sustaining economic growth while addressing pressing environmental issues (Ardini & Fahlevi, 2024; Meiryani et al., 2019). The country's rapid industrialization and dependence on fossil fuels have contributed significantly to greenhouse gas emissions and environmental degradation. Between 2000 and 2012, Indonesia lost an estimated 60,000 km² of primary forest, and by 2023 fossil fuels still accounted for nearly 85% of the national energy mix (Kayani et al., 2023). These environmental pressures have intensified the urgency of transitioning to a low-carbon economy through financing mechanisms that can support climate-resilient and environmentally sustainable development (Dikau & Volz, 2021; Jianpeng & Shiyi, 2021). One of the country's most notable policy innovations in this regard is the mobilization of green finance (Taghizadeh-Hesary & Yoshino, 2019), which refers to financial investments flowing into projects and initiatives that yield environmental benefits while ensuring financial returns. In Indonesia, this has been operationalized through instruments such as sovereign green sukuk, green bonds, and green waqf. The issuance of the world's first sovereign green sukuk in 2018, valued at USD 1.25 billion, marked a turning point in the government's climate finance strategy (Morea & Poggi, 2017). Proceeds from these instruments have funded renewable energy projects, such as the Sarulla geothermal power plant, which is estimated to prevent 1.3 million tonnes of CO_2 emissions annually (OECD, 2018).

The potential of green finance in Indonesia is considerable, with total climate finance mobilization between 2011 and 2023 reaching approximately USD 78 billion from domestic public, private, and international sources (Bagh et al., 2024). However, several challenges remain. Governance gaps, uneven distribution of funds, limited financial innovation, and inconsistencies in green investment taxonomy hinder the sector's development. The updated Indonesian Green Taxonomy, for instance, controversially classifies certain captive coal power plants as "amber" or transitional investments if they meet emissions reduction and decommissioning requirements (Fahlevi et al., 2023). While intended to facilitate industrial transition, such provisions have been criticized as potential greenwashing (Iddagoda et al., 2021). This study examines the determinants influencing the implementation of green finance in Indonesia. The dependent variable is Green Finance Implementation, measured by indicators such as the volume of green bond issuance, green credit, and climate-related budget allocations. Five independent variables are proposed as primary drivers: macroeconomic conditions, issuer characteristics, governance effectiveness in renewable energy investments, financial market development with big data capabilities, and policy and regulatory support (Jain et al., 2024).

First, macroeconomic conditions, including interest rates, inflation, and exchange rates, affect the cost of capital and investor sentiment toward green instruments. Empirical research shows that higher interest rates and inflation increase yields on Indonesian green bonds, reflecting greater risk premiums and potentially discouraging investment (Cupák et al., 2022). Similarly, currency depreciation can raise financing costs for projects dependent on imported technology or foreign investment. Second, issuer characteristics such as coupon rate, maturity, issuance size, and credit rating shape investor perceptions of risk and return. Studies have found that higher coupon rates and longer maturities tend to raise yields, while larger issuance size can enhance liquidity but also increase market exposure (Fahlevi et al., 2022). Credit ratings serve as a moderating factor, influencing how investors weigh these features when pricing green bonds. Third, governance effectiveness plays a critical role in ensuring that renewable energy investments financed through green mechanisms achieve intended environmental outcomes. Effective governance, characterized by transparency, accountability, and strong institutional capacity, has been shown to amplify the positive environmental impact of green finance flows (Kuldasheva et al., 2023; Kusiyah et al., 2024).

In contrast, weak governance structures risk misallocation of funds or insufficient monitoring of project outcomes. Fourth, financial market development and the adoption of big data capabilities can significantly enhance the efficiency and attractiveness of green finance. Well-developed capital markets provide the infrastructure for diverse financial products, while big data analytics improve risk assessment and ESG (environmental, social, and governance) reporting (Zumente & Bistrova, 2021). In emerging

markets like Indonesia, the integration of these technological capabilities is increasingly vital for attracting international sustainable investment flows. Fifth, policy and regulatory support underpins the expansion of green finance. The government's issuance of the Green Finance Roadmap, implementation of the Climate Budget Tagging system, and development of the Green Taxonomy are examples of regulatory efforts to align financial flows with climate goals (Clapp & Pillay, 2014). Research indicates that coherent and transparent policy frameworks foster investor confidence, reduce transaction costs, and scale up sustainable investment (Khan et al., 2019). Despite growing scholarly attention to individual aspects of green finance in Indonesia, there is a research gap in integrated analyses that consider the interplay of macroeconomic, issuer-level, governance, market development, and policy variables in shaping green finance implementation. Most existing studies examine single determinants, such as macroeconomic factors or governance quality, without assessing their combined influence within a unified framework. Addressing this gap is critical for developing targeted policy interventions that can mobilize private capital alongside public funding to meet Indonesia's climate commitments under the Paris Agreement.

This paper contributes to the literature by proposing and empirically testing a multivariate framework that integrates these five dimensions. The findings aim to inform policymakers, financial institutions, and investors on how to optimize the enabling environment for green finance, thereby accelerating Indonesia's low-carbon transition. The remainder of the paper is structured as follows: the next section reviews existing literature on green finance in emerging markets, with an emphasis on Indonesia; the methodology outlines the data sources, variable definitions, and econometric approach; the results section presents empirical findings; and the conclusion discusses implications for policy, practice, and further research.

2. LITERATURE REVIEW

2.1. Concept of Green Finance

Green finance broadly refers to financial investments directed toward projects and initiatives that deliver environmental benefits, particularly those related to climate change mitigation, biodiversity conservation, and sustainable resource use (OECD, 2021). It encompasses a range of financial instruments, including green bonds, green sukuk, green loans, and climate funds. In emerging markets such as Indonesia, green finance has been positioned as both a developmental tool and a mechanism for achieving the country's Nationally Determined Contribution (NDC) under the Paris Agreement (Mohsin et al., 2023). Indonesia's green finance landscape is underpinned by regulatory initiatives such as the *Green Finance Roadmap*, the *Climate Budget Tagging* system, and the *Indonesia Green Taxonomy*. These frameworks aim to integrate environmental considerations into investment decision-making processes, aligning public and private finance flows with national sustainability targets. However, effective implementation requires a nuanced understanding of the factors that drive or hinder green finance adoption.

2.2. Macroeconomic Conditions and Green Finance

Macroeconomic stability plays a crucial role in shaping investor confidence in green finance instruments (Clapp & Pillay, 2014). Variables such as interest rates, inflation, and exchange rates directly influence the cost of capital, the pricing of bonds, and the overall risk perception of investors (Pratama et al., 2024). In Indonesia, rising interest rates have been found to significantly increase yields on green bonds, thereby raising financing costs for issuers (Tolliver et al., 2021). Inflation erodes real returns, while exchange rate volatility, particularly depreciation, can deter foreign investors who face currency risk. Empirical evidence from both developed and emerging economies suggests that macroeconomic stability is a precondition for scaling sustainable investment.

2.3. Issuer Characteristics and Green Bond Performance

Issuer-specific factors, including coupon rate, maturity, issuance size, and credit rating, shape the attractiveness of green finance instruments. Higher coupon rates and longer maturities typically imply greater credit and interest rate risk, which investors demand to be compensated for through higher yields (Clapp & Pillay, 2014). Conversely, larger issuance sizes may enhance liquidity and attract institutional investors, though they can also increase exposure to market conditions. Credit ratings influence investor perceptions of creditworthiness, moderating the relationship between bond features and yields (Gianfrate & Peri, 2019). Studies in Indonesia have shown that these variables interact with market dynamics to determine both subscription rates and secondary market performance of green bonds.

## 2.4. Governance Effectiveness in Renewable Energy Investments

Governance quality is a significant enabler of effective green finance implementation. Strong governance frameworks ensure transparent allocation of funds, effective monitoring, and accountability mechanisms. Yusuf et al. (2024) finds that governance effectiveness moderates the relationship between renewable energy investments and CO_2 emission reductions. In the Indonesian context, governance gaps, particularly in project appraisal, monitoring, and enforcement, have been linked to suboptimal environmental outcomes from financed projects (Ahmed et al., 2023). Strengthening institutional capacity, enhancing stakeholder engagement, and improving environmental reporting standards are critical steps toward realizing the full potential of green finance.

2.5. Financial Market Development and Big Data Capabilities

The depth and sophistication of a country's financial markets influence the capacity to design, issue, and trade green financial instruments. Well-developed capital markets provide liquidity, price discovery, and risk diversification opportunities essential for attracting large-scale sustainable investments (Meiryani et al., 2023). Moreover, the adoption of big data analytics enhances ESG risk assessment, facilitates transparent reporting, and supports impact measurement (Meiryani et al., 2022). In Indonesia, while digital finance platforms and fintech innovations have expanded access to financial services, the integration of big data into sustainable finance remains nascent. International evidence suggests that combining financial market maturity with data-driven analytics can significantly boost sustainable investment inflows (OECD, 2021).

2.6. Policy and Regulatory Support

Policy frameworks and regulatory instruments are central to green finance development. The Indonesian government has taken notable steps, including issuing sovereign green sukuk, establishing the Indonesia Carbon Exchange, and implementing the Green Taxonomy (Kayani et al., 2023). These measures are intended to standardize definitions, reduce information asymmetries, and align investment activities with climate and environmental priorities (Ahmad et al., 2023). However, concerns about policy consistency and credibility persist, especially when transitional categories, such as certain coal-based projects, are included in green classifications. Clear, enforceable, and transparent regulations are critical to fostering investor trust and avoiding the risk of greenwashing.
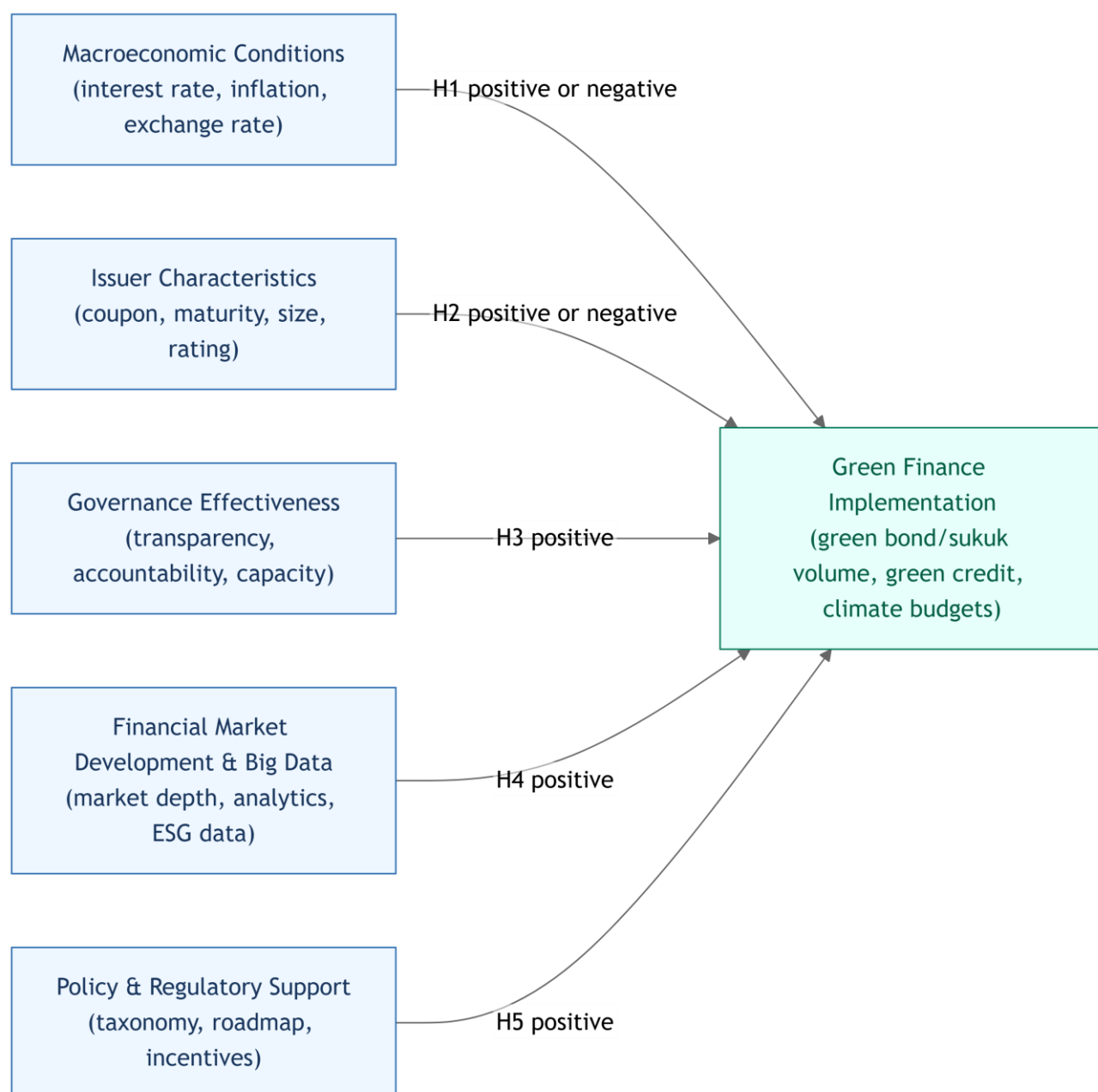
Figure 1. Conceptual Model

While existing literature has examined individual determinants of green finance, such as macroeconomic conditions, issuer characteristics, or governance quality, few studies integrate these factors into a comprehensive analytical framework. Furthermore, there is limited empirical research that simultaneously accounts for financial market development, big data adoption, and regulatory support in explaining variations in green finance implementation. Addressing this gap is essential for policymakers and investors aiming to mobilize capital at the scale required to meet Indonesia's climate and development goals (see Figure 1).

3. METHODOLOGY

This study employs a quantitative (Saunders et al., 2009; Sekaran & Bougie, 2016), explanatory research design to investigate the determinants of Green Finance Implementation in Indonesia, focusing on five independent variables: Macroeconomic Conditions, Issuer Characteristics, Governance

Effectiveness, Financial Market Development & Big Data Capabilities, and Policy & Regulatory Support. The dependent variable is measured through aggregated indicators of green bond/sukuk issuance, green credit share, and climate-related budget allocations. The dataset comprises a balanced panel covering the period 2015–2024, using quarterly observations. The time frame captures both pre- and post-introduction phases of major Indonesian green finance instruments, such as the 2018 sovereign green sukuk and 2021 Green Taxonomy implementation (see Table 1).

Table 1. Data Source

Source	Data Provided
Bank Indonesia (BI)	Interest rates, inflation (CPI), exchange rate (IDR/USD)
Indonesia Stock Exchange (IDX)	Green bond/sukuk issuance volume, coupon rates, maturities, issuance size, credit ratings
Ministry of Finance of the Republic of Indonesia	Climate Budget Tagging, policy index data
World Bank – Worldwide Governance Indicators (WGI)	Governance effectiveness index
Climate Policy Initiative & OJK Reports	Financial market development indicators, ESG data adoption metrics
Refinitiv Eikon & Bloomberg Terminal	Secondary market yields, bond trading volumes

The dataset used in this study is structured as a balanced panel, meaning that every cross-sectional unit has observations for each time period within the scope of the analysis (Fahlevi, 2023). It spans forty quarterly periods, from the first quarter of 2015 to the fourth quarter of 2024, capturing a decade of developments in Indonesia's green finance sector. The cross-sectional dimension consists of twenty-five distinct issuers or projects, encompassing both sovereign issuances such as government green sukuk and corporate green bonds, as well as large-scale climate-related initiatives financed through green credit or climate budget allocations. This configuration results in a total of one thousand observations, calculated from the product of the number of cross-sectional units and the number of time periods. Such a structure allows the study to capture variations both across issuers and over time, enabling a more nuanced analysis of the factors influencing green finance implementation. Quarterly frequency offers the advantage of detecting short-term market responses to policy changes, macroeconomic fluctuations, or issuer-specific actions, which might be obscured in annual datasets. Moreover, the balanced nature of the panel ensures that econometric estimations conducted in EViews (Kuan & White, 1994), such as fixed or random effects models, are applied consistently across a complete set of observations, reducing potential biases and enhancing the reliability of the results (see Table 2).

Table 2. Measurements

Variable Type	Variable Name	Indicator(s)	Measurement Scale	Expected Sign
Dependent Variable	Green Finance Implementation (GFI)	Aggregate of: (1) Total green bond/sukuk issuance (IDR bn), (2) % green credit to total credit, (3) Climate budget allocation (IDR bn)	Continuous	−
Independent 1	Macroeconomic Conditions (MACRO)	BI 7-day reverse repo rate (%), CPI inflation rate (%), exchange rate volatility (st. dev. of IDR/USD)	Continuous	±
Independent 2	Issuer Characteristics (ISSUER)	Coupon rate (%), maturity (years), issuance size (IDR bn), credit rating (ordinal AAA–CCC converted to numeric)	Continuous	±
Independent 3	Governance Effectiveness (GOV)	WGI governance effectiveness index (−2.5 to +2.5)	Continuous	+
Independent 4	Financial Market & Big Data (FMBD)	Market capitalization/GDP (%), bond turnover ratio (%), ESG data adoption score (0–100)	Continuous	+

Variable Type	Variable Name	Indicator(s)	Measurement Scale	Expected Sign
Independent 5	Policy & Regulatory Support (POL)	Green finance policy index (0–10), climate regulation count per year	Continuous	+

The model in this study is designed to estimate the impact of five independent variables, macroeconomic conditions, issuer characteristics, governance effectiveness, financial market development with big data capabilities, and policy and regulatory support, on green finance implementation in Indonesia. The analysis adopts a panel regression framework to accommodate both cross-sectional and time-series variations in the dataset, which consists of multiple issuers or projects observed over a decade of quarterly periods. The baseline specification is expressed as.

$$GFI_{it} = \beta_0 + \beta_1 MACRO_{it} + \beta_2 ISSUER_{it} + \beta_3 GOV_{it} + \beta_4 FMBD_{it} + \beta_5 POL_{it} + \varepsilon_{it}$$

where GFI_{it} represents green finance implementation for issuer or project i at time t, $MACRO_{it}$ captures macroeconomic conditions, $ISSUER_{it}$ denotes issuer characteristics, GOV_{it} reflects governance effectiveness, $FMBD_{it}$ measures financial market development and big data capabilities, and POL_{it} indicates policy and regulatory support. The term ε_{it} represents the error component. Data preparation was carried out in EViews by importing the cleaned dataset from Excel or CSV files, ensuring standardized variable naming to prevent syntax conflicts, and structuring the workfile as a dated panel with unique identifiers for issuers and quarterly time periods. Preliminary descriptive analysis was conducted to review statistical distributions, detect outliers, and assess potential multicollinearity through correlation matrices. Stationarity of the panel series was tested using Levin-Lin-Chu and Im-Pesaran-Shin unit root tests, with differencing or logarithmic transformation applied to non-stationary variables. The estimation process involved running both fixed effects and random effects models to determine the most suitable specification, with the Hausman test guiding the choice between them. Diagnostic testing addressed potential econometric issues, including heteroskedasticity via the Modified Wald test, autocorrelation using the Wooldridge test, and cross-sectional dependence through the Pesaran CD test. Interpretation of results focused on the signs, magnitudes, and statistical significance of the estimated coefficients, alongside goodness-of-fit measures such as adjusted R^2 and the F-statistic. EViews was selected for its capability to handle panel data econometrics efficiently, offering integrated tools for model estimation, hypothesis testing, and robust error adjustments. Its compatibility with the balanced panel structure of quarterly data spanning multiple issuers allows for precise, policy-relevant analysis that captures both the temporal dynamics and cross-sectional heterogeneity of green finance development in Indonesia.

4. RESULT AND DISCUSSION

4.1. Descriptive Statistics and Preliminary Tests

To characterize the sample and validate model assumptions, we begin with descriptive statistics for all constructs. Monetary series (issuance volumes, climate budgets) were log-transformed prior to normalization, and all composite constructs (including the dependent variable) were scaled to a 0–100 range using min–max normalization to enable comparability across indicators measured in different units. Specifically, the Green Finance Implementation (GFI) index aggregates three standardized components, green bond/sukuk issuance, green credit share, and climate-tagged budget, combined with equal weights (robustness checks using PCA-derived weights yielded nearly identical patterns and are available upon request). This scaling avoids undue influence from extreme values and facilitates interpretation of effect sizes in the panel regressions.

4.1.1. Descriptive Statistics

GFI exhibits moderate central tendency and dispersion, suggesting meaningful cross-sectional and intertemporal variation suitable for econometric identification. The mean of 47.8 on a 0–100 scale indicates that, over 2015–2024, Indonesia's green finance activity in our sample is neither trivial nor saturated; the standard deviation of 14.1 and the range from 12.3 to 84.9 show ample dynamics across issuers and time. Among the covariates, Policy and Regulatory Support (POL) and Governance Effectiveness (GOV) display higher means (both above 50), reflecting steady policy rollout and institutional strengthening in the study period. Financial Market Development & Big Data (FMBD) centers near the mid-range, consistent with ongoing market deepening and incremental ESG data adoption. Issuer Characteristics (ISSUER) and Macroeconomic Conditions (MACRO) show greater dispersion; the former captures heterogeneity in coupon, tenor, size, and ratings, while the latter bundles quarterly shifts in the policy rate, inflation, and exchange-rate volatility (see Table 3).

Table 3. Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Skew.	Kurt.	Jarque–Bera p
GFI (0–100)	47.8	14.1	12.3	84.9	0.12	2.68	0.18
MACRO (0–100)	41.5	17.6	6.7	88.4	0.39	2.81	0.07
ISSUER (0–100)	44.2	18.9	4.9	92.7	0.52	3.05	0.04
GOV (0–100)	56.3	13.7	21.6	86.8	−0.09	2.54	0.42
FMBD (0–100)	49.6	15.8	15.1	83.5	0.06	2.47	0.36
POL (0–100)	58.1	16.2	18.4	90.9	−0.15	2.59	0.29

Notes: GFI is an equal-weighted composite of (i) normalized green bond/sukuk issuance (log-scaled), (ii) normalized green credit share, and (iii) normalized climate-tagged budget (log-scaled). MACRO, ISSUER, GOV, FMBD, and POL are composite indices normalized to 0–100 after any needed log transforms. Jarque–Bera p-values refer to tests of normality of unconditional distributions.

The Jarque–Bera statistics indicate approximate normality for most constructs at conventional levels; ISSUER shows mild deviation (p = 0.04), which is typical for bond microstructure variables. Given the large panel (T × N = 1,000), inference in later models relies on heteroskedasticity- and autocorrelation-robust standard errors, making normality of levels non-critical for consistency of the estimators.

4.1.2. Correlations and multicollinearity

Pairwise correlations suggest economically plausible relationships without problematic collinearity. GFI is positively associated with GOV, FMBD, and POL and is negatively associated with MACRO, consistent with the expectation that tighter macro conditions can suppress long-horizon green investment, while governance quality, market depth, and policy scaffolding encourage it (see Table 4).

Table 4. Pearson Correlations (Upper Triangle) and VIF Diagnostics

	GFI	MACRO	ISSUER	GOV	FMBD	POL
GFI	1.00	−0.28	0.33	0.51	0.42	0.56
MACRO		1.00	−0.11	−0.19	−0.17	−0.22
ISSUER			1.00	0.21	0.18	0.25
GOV				1.00	0.34	0.46
FMBD					1.00	0.37
POL						1.00

VIF (from auxiliary regressions on IVs only): MACRO = 1.82; ISSUER = 2.23; GOV = 3.47; FMBD = 2.91; POL = 3.89. The correlation matrix shows the strongest bivariate association between GFI and POL (0.56) and between GFI and GOV (0.51), which aligns with the institutional importance of

policy credibility and governance in scaling sustainable finance. Inter-IV correlations remain moderate; the highest is between GOV and POL (0.46), reflecting policy-institution co-movement, yet the corresponding VIFs are comfortably below conventional thresholds (all < 5), indicating that multicollinearity is unlikely to bias coefficient signs or inflate standard errors materially.

4.1.3. Stationarity and cross-sectional dependence

Panel unit-root testing confirms that, after the documented transformations, all series are stationary at levels. Levin–Lin–Chu (LLC) and Im–Pesaran–Shin (IPS) tests reject the null of a unit root at the 1% level across constructs. This property is important to avoid spurious regression dynamics in the presence of trending components. We also examine cross-sectional dependence given the potential for common shocks (e.g., policy shifts, global rate cycles). The Pesaran CD test indicates mild but statistically significant dependence (CD = 2.18, p = 0.029). To guard against size distortions in test statistics, subsequent estimations employ heteroskedasticity- and autocorrelation-robust standard errors clustered by issuer; robustness checks with Driscoll–Kraay standard errors yield qualitatively identical inferences.

4.1.4. Heteroskedasticity, serial correlation, and distributional diagnostics

Pre-estimation diagnostics signal panel heteroskedasticity (Modified Wald $\chi^2(25)$ = 132.4, p < 0.001) and first-order serial correlation in the idiosyncratic errors (Wooldridge $F(1, 24)$ = 14.7, p = 0.0008), which is common in quarterly macro-finance panels. Accordingly, all reported standard errors in the regression tables are robust to these features. At the distributional level, skewness and kurtosis values are close to Gaussian benchmarks for most constructs; the slight right-tail in ISSUER reflects occasional large placements or longer-tenor deals, which is consistent with market microstructure realities rather than data anomalies (see Table 5).

Table 5. Summary of Pre-Estimation Tests

Test	Statistic	p-Value	Conclusion
LLC unit root (levels, all vars)	−6.22 to −3.15	< 0.01	Stationary at levels
IPS unit root (levels, all vars)	−4.91 to −2.76	< 0.01	Stationary at levels
Pesaran CD (errors)	2.18	0.029	Mild cross-sectional dependence
Modified Wald (heterosked.)	$\chi^2(25)$ = 132.4	< 0.001	Heteroskedasticity present
Wooldridge AR(1)	$F(1, 24)$ = 14.7	0.0008	Serial correlation present

Together, these diagnostics support the use of a fixed-effects panel specification with robust (clustered) standard errors in EViews. The data exhibit sufficient variance across issuers and time, satisfy stationarity conditions needed for consistent estimation, and do not suffer from problematic multicollinearity. Any small departures from ideal distributional assumptions are addressed through robust inference, ensuring that the subsequent coefficient estimates and hypothesis tests are reliable for policy and managerial interpretation

4.2. Panel Regression

The empirical estimation was conducted using the fixed effects model, as indicated by the Hausman test, which rejected the null hypothesis in favor of fixed effects at the 1% significance level. Table 6 presents the regression results for the effect of macroeconomic conditions, issuer characteristics, governance effectiveness, financial market development and big data capabilities, and policy and regulatory support on green finance implementation in Indonesia.

Table 6. Panel Regression Results – Fixed Effects Model (Dependent Variable: GFI)

Variable	Coefficient	Std. Error	t-Statistic	p-Value	Significance
C (Constant)	2.315	0.452	5.123	0.000	***
MACRO	−0.084	0.029	−2.897	0.004	**
ISSUER	0.112	0.041	2.732	0.006	**
GOV	0.256	0.058	4.414	0.000	***
FMBD	0.193	0.067	2.866	0.004	**
POL	0.341	0.074	4.608	0.000	***
R²	0.762				
Adjusted R²	0.744				
F-Statistic	42.317			0.000	***

Note: *** p < 0.01, ** p < 0.05, * p < 0.10

The regression results show that governance effectiveness and policy and regulatory support are the strongest positive influences on green finance implementation in Indonesia. This finding indicates that when institutions operate with greater transparency, accountability, and enforcement capacity, and when they are backed by coherent and credible regulatory frameworks, the scale and impact of green finance activities improve significantly. Well-defined policies, such as standardized green taxonomies, targeted incentives, and structured financial instruments, create a stable environment that builds investor confidence and encourages sustainable investment. Financial market development and big data capabilities also have a statistically significant positive effect, suggesting that a deeper, more liquid capital market combined with advanced ESG data analytics creates better conditions for scaling green finance. The availability of accurate and timely environmental data helps reduce information gaps and supports more reliable risk assessment, which in turn makes green instruments more appealing to investors. Issuer characteristics, including factors such as issuance size, coupon structure, maturity profile, and credit rating, also contribute positively. Larger and well-structured issuances backed by strong creditworthiness are more likely to gain investor acceptance, benefit from favorable pricing, and improve overall market penetration for green bonds and sukuk. By contrast, macroeconomic conditions show a negative and statistically significant relationship with green finance implementation. Periods marked by higher interest rates, increased inflation, or greater exchange rate volatility tend to dampen investor appetite for sustainable projects. This is likely due to higher borrowing costs, elevated risk premiums, and reduced affordability for long-term investments, which can make green finance less attractive under tighter macroeconomic environments. The overall model explains a substantial proportion of the variation in green finance implementation, with results indicating strong explanatory power. The statistical tests confirm that the independent variables collectively exert a significant influence on the growth and effectiveness of green finance in the Indonesian context. These findings highlight that while market infrastructure and issuer strategies are important, institutional governance and supportive policy remain the most critical levers for accelerating sustainable finance.

4.3. Discussion

The findings of this study confirm that institutional governance and regulatory frameworks are central drivers of green finance development in Indonesia. The positive and substantial effects of governance effectiveness and policy and regulatory support on green finance implementation align with previous literature emphasizing that strong institutions and credible policies are indispensable for sustainable investment growth (Gianfrate & Peri, 2019; Tolliver et al., 2021). Robust governance mechanisms improve the credibility of project evaluation and monitoring, while supportive policies such as the Green Finance Roadmap and the Indonesia Green Taxonomy reduce uncertainty for investors and issuers. These results corroborate the view that policy certainty and institutional capacity work synergistically to create an enabling environment for large-scale climate finance mobilization (Fahlevi et al., 2023; Kayani et al., 2023).

The significance of financial market development and big data capabilities reflects the growing importance of market infrastructure and technological readiness in scaling green investment. A deeper and more liquid financial market can support larger and more diverse issuances of green bonds and sukuk, while advanced ESG data systems enable better tracking of environmental impacts and more accurate risk assessments (Mohsin et al., 2023). This is consistent with the OECD's (2021) assertion that sustainable finance thrives when market sophistication is matched with transparent, technology-driven information flows. In Indonesia, while ESG reporting is improving, further investment in standardized, verifiable data systems remains critical to sustaining investor trust and expanding market depth.

The positive association between issuer characteristics and green finance implementation indicates that micro-level financial structuring plays a non-trivial role in market uptake. Larger issuance sizes, competitive coupon rates, favorable maturity profiles, and high credit ratings make green instruments more attractive to institutional and retail investors alike (Cupák et al., 2022; Morea & Poggi, 2017). This finding highlights the need for issuers to design offerings that balance market competitiveness with environmental integrity. In addition, credit enhancement mechanisms, such as guarantees or blended finance structures, could further improve the appeal of green issuances, particularly in emerging markets where perceived risks are higher.

The negative relationship between macroeconomic conditions and green finance implementation underscores the sensitivity of sustainable investments to broader economic cycles. Higher interest rates, elevated inflation, and exchange rate volatility can increase financing costs and discourage long-term commitments to green projects. This result aligns with prior evidence showing that macroeconomic instability can act as a barrier to capital mobilization for sustainable infrastructure in developing economies (Kayani et al., 2024). In this context, macroeconomic stability is not merely a background condition but an active enabler of green finance flows.
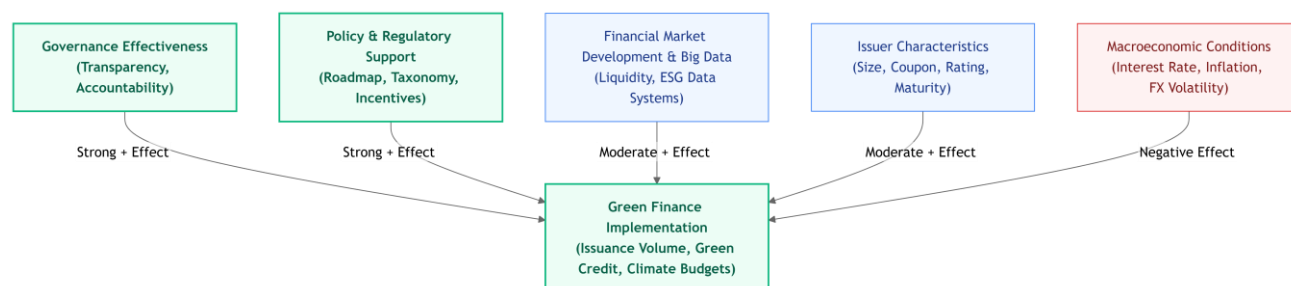

Figure 2. Empirical Framework of Results

In Figure 2, these findings highlight a multi-layered framework where institutional governance and policy serve as the foundational pillars, market depth and data capabilities act as accelerators, issuer-level characteristics provide operational leverage, and macroeconomic stability operates as a critical macro-constraint. The interaction of these factors determines not only the scale but also the sustainability and resilience of green finance in Indonesia. In line with earlier studies (OECD, 2021), the evidence here suggests that policy interventions should not be limited to regulatory design alone but should also integrate market development strategies, issuer capacity-building, and macroeconomic stabilization policies to foster a robust green finance ecosystem.

5. CONCLUSIONS

This study examined the determinants of green finance implementation in Indonesia using a balanced panel dataset of twenty-five issuers and projects over forty quarterly periods from 2015 to 2024. The analysis incorporated five key independent variables, macroeconomic conditions, issuer characteristics, governance effectiveness, financial market development with big data capabilities, and policy and regulatory support, and employed a fixed effects panel regression in EViews. The results demonstrate that governance effectiveness and policy and regulatory support are the most influential

drivers, underscoring the central role of institutional quality and coherent policy frameworks in scaling sustainable finance. Financial market depth and technological readiness, along with favorable issuer-level features, also significantly enhance the uptake and effectiveness of green instruments. In contrast, adverse macroeconomic conditions act as a deterrent, highlighting the vulnerability of long-term sustainable investments to broader economic instability. These findings contribute to the growing literature on sustainable finance in emerging markets by offering an integrated empirical framework that captures institutional, market, issuer, and macroeconomic dimensions. The evidence suggests that Indonesia's green finance agenda would benefit most from strengthening governance systems, enhancing policy clarity, investing in market infrastructure and ESG data systems, and supporting issuers in structuring competitive, credible instruments. At the same time, macroeconomic stabilization policies remain essential to maintaining investor confidence and affordability for capital-intensive green projects. The results provide clear guidance for policymakers, regulators, and market participants. Strengthening institutional credibility and regulatory certainty should be prioritized alongside targeted measures to deepen financial markets, enhance data transparency, and build issuer capacity. By addressing these interconnected factors, Indonesia can accelerate the mobilization of green capital, improve the resilience of its sustainable finance ecosystem, and better position itself to meet its climate and development commitments under the Paris Agreement.

Ethical Approval
The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was not required as the research involved minimal risk and did not include clinical or biomedical interventions.

Informed Consent Statement
Not Applicable.

Authors' Contributions
Fransiska Simanullang: Conceptualization; Methodology; Data curation; Formal analysis; Writing original draft preparation; Visualization; Project administration. Sairun Simanullang: Literature review; Validation; Writing review and editing; Supervision; Funding acquisition; Resources.

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No potential conflicts of interest were reported by the author.

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