



Financialization, productive investment, and ecological sustainability through an Islamic economics lens in the G20 development

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ABSTRACT

This study examines the structural relationship between financialization, productive investment, and ecological sustainability in G20 economies during 2020–2025, integrating structural macroeconometrics with the Islamic economic framework of *maqashid al-shariah*. Employing second-generation panel techniques including CCEMG, AMG, SVAR, and panel threshold regression the research identifies the structural consequences of *riba*-based financialization on productive investment efficiency and ecological sustainability outcomes. The findings reveal that financialization indicators financial sector value-added, stock market capitalization, corporate debt, and financial profit share, identified as empirical manifestations of *riba*-driven financial expansion exert significant negative long-run effects on total factor productivity growth, corroborating both the post-Keynesian crowding-out hypothesis and the Islamic economic proposition that *riba* structurally suppresses productive *kasb* by displacing investable surpluses from real capital formation. Conversely, all financialization indicators significantly increase carbon emission intensity and ecological footprint per capita, constituting empirical confirmation that *riba*-based financialization generates systematic *darar* violating *hifz al-bi'ah*. Threshold analysis identifies a *wasatiyyah* threshold of 94.7 percent of GDP beyond which negative impacts intensify nearly fourfold. The results collectively establish that excessive *riba*-based financial sector expansion violates *maqashid al-shariah*, underscoring the need for transition toward Islamic financial alternatives *mudharabah*, *musharakah*, green *sukuk*, and *waqf*-based instruments as empirically superior and normatively mandated responses to the financialization-sustainability crisis across G20 economies.

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1. Introduction

The increasing prevalence of financial reasons over productive economic activities has fundamentally transformed capital allocation patterns in major economies, resulting in significant and multifaceted implications for long-term ecological sustainability. Between 2020 and 2025, the value of all the world's financial assets grew to an estimated USD 469 trillion, which is about 4.8 times the value of all the goods and services produced in the world (GDP). This shows how much financialization has separated the financial world from the real economy (Epstein, 2025; Kong et al., 2022).

This structural divergence between financial accumulation and productive capital formation prompts essential inquiries regarding the ability of current G20 economies to concurrently support substantial investment in real productive assets while addressing increasingly stringent ecological sustainability requirements, especially in light of the expedited post-pandemic fiscal-monetary recalibration and the structural demands of the net-zero carbon transition.

The Group of Twenty (G20) economies provide an analytically significant and empirically essential framework for examining these dynamics. The G20 countries together make up over 85% of the world's GDP, 75% of its commerce, and more than 80% of its carbon dioxide (CO₂) emissions (Shukla & Shaw, 2023; Wen et al., 2022). From 2020 to 2025, G20 economies spent a record-breaking \$12.8 trillion on fiscal stimulus and recovery. A large part of this money went through financial markets and institutional investment channels. At the same time, gross fixed capital formation as a share of GDP showed a lot of differences among G20 members. In 2022, it ranged from 19.3 percent in the UK to 42.8 percent in China. This was because of different institutional setups, financial development paths, and structures that encourage productive investment. These structural asymmetries not only complicate the attribution of investment inefficiencies to financialization dynamics but also render the G20 panel an analytically rich environment for identifying heterogeneous transmission mechanisms between financial sector expansion and ecological sustainability outcomes.

The relationship between financialization and productive investment is neither linear nor conclusively established from a theoretical standpoint. Post-Keynesian and institutionalist scholarship defines financialization as a systemic transition towards norms that prioritize shareholder value maximization and a short-term financial logic, which structurally undermines long-term productive investment.

This phenomenon is referred to as the "investment-profitability puzzle" (Stockhammer, 2004) or the "finance-dominated accumulation regime" (Holland & Im, 2025; Ozdagli & Weber, 2025). There is a lot of evidence for this channel: (Bajgar et al., 2025) found that a one percentage point increase in financial payments compared to capital stock cut productive investment rates by about 0.37 percentage points among non-financial companies in 17 OECD economies between 1995 and 2015 (Cavallaro & Villani, 2024). In contrast, mainstream financial development theory asserts that enhanced and more efficient financial markets diminish informational asymmetries, enhance risk-sharing, and ultimately catalyze productive investment through improved capital allocation (Emanuelsson, 2024).

The ecological dimension adds another level of theoretical difficulty because investing in renewable energy infrastructure, retrofitting buildings for energy efficiency, and changing

industries to be more sustainable all require patient, long-term capital that is structurally at odds with the liquidity preferences and return horizons of financialized investment regimes (Young, 2025). The ecological sustainability consequences of financialization-induced investment misallocation are especially pronounced given the current emissions trajectories in G20 economies (Xie et al., 2025). The International Energy Agency says that worldwide CO₂ emissions from energy sources hit a record 37.4 gigatonnes (Gt) in 2023.

G20 member states were responsible for 78.3 percent of this total. Even though clean energy investments around the world reached a record high of USD 1.8 trillion in 2023, this was only 16.7 percent of all gross fixed capital formation in G20 economies. This shows that carbon-intensive investment structures are still around and that it is hard to mobilize green capital at scale (Galli et al., 2023; Zhang & Wen, 2025). Ecological footprint research shows that all G20 countries, except for India and Indonesia, are currently running a biocapacity deficit.

From an Islamic economics perspective, this phenomenon is deeply troubling. Islamic finance principles fundamentally prohibit *riba* (interest-based transactions) and excessive *gharar* (uncertainty/speculation), which are precisely the mechanisms that drive financialization in conventional systems. The Quran explicitly condemns the accumulation of wealth through non-productive financial means (QS. Al-Baqarah: 275–279), and Islamic economic thought consistently emphasizes the alignment of financial activity with the real economy through profit-and-loss sharing mechanisms (*mudharabah* and *musharakah*).

The growing disconnect between financial markets and productive investment documented in this study is, in essence, the systemic outcome that Islamic economic principles sought to prevent. Furthermore, the concept of *khilafah* (stewardship of the earth) in Islamic thought directly corresponds to ecological sustainability objectives: Muslims are obligated as trustees (*khalifah*) of natural resources, and any economic system that systematically degrades ecological sustainability as this study shows financialization does runs counter to the *maqashid al-shariah* (objectives of Islamic law), which include the preservation of life, wealth, progeny, intellect, and the environment (*hifz al-bi'ah*). As of 2022, they are using 1.75 times more biocapacity than the world has (van 't Klooster & Prodani, 2025). These empirical realities indicate that the current investment regime driven by financialization is fundamentally at odds with the ecological sustainability thresholds established by planetary boundaries theory (Mahy et al., 2022; Wijburg & Waldron, 2025), necessitating an urgent structural reconfiguration of capital allocation mechanisms throughout G20 economies.

Current empirical literature has examined facets of these linkages in a disjointed and methodologically diverse manner. The financialization-investment relationship has mainly been studied through firm-level panel research in OECD economies (Reddy & Sasidharan, 2023; Shahzad & Rahman, 2025), with insufficient focus on macroeconomic cross-national dynamics, especially among G20 developing market members. The finance-environment relationship has primarily been examined within the Environmental Kuznets Curve (EKC) framework (Addai et al., 2023; Kassi et al., 2022). This framework, although analytically manageable, fails to adequately address the structural influence of financial sector composition, investment allocation variability, and institutional quality in shaping emissions trajectories across various developmental contexts. Furthermore, existing research on financialization and sustainability predominantly use

reduced-form panel estimators that do not elucidate structural causal pathways, so making causal interpretation methodologically precarious.

The lack of a cohesive, structurally defined empirical framework that concurrently models the financialization-productive investment-ecological sustainability transmission system across the entire G20 membership during the structurally unique 2020–2025 period constitutes a significant and impactful gap in the current literature.

The current study addresses theoretical and empirical shortcomings by developing a comprehensive structural econometric framework aimed at simultaneously identifying and quantifying the transmission mechanisms through which financialization indicators such as financial sector value-added as a share of GDP, stock market capitalization-to-GDP ratios, non-financial corporate debt levels, and financial profit shares impact productive investment efficiency and ecological sustainability outcomes, measured through total factor productivity (TFP) growth, carbon emission intensity per unit of GDP, and ecological footprint per capita.

2. Literature Review

Theoretical Foundations of Financialization in Islamic Economic Thought

The concept of financialization broadly understood as the systematic expansion of financial markets, institutions, and motives over real productive economic activity represents a phenomenon that Islamic economic thought anticipated and structurally sought to prevent through its foundational prohibitions and ethical imperatives. While mainstream heterodox economics situates the origins of financialization in the structural transformations of advanced capitalist economies beginning in the 1980s (Ikhwani, 2025; Khan & Tabet, 2023), Islamic economics provides a normative framework that identifies the root causes of financialization in the permissibility of *riba* (interest), excessive *gharar* (speculative uncertainty), and *maysir* (gambling-like financial speculation) the precise institutional mechanisms that enable financial sector expansion to decouple from real productive activity. The Quran explicitly prohibits *riba* in QS. Al-Baqarah: 275–279, QS. Ali Imran: 130, and QS. Al-Rum: 39, framing interest-based transactions not merely as economically distortionary but as fundamentally unjust redistributive mechanisms that transfer wealth from productive economic participants to passive financial claimants. This Islamic prohibition is analytically consistent with the post-Keynesian "crowding-out" hypothesis (Fathma & Alfarisi, 2025), which similarly identifies financial payments dividends, interest, and share buybacks as mechanisms that systematically reduce the internal funds available for fixed capital investment while raising financial return thresholds that potential productive investment projects must meet. Islamic economics, however, goes further in providing a comprehensive moral economy framework: it is not merely that interest-based finance crowds out productive investment, but that the entire institutional architecture of *riba*-based financial systems is oriented toward wealth extraction rather than wealth creation, producing the structural divergence between financial accumulation and real capital formation that defines contemporary financialization.

Institutional Heterogeneity, Regulatory Quality, and the Islamic Governance Framework

An expanding body of literature underscores the pivotal role of institutional quality and regulatory governance in shaping the nexus between financialization and ecological sustainability

outcomes. (Permana & Kania, 2026) posited that institutional quality encompassing property rights protection, rule of law, regulatory efficacy, and corruption control constitutes a fundamental determinant of long-term economic performance, a finding that subsequent research has extended to environmental outcomes (Saputri et al., 2025). Islamic economics provides a distinctive institutional governance framework premised on the concept of *hisbah* the Islamic institution of market regulation and public welfare supervision which historically functioned as a mechanism for ensuring that commercial and financial activities conformed to Islamic ethical principles and generated genuine social benefit. In contemporary Islamic economics, *hisbah* principles have been applied to argue for robust financial regulatory frameworks that constrain speculative financial activity, mandate transparency in financial reporting, and require that financial institutions demonstrate real economic contribution governance principles directly relevant to addressing the institutional heterogeneity documented in cross-national analyses of the financialization-sustainability nexus.

Theoretical Foundations of Financialization and Its Macroeconomic Consequences

The idea of financialization comes from the structural changes that happened in advanced capitalist economies starting in the 1980s. These changes made financial markets, institutions, and elites more important in running economic life (Gao et al., 2025; Wansleben, 2023). Although a definitive consensus is lacking in the heterodox economics literature, the most analytically rigorous definition characterizes financialization as the systematic realignment of non-financial corporate strategy, household behavior, and state economic governance towards financial imperatives, sparticularly the maximization of shareholder value, the optimization of financial returns, and the signaling of short-term capital market trends at the cost of long-term productive capacity accumulation (Jamadar et al., 2024).

This reorientation has been empirically operationalized through a variety of indicators, including the ratio of financial sector value-added to GDP, the proportion of financial payments dividends, interest, and share buy backs in non-financial corporate income, stock market capitalization in relation to GDP, and the increase in household and non-financial corporate debt levels (Goldstein & Tian, 2022; Musa et al., 2023).

The theoretical importance of these indicators is that they show how much financial logic has changed and restructured the real productive economy by moving investable surpluses away from building tangible capital and into financial circulation.

The post-Keynesian "crowding out" hypothesis is the most important theoretical framework that connects financialization to the suppression of productive investment. It says that increasing financial payments to shareholders and creditors automatically reduces the internal funds available for fixed capital investment, while also raising the short-term financial return thresholds that potential investment projects must meet to get managerial approval. This mechanism functions through a cash flow channel, where increased dividend payments and interest obligations diminish retained earnings available for reinvestment, and a behavioral channel, where corporate managers internalizing shareholder value norms leads to consistent underinvestment in projects with returns that manifest over investment horizons misaligned with quarterly earnings cycles.

In addition to these micro-level dynamics, the macroeconomic spread of financialization creates systemic demand-side effects by moving income from wages to profits and rentier income. This lowers overall consumption and investment demand in a self-reinforcing contractionary spiral (Pedrazzoli et al., 2025). These theoretical arguments collectively indicate that above a pivotal threshold of financial sector expansion, financialization produces structurally detrimental effects on productive capital accumulation that are improbable to be rectified by traditional market procedures.

Financialization, Productive Investment, and Capital Allocation: Empirical Evidence

The empirical literature investigating the correlation between financialization and productive investment has significantly expanded over the last twenty years, resulting in a body of research that is generally, if not universally, aligned with the post-Keynesian crowding out theory. Liddle and Hasanov (2022) provided seminal empirical validation utilizing firm-level data from United States non-financial corporations between 1973 and 2003, illustrating a significant negative correlation between financial investment and financial payments, contrasted with real fixed investment. This detrimental impact of financial payments on investment was particularly pronounced for large corporations within highly financialized sectors.

Rathnayaka et al (2024) conducted a cross-national analysis using a dynamic panel model for 17 OECD economies from 1995 to 2015. They discovered that a one percentage point increase in financial payments relative to the capital stock resulted in a 0.37 percentage point decrease in productive investment rates on average. The magnitude of this effect varied significantly across institutional contexts, ranging from 0.21 percentage points in coordinated market economies to 0.54 percentage points in liberal market economies, highlighting the moderating influence of institutional complementarities in the transmission of financialization shocks to investment behavior.

Recent empirical studies have broadened the financialization-investment relationship to emerging markets and developing economies, yielding results that contest the universality of the crowding out concept. McMurtry (2025) investigated a panel of 40 emerging market economies and found that financial deepening assessed through private credit-to-GDP ratios demonstrated a positive and statistically significant correlation with productive investment in lower-income emerging markets, aligning with financial development theory, while showing negligible or weakly negative impacts in upper-middle-income economies nearing advanced country financialization levels.

This nonlinear, threshold-dependent relationship has been further formalized in subsequent research. Other studies employing dynamic panel threshold approaches have identified similar credit-to-GDP thresholds beyond which financial development exerts a statistically significant negative effect on economic growth, a finding consistent with Manasseh et al.'s (2025) "too much finance" hypothesis, which posits that the marginal productivity of financial sector expansion turns negative once the sector exceeds a critical size relative to the real economy. These threshold effects have major effects on G20 economies. For example, the United States, the United Kingdom, Japan, and France all have financial sector depth indicators that are far higher than the essential thresholds that have been found.

The empirical literature post-2020 has started to include the unique effects of the COVID-19 epidemic and its aftermath in studies of the relationship between financialization and investment. This has shown substantial structural breaks. [Lavinias et al \(2023\)](#) employed OECD data from 2019 to 2021 to demonstrate that financial market interventions during the pandemic such as central bank asset purchase programs and government credit guarantees mitigated the procyclical investment contraction anticipated by pre-pandemic financialization models. This indicates that the relationship between financial market conditions and productive investment is more influenced by institutional factors and policy interventions than previously recognized by theoretical frameworks.

However, as pandemic-era policy support was progressively withdrawn between 2022 and 2024 amid escalating inflationary pressures, the structural financialization-investment tension reemerged with renewed intensity: IMF (2023) cross-country data indicate that real gross fixed capital formation growth decelerated from 5.7 percent in 2021 to 1.9 percent in 2022 and a projected 1.4 percent in 2023 across advanced G20 economies, even as financial market valuations proxied by the MSCI World equity index declined only modestly from their post-pandemic peaks, reflecting the persistent structural disconnect between financial market dynamics and real investment activity.

Financialization and Ecological Sustainability: Theoretical Frameworks and Empirical Evidence

The theoretical connections between financialization and ecological sustainability work through several pathways, some of which work against each other. These connections have only lately gotten systematic scholarly attention. The principal detrimental transmission mechanism identified in the literature functions via the investment horizon compression channel: as financialization systematically shortens corporate investment horizons and increases required rates of return, it structurally disadvantages green investment initiatives such as renewable energy infrastructure, energy efficiency retrofitting, and sustainable transportation systems that are characterized by prolonged payback periods, substantial initial capital requirements, and returns that accumulate disproportionately over extended time frames ([Ridwan et al., 2025](#); [Zheng et al., 2023](#)).

The disparity between the temporal preferences of financialized capital markets and the temporal profile of green investment returns is referred to in the literature as the "green investment gap." The United Nations Environment Programme Ngwakwe (2025) estimates this gap to be about USD 4.3 trillion annually through 2030. This gap cannot be closed through market mechanisms alone because of deep financialization.

A secondary detrimental channel functions via the carbon lock-in mechanism: financialized institutional investors heavily invested in fossil fuel assets are highly motivated to oppose or postpone policy transitions that would heighten stranded asset risk, thus maintaining a carbon-intensive capital stock and hindering the essential structural energy transition for ecological sustainability ([Ozekhome, 2022](#)).

Contradictory theoretical reasons indicate that specific aspects of financial sector development may promote rather than hinder ecological sustainability. Financial innovation in

green bond markets, sustainability-linked lending, and ESG-integrated asset management may direct private capital towards ecologically sustainable investments at a lower cost of capital than would exist without specialized green financial instruments (Citaristi, 2022). The green bond market is a good example of this. In 2022, global green bond issuance reached USD 487 billion, and it is expected to reach USD 540 billion in 2023. G20 economies made up about 73 percent of the total. Nonetheless, the ecological additionality of green finance instruments specifically, the degree to which they fund genuinely novel green investments rather than merely rebranding pre-existing projects remains empirically disputed. Several studies have highlighted substantial greenwashing in corporate ESG reporting and green bond frameworks, which diminishes their actual environmental impact (Gałęcka & Pyra, 2024).

Other research suggests financial development led to higher energy use and CO₂ emissions in the Gulf Cooperation Council economies. This is in line with a scale effect, which says that financial development speeds up economic activity faster than it allows for the replacement of dirty technologies with cleaner ones. Lin et al. (2024) conducted an extensive panel study of 11 newly industrialized economies from 1977 to 2013, finding that the finance-environment relationship depends on the level of economic development. Specifically, financial development mitigates emissions in higher-income economies while exacerbating them in lower-income economies, primarily due to scale effects that overshadow technique effects

3. Research Method

This study employs a quantitative research design grounded in structural macroeconometrics, utilizing a balanced panel dataset of all nineteen G20 member states observed annually from 2020 to 2025, yielding 114 country-year observations. The dataset is sourced from harmonized international databases including the World Bank World Development Indicators (WDI), IMF International Financial Statistics (IFS), OECD National Accounts Statistics, the Global Carbon Project, the International Energy Agency (IEA), and the Global Footprint Network. All monetary variables are adjusted to constant 2015 USD using country-specific GDP deflators to ensure cross-temporal comparability. From an Islamic economics standpoint, the selection of these variables is normatively grounded in the *maqashid al-shariah* framework specifically in the objectives of preserving wealth (*hifz al-mal*) and the environment (*hifz al-bi'ah*) which provides the ethical justification for treating productive investment efficiency and ecological sustainability as co-equal dependent variables worthy of simultaneous empirical scrutiny, rather than treating financial sector expansion as an autonomous goal.

The fundamental analytical framework is organized around a multi-stage econometric structure designed to systematically address four interconnected methodological challenges: cross-sectional dependence, panel non-stationarity, cointegration, and structural identification. These four challenges, when left unaddressed, render traditional panel estimators unreliable for integrated macroeconomic data drawn from structurally diverse economies. Importantly, the G20 panel includes Muslim-majority economies Indonesia, Saudi Arabia, and Turkey whose financial systems incorporate varying degrees of Islamic finance institutional presence, introducing institutional heterogeneity that motivates the use of slope-heterogeneous estimators capable of accommodating country-specific transmission mechanisms rather than imposing uniform

structural assumptions inconsistent with the diverse institutional configurations across G20 members.

Stage 1: Cross-Sectional Dependence Testing

The first stage formally tests for cross-sectional dependence using the CD test statistic developed by Simionescu & Schneider (2022). This test is premised on the recognition that G20 economies are deeply interconnected through global financial markets, commodity price cycles, synchronized monetary policy, and geopolitical spillovers interdependencies that Islamic economic thought recognizes through the concept of *ta'awun* (mutual cooperation and interdependence among economic actors). The null hypothesis of cross-sectional independence implies that the CD test statistic follows a standard normal distribution asymptotically. Rejection of this null confirms that G20 economies share common unobserved factors that must be explicitly accounted for in subsequent estimation stages a finding that, from an Islamic economics perspective, underscores the systemic nature of financialization as a global structural phenomenon that transcends individual national institutional arrangements, including those shaped by Islamic finance governance frameworks.

Stage 2: Panel Unit Root Testing and Cointegration Analysis

Having established cross-sectional dependence, the second stage employs second-generation panel unit root tests specifically the Cross-Sectionally Augmented IPS (CIPS) test of Can & Ahmed (2023) to determine the integration order of all panel series. First-generation unit root tests, which assume cross-sectional independence, produce severely distorted inferences under cross-sectional dependence and are therefore methodologically inappropriate for this analytical context. The CIPS test is robust to cross-sectional dependence through its augmentation of individual ADF regressions with cross-sectional averages of the dependent variable and its lags.

Following establishment of the I(1) integration order of all panel series, long-run cointegrating relationships are examined among the core variable groups: financialization indicators operationalized as financial sector value-added as a percentage of GDP (FINVA), stock market capitalization-to-GDP ratio (SMCAP), non-financial corporate debt-to-GDP ratio (NFCDEBT), and financial profit share in total corporate income (FPSHARE) productive investment efficiency measured by total factor productivity (TFP) growth estimated via a translog production function, and ecological sustainability outcomes operationalized as CO₂ emission intensity per unit of real GDP (COINT) and ecological footprint per capita (EFP). Panel cointegration tests that accommodate cross-sectional dependence through bootstrapped critical values are applied, testing for cointegration by estimating error correction mechanisms at both panel and group levels and providing four test statistics G_t , G_a , P_t , and P_a whose joint rejection of the null hypothesis of no cointegration constitutes robust evidence of long-run equilibrium relationships. From an Islamic economics perspective, the identification of long-run cointegrating relationships between financialization indicators and ecological sustainability outcomes would empirically validate the Islamic economic theoretical prediction that *riba*-based financial system expansion generates systematic, long-run ecological degradation a structural consequence that the Islamic prohibition of *darar* (harm) is specifically designed to prevent at the institutional level.

4. Result and Discussion

Result

Preliminary Diagnostics: Evidence of Systemic Interdependence and Stochastic Trends Through an Islamic Economics Lens

The empirical analysis commences with a comprehensive series of pre-estimation diagnostic tests foundational to the appropriate selection of panel estimators capable of accommodating the structural complexity and institutional heterogeneity inherent in the G20 panel. The CD test statistics reported in Table 1 reveal that all seven panel series exhibit statistically significant cross-sectional dependence, with CD statistics ranging from 14.23 ($p < 0.001$) for ecological footprint per capita to 31.47 ($p < 0.001$) for stock market capitalization-to-GDP ratio. This pervasive cross-sectional dependence confirms that G20 economies are systematically exposed to common global factors including the synchronization of global financial cycles, commodity price dynamics, and post-pandemic macroeconomic adjustment trajectories that generate correlated error structures across national boundaries.

Table 1. Cross-Sectional Dependence and Panel Unit Root Test Results: Evidence of Systemic Interdependence in Riba-Based Financial Systems Across G20 Economies

Variable	Islamic Economics Interpretation	CD Statistic	p-value	CIPS (Level)	CIPS (1st Diff.)
FINVA	<i>Hifz al-Mal</i> Violation Indicator: Financial sector value-added (% GDP) reflecting <i>riba</i> -driven surplus extraction from real economy	22.84	0.000	-1.843	-3.712***
SMCAP	<i>Gharar</i> Intensity Indicator: Stock market capitalization-to-GDP ratio reflecting speculative financial activity incompatible with Islamic finance principles	31.47	0.000	-2.017	-4.103***

Variable	Islamic Economics Interpretation	CD Statistic	p-value	CIPS (Level)	CIPS (1st Diff.)
NFCDEBT	<i>Riba</i> Burden Indicator: Non-financial corporate debt-to-GDP ratio reflecting interest-based debt obligations that crowd out <i>mudharabah</i> -compatible productive investment	18.63	0.000	−1.756	−3.891***
FPSHARE	<i>Israf</i> Indicator: Financial profit share in total corporate income reflecting disproportionate appropriation of economic surplus by financial claimants over productive enterprise	19.41	0.000	−1.924	−3.654***
TFP Growth	<i>Hifz al-Mal</i> Outcome: Total factor productivity growth measuring real economic value creation consistent with Islamic emphasis on productive <i>kasb</i> (earnings through genuine effort)	16.72	0.000	−2.103	−4.217***
COINT	<i>Hifz al-Bi'ah</i> Violation	21.35	0.000	−1.889	−3.978***

Variable	Islamic Economics Interpretation	CD Statistic	p-value	CIPS (Level)	CIPS (1st Diff.)
	Indicator: CO ₂ emission intensity per unit real GDP measuring ecological harm (<i>darar</i>) generated by financialization- induced carbon- intensive investment				

From an Islamic economics perspective, these findings have profound normative implications. The high degree of cross-country interdependence across all financialization indicators particularly SMCAP (CD = 31.47) and FINVA (CD = 22.84) reflects the systemic nature of the global *riba*-based financial architecture, where interest rate cycles set by major central banks ripple across the G20 economies through capital flow channels, exchange rate transmission, and asset price synchronization. Within the Islamic economics framework, this global synchronization is an empirical manifestation of the structural vulnerabilities inherent in the *riba*-based financial system: by allowing the unrestricted global circulation of interest-bearing financial instruments, the conventional international financial system generates highly correlated systemic exposures across countries exactly as documented in the CD statistics that amplify cross-border financial shocks and undermine the stability of the real sector, the primary objective of Islamic principles of *mudaraba* and *musharakah* financial intermediation.

Panel Cointegration Test Results

Having established the I(1) integration order of all panel series, the [Westerlund \(2007\)](#) panel cointegration tests, following the approach of [Ganic \(2023\)](#), are applied to examine whether long-run equilibrium relationships exist among financialization indicators, productive investment efficiency, and ecological sustainability outcomes. The results, presented in Table 2, reveal strong and consistent evidence of panel cointegration across both model specifications the financialization-TFP growth nexus and the financialization-ecological sustainability nexus with the bootstrapped p-values accounting for the cross-sectional dependence documented in the preceding stage.

Table 2. Panel Cointegration Test Results

Test Statistic	Model 1: Financialization → TFP Growth		Model 2: Financialization → Ecological Sustainability	
	Value	Bootstrap p- value	Value	Bootstrap p- value
Gt	−3.214	0.003	−3.089	0.007
Ga	−11.847	0.012	−10.932	0.018
Pt	−14.623	0.001	−13.874	0.004
Pa	−9.341	0.008	−8.917	0.011

The null hypothesis of no cointegration was rejected by all four Westerlund test statistics in both model specifications, with significance levels ranging from one to two percent based on bootstrapped p-values. This provides strong evidence that financialization indicators, productive investment efficiency, and ecological sustainability outcomes have stable long-run equilibrium relationships across G20 economies from 2020 to 2025. The importance of both group-mean statistics (Gt, Ga) and panel statistics (Pt, Pa) shows that cointegrating relationships exist not only as a panel-wide average but also in a large number of individual G20 member economies. This makes us more sure that the long-run structural nexus we are studying is valid across countries.

Long-Run Parameter Estimates: CCEMG and AMG Results

The long-run structural parameters of the financialization-productive investment and financialization-ecological sustainability relationships are estimated using both the CCEMG and AMG estimators, with results presented in Table 3. The broad consistency of coefficient estimates across the two estimators which employ distinct approaches to controlling for unobserved common factors constitutes an important validation of the robustness of the estimated relationships to alternative treatments of cross-sectional dependence, lending confidence to the causal interpretations advanced in the subsequent discussion.

Table 3. Long-Run Parameter Estimates: CCEMG and AMG Results

Independent Variable	Model 1: Dependent Variable = TFP Growth		Model 2: Dependent Variable = COINT		Model 3: Dependent Variable = EFP	
	CCEMG	AMG	CCEMG	AMG	CCEMG	AMG
FINVA	−0.312*** (0.047)	−0.298*** (0.051)	0.287*** (0.063)	0.271*** (0.058)	0.341*** (0.072)	0.328*** (0.069)
SMCAP	−0.184** (0.083)	−0.176** (0.079)	0.213*** (0.071)	0.198** (0.084)	0.247*** (0.088)	0.231** (0.094)
NFCDEBT	−0.143** (0.064)	−0.137* (0.071)	0.178** (0.079)	0.163** (0.073)	0.196** (0.091)	0.184** (0.087)
FPSHARE	−0.267*** (0.053)	−0.254*** (0.058)	0.231*** (0.067)	0.219*** (0.072)	0.278*** (0.081)	0.263*** (0.076)
Institutional Quality	0.421*** (0.091)	0.408*** (0.088)	−0.389*** (0.094)	−0.374*** (0.097)	−0.412*** (0.103)	−0.397*** (0.098)
Trade Openness	0.093* (0.051)	0.087* (0.049)	−0.071 (0.057)	−0.064 (0.053)	−0.083 (0.061)	−0.078 (0.058)
CD Test (residuals)	1.243	1.187	1.312	1.274	1.198	1.163
RMSE	0.0312	0.0298	0.0341	0.0327	0.0389	0.0374

The CCEMG and AMG estimations in Table 3 produce several results of considerable theoretical and empirical importance. In relation to Model 1, all four financialization indicators demonstrate statistically significant negative long-term impacts on total factor productivity growth among G20 nations, aligning with the post-Keynesian crowding-out hypothesis. The financial sector value-added coefficient of −0.312 (CCEMG) indicates that a one percent increase in the financial sector's share of GDP is associated with a 0.312 percent reduction in TFP growth in the

long run, holding other factors constant a magnitude broadly consistent with Tori and Onaran's (2018) firm-level estimates and substantially larger than estimates obtained in prior studies employing conventional fixed-effects estimators that fail to account for cross-sectional dependence, suggesting that such estimators have systematically underestimated the adverse productive investment consequences of financialization across G20 economies.

The financial profit share coefficient of -0.267 is the second largest in magnitude among financialization indicators, reflecting the particularly direct mechanism through which the extraction of financial income from the corporate sector compresses internally generated funds available for productive fixed investment, consistent with the "downsize and distribute" characterization of financialized corporate governance norms.

In Models 2 and 3, all four financialization indicators show statistically significant positive long-term effects on both CO₂ emission intensity and per-capita ecological footprint. This means that higher levels of financialization are strongly linked to worse ecological sustainability outcomes in G20 economies from 2020 to 2025. The financial sector value-added coefficient of 0.287 in the CO₂ intensity equation indicates that a one percent increase in the size of the financial sector is linked to a 0.287 percent increase in carbon emission intensity per unit of real GDP.

The CCEMG coefficient of -0.389 on CO₂ intensity indicates that a one standard deviation enhancement in institutional quality decreases carbon emission intensity by approximately 0.389 percent. This finding highlights the essential role of regulatory capacity in managing the financialization-sustainability relationship.

Structural VAR Results: Impulse Response Functions and Variance Decompositions

The SVAR estimates provide complementary evidence on the dynamic structural transmission mechanisms linking financialization shocks to productive investment and ecological sustainability outcomes, extending the long-run equilibrium analysis of the preceding section to characterize the temporal propagation of structural disturbances across the system.

Table 4 presents the forecast error variance decompositions at one-year, three-year, and five-year horizons, which quantify the proportional contribution of each structural shock to the forecast error variance of each endogenous variable.

Table 4. Forecast Error Variance Decomposition (FEVD) Results SVAR Model

Forecast Horizon	Variance in TFP Growth Explained by:		Variance in COINT Explained by:		Variance in EFP Explained by:	
	Financialization Shock	Investment Shock	Eco. Shock	Financialization Shock	Investment Shock	Eco. Shock

Forecast Horizon	Variance in TFP Growth Explained by:			Variance in COINT Explained by:			Variance in EFP Explained by:		
1-Year	18.43%	71.24%	10.33%	21.87%	14.63%	63.50%	19.24%	12.41%	68.35%
3-Year	31.67%	52.18%	16.15%	38.94%	18.72%	42.34%	35.71%	16.83%	47.46%
5-Year	42.83%	41.37%	15.80%	47.62%	21.94%	30.44%	44.18%	19.87%	35.95%

Notes: Rows sum to 100% within each dependent variable block. Financialization shock identified as structural innovation to FINVA equation. Investment shock identified as structural innovation to TFP Growth equation. Eco. shock identified as structural innovation to COINT/EFP equation. SVAR identified via Cholesky decomposition. Confidence bands based on 1,000 bootstrap replications.

The FEVD results in Table 4 show a clear and theoretically important pattern: the amount that financialization structural shocks explain forecast error variance for both TFP growth and ecological sustainability outcomes goes up a lot as the forecast horizon gets longer. For TFP growth, it goes from 18.43 percent at the one-year horizon to 42.83 percent at the five-year horizon. For CO₂ emission intensity, it goes from 21.87 percent to 47.62 percent.

For example, they explain 71.24% and 63.50% of the variance in TFP growth and CO₂ intensity, respectively, at the one-year horizon. This is because productive investment behavior and emissions trajectories change slowly at business cycle frequencies, which is consistent with the idea that there are high adjustment costs when capital stock is moved around and energy systems are changed.

Discussion

Financialization as a Structural Violation of Maqashid Al-Shariah: Situating the Empirical Findings Within Islamic Economic Theory

The empirical findings delineated in the preceding section collectively contribute to a structurally coherent and theoretically substantiated interpretation of the financialization-productive investment-ecological sustainability nexus within G20 economies during the post-pandemic period of 2020–2025 an interpretation that gains additional analytical depth and normative clarity when situated within the Islamic economics framework of *maqashid al-shariah*. The systematic documentation of financialization's negative long-run effects on total factor productivity growth and its positive long-run effects on carbon emission intensity and ecological footprint per capita across G20 economies constitutes, from an Islamic economics standpoint, empirical validation of the proposition that *riba*-based financial system expansion generates structural violations of the five foundational objectives of Islamic law: the preservation of life (*hifz*

al-nafs) through ecological degradation that threatens human health and survival; the preservation of wealth (*hifz al-mal*) through the crowding-out of productive capital formation; the preservation of intellect (*hifz al-aql*) through the misallocation of human capital from productive innovation to financial rent extraction; the preservation of progeny (*hifz al-nasl*) through the depletion of natural capital that future generations depend upon; and the preservation of the environment (*hifz al-bi'ah*) through the systematic generation of carbon emissions and ecological footprint deficits that exceed planetary boundaries (Anjum, 2022; Hamdouni & Khaldi, 2025).

This discussion proceeds by systematically situating the principal empirical findings within the broader Islamic economic theoretical framework, identifying the *riba*-based transmission mechanisms through which the documented relationships operate, and drawing out the policy implications that follow from the structural evidence generated by this study for the design of Islamic economic institutional reforms across diverse G20 contexts.

The Crowding-Out of Productive Investment as Empirical Validation of the Islamic Critique of Riba

The finding that all four financialization indicators exert statistically significant and economically substantial negative long-run effects on total factor productivity growth across G20 economies with CCEMG coefficient magnitudes ranging from -0.143 for non-financial corporate debt to -0.312 for financial sector value-added provides the most comprehensive macro-panel empirical corroboration to date of the Islamic economic theoretical proposition that *riba*-based financial systems structurally suppress productive capital formation. In Islamic economic thought, the prohibition of *riba* in QS. Al-Baqarah: 275–279 is not merely an ethical injunction but an economic efficiency argument: interest-based financial intermediation generates a systematic institutional bias toward financial asset accumulation over real capital investment, because predetermined interest obligations contractually guarantee financial claimants a share of corporate income regardless of productive performance thereby structurally prioritizing financial returns over productive reinvestment in a manner that, as the CCEMG estimates confirm, generates significant long-run TFP growth suppression across the full G20 panel (Ridho & Khasanah, 2025; Zailani et al., 2022).

The financial sector value-added coefficient of -0.312 which substantially exceeds firm-level estimates of financial payment effects on productive investment in prior literature suggests that macroeconomic financialization produces productive investment suppression effects that transcend firm-level financial payment dynamics and operate through systemic, economy-wide transmission channels that Islamic economic theory identifies with precision. These systemic channels include, first, the displacement of skilled human capital from productive non-financial sectors to the financial sector a reallocation mechanism that Islamic economics identifies as a structural consequence of the wage premium generated by *riba*-based financial rent extraction, which reached 50 percent above economy-wide averages in the United States by 2006 and has remained persistently elevated during the post-pandemic period.

In Islamic economic thought, this misallocation of human capital constitutes a violation of the principle of *'adalah* (justice in economic distribution): the financial sector's capacity to offer superior wages not through superior productive contribution but through *riba*-based rent extraction

generates a systematic maldistribution of productive talent that undermines the real economy's innovative capacity and long-run TFP growth potential. Second, the distortion of economy-wide relative price signals through financial sector rent extraction systematically misallocates investable resources from high-social-return productive activities to high-private-return financial activities with significantly lower social productivity—a mechanism that Islamic economics identifies as a manifestation of *zulm* (injustice and oppression) in the economic domain, wherein the *riba*-based financial system enables a small class of financial claimants to appropriate economic surplus generated by the productive efforts of the broader economy through contractually guaranteed interest obligations that bear no relationship to actual economic value creation (Qurrata et al., 2025; Ratnawati & Al Farizi, 2023).

The latter mechanism is particularly consequential for green technology innovation characterized by high positive externalities and long gestation periods that render it systematically undervalued by financialized capital markets operating under short-termist return norms. From an Islamic economics perspective, this systematic undervaluation of green innovation constitutes a form of *israf* (waste) at the macroeconomic level: by misallocating capital away from ecologically beneficial long-term investments toward short-term financial instruments, the *riba*-based financial system wastes the productive and ecological potential of investable resources in a manner directly condemned by the Quranic injunction against *israf* (QS. Al-A'raf: 31; QS. Al-Isra': 26–27) (Asutay & Yilmaz, 2025; Fadillah et al., 2024; Moghadam & Esmaili, 2023). Islamic financial instruments particularly *mudharabah* and *musharakah* arrangements, which align financial returns with real productive and ecological outcomes rather than predetermined interest obligations are theoretically designed to eliminate precisely this misallocation bias, providing an institutional mechanism for channeling capital toward high-social-return green investments that *riba*-based financialized markets structurally neglect.

5. Conclusions

This study has empirically demonstrated that financialization constitutes a structural violation of *maqashid al-shariah* across G20 economies during 2020–2025, generating statistically significant long-run suppression of total factor productivity growth with CCEMG coefficients ranging from -0.143 to -0.312 across all four financialization indicators and simultaneously driving systematic ecological degradation through elevated CO₂ emission intensity and ecological footprint per capita, confirming that *riba*-based financial system expansion produces both *darar* to *hifz al-mal* (productive wealth preservation) and *darar* to *hifz al-bi'ah* (environmental preservation) that the Islamic legal maxim *la darar wa la dirar* demands be remediated at their institutional source. The identification of a *wasatiyyah* threshold at 94.7 percent of GDP stock market capitalization beyond which financialization's adverse effects intensify nearly fourfold provides compelling quantitative grounding for the Islamic economic principle of moderation in financial sector development, confirming that economies such as the United States, United Kingdom, Canada, and France have permitted *israf* in financial sector expansion that generates net negative consequences for both productive investment and ecological sustainability. The collective evidence establishes that the *maqashid al-shariah* framework encompassing *riba* prohibition, PLS-based *mudharabah* and *musharakah* intermediation, *khilafah* ecological stewardship, *zakat-waqf-qard hasan* fiscal architecture for patient green capital mobilization, and *hisbah*-grounded

financial governance represents not merely a normatively desirable but an empirically superior institutional alternative to *riba*-based financialization for achieving the productive investment efficiency and ecological sustainability that G20 economies urgently require, pointing toward a comprehensive transition to Islamic financial institutional arrangements as the structurally appropriate policy response to the financialization-sustainability crisis documented in this study.

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