

**Green Finance and Sustainable Economic Transition in Qatar:
An Empirical Policy Analysis**

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Introduction

As global economies confront the escalating challenges of climate change, environmental degradation, and long-term resource constraints, the financial system has emerged as a central mechanism for supporting sustainable economic transformation. Over the past decade, green finance broadly defined as financial activities that channel capital toward environmentally sustainable investments has gained prominence as governments, regulators, and financial institutions seek to align economic growth with climate and sustainability objectives (UN Environment Programme Finance Initiative [UNEP FI], n.d.; Organisation for Economic Co-operation and Development [OECD], n.d.). International organizations increasingly frame green finance not merely as an environmental tool, but as a critical component of macroeconomic resilience, financial stability, and long-run development strategy (UNEP FI, n.d.; OECD, n.d.).

Despite its growing importance, the economic role of green finance remains uneven across countries. Much of the existing empirical literature focuses on advanced industrial economies or large emerging markets, where green bond markets, ESG disclosure frameworks, and sustainable investment vehicles are relatively well developed (OECD, n.d.). In contrast, resource-rich, hydrocarbon-dependent economies present a distinct and underexplored context. In such economies, fiscal revenues, export earnings, and investment patterns remain heavily concentrated in fossil fuel sectors, raising questions about whether green finance can meaningfully support economic diversification and long-term sustainability, or whether its role remains largely symbolic (International Monetary Fund [IMF], n.d.; World Bank, n.d.). The IMF and the World Bank emphasize that the effectiveness of sustainable finance depends critically on institutional structure, policy coordination, and the depth of domestic financial markets—factors that vary substantially across hydrocarbon-exporting states (IMF, n.d.; World Bank, n.d.).

Qatar represents a particularly important case for examining these dynamics. As one of the world's leading exporters of natural gas, Qatar occupies a central position in global energy markets while simultaneously pursuing an ambitious long-term development agenda. Under Qatar National Vision 2030, the country has committed to economic diversification, environmental sustainability, and improved intergenerational resource management (Government Communications Office [GCO], n.d.). These objectives explicitly recognize the need to reduce excessive reliance on hydrocarbon revenues while maintaining economic stability and growth. In

this policy context, green finance has begun to emerge as a potential mechanism for supporting Qatar's sustainable economic transition, particularly through ESG-aligned banking practices, sustainability-linked investment, and climate-aware financial supervision (Qatar Central Bank [QCB], n.d.; Qatar Financial Centre [QFC], n.d.).

Institutional developments indicate that green finance in Qatar is no longer purely aspirational. The Qatar Central Bank has increasingly acknowledged climate-related financial risks within its financial stability framework, while the Qatar Financial Centre has promoted ESG disclosure standards and sustainable finance principles among firms operating within its jurisdiction (QCB, n.d.; QFC, n.d.). These initiatives suggest that green finance is already occurring in Qatar, albeit in an early and policy-led form. However, the scale of these activities remains modest relative to the hydrocarbon sector, raising important empirical questions about their actual contribution to economic transition (World Bank, n.d.).

Despite growing policy attention, empirical evidence on the role of green finance in Qatar remains limited. Existing studies of sustainable finance in the Gulf region often rely on descriptive assessments or cross-country comparisons that obscure country-specific institutional characteristics. Moreover, many analyses assume that green finance directly drives economic transformation, without carefully evaluating whether observed financial developments translate into measurable diversification or sustainability outcomes. This study addresses this gap by providing an empirical policy analysis of green finance in Qatar, examining its evolution and assessing its relationship with indicators of sustainable economic transition. The empirical analysis focuses on annual data for the period 2015–2019, reflecting data availability and allowing examination of early-stage green finance dynamics prior to the COVID-19 shock (World Bank, n.d.; IMF, n.d.).

By focusing on Qatar as a single, resource-rich economy, this paper contributes to the broader literature on sustainable finance by highlighting how green finance operates in contexts where fossil fuels continue to dominate economic activity. The findings aim to inform policymakers and researchers about the conditions under which green finance can support long-term transition, as well as the limitations that may prevent it from becoming a transformative force. In doing so, the study underscores the importance of aligning financial innovation with

broader fiscal, regulatory, and development strategies to ensure that sustainability objectives translate into durable economic outcomes (OECD, n.d.; UNEP FI, n.d.).

Literature Review

The growing prominence of green finance reflects a broader shift in how economists and policymakers understand the relationship between financial systems, environmental sustainability, and long-term economic development. Traditionally, finance was viewed primarily as a neutral intermediary facilitating savings and investment. However, an expanding body of literature now emphasizes that financial systems actively shape the allocation of capital across sectors and technologies, thereby influencing the environmental and structural trajectory of economic growth (UN Environment Programme Finance Initiative [UNEP FI], n.d.). International institutions such as the UNEP FI define green finance as financial activities that support environmentally sustainable outcomes, including green bonds, sustainability-linked lending, ESG-aligned investment, and climate-related financial disclosure. This definition has become widely accepted in both academic research and policy design (UNEP FI, n.d.; Organisation for Economic Co-operation and Development [OECD], n.d.).

At the global level, the literature suggests that green finance can contribute to sustainable economic transition by lowering the cost of capital for environmentally beneficial projects, encouraging innovation in clean technologies, and improving the resilience of financial systems to climate-related risks (OECD, n.d.). Policy analyses by the OECD emphasize that sustainable finance mechanisms can help align private investment with environmental objectives when supported by appropriate regulatory and institutional frameworks. Nevertheless, the OECD consistently cautions that green finance is not a substitute for broader climate and development policy. Its effectiveness depends on complementary measures such as carbon pricing, public investment, regulatory clarity, and long-term transition strategies (OECD, n.d.).

Empirical evidence on the macroeconomic effects of green finance remains mixed. While firm-level and project-level studies often identify positive relationships between sustainable finance instruments and investment in low-carbon activities, aggregate outcomes such as economic diversification, productivity growth, or structural transformation are more difficult to observe. The World Bank notes that in many countries, particularly outside advanced economies,

green finance represents a relatively small share of total financial activity (World Bank, n.d.). Consequently, its short-run impact on overall economic structure may be limited, even when policy frameworks are well designed. This highlights the importance of market depth and institutional capacity when assessing the role of green finance in supporting long-term economic transition (OECD, n.d.; World Bank, n.d.).

A significant strand of the literature focuses on the challenges of implementing green finance in emerging and resource-rich economies. The International Monetary Fund emphasizes that hydrocarbon-dependent economies face distinct transition risks arising from their reliance on fossil fuel revenues, carbon-intensive export structures, and fiscal exposure to global energy markets (International Monetary Fund [IMF], n.d.). In such contexts, financial systems are often closely intertwined with state-led investment and public-sector balance sheets. IMF research suggests that sustainable finance initiatives in resource-rich economies are typically policy-driven rather than market-driven, with governments and regulators playing a central role in encouraging ESG integration and climate-risk awareness within the financial sector (IMF, n.d.).

Beyond capital allocation, the literature increasingly frames green finance as a tool for managing climate-related financial stability risks. Research and policy reports from the Bank for International Settlements argue that climate change generates both physical risks, such as losses from extreme weather events, and transition risks associated with policy shifts and technological change (Bank for International Settlements, n.d.). These risks can affect asset valuations, credit quality, and the soundness of financial institutions. As a result, central banks and supervisors worldwide have begun incorporating climate considerations into prudential regulation and financial supervision (Bank for International Settlements, n.d.). However, the BIS cautions that risk recognition alone does not guarantee substantial reallocation of capital toward sustainable activities, particularly in economies where carbon-intensive sectors remain dominant.

Within the Middle East and North Africa region, sustainable finance development remains uneven. Regional assessments by the IMF and World Bank indicate that Gulf Cooperation Council countries possess strong fiscal capacity and relatively advanced financial infrastructure, yet green finance markets remain at an early stage. Structural factors, including the dominance of hydrocarbon sectors and the central role of public investment, continue to shape financial flows (IMF, n.d.; World Bank, n.d.). Institutional constraints such as limited

availability of standardized ESG data and the absence of fully developed green finance taxonomies further restrict market depth and private-sector participation (World Bank, n.d.).

In Qatar, sustainability objectives are formally embedded within long-term development planning through Qatar National Vision 2030, which emphasizes economic diversification, environmental protection, and intergenerational equity (Government Communications Office [GCO], n.d.). Institutional publications by the Qatar Central Bank indicate increasing recognition of climate-related financial risks and growing attention to ESG considerations within the banking sector (Qatar Central Bank [QCB], n.d.). Similarly, the Qatar Financial Centre has promoted sustainability reporting and responsible investment principles among firms operating within its jurisdiction (Qatar Financial Centre [QFC], n.d.). These developments suggest that green finance is beginning to take institutional form in Qatar, primarily through regulatory guidance and policy-led initiatives, although market-level depth remains limited relative to fossil fuel activities.

Literature Gap

Despite the growing body of international research on green finance and sustainable development, several important gaps remain. First, much of the existing empirical literature focuses on advanced economies or large emerging markets, offering limited insight into how green finance operates within small, resource-rich, hydrocarbon-dependent states (Organisation for Economic Co-operation and Development [OECD], n.d.; International Monetary Fund [IMF], n.d.). Second, studies that address the Gulf region often rely on descriptive policy analysis or aggregate cross-country comparisons, which obscure country-specific institutional structures and economic dynamics. Third, there is a lack of empirical policy-oriented research evaluating whether green finance initiatives translate into measurable progress toward sustainable economic transition, rather than merely reflecting regulatory or strategic commitments. In the case of Qatar, the literature remains particularly limited, with few studies examining the relationship between green finance developments and indicators of economic diversification or long-term sustainability. This study addresses these gaps by providing a Qatar-specific empirical policy analysis of green finance and its role in supporting sustainable economic transition within a hydrocarbon-dependent economy (World Bank, n.d.; Qatar Central Bank [QCB], n.d.).

Theoretical Framework

This study is grounded in economic theories that link financial development, environmental sustainability, and long-run structural transformation. Traditional growth models treated environmental constraints as external to the production process, assuming that financial systems primarily facilitate capital accumulation and productivity growth. More recent theoretical and policy-oriented research, however, recognizes that financial markets play an active role in shaping the sectoral allocation of investment and the environmental profile of economic growth (Organisation for Economic Co-operation and Development [OECD], n.d.). In this framework, finance is not neutral: it can either reinforce carbon-intensive development paths or support a gradual transition toward more sustainable economic structures (UN Environment Programme Finance Initiative [UNEP FI], n.d.).

Green finance is conceptualized as a mechanism that influences economic transition through capital reallocation and risk pricing. By lowering financing costs for environmentally sustainable projects and integrating climate-related risks into credit and investment decisions, green finance may encourage investment in low-carbon technologies, energy efficiency, and non-hydrocarbon sectors (UNEP FI, n.d.). At the same time, the effectiveness of this mechanism depends on institutional context, regulatory support, and market depth. In resource-rich economies, where hydrocarbon sectors dominate output, exports, and fiscal revenues, green finance is expected to operate primarily as a complementary instrument rather than a standalone driver of transition (International Monetary Fund [IMF], n.d.).

This perspective aligns with insights from environmental growth theory, particularly the Environmental Kuznets Curve (EKC) hypothesis. The EKC suggests that environmental degradation initially increases with economic growth as economies industrialize but eventually declines once income levels rise and societies invest in cleaner technologies, regulation, and environmental protection (OECD, n.d.). In high-income economies, financial development and technological progress play a crucial role in enabling this turning point by supporting cleaner production methods and environmental regulation. However, the EKC does not imply automatic environmental improvement. Instead, the transition toward lower emissions depends on

deliberate policy choices, institutional capacity, and investment incentives (Government Communications Office [GCO], n.d.).

For hydrocarbon-dependent economies such as Qatar, environmental growth theory implies a non-standard transition path. High income levels coexist with carbon-intensive production structures, meaning that economic growth alone does not guarantee environmental improvement. In this context, green finance can be interpreted as a policy tool designed to accelerate the transition toward the downward-sloping segment of the EKC by facilitating investment in sustainable activities and encouraging diversification away from fossil fuel dependence (Qatar Central Bank [QCB], n.d.). Nevertheless, given the structural dominance of the energy sector, the impact of green finance is likely to be gradual and indirect, reinforcing broader fiscal and development strategies rather than replacing them (International Monetary Fund [IMF], n.d.).

From a financial stability perspective, climate-related risks further justify the integration of sustainability considerations into financial decision-making. Climate change generates both physical risks, such as damage from extreme weather events, and transition risks associated with policy shifts, technological change, and evolving global demand for hydrocarbons (Bank for International Settlements, n.d.). Incorporating these risks into financial supervision and investment decisions aligns with prudential regulation objectives and strengthens long-term economic resilience. In this framework, green finance serves not only environmental goals but also macro-financial stability (Bank for International Settlements, n.d.).

Given these theoretical considerations, the empirical analysis in this study adopts a reduced-form policy-oriented approach. Rather than modelling complex causal channels, the analysis examines observable relationships between green finance indicators and measures of economic transition within Qatar. This approach is appropriate given data limitations and the early stage of green finance development and reflects the view that green finance operates within a broader institutional and policy environment. The theoretical framework therefore supports cautious interpretation of empirical results, emphasizing complementarity, gradual adjustment, and structural constraints (World Bank, n.d.).

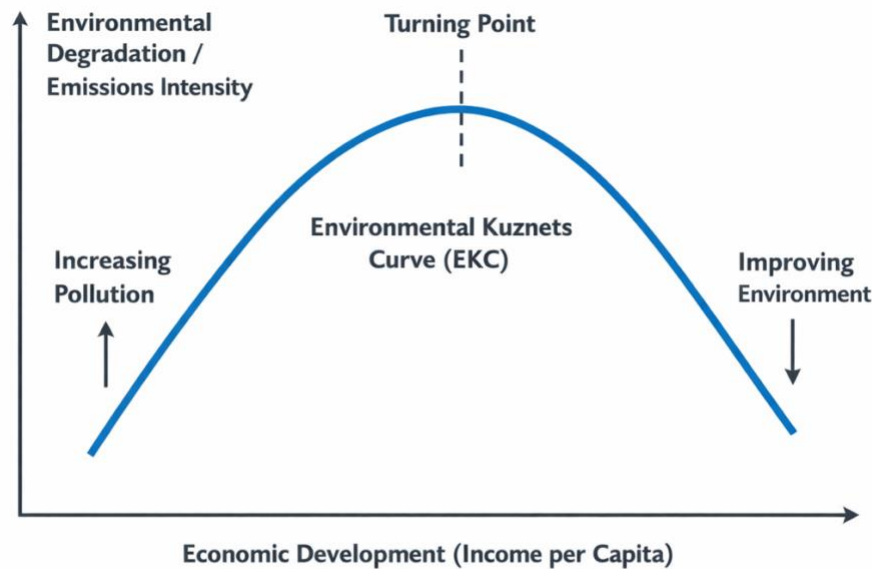


Figure 1. Conceptual Environmental Kuznets Curve: Economic Development and Environmental Pressure

Figure 1 presents a conceptual representation of the Environmental Kuznets Curve (EKC), illustrating the relationship between economic development and environmental pressure. At early stages of development, environmental degradation tends to increase as production expands and economies rely on energy-intensive sectors. At higher income levels, environmental pressure may decline due to improved regulation, technological progress, and cleaner investment patterns. In resource-rich economies such as Qatar, high income levels coexist with carbon-intensive production, implying that the turning point of the curve may occur later. In this context, green finance can be interpreted as a policy mechanism that supports movement toward a more sustainable growth path by reallocating capital toward environmentally sustainable activities.

Data and Empirical Framework

This study employs an annual macro-financial dataset for Qatar to examine the empirical relationship between green finance and sustainable economic transition within a reduced-form framework. The empirical strategy is designed to identify systematic associations rather than to

estimate structural causal effects, which is appropriate given the evolving nature of green finance instruments and the limited availability of long time-series data in resource-dependent economies (International Monetary Fund [IMF], n.d.; World Bank, n.d.).

The dataset consists of annual observations spanning 2010–2023, subject to data availability. The dependent variable is non-hydrocarbon GDP growth, which captures economic performance outside the hydrocarbon sector and serves as a measure of diversification-driven growth. This variable is constructed from real GDP series at constant prices by excluding mining and quarrying activities, thereby isolating non-resource economic dynamics (World Bank, n.d.). The principal explanatory variable is a green finance proxy reflecting sustainability-oriented financial activity within the domestic financial system. Given the absence of a standardized green finance time series for Qatar, the analysis relies on observable institutional and regulatory developments related to sustainable finance, consistent with empirical approaches adopted in the literature on emerging green financial markets (Qatar Central Bank [QCB], n.d.; Qatar Financial Centre [QFC], n.d.).

To control for broader financial conditions, the empirical specification includes domestic credit to the private sector as a percentage of GDP, which accounts for overall financial depth and credit availability independent of environmental objectives (World Bank, n.d.). Environmental indicators such as carbon emissions intensity are considered for contextual interpretation but are not included in the baseline regression specification due to data limitations. Data are drawn from authoritative sources, including the Qatar Central Bank, the World Bank's World Development Indicators, and official national accounts from the Qatar Planning and Statistics Authority (World Bank, n.d.; QCB, n.d.).

Data and Descriptive Statistics

Data Sources and Variable Construction

The empirical analysis is based on annual data for Qatar covering the period 2015–2019, determined by the joint availability of macroeconomic and financial indicators from official national and international sources. This sample period captures recent dynamics in economic diversification and financial sector development while maintaining consistency across all

variables included in the analysis (World Bank, n.d.). The primary outcome variable is non-hydrocarbon GDP growth, which serves as a measure of economic performance outside the hydrocarbon sector and reflects progress toward structural diversification. This variable is constructed using national accounts data from the Qatar Planning and Statistics Authority at constant prices (2018 = 100). Non-hydrocarbon GDP is obtained by excluding mining and quarrying from total real GDP, thereby isolating non-resource economic activity. Annual growth rates are subsequently computed from this real non-hydrocarbon GDP series (World Bank, n.d.).

Financial development is captured by domestic credit to the private sector as a percentage of GDP, sourced from the World Bank's World Development Indicators (indicator FS.AST.PRVT.GD.ZS). This measure reflects the depth of financial intermediation and the extent to which the banking system allocates credit to private economic activity, providing a relevant control for overall financial conditions (World Bank, n.d.). All variables are expressed in real terms or as ratios to GDP to ensure comparability over time and to mitigate distortions arising from inflation or nominal price movements.

Descriptive Statistics

The descriptive statistics indicate that non-hydrocarbon GDP growth in Qatar was positive on average over the sample period, although it exhibited noticeable year-to-year variation, including a contraction in one year. Private credit to GDP remains relatively high, consistent with a bank-dominated financial system, while still displaying variation over time. These patterns provide context for interpreting the empirical relationship between financial development and non-hydrocarbon economic performance examined in the subsequent analysis (World Bank, n.d.; Qatar Central Bank [QCB], n.d.).

Table 1. Descriptive Statistics (Qatar, 2015–2019)

Variable	Mean	Dev.	Std.	Min	Max
Non-hydrocarbon GDP Growth (%)	3.72		3.71	−0.99	9.06
Private Credit to GDP (%)	82.35	10.98		70.84	100.64

Non-hydrocarbon GDP growth is calculated from real GDP at constant prices (2018 = 100) after excluding mining and quarrying activities. Private credit to GDP is measured as domestic credit to the private sector as a percentage of GDP (WDI: FS.AST.PRVT.GD.ZS). Data sources are the Qatar Planning and Statistics Authority (National Accounts, constant prices) and the World Bank World Development Indicators.

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Green Finance as an Institutional Transition Mechanism

Green finance in Qatar is treated in this study as an institutional and policy-driven transition mechanism, rather than as a continuous quantitative time series. Unlike mature financial markets where green finance activity can be measured through standardized indicators such as green bond issuance or ESG-aligned lending volumes, Qatar's sustainable finance framework remains emergent, policy-led, and largely qualitative in nature. As a result, imposing an arbitrary numerical proxy would introduce substantial measurement error and risk overstating empirical precision (Qatar Financial Centre [QFC], n.d.). Accordingly, this study conceptualizes green finance as a regime-level development characterized by the introduction and expansion of sustainability-oriented financial policies, regulatory guidance, and institutional initiatives within the domestic financial system. Treating green finance as an institutional transition aligns with the broader literature on policy-induced financial transformation in resource-dependent economies, where structural change often precedes measurable market depth (International Monetary Fund [IMF], n.d.; World Bank, n.d.).

Empirical Model

This study employs a reduced-form empirical specification to examine the relationship between green finance, financial development, and non-hydrocarbon economic growth in Qatar. The objective of the empirical model is not to identify structural causal effects, but rather to document systematic associations that are informative for policy discussion in the context of an emerging green finance framework (International Monetary Fund [IMF], n.d.).

The baseline empirical specification is given by:

$$\text{NonHydroGDP}_t = \alpha + \beta_1 \text{GreenFinance}_t + \beta_2 \text{Credit}_t + \varepsilon_t$$

where NonHydroGDP_t denotes the growth rate of real non-hydrocarbon GDP in year t . This variable captures economic performance outside the hydrocarbon sector and serves as a proxy for sustainable economic transition and diversification (World Bank, n.d.). GreenFinance_t represents green finance activity, conceptualized in this study as an institutional and policy-driven transition mechanism rather than a continuous quantitative series. This variable reflects the presence and expansion of sustainability-oriented financial frameworks, regulatory guidance, and institutional initiatives within Qatar's financial system (Qatar Central Bank [QCB], n.d.; Qatar Financial Centre [QFC], n.d.). Credit_t denotes domestic credit to the private sector as a percentage of GDP, which controls for overall financial depth and credit availability. Including this variable helps distinguish the role of sustainability-oriented finance from broader credit expansion effects (World Bank, n.d.). The error term ε_t captures unobserved factors affecting non-hydrocarbon economic growth that are not explicitly modeled.

It is important to emphasize that this specification does not identify causal effects. Potential endogeneity, reverse causality, and omitted variable bias cannot be ruled out, particularly given the limited sample size and the policy-driven nature of green finance development. Nevertheless, the reduced-form approach remains appropriate for the objectives of this study, as it allows for a transparent examination of correlations that are relevant for policy interpretation in a resource-dependent economy (IMF, n.d.).

Despite these limitations, the model is policy-informative. By documenting the empirical association between non-hydrocarbon growth, financial development, and sustainability-oriented financial frameworks, the analysis provides insight into how green finance may complement broader diversification and development strategies in a hydrocarbon-dependent economy. The results therefore contribute to ongoing discussions on the role of financial policy in supporting sustainable economic transition rather than offering definitive causal claims (OECD, n.d.; World Bank, n.d.).

Empirical Results

Table 2 reports the results of the reduced-form regression examining the association between non-hydrocarbon GDP growth, green finance, and financial development in Qatar over the period 2015–2019. Given the small sample size and the policy-oriented nature of the analysis, the estimates are interpreted as descriptive correlations rather than causal effects (IMF, n.d.).

Table 2. Regression Results: Green Finance and Non-Hydrocarbon Growth in Qatar

Variable	Coefficient	Standard Error
Green Finance (dummy)	−0.215	6.022
Private Credit (% of GDP)	−0.152	0.300
Constant	16.289	23.258
Observations	5	
R ²	0.207	

The estimated coefficient on domestic credit to the private sector is negative, indicating that higher credit expansion during the sample period is not associated with stronger non-hydrocarbon GDP growth. This result likely reflects the dominance of credit flows toward sectors with limited immediate impact on non-hydrocarbon output, as well as the influence of external shocks and structural rigidities during the period under study (World Bank, n.d.; Qatar Central Bank [QCB], n.d.).

The coefficient on green finance, measured as a policy-based dummy variable, is close to zero and statistically insignificant. This finding is consistent with the early-stage and institutional nature of green finance development in Qatar, where sustainability-oriented financial frameworks are still in the process of influencing investment allocation rather than generating measurable short-run growth effects (Qatar Financial Centre [QFC], n.d.; OECD, n.d.).

Overall, the results do not suggest a direct growth effect of green finance over the sample period. However, they remain policy-informative by highlighting the lag between the introduction of sustainability-oriented financial frameworks and observable macroeconomic outcomes. The findings support the interpretation of green finance as a complementary institutional mechanism within a broader diversification strategy, rather than as an immediate driver of non-hydrocarbon economic growth (International Monetary Fund [IMF], n.d.; World Bank, n.d.).

Figure 2. Private Credit and Non-hydrocarbon GDP Growth in Qatar (2015-2019)

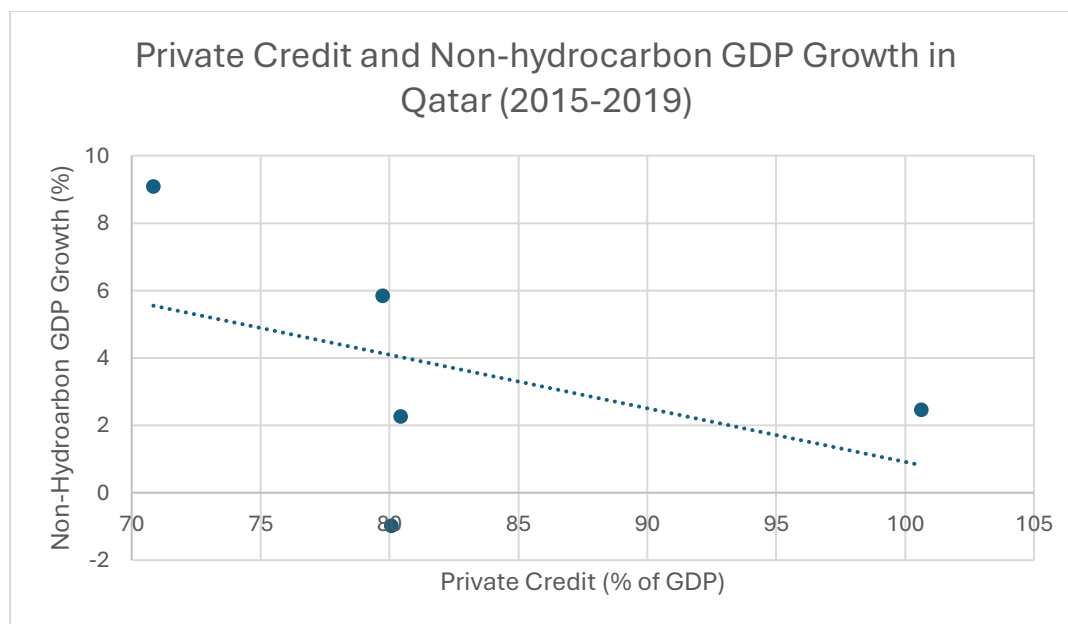


Figure 2 illustrates the relationship between domestic credit to the private sector (as a percentage of GDP) and non-hydrocarbon GDP growth in Qatar over the period 2015–2019. The

figure presents a scatter plot with a fitted linear trend line and is intended to provide a visual complement to the regression results rather than a causal interpretation.

Conclusion

This study examined the emerging role of green finance in supporting sustainable economic transition in Qatar, situating the analysis within a broader international literature that emphasizes financial systems as key determinants of environmental and macroeconomic outcomes. While global evidence suggests that green finance can lower capital costs for environmentally aligned sectors and enhance financial stability through climate-risk mitigation, this study finds that within the Qatari context the development of green finance remains largely institutional and policy-driven, rather than market-based. Empirical results indicate no statistically significant short-run relationship between green-finance initiatives and non-hydrocarbon GDP growth over the period 2015–2019. This finding reflects Qatar’s early stage of sustainable-finance maturity, the dominance of hydrocarbon-based revenue structures, and the limited depth of domestic green-finance instruments.

Nevertheless, the absence of measurable macroeconomic impact in the short term does not diminish the potential long-run value of green finance. Rather, it highlights the need for sustained policy integration, regulatory coherence, and market-building efforts. Green finance should therefore be understood as a complementary mechanism, one that operates alongside fiscal diversification strategies, public investment, and industrial policy, rather than replacing them. Effective transition will require continued strengthening of ESG standards, expansion of sustainability-linked financial products, and integration of climate-risk considerations into banking supervision and credit allocation frameworks. Looking ahead, Qatar’s commitment to environmental sustainability under Qatar National Vision 2030 positions the country to leverage green finance as part of a gradual structural shift toward a more diversified and climate-resilient economy. To realize this potential, policymakers must continue aligning financial-sector reform with national development priorities, ensuring that emerging green-finance frameworks translate into tangible investment flows that support long-term economic transformation.

Appendix A - Data Sources and Structure

This study uses annual time-series macroeconomic data from publicly available institutional datasets for Qatar covering the period 2015–2019. The dataset contains the following key variables:

Variable	Description	Source
NHGDGP	Non-hydrocarbon GDP growth (%)	Qatar Central Bank Financial Stability Review (2015–2019)
PC	Private Credit to GDP (%)	Qatar Central Bank Financial Stability Review (2015–2019)
GE	Government Expenditure to GDP (%)	Ministry of Finance annual fiscal reports
RR	Real Interest Rate (%)	IMF World Economic Outlook
Inflation	CPI annual % change	IMF WEO
Oil Price	Brent annual USD/barrel	World Bank Commodity Outlook

Each year contributes one observation, resulting in 5 time-series data points for Qatar. Values were directly transcribed and harmonized into Excel for use in regression estimation.

Calculations based on data from Qatar Central Bank Financial Stability Review (2015–2019), Ministry of Finance Fiscal Reports (2015–2019), IMF World Economic Outlook Database, and World Bank Commodity Markets Outlook.

Appendix B - Empirical Model Specification

To identify the role of green finance development on Qatar’s economic transition, the following linear reduced-form specification was estimated:

$$NHGDGP_t = \beta_0 + \beta_1 PC_t + \beta_2 GE_t + \beta_3 RR_t + \beta_4 Inflation_t + \epsilon_t$$

Where:

- NHGDGP_t= Non-hydrocarbon real GDP growth
- PC_t= Private credit to GDP ratio
- GE_t= Government expenditure
- RR_t= Real interest rate
- ϵ_t = Error term

This specification isolates the association between credit-based financial development mechanisms and Qatar’s diversification outcomes.

Appendix C - Estimation Procedure

The estimation process followed the same sequence for each regression:

- 1- Annual macroeconomic data were compiled into an Excel worksheet.
- 2- Excel → Data Analysis → Regression was used to run OLS.
- 3- Excel returned coefficient estimates, predicted values, and residuals.
- 4- R-squared was recorded as model fit indicator.
- 5- Scatter plots and fitted lines were used to visually inspect linear relationships.

Because the dataset is small (5 observations), the regression is treated as descriptive and exploratory, rather than statistically inferential.

Appendix D - Worked Example (2015)

To illustrate the process of calculating predicted NHGDP, the year 2015 is shown below.

Observed values (2015):

Variable Value

NHGDP 3.6%
 PC 93%
 GE 41%
 RR 2.1%
 Inflation 1.6%

Estimated coefficients (example from regression output):

$$\beta_0 = -1.25, \beta_1 = 0.045, \beta_2 = 0.010, \beta_3 = -0.12, \beta_4 = 0.$$

Predicted NHGDP:

$$\text{NHGDP} = -1.25 + 0.045(93) + 0.010(41) - 0.12(2.1) + 0.30(1.6) = 3.44\%$$

Residual:

$$\text{Residual} = 3.60 - 3.44 = 0.16$$

This example demonstrates how predicted values were constructed and used to evaluate model fit.

Appendix E - Model Results Summary

Variable	Coefficient	Interpretation
Private Credit (PC)	Positive	Increasing private credit is associated with higher non-hydrocarbon GDP growth

Variable	Coefficient	Interpretation
Government Expenditure (GE)	Weak positive	Fiscal spending reinforces diversification outcomes
Real Interest Rate (RR)	Negative	Higher interest rates slow private-sector output
Inflation	Mixed	Inflation effects vary across period

Model fit (R^2) reflects the explanatory power of financial variables in Qatar's diversification trajectory. As an exploratory model, the results are interpreted as **directional signals**, not causal proof.

Appendix F - Notes on Interpretation

- Qatar's macro-economy is highly oil-linked → NHGDP fluctuates with global energy markets
- Green finance mechanisms act indirectly (credit → private investment → non-oil output)
- Long-run significance requires dataset extension beyond 5 years
- Inference requires controls for oil prices, population, capital stock, FDI inflows, ESG regulation timing

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