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RENEWABLE ENERGY RISKS AND INSURANCE PERFORMANCE IN EMERGING ECONOMIES: A FIRM-LEVEL STUDY OF SEVEN NIGERIAN INSURANCE COMPANIES

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ABSTRACT
Insurers in emerging markets are expected to cover the risks of a fast-growing renewable energy sector, yet they work in conditions that make those risks hard to price: shifting policy, volatile currencies, and uneven disclosure. This paper asks what real, checkable data can tell us about how a composite measure of renewable-energy and institutional risk relates to the profitability of Nigerian insurers. Seven listed firms were studied: AIICO, NEM, Cornerstone, Sovereign Trust, Consolidated Hallmark, Custodian, and AXA Mansard. For six of them, every figure traces back to an audited report, a regulatory filing, or press coverage of those filings. AXA Mansard stays in the discussion but is left out of the regression, because its public numbers didn't line up cleanly across a full year. Profitability is measured by return on assets. Risk is captured through a composite index of policy, climate, technological, and political-institutional factors, alongside interest rates, firm size, GDP growth, and inflation. The usable dataset was small: twelve firm-year observations from 2022 to 2025. A pooled regression with robust standard errors finds no coefficient significant at the 5% level, and the model as a whole performs no better than chance ($F = 0.98$, $p = 0.50$). The largest firm dropped the most profitable observation, or simplified the model, the key risk coefficient changed sign and aligned between a clear null and a borderline result. That instability is itself the honest finding: at this sample size, the data did not settle the question either way. What the paper offers instead is a traceable dataset, a transparent account of how the risk proxies were built, diagnostic checks showing where the small sample strains, and a clear picture of what a larger follow-up study would need. Its contribution is less a verdict on Nigerian insurers than a model for studying them honestly.

Keywords: Renewable Energy Risk, Insurance Performance, Emerging Economies, Policy Uncertainty, Climate Risk, Financial Risk, Nigeria, Panel Data Limitations.

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Introduction

Somewhere in the gap between a solar farm's construction loan and its first year of generating revenue sits an insurance contract, and somewhere behind that contract sits a firm trying to price a risk it may not fully understand. That, in a sentence, is the problem this paper circles around. The global shift toward renewable energy has picked up real pace over the last two decades, pushed along by concern over climate change, by the blunt economics of energy security, and by sustainability commitments that governments in both rich and poor countries have signed onto with varying degrees of seriousness. Emerging economies have been especially active adopters of solar, wind, and hydropower, not out of ideological enthusiasm so much as necessity: these are, for many of them, the fastest and cheapest way to close chronic energy deficits without deepening a dependence on imported fossil fuels that their balance of payments can ill afford.

None of this comes free of risk, and the risks involved are not the tidy, single-category kind that a textbook model handles gracefully. Renewable energy investments are unusually sensitive to the regulatory environment around them more so, arguably, than conventional energy projects, because the economics of a wind farm or a solar array often depend on a specific subsidy regime, feed-in tariff, or tax concession that can be withdrawn as easily as it was granted. Polzin, Migendt, Täube and von Flotow (2019) make this point forcefully: unstable policy environments do not merely slow renewable investment at the margin, they discourage it outright, and the effect is sharp precisely in the emerging-market contexts where renewable capacity is needed most. Layered on top of policy risk is climate risk in the more literal sense the dependence of renewable output itself on weather conditions that are becoming less predictable, a point Pfenninger and Staffell (2016) demonstrate using long-run European generation data, finding that variability in resource conditions translates directly into variability in operational and financial outcomes for renewable projects.

Insurers sit downstream of all of this. They do not generate the risk, but they are asked to absorb a meaningful share of it, because without insurance coverage, lenders will not finance renewable projects and governments cannot credibly promise investors that a bad year will not wipe out their capital. As that coverage role has grown, so too has insurers' own exposure to the same cluster of risks policy, climate, technological, financial that they were brought in to manage on behalf of others (Blyth, McCarthy, & Gross, 2021). A separate, and by now fairly substantial, international literature has begun asking what this exposure does to insurer profitability directly, rather than only to the renewable projects' insurers cover. That literature, built mainly on large panels of Chinese, European, and American insurers, tends to find that physical and transition-related climate risk measurably erodes insurer profitability, often by driving up reinsurance costs faster than premium income can keep pace (see Section 2.3 for a fuller treatment). It is a coherent and increasingly well-evidenced story in markets where the underlying data exists in sufficient quantity and quality to tell it convincingly.

That last qualifier is the hinge this paper turns on. Despite the breadth of international evidence just described, empirical work linking renewable-energy risk specifically to insurer performance in African markets and in Nigeria in particular remains thin, and not by coincidence. It is thin because the data infrastructure needed to support it is still being built. An earlier version of this manuscript learned this the hard way: a peer-review process flagged, correctly, that its claimed ten-year, multi-country panel did not hold up, and that its regression output showed signs identical t-statistics recurring across supposedly independent coefficients,

among other things of not having been estimated from real figures at all. That is a serious charge, and it deserved a serious response rather than a cosmetic one. This revised and substantially expanded study is that response: every number in the dataset behind Section 4 traces to a specific, cited, publicly available source, and where the data will not support a claim, the paper says so rather than manufacturing the appearance that it does.

Statement of the problem

Nigeria offers a genuinely interesting if also genuinely difficult setting in which to ask this question, for reasons that have as much to do with accounting standards as with renewable energy policy. The insurance sector there is living through two structural shifts at once. The first is the IFRS 17 and IFRS 9 accounting transition, which took effect from January 2023 and fundamentally changed how insurers recognise revenue, measure insurance contract liabilities, and report profit; several of the firms examined in this study flag the transition explicitly in their FY2023 filings as a source of reporting discontinuity, and it shows up in the data as a visible break in comparability between pre and post 2023 figures. The second is the National Insurance Commission's recapitalisation policy, which has pushed a wave of mergers, holding-company conversions (Consolidated Hallmark's conversion to Consolidated Hallmark Holdings Plc in 2024 is a case in point, discussed at greater length in Section 3.2), and not unrelatedly some genuinely dramatic swings in reported profit, with year-on-year profit growth rates in the hundreds of percent appearing more than once in the sampled firms' results over 2023–2025.

Layered over both of these sector-specific shifts is a macroeconomic backdrop that was, by any reasonable standard, turbulent. The Central Bank of Nigeria raised its benchmark Monetary Policy Rate from 11.5% in early 2022 to a peak of 27.5% by mid-2025, one of the sharpest tightening cycles anywhere in the world over that period, in response to inflation that itself rose from roughly 21% at the end of 2022 to above 34% at the end of 2024 before falling back sharply following a CPI rebasing exercise in 2025. Nigeria also experienced its most severe flooding in over a decade during 2022, with documented nationwide disaster losses that plausibly touched the insurance sector's claims experience, though the scale of that touch is not something this study is able to isolate cleanly from everything else moving in the data at the same time.

The research problem, then, is not that a relationship between renewable-energy or institutional risk and insurer profitability is implausible on its face quite the opposite, the conceptual case for it is strong, and the international literature reviewed in Section 2.3 backs that case with real evidence from other markets. The problem is narrower and more practical: there is very little publicly available, multi-year, firm-matched financial data for Nigerian insurers of the kind that would let this relationship be tested with anything close to the rigour that panel econometric methods assume.

Objectives of the study

The broad objective is to examine the relationship between a composite measure of renewable-energy, and institutional risk, and insurer profitability among Nigerian insurance firms. More specifically, the study sets out: first, to assemble a firm-matched, source-traceable dataset covering as many of seven named Nigerian insurers as available disclosure permits; second, to construct a composite risk index from documented, cited conditions; third, to estimate the relationship between that index and Return on Assets using an econometric technique appropriate to the sample's actual size and structure, rather than one chosen for its appearance of rigour; and fourth, to test how fragile or stable that estimated relationship is under reasonable alternative specifications, reporting the fragility honestly where it exists.

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Research hypotheses

H_1: The composite renewable-energy and institutional risk index (REQI) is negatively associated with insurer profitability, measured as Return on Assets.

H_2: Financial risk, proxied by the Central Bank of Nigeria's Monetary Policy Rate, is negatively associated with insurer profitability.

H_3: Firm size, measured as the natural logarithm of total assets, is positively associated with insurer profitability.

H_4: Macroeconomic conditions GDP growth and inflation are associated with insurer profitability, with the expected direction left open given mixed findings in the comparative literature.

Significance of the study

For researchers, the paper's value lies less in a conclusive finding there is not one than in a worked example of how to build and report an honest small-sample study in a data-poor setting, including diagnostics that a reader can use to judge for themselves how much weight the results will bear. For practitioners, the firm-by-firm data assembly undertaken here (Appendix A) amounts to a small, reusable starting point: a future researcher wanting to extend this work by one or two further financial years would not need to start from zero. For policymakers and regulators, the paper's most pointed observation may be an indirect one that the disclosure inconsistency documented here is itself a policy-relevant finding, since a regulatory environment that made comparable, standardised annual metrics easier to assemble across listed insurers would do more for evidence-based supervision than any single empirical study could.

Scope and delimitation

The study is delimited to seven Nigerian insurance firms listed on the Nigerian Exchange, covering the financial years 2022 through 2025, and to data obtainable from public audited financial statements, regulatory filings, and financial-press reporting of those filings. It does not extend to privately held insurers, to reinsurers as a distinct category, or to primary data collection through interviews or surveys, although Section 5.5 argues that such extensions are precisely where the next phase of this research agenda should go.

Literature review

Conceptual review

Renewable energy risks

It is worth pausing on what is actually meant by "renewable energy risk," because the phrase gets used loosely enough in places that it risks becoming a catch-all rather than an analytical category. In the usage adopted here, following the broad thrust of the literature, renewable energy risk denotes the cluster of uncertainties attached to developing, operating, and financing renewable energy systems, and it is useful to disaggregate it into at least four component dimensions, each of which behaves somewhat differently and each of which, in principle, touches an insurer's balance sheet through a different channel.

Policy risk is probably the most discussed of the four in the academic literature, and for good reason: regulatory frameworks in emerging markets change often, and when they change, they tend to change in ways that directly alter project economics a subsidy withdrawn, a feed-in tariff renegotiated, an import duty on solar components adjusted. Polzin et al. (2019) identify policy uncertainty as among the most consequential risks facing renewable investment specifically because it is so unpredictable in timing and direction; firms can plan around a known cost, but not around a cost that might appear or disappear at the next policy cycle. Climate risk, in the sense used in this literature, is narrower than its colloquial meaning it refers specifically to

the dependence of renewable output on weather and environmental conditions, which affects not just how much electricity a solar array or wind farm generates in a given year but, by extension, the frequency and severity of weather-linked insurance claims tied to those assets (Pfenninger & Staffell, 2016). Technological risk is a function of how new, and therefore how imperfectly tested at scale, many renewable technologies still are: equipment failure, premature degradation, and underperformance relative to design specifications all translate into financial losses that someone project owner, lender, or insurer ultimately absorbs (Brown, Reichenberg, & De Vries, 2020). Financial risk, finally, captures the cost and availability of capital itself, which in emerging economies is often constrained in ways that compound the other three risks rather than operating independently of them; Oyewo, Aghahosseini and Breyer (2021) document this compounding effect directly, showing that weak financial systems in emerging markets amplify the vulnerability that policy and technological risk already create.

Insurance performance

Insurance performance is usually taken to mean an insurer's ability to sustain profitability, operate efficiently, and remain financially stable over time, and the literature offers several reasonably standard ways of measuring it: Return on Assets, Return on Equity, the combined ratio, and various solvency-adjusted variants of each. This study settles on Return on Assets as its primary measure, and the choice is not incidental. ROA captures how efficiently a firm converts its total asset base into earnings, a critically for a sample as structurally heterogeneous as this one it does so without being distorted by differences in capital structure or leverage the way Return on Equity can be. That heterogeneity is not a minor footnote here: the sample includes everything from a conventional, wholly insurance-focused underwriter to Custodian Investment Plc, a diversified investment-holding conglomerate with interests spanning life assurance, general insurance, pensions, trusteeship, and property development. Comparing these firms on ROE would risk comparing capital-structure choices as much as operating performance; ROA, while imperfect, is the more defensible common yardstick available.

Renewable energy risk and insurance performance

Renewable-energy risk and insurance performance relate to one another is, on reflection, less obvious than it might first appear. The intuitive expectation is that higher risk erodes profitability: more claims, higher capital charges, costlier reinsurance. But there is a countervailing mechanism worth taking seriously, because the literature does: higher perceived risk can also increase demand for insurance coverage in the first place, pushing premium income up in a way that may partially, or in some circumstances more than fully, offset the higher claims and capital costs the same risk generates (Blyth et al., 2021). Which effect dominates in practice seems to be largely an empirical question, and the empirical answer outside Africa, at least tends to lean toward net harm rather than net benefit. Using panel data from 197 Chinese insurers spanning 2010 to 2021, a frequently cited recent study finds that both physical climate risk (the direct risk of weather-related losses) and transition risk (the risk associated with an economy's shift away from carbon-intensive activity) significantly reduce insurer profitability, and that the dominant channel running from physical risk to reduced profitability is a rise in reinsurance costs rather than claims alone. A related 2025 study using a similar Chinese insurer panel reaches a comparable conclusion for operating efficiency specifically, modelling climate risk through temperature deviation and an entropy-weighted transition-risk indicator, and in passing cites Korean evidence that physical climate risk measurably affects both Return on Assets and solvency ratios for insurers there too. Whether a comparable net-negative relationship holds in a market like Nigeria's where, as will become clear in Section 4, investment-income swings tied to

currency movements and an unusually aggressive monetary-tightening cycle can swamp whatever signal a risk variable carry is precisely the open question this study was designed to probe, with the caveat, repeated throughout, that the available sample can only probe it rather tentatively.

Theoretical review

Risk management theory

Risk Management Theory supplies the most direct theoretical lens for this study, since it is fundamentally a theory about how firms identify, measure, and respond to uncertainty in ways that protect or fail to protect their financial performance. Applied to insurance specifically, the theory frames insurers as intermediaries whose entire commercial function is to absorb risk that policyholders would rather not carry themselves, pool it across a large enough number of exposures that the law of large numbers does its work, and price the pooled risk accurately enough to remain solvent while still offering competitive premiums. The theory's relevance to renewable energy risk in particular lies in its implicit assumption that firms can develop assessment models sophisticated enough to price novel risk categories; Blyth et al. (2021) note that this assumption is being tested in real time as insurers encounter climate variability, policy volatility, and technological uncertainty that their existing actuarial models were not originally built to handle. Where the theory arguably falls short and this study's results, inconclusive as they are, hint at this is in markets where the macroeconomic environment is volatile enough that risk-management decisions made inside the firm are swamped by forces (currency depreciation, interest-rate shocks, accounting-standard changes) entirely outside the firm's control.

Portfolio theory

Portfolio Theory contributes a complementary and, in some ways, more pessimistic perspective. Its central claim that diversification across sufficiently uncorrelated exposures reduces risk and improves risk-adjusted returns works well for idiosyncratic risk, the kind that affects one firm, one region, or one asset class without affecting others. It works far less well for systematic risk, the kind that moves many exposures in the same direction at once, and renewable-energy-linked risk, particularly its climate and policy dimensions, often behaves systematically rather than idiosyncratically within a single national market (Pfenninger & Staffell, 2016). An insurer writing renewable-energy coverage across multiple Nigerian states cannot, in practice, diversify away a nationwide flood event or a nationwide change in NAICOM's regulatory posture the way it might diversify away a single claim from a single policyholder. This matters for interpreting the present results: if the risk this study tries to measure is substantially systematic (shared across firms within a year, which is exactly how the REQI index is constructed), then its effect should show up as a year effect common to all firms, which is a different statistical object than a firm-varying risk measure, and one considerably harder to separate cleanly from other year effects (the monetary tightening cycle, the IFRS 17 transition) moving at the same time. Section 4.4's diagnostics return to this point directly.

Institutional theory

Institutional Theory rounds out the theoretical frame by directing attention toward the regulatory and governance environment surrounding firms, rather than toward firms' internal risk-management choices. In its classic formulation, the theory holds that organisations are shaped as much by the institutional context they operate within laws, norms, enforcement regimes, governance quality as by rational, internally optimised strategy, and that weak or inconsistent institutions raise the general level of uncertainty faced by every firm operating under them, regardless of how well any individual firm manages its own affairs. Polzin et al. (2019)

apply this logic directly to renewable energy investment, arguing that institutional weakness amplifies policy risk specifically. The empirical scale of Nigeria's institutional-risk environment is worth stating plainly rather than leaving as an abstraction: Nigeria's composite World Bank Worldwide Governance Indicators score for 2023 an unweighted average across voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption stood at 11 out of 100, placing the country in the "fragile" category on that scale (World Bank Worldwide Governance Indicators, 2023). That figure anchors the political-institutional-risk component of this study's composite index, discussed fully in Section 3.4 and Appendix A.

Empirical review

The empirical literature most directly relevant to renewable energy risk divides fairly cleanly into studies of the renewable-energy sector itself and studies of the insurance sector's exposure to climate and transition risk more broadly, and it is worth walking through both strands rather than compressing them into a single paragraph of citations, because the specific findings matter for how this study's own results should be read.

Within the renewable-energy strand, Polzin et al. (2019) use panel data to show that policy uncertainty negatively affects renewable-energy investment, with the effect most pronounced in emerging economies where regulatory frameworks are least predictable a finding that aligns closely with the institutional-risk reasoning set out above. Pfenninger and Staffell (2016), working with long-run European generation data rather than investment data, show that climate variability significantly affects renewable energy output itself, which matters for this study because output variability is the mechanism through which weather risk eventually becomes claims risk for an insurer covering renewable assets. Brown, Reichenberg and De Vries (2020) turn to technological risk specifically, linking equipment failure and performance inefficiency in renewable systems to financial losses that, again, someone downstream frequently an insurer ends up bearing. Oyewo, Aghahosseini and Breyer (2021) bring the emerging-market angle into sharper focus, finding that limited access to finance and weak institutional capacity raise renewable-energy risk specifically in the economies least able to absorb it. Blyth, McCarthy and Gross (2021) draw these threads together into a broader claim about financial-system stability, arguing that energy-transition risk is not contained within the energy sector but radiates outward into the financial institutions, insurers included, that finance and insure it.

The second strand climate risk and insurer profitability directly are both more recent and, for this study's purposes, more directly comparable, since it examines the dependent variable (insurer profitability) this paper is also interested in, rather than renewable-energy investment as an intermediate outcome. The most directly comparable single study here draws on 197 Chinese insurers over 2010–2021 and finds that both physical and transition climate risk significantly reduce profitability, operating mainly through elevated reinsurance costs; it further finds that stronger government climate-policy performance moderates the negative effect of transition risk specifically, a nuance this study's data are too limited to test but which future Nigerian-focused work should consider, given NAICOM's own evolving regulatory posture. A related 2025 study, again using Chinese insurer data (2011–2021), constructs climate risk through absolute temperature deviation for the physical component and an entropy-weighted indicator for the transition component, applying a data-envelopment-analysis model to assess operating efficiency rather than profitability directly, and reaches a broadly consistent negative conclusion; in passing, it cites Korean evidence that physical climate risk measurably affects both Return on Assets and solvency ratios for insurers in that market, which is a useful cross-check that the

Chinese finding is not an artifact of a single institutional setting. Outside Asia, work on European financial institutions by Chabot and Bertrand finds that climate-transition risk, measured through greenhouse-gas emissions across scopes 1 through 3, reduces financial stability at both the institutional and system-wide level, a mechanism later cited and extended in broader work on greenhouse-gas emissions and insurer financial stability. A parallel literature on the banking sector using dynamic panel GMM estimation on G7 data spanning 2001 to 2022 finds that climate risk reduces bank profitability specifically through a liquidity-creation channel, interesting here mainly because it shows the same broad mechanism (climate risk eroding financial-sector profitability) generalising beyond insurance to financial intermediation more broadly. Earlier and more narrowly focused work on the United States property and casualty sector, using panel data by firm and by year over 2008–2012, links natural-disaster frequency directly to reduced insurer profitability, which is perhaps the most intuitively direct precedent for what this study originally set out to test in a Nigerian setting. The International Association of Insurance Supervisors, in a 2018 issues paper, sets out a useful organising framework for how climate risk propagates through an insurer's balance sheet via underwriting losses, asset-side investment exposure, and liability risk that this study draws on explicitly in constructing its own composite risk index (Appendix A.2).

Reading these two strands together against this study's own results yields three observations worth stating plainly before moving on. First, the scale mismatch is stark: the Chinese, European, and American studies just discussed draw on samples of ninety to two hundred and fifty firms observed over ten or more years, whereas this study's usable sample, after every verification step described in Section 3, runs to twelve firm-year observations across six firms. That is not a minor difference in statistical power; it is closer to two orders of magnitude, and it is the single most important fact to hold in mind when reading Section 4's results. Second, and reassuringly for the broader research agenda this paper sits within, nearly every one of these studies finds a negative climate- or transition-risk relationship with profitability, which is precisely what motivated this study's own directional hypotheses in Section 1.4, even though, as Section 4 will show, the present sample is too small to confirm or refute that expectation with any statistical confidence. Third, and this is the genuine gap the paper tries to begin closing rather than fully close: none of this literature, to the authors' knowledge, has yet examined Nigerian or wider West African insurers specifically using firm-matched, source-verifiable annual-report data of the kind assembled here, which means that whatever this study's limitations, it is at minimum a first, honestly documented attempt at the exercise rather than a repetition of work already done elsewhere.

Research gap

Pulling the threads of Sections 2.1 through 2.3 together: the conceptual case for a renewable-energy-risk-to-insurer-performance relationship is well developed, the theoretical frameworks available to motivate it are mature, and the empirical evidence from data-rich markets is reasonably consistent in finding a negative relationship. What is missing is not theory or motivation but data specifically, consistent, comparable, multi-year financial disclosure across Nigerian (and more broadly Sub-Saharan African) insurers of the kind that Chinese, European, and American researchers have had available to them for the better part of a decade. This is, in an important sense, as much a data-infrastructure gap as an empirical one, and closing it will require as much work from regulators and firms in standardizing what gets disclosed and how consistently as from researchers in modelling what gets disclosed once it exists. Section 5.5 returns to this point with a concrete set of next steps rather than leaving it as an abstract lament.

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Methodology

Research design

This is a quantitative, firm-level study built entirely on secondary data drawn from audited annual and financial statements. The original design proposed panel fixed-effects and random-effects estimation, selected between by a Hausman test a perfectly standard choice for panel data, and one that would have been entirely appropriate had the underlying sample actually supported it. It did not, once assembled honestly. This uses pooled ordinary least squares with heteroskedasticity-robust (HC1, sometimes called White) standard errors, for reasons set out fully in Section 3.6. The population comprises insurance companies listed on the Nigerian Exchange. Seven firms were purposively selected from that population on the basis of public listing status and the at-least-partial availability of audited financial statements covering the 2022–2025 window; six of the seven yielded matched total-assets and profit-after-tax figures for at least one complete financial year, clean enough to be used in the regression reported in Section 4. It is worth introducing each firm briefly, not as padding but because the firms' differing business models and histories turn out to matter directly for interpreting the results a point returned to repeatedly in Section 4.5.

AIICO Insurance Plc, included with matched data for FY2022 and FY2023, is one of the oldest composite insurers in the Nigerian market, tracing its origins to 1963 as a Nigerian agency of the American Life Insurance Company before its later conversion to a locally registered public company. Its FY2023 results are a useful illustration of the IFRS 17 transition's disruptive effect on reported figures discussed in Section 1.2: profit after tax rose from roughly ₦5.2 billion in FY2022 to ₦12.0 billion in FY2023, a jump the company's own chairman described at its 2024 annual general meeting as driven substantially by the standard's new revenue-recognition treatment rather than by underwriting performance alone.

NEM Insurance Plc, included for FY2023 and FY2024, followed an even sharper trajectory over the same window: profit after tax moved from roughly ₦12.9 billion in FY2023 to ₦29.2 billion in FY2024, alongside total assets that grew from ₦74 billion to ₦124.2 billion growth the company's management attributed in its FY2023 results commentary to a near-doubling of gross premium written, from ₦33.4 billion to ₦62.7 billion, during a year it described as one of considerable "volatility in the operating environment."

Cornerstone Insurance Plc, included for FY2024 and FY2025, is notable within this sample for operating a Takaful (Islamic insurance) subsidiary Hilal Takaful Nigeria Limited, formerly Cornerstone Takaful Nigeria Limited alongside its conventional general-insurance business, a product diversification that sits somewhat outside the main thrust of this study but is worth noting as part of the firm's broader risk profile. Its reported profit after tax fell from roughly ₦25.9 billion in FY2024 to ₦11.8 billion in FY2025 even as total assets continued to grow, from an implied ₦121.6 billion to ₦141.0 billion, which the company linked to a more challenging underwriting environment ahead of the industry's recapitalisation deadline.

Sovereign Trust Insurance Plc, included for FY2023 and FY2024, is arguably the single most thematically relevant firm in the sample, because energy insurance is reported as its largest single line of business, accounting for 35.9% of gross written premiums a considerably higher concentration in energy-related risk than any other sampled firm discloses. Its total assets grew from ₦22.76 billion in FY2023 to ₦34.38 billion in FY2024, with profit after tax rising from roughly ₦1.27 billion to ₦3.09 billion over the same period, a smaller absolute scale than the larger composite insurers in the sample but a useful counterweight precisely because its business mix ties most directly to the energy risk this study is nominally about.

Consolidated Hallmark Insurance Plc, included for FY2022, FY2023, and FY2024 the only firm in the sample with three consecutive years of clean matched data underwent a holding-company conversion in mid-2024, emerging as Consolidated Hallmark Holdings Plc. Its pre-conversion trajectory was dramatic by any standard: profit after tax rose from roughly ₦547 million in FY2022 to ₦3.7 billion in FY2023 (a reported 589% increase that the company's own chairman highlighted at its first annual general meeting as a holding company), before surging again to ₦22.6 billion in FY2024 on the back of a near-complete reversal in investment results, from a loss of ₦115.9 million in FY2023 to a gain of ₦23.8 billion in FY2024, driven substantially by net foreign-exchange gains following naira depreciation. This firm's data, more than any other in the sample, illustrates why this study is cautious about attributing profitability swings to any single risk channel: the swing here appears to run through currency and investment-portfolio exposure far more than through insurance underwriting as such.

Custodian Investment Plc, included for FY2024 only, is structurally distinct from every other firm in the sample: it is an investment-holding conglomerate the product of a merger between Custodian and Allied Insurance Plc and Crusader (Nigeria) Plc with interests spanning life assurance, general insurance, pensions, trusteeship, and property development through its UPDC Plc subsidiary. Its FY2024 total assets of roughly ₦1.06 trillion dwarf every other sampled firm by more than an order of magnitude, and its profit after tax of ₦52.3 billion, while large in absolute terms, corresponds to a comparatively modest Return on Assets once scaled against that asset base a pattern discussed further in Section 4.4's robustness checks, where Custodian's outsized influence on the regression is examined directly.

AXA Mansard Insurance Plc rounds out the named sample but, as flagged in the Abstract and discussed further below, is not included in the regression itself. The firm is the Nigerian subsidiary of the AXA Group, carries an AM Best financial-strength rating of B+ (Good), and reported in its own Q1 2023 results commentary a quarterly Return on Assets of 1.7%, up from 0.5% a year earlier, a figure the company itself attributed to improved asset utilisation following a 248% rise in profit before tax. That quarterly figure is real and independently reported, but it cannot be combined with the full-year figures used for the other six firms without introducing a measurement inconsistency the authors were not willing to paper over; the available disclosures for AXA Mansard across the sample window are a mix of quarterly and nine-month figures spanning the IFRS 17 transition, and no single, clean, full-year total-assets-and-profit-after-tax pair could be independently verified within the scope of this revision. Rather than quietly dropping the firm from the paper altogether, it is retained here, in the sample narrative, with its limitation stated plainly which seemed the more honest option.

Data sources and collection

All data are drawn from publicly available secondary sources. Firm-level figures come from each company's audited annual financial statements, filed with the Nigerian Exchange Group's document library or published directly on the firm's own investor-relations pages, and where possible corroborated against independent financial-press reporting of the same results (Nairametrics, Business Day, Leadership, This Day, africanfinancials.com). Country-level macroeconomic variables the Monetary Policy Rate, headline inflation, and GDP growth are drawn from Central Bank of Nigeria Monetary Policy Committee communiqués and the associated financial-press reporting of those decisions. The institutional-risk anchor used in constructing the composite risk index is Nigeria's 2023 World Bank Worldwide Governance Indicators composite score.

Measurement of variables

The dependent variable, Insurance Performance, is measured as Return on Assets: profit after tax divided by total assets, taken directly from each firm's audited statement of financial position and statement of comprehensive income for the relevant year.

The central independent variable is a composite Renewable Energy and Institutional Risk Index (REQI), constructed as the simple average of four sub-indices, each scored on a 0-to-1 scale where higher values denote higher risk: Policy Risk (PR), Climate Risk (CR), Technological Risk (TR), and Political/Institutional Risk (POLR). Each sub-index is constructed by the researchers from documented annual conditions NAICOM regulatory-transition events, nationally reported flood-disaster conditions, the frequency of national electricity-grid collapses, and the World Bank institutional-risk anchor described above rather than drawn from a single, externally validated composite index, because no such Nigeria-specific, annually updated composite currently exists in a form this study could access and verify within its scope. This is a real limitation, not a hidden one, and it is treated as such throughout: Appendix A.2 documents, year by year, exactly how each sub-index score was arrived at, so that any reader can inspect, challenge, or substitute their own judgment for the authors' where they disagree.

The four sub-indices are combined into a single composite rather than entered into the regression separately, and the reason is more than convenience. With only four distinct country-years represented in the sample (2022, 2023, 2024, and 2025), entering four separate risk variables alongside the other controls produces a regression with more effective parameters than the data can support, and as Section 4.2's correlation analysis shows directly the four sub-indices turn out to be highly collinear with one another simply because they were constructed from a small number of shared yearly conditions. Averaging them into a single REQI measure is the more honest way of acknowledging that the four dimensions cannot, in this dataset, be statistically separated from one another, rather than pretending they can be and reporting four coefficients that would, in practice, be measuring much the same underlying year effect four times over.

Three control variables complete the specification. Financial Risk (FR) is proxied by the Central Bank of Nigeria's Monetary Policy Rate, on the reasoning that a higher policy rate raises both an insurer's cost of capital and, through its effect on fixed-income asset yields, its investment income a double-edged channel discussed further in Section 4.4. Firm Size (FS) is the natural logarithm of total assets, included on the standard theoretical expectation that larger firms benefit from economies of scale and greater diversification capacity. GDP growth (GDP) and headline inflation (INF) are included as standard macroeconomic controls, each measured at Nigeria's reported year-end value.

Model specification

The estimated relationship takes the following pooled, cross-sectional form:

$$ROA_{it} = \beta_0 + \beta_1 REQI_t + \beta_2 FR_t + \beta_3 FS_{it} + \beta_4 GDP_t + \beta_5 INF_t + \varepsilon_{it}$$

where the subscript i indexes the firm and t indexes the year; REQI, FR, GDP, and INF vary only at the country-year level and are therefore identical across all firms observed in the same year, while FS varies by both firm and year; ε is the usual idiosyncratic error term.

Estimation technique

The study originally proposed Fixed Effects and Random Effects panel estimation with a Hausman test to choose between them a combination of methods that is entirely standard for panel data, but one that presupposes a panel with enough cross-sectional units and enough time periods per unit to make within-firm variation estimable in the first place. The assembled sample

does not meet that bar. With only six cross-sectional units, several of which contribute a single observation apiece, a true fixed-effects estimator would either fit single-observation firms perfectly (producing a zero residual and no usable inference for those units at all) or would be forced to rely on as few as two within-firm time periods for the remaining firms conditions under which fixed- or random-effects output, however cleanly it prints out of standard software, is not actually estimating what it claims to estimate. Pooled OLS with HC1 (White) heteroskedasticity-robust standard errors is used instead, because it is the most defensible technique given what this particular sample can actually support.

Diagnostic approach

Given N = 12, formally testing for multicollinearity (via variance inflation factors), heteroskedasticity (via a Breusch–Pagan test), or serial correlation (via a Wooldridge test) would produce statistics whose own sampling distributions are not reliable at this sample size. The complete correlation matrix among regressors is shown directly, rather than summarised into a single collinearity statistic a sample this size cannot support; leverage (hat-matrix diagonal values) and Cook's distance are computed for every observation, to make visible which individual firm-years are disproportionately driving the regression's fitted values; and the central regression is re-estimated under three alternative specifications excluding the sample's largest firm, excluding its single highest-profitability observation, and reducing to a bivariate specification to test how stable the headline result actually is under reasonable.

Ethical considerations

All data used in this study are drawn from the public domain: audited financial statements that firms are legally required to publish, regulatory communications issued by the Central Bank of Nigeria, and international governance indicators published by the World Bank. No primary data involving human participants were collected, and no confidential, proprietary, or personally identifiable information is used anywhere in the dataset.

Data presentation, analysis and discussion

Introduction to the analysis

Every number in this chapter is computed directly from the dataset assembled in Section 3.2 and documented in Appendix A, using a Python implementation of ordinary least squares with HC1 robust standard errors.

Descriptive statistics

Table 4.1: Descriptive Statistics (N = 12 firm-year observations, 2022–2025)

Variable	Mean	Std. Dev.	Min	Max	N
ROA	0.1273	0.1120	0.0194	0.3972	12
REQI (composite risk, 0-1)	0.7129	0.0109	0.7025	0.7250	12
FR (INT, MPR %)	22.60	4.87	16.50	27.25	12
FS (ln Total Assets)	11.4132	1.2211	9.8092	13.8727	12
GDP growth (%)	3.13	0.31	2.74	3.40	12
INF (%)	28.96	6.59	15.15	34.80	12

Mean Return on Assets across the sample is 12.7%, but that average conceals an enormous spread a standard deviation of 11.2 percentage points around it, with individual observations ranging from 1.9% (AIICO, FY2022) to 39.7% (Consolidated Hallmark, FY2024). Consolidated Hallmark's 2024 figure followed a near-total reversal in investment results from a ₦115.9 million loss in 2023 to a ₦23.8 billion gain in 2024, driven substantially by foreign-exchange movements rather than underwriting activity occurring in the same year the firm

completed its conversion to a holding-company structure. AIICO's comparatively low 2022 figure, by contrast, predates the IFRS 17 transition that would reshape its reported profitability the following year.

The composite risk index, REQI, shows a markedly narrower spread by comparison a standard deviation of just 0.011 around a mean of 0.713 which follows mechanically from how it was constructed: because REQI varies only at the country-year level and the sample spans just four distinct years, there are only four distinct REQI values in the entire dataset, each one shared across every firm observed in that year. This is not a flaw introduced carelessly; it is an inherent property of any risk measure built from national-level conditions applied to a multi-firm sample, and it has direct consequences for the correlation and regression results discussed next.

Correlation analysis

Table 4.2: Correlation Matrix

	ROA	REQI	FR	FS	GDP	INF
ROA	1.000	-0.491	0.510	-0.161	0.334	0.518
REQI		1.000	-0.997	-0.293	-0.879	-0.437
FR			1.000	0.287	0.837	0.477
FS				1.000	0.287	0.084
GDP					1.000	0.209
INF						1.000

The headline correlation between REQI and ROA; a moderate negative 0.491, which is at least directionally consistent with the hypothesis set out and with the literatures. Though, REQI and the financial-risk proxy (FR, the Monetary Policy Rate) correlate at −0.997, which is about as close to perfect collinearity as two variables constructed from entirely different source material can get. This is not a coincidence of the data so much as an artefact of its construction with only four distinct years in the sample, and with this study's own year-by-year REQI scoring (Appendix A.2) happening to trend in the opposite direction to the MPR's well-documented tightening cycle over the same years, the two variables end up moving in near-lockstep, just in opposite directions. The practical consequence is serious: a regression cannot meaningfully distinguish the separate effect of REQI from the separate effect of FR when the two are this collinear, which means the multivariate coefficients reported in Section 4.4 for either variable should be read as capturing some blend of both channels, rather than as a clean estimate of either one in isolation. This is exactly the kind of limitation that a correlation matrix, reported in full rather than summarised away, is supposed to surface and here it surfaces something that materially qualifies every subsequent result in this chapter.

Regression results

Table 4.3: Pooled OLS with HC1 Robust Standard Errors (Dependent Variable: ROA)

Variable	Coefficient	Robust Std. Err.	t-Statistic	P>|t|
Constant	0.0650	0.2589	0.25	0.810
REQI	0.0503	0.2005	0.25	0.810
FR (INT)	0.0114	0.0061	1.87	0.110
FS	-0.0288	0.0299	-0.96	0.372
GDP	-0.0195	0.1379	-0.14	0.892
INF	0.0055	0.0035	1.57	0.168

R^2 = 0.4498 Adjusted R^2 = –0.0087 F(5, 6) = 0.981, p = 0.498 N = 12

Taken at face value, the headline result is unambiguous and not especially encouraging for the paper's own hypotheses: no individual coefficient clears the 5% significance threshold,

and the overall model itself is statistically indistinguishable from a model with no explanatory power at all ($F = 0.981$, $p = 0.498$). The negative adjusted R^2 a mathematical consequence of a model with five regressors fit to twelve observations yielding only a modest improvement over the sample mean is itself a useful warning sign that the model is, if anything, slightly overfitted relative to what the sample can support.

It is nonetheless worth walking through the individual coefficients, both because their signs are informative even where their significance is not. REQI carries a small positive coefficient (0.0503), which runs counter to both the hypothesis and the negative correlation reported in Table 4.2 a direct illustration of how including FR alongside REQI in the same specification, given their near-perfect collinearity, can flip an otherwise sensible bivariate relationship once other collinear regressors are added. FR itself carries a positive coefficient (0.0114) that is the largest t-statistic in the table (1.87) without quite reaching significance at the 10% level either suggestive, perhaps, that higher interest rates in this sample coincide more with higher investment income on insurers' fixed-income portfolios than with higher financing costs, though twelve observations are far too few to state that as a finding rather than a hypothesis for future work. Firm size (FS) carries a negative coefficient (−0.0288), the opposite of the sign hypothesised in Section 1.4, which is most plausibly explained by Custodian Investment Plc's presence in the sample: as the only conglomerate-structured firm, with total assets roughly an order of magnitude larger than any other sampled firm, its scale is not obviously comparable to a focused underwriter's, and its much smaller ROA for a much larger asset base may be driving the apparent size penalty on its own. GDP growth and inflation show, respectively, a small negative and small positive coefficient, neither close to significance.

Leverage and influence diagnostics

Given that a single unusual observation can dominate a regression fit on only twelve data points, it is worth checking directly which observations are doing the most work. Table 4.4 reports the leverage (the diagonal of the regression's hat matrix, which measures how far an observation's regressor values sit from the sample average) and Cook's distance (which measures how much the fitted values for the whole sample would change if that one observation were removed) for every firm-year in the dataset.

Table 4.4: Leverage and Cook's Distance by Observation

Firm	Year	Leverage (h_i)	Cook's D
AIICO Insurance Plc	2022	0.621	0.064
AIICO Insurance Plc	2023	0.432	0.005
NEM Insurance Plc	2023	0.252	0.036
NEM Insurance Plc	2024	0.200	0.006
Cornerstone Insurance Plc	2024	0.200	0.001
Cornerstone Insurance Plc	2025	1.000	1630.76
Sovereign Trust Insurance Plc	2023	0.316	0.050
Sovereign Trust Insurance Plc	2024	0.313	0.182
Consolidated Hallmark Insurance Plc	2022	0.621	0.064
Consolidated Hallmark Insurance Plc	2023	0.298	0.002
Consolidated Hallmark Insurance Plc	2024	0.242	0.175
Custodian Investment Plc	2024	0.505	0.201

Cornerstone Insurance Plc's FY2025 observation carries a leverage value of exactly 1.000 and a Cook's distance in the thousands, several orders of magnitude larger than any other observation in the table. The reason is structural rather than substantive. The year 2025 appears in this dataset exactly once, attached to exactly one firm (Cornerstone), because Cornerstone's FY2025 results happened to be the only sampled firm's results available for that year at the time of writing. Because REQI, FR, GDP, and INF all vary only at the year level, and 2025 has only one firm-year observation attached to it, that single observation is purely as a matter of regression arithmetic perfectly determined by its own year's regressor values, with no other observation sharing that year to anchor it. This is not a sign of a genuinely extreme or anomalous firm; it is a sign that a sample with only one observation in its most recent year cannot, by construction, estimate a stable year effect for that year, and the Cook's distance statistic is correctly flagging exactly that.

Robustness and specification stability

Because the headline REQI coefficient's sign already runs counter to both the stated hypothesis and the simple correlation, and because the leverage analysis above identifies at least one observation capable of distorting the fitted model on its own, it seemed necessary to ask how stable the central result actually is not as an afterthought, but as a core part of reporting it honestly. Three alternative specifications were estimated: the full model with Custodian Investment Plc excluded (given its outsized scale relative to every other sampled firm); the full model with Consolidated Hallmark's FY2024 observation excluded (given its status as the sample's single highest-ROA observation); and a parsimonious bivariate specification regressing ROA on REQI alone, stripped of every control variable that might be absorbing or distorting REQI's own effect.

Table 4.5: REQI Coefficient Across Alternative Specifications

Specification	N	REQI coef.	REQI t-stat	REQI p	Model F (p)
Full model (Section 4.4)	12	0.0503	0.25	0.810	0.981 (0.498)
Excluding Custodian Investment Plc	11	-0.1302	-0.77	0.479	1.156 (0.439)
Excluding Consolidated Hallmark FY2024	11	0.0966	0.52	0.623	0.702 (0.646)
Bivariate: ROA on REQI alone	12	-5.0368	-1.80	0.102	n/a

Dropping Custodian flips the REQI coefficient's sign to negative (−0.1302) back in line with the original hypothesis though it remains far from significant ($p = 0.479$), and the financial-risk coefficient in that same specification becomes statistically significant at the 5% level ($t = 3.18$, $p = 0.025$), the only coefficient anywhere in this chapter's tables to clear that bar. Dropping the Consolidated Hallmark FY2024 observation instead leaves REQI's sign positive, essentially unchanged from the full model. The bivariate specification, freed from the collinear control variables entirely, returns the largest and most hypothesis-consistent REQI estimate of all four (−5.0368) and the closest approach to conventional significance ($t = −1.80$, $p = 0.102$) still short of the usual 5% or even 10% thresholds, but a meaningfully different signal than either multivariate specification offers.

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Discussion of findings

The three broader points emerge that go beyond this chapter's individual statistics. The first is a point about scale that bears repeating even at the risk of redundancy with Section 2.3: the international studies finding robust, statistically significant negative relationships between climate or transition risk and insurer profitability draw on samples of ninety to two hundred and fifty firms observed over a decade or more. This study's twelve observations are not a smaller version of that evidence; they are, realistically, too few to detect an effect of plausible real-world magnitude with any statistical confidence, even granting that such an effect genuinely exists in the underlying population of Nigerian insurers. A null or unstable result from a sample this size is therefore close to the expected outcome under reasonable priors, not a surprising one, and should not be read as evidence against the broader international literature.

The second point concerns what actually seems to be driving profitability in this specific sample, insofar as the data allow any inference at all. Across the firm narratives in Section 3.2 and the descriptive statistics in Section 4.2, the recurring theme is not renewable-energy or institutional risk as such but a cluster of distinctly Nigerian, distinctly 2022–2025 events: the IFRS 17 accounting transition reshaping reported profit across nearly every sampled firm; naira depreciation and the associated foreign-exchange gains and losses running through investment portfolios, most dramatically at Consolidated Hallmark; and corporate restructuring, in Custodian's conglomerate structure and Consolidated Hallmark's holding-company conversion, altering how profitability itself should even be measured and compared across firms. None of these are exogenous shocks unrelated to institutional risk in the broadest sense accounting-standard changes and currency volatility are themselves downstream of policy and macroeconomic conditions but they are not the specific renewable-energy and climate channels this study's REQI index was built to capture, and conflating the two would overstate what this analysis has actually shown.

The third point is more methodological than substantive, and in some ways, it is the paper's real conclusion. A twelve-observation, four-distinct-year sample, with its risk variable measured only at the year level, cannot statistically separate a genuine risk effect from a genuine year effect, and no amount of careful index construction changes that underlying arithmetic. What this chapter has tried to do instead reporting the full correlation matrix rather than a single collinearity statistic, computing and explaining leverage and Cook's distance rather than reporting R^2 alone, and estimating and disclosing four specifications rather than the one most favourable to the hypothesis is less about answering the research question definitively than about showing, transparently, exactly how far the available data can and cannot take that answer. We think that is a more useful contribution, at this stage of the research agenda, than a confident but unsupportable headline finding would have been.

Summary of findings

This study set out to examine whether a composite index of renewable-energy and institutional risk, alongside financial-risk, firm-size, and macroeconomic controls, is associated with profitability among Nigerian insurance firms. Working from real, source-verified financial-statement data for six of seven named firms twelve firm-year observations spanning 2022 to 2025 a pooled OLS regression with robust standard errors found no statistically significant relationship between the composite risk index and Return on Assets, nor between any control variable and Return on Assets, at conventional significance levels. Descriptive analysis showed that firm-level profitability varied far more across the sample than the risk, size, or macroeconomic variables alone could plausibly explain, with much of that variation traceable to

firm-specific and sector-wide events the IFRS 17 accounting transition, corporate restructuring, and currency-linked investment-income swings rather than to the renewable-energy risk channels the study was originally designed to isolate. A set of robustness checks, reported in full rather than selectively, showed that the central risk coefficient's sign and significance shift depending on which firms and which control variables are included, which is itself reported as a substantive finding about the fragility of inference at this sample size rather than treated as a nuisance to be smoothed over in the write-up.

Conclusion

Two conclusions follow from this work, and it is worth keeping them separate because they operate at different levels. The substantive conclusion is narrow: this study does not find reliable evidence, in a twelve-observation Nigerian sample, that renewable-energy or institutional risk is associated with insurer profitability. That should be read as an inconclusive result rather than as a refutation of the broader international literature reviewed in Section 2.3, which consistently finds such relationships using samples one to two orders of magnitude larger. Absence of evidence, at this sample size, is a long way from evidence of absence, and the paper has tried throughout not to blur that distinction.

The methodological conclusion is broader and, we would argue, more consequential for how this specific research area should develop from here. A central criticism levelled at an earlier version of this paper that its regression output showed signs of fabrication, most visibly in identical t-statistics recurring across what were presented as independently estimated coefficients turned out, on investigation, to reflect a genuine underlying problem rather than a cosmetic one: the claimed ten-year, multi-country panel had not, in fact, been assembled from real data at all. Rebuilding the analysis from the ground up, around real figures individually sourced and cited for seven named firms, surfaces exactly why that earlier shortcut was taken, even if it does not excuse it: consistent, multi-year, mutually comparable financial disclosure is not yet readily available across Nigeria's listed insurers, particularly across the disruptive window created by the IFRS 17 transition. That is itself a finding of consequence for anyone working in this specific corner of the literature, and arguably a more durable one than any single regression coefficient this paper could have reported.

Recommendations

Several recommendations follow from the analysis, directed at somewhat different audiences, and it seems more useful to say which each one is aimed at rather than present them as a single list.

For insurance firms, the clearest recommendation is to strengthen risk-assessment frameworks in ways that incorporate climate, policy, and technology-performance data into underwriting models, even in a market where formal, externally validated indices of the kind this study had to construct its own proxy for remain underdeveloped. The gap in available indices is itself an opportunity: a firm willing to invest in building better internal risk data ahead of its competitors stands to price renewable-energy-linked and climate-linked exposures more accurately than the market as a whole currently can.

For regulators principally NAICOM, but also the Central Bank of Nigeria and the Nigerian Exchange, given their shared role in shaping what gets disclosed and how — the recommendation is to recognise that policy volatility and transition periods, however well-intentioned, impose a double cost: they complicate insurer performance in the near term, as this study's firm narratives illustrate repeatedly, and they complicate the very research infrastructure that would otherwise let regulators and researchers alike assess that performance with

confidence. A modest, standardised set of comparable, annually disclosed performance metrics Return on Assets, total assets, combined ratio, at minimum made consistently available across listed insurers would directly address the data constraint that shaped nearly every methodological choice made in this paper.

For the industry as a whole, there is a clear case for developing specialised renewable-energy insurance products weather-index insurance, performance guarantees, and technology-failure coverage among them that remain comparatively underdeveloped in the Nigerian market relative to the scale of renewable-energy risk firms like Sovereign Trust, with over a third of its premium income already tied to energy risk, are visibly carrying.

For the sector's human capital base, building deeper actuarial and climate-risk expertise within Nigerian insurance firms would support not only better underwriting but exactly the kind of empirical self-assessment this study represents; a sector that can produce its own rigorous internal risk analytics is also a sector better placed to supply the kind of external data researchers like us depend on.

Contribution to knowledge

This study's contribution is best understood as threefold rather than as a single headline finding. First, it offers a fully source-traceable, firm-matched Nigerian insurance dataset that future researchers can extend directly, rather than having to reconstruct from scratch. Second, it offers a transparent, worked demonstration of why pooled OLS, honestly reported as a second-best method chosen for a specific, disclosed reason, is preferable in a small, unbalanced sample to fixed- or random-effects estimation presented as though the data supported it when it does not. Third, and perhaps most directly tied to this paper's own history, it offers a concrete illustration of the difference between research output that merely looks methodologically sophisticated and research output that is point by point.

Limitations and an agenda for further research

The limitations of this study have been flagged throughout rather than reserved for a single closing section, but it is worth gathering them here for clarity. The most consequential is sample size: twelve firm-year observations across six firms are genuinely small base from which to draw confident causal, or even strongly associational, conclusions, and the null and unstable results reported in Section 4 should be read as "not detected in this sample" rather than "does not exist in the underlying population." A second limitation, discussed at length in Section 3.4 and documented in Appendix A.2, is that the composite risk index (REQI) is a researcher-constructed proxy rather than an externally validated instrument; future work would be considerably strengthened by substituting formal series the full World Bank Worldwide Governance Indicators panel rather than a single-year anchor, ND-GAIN climate vulnerability scores, and NERC or National Bureau of Statistics technical-loss and grid-reliability statistics once enough comparable firm-year Nigerian insurer data exists to match against them at the annual frequency this kind of index properly requires. A third limitation is that AXA Mansard Insurance Plc, while retained in the sample narrative because its exclusion seemed less honest than pretending it was never considered, could not be included in the regression itself for the data-availability reasons set out in Section 3.2; a follow-up study extending this dataset by even one or two further completed financial years should be well placed to close that particular gap.

Future research should extend the panel to at least eight to ten years per firm across a larger set of African insurers not only Nigerian ones, given that several of the institutional and macroeconomic pressures documented here (currency volatility, regulatory transition, climate exposure) are regional rather than uniquely Nigerian phenomena. It should incorporate primary

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data collection interviews with underwriters, actuaries, and NAICOM officials to supplement what audited financial statements alone cannot reveal about how renewable-energy risk is actually priced inside these firms, as opposed to how it shows up, several steps removed, in a reported ROA figure. And it should examine the role of reinsurance explicitly and separately from primary underwriting, since several of the profit swings documented in Section 3.2 and Section 4.2Consolidated Hallmark's investment-result reversal most visibly appear to run through channels (reinsurance costs, investment-portfolio currency exposure) that a single-equation ROA model, however carefully specified, cannot cleanly disentangle from one another. None of this diminishes what the present study has tried to do; it is, if anything, the clearest possible evidence that the present study has succeeded in mapping out where the real work still needs to happen.

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[Firm-level annual-report and financial-press sources are listed separately in Appendix A, to keep firm-level and academic citations distinguishable.]

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Appendix A: Firm-level data sources and risk-index construction

A.1 Firm financial data

AIICO Insurance Plc - FY2022/FY2023 audited results via company press releases (aiicoplc.com/images/financialreports) and Leadership Newspaper, 'AIICO Insurance Records N12bn Profit In 2023' (31 July 2024).

NEM Insurance Plc - FY2023/FY2024 results via africanfinancials.com/company/ng-nem/ and BusinessDay, 'NEM Insurance grows 2023 revenue by 66% to N52.1bn' (3 July 2024).

Cornerstone Insurance Plc - FY2024/FY2025 results via The Guardian (Nigeria), 'Insurer posts N11.76 billion profit'; FY2023 Life Business Financial Condition Report, cornerstone.com.ng.

Sovereign Trust Insurance Plc - FY2023/FY2024 audited financial highlights, NGX document library (doclib.ngxgroup.com); Leadership Newspaper, 'Sovereign Trust Insurance Total Assets Hit N22.7bn' (24 June 2024); business-line composition (energy insurance as 35.9% of gross written premium) via MarketScreener corporate announcement, July 2025.

Consolidated Hallmark Insurance Plc - FY2022/FY2023 figures via AllAfrica.com, 'Consolidated Hallmark Insurance Announces 589 Percent Growth in Profit' (4 July 2024); FY2024 figures via BusinessDay, 'Consolidated Hallmark profits hit record high as transition to Holdco pays off' (14 April 2025).

Custodian Investment Plc - FY2024 figures via africanfinancials.com/company/ng-custod/ and Simply Wall St company data; corporate structure and subsidiary detail via custodianplc.com.ng.

AXA Mansard Insurance Plc - sample-frame inclusion only (Section 3.2); Q1 2023 company-reported Return on Assets (1.7%, up from 0.5%) via corporate.axamansard.com press release, 'AXA Mansard Insurance delivers strong revenue growth at 13%...' (21 June 2023); AM Best rating affirmation, March 2023; full-year matched figures not independently verified within the scope of this revision.

A.2 Composite risk index (REQI) construction

Policy Risk (PR), Climate Risk (CR), Technological Risk (TR), and Political/Institutional Risk (POLR) are each scored on a 0-to-1 scale (1 = highest risk) for each year in the sample, based on the documented conditions summarised below, and averaged to form REQI:

2022: PR = 0.55 (pre-IFRS 17, a comparatively stable reporting regime relative to the years that followed); CR = 0.80 (Nigeria's most severe flooding in over a decade, widely reported nationally); TR = 0.65 (chronic national electricity-grid instability, with multiple documented collapses); POLR = 0.90 (World Bank WGI composite trend, pre-2023 reading).

2023: PR = 0.75 (the IFRS 17/IFRS 9 transition year, a period of high reporting disruption across the sector, confirmed directly in multiple sampled firms' FY2023 filings); CR = 0.55 (moderate climate conditions relative to the severity of 2022); TR = 0.70; POLR = 0.89 (World Bank WGI 2023 composite score of 11/100).

2024: PR = 0.65 (continued post-IFRS 17 adjustment, overlapping with NAICOM's recapitalisation-policy announcement); CR = 0.60; TR = 0.68; POLR = 0.88 (interpolated, reflecting the WGI literature's own finding that governance scores change only slowly from year to year).

2025: PR = 0.70 (recapitalisation-deadline pressure, as reflected in sampled firms' own 2025 results commentary); CR = 0.58; TR = 0.66; POLR = 0.87 (interpolated).

Note: *These scores are the researchers' own construction from documented events, openly presented as such rather than dressed up as an externally validated index; they are set*

out here in full, year by year, precisely so that any reader can inspect, challenge, or substitute their own judgment for the authors' wherever they find reason to disagree. That openness is offered as the direct, practical alternative this revision provides to the undocumented, unverifiable risk scores that appeared in the earlier draft of this paper.