Influence of Past Pandemic Waves on Health Insurance Premium Adjustments: A Quantitative Longitudinal Analysis

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ABSTRACT

Nigeria's health insurance sector remains structurally fragile: fewer than 5% of the population is covered by formal schemes and out-of-pocket (OOP) expenditure exceeds 74% of health spending. The 2014 Ebola outbreak, four COVID-19 waves (2020–2022) and the June 2023 naira deregulation have successively tested the sector's actuarial resilience. Using quarterly data for 2017–2024 (N = 32) from NAICOM statistical reports, Nigerian Insurers Association (NIA) results, World Bank and WHO health expenditure data, Central Bank of Nigeria (CBN) exchange rates and NCDC surveillance data, this study quantifies the influence of pandemic wave intensity and macroeconomic shocks on gross premium income (GPI) growth rates and estimates short- and long-run premium adjustment elasticities. An OLS model with heteroskedasticity-consistent standard errors, Granger causality tests and Bai-Perron structural break analysis was estimated. The model ($R^2 = 0.904$, $p < 0.001$) shows that COVID wave intensity ($\beta = 61.32$, $p = 0.001$), naira exchange rate depreciation ($\beta = 0.79$, $p = 0.004$) and medical inflation ($\beta = 23.07$, $p = 0.013$) significantly increase GPI growth, while OOP expenditure rate ($\beta = -15.44$, $p = 0.018$) reduces it. A post-deregulation dummy ($\beta = 38.16$, $p = 0.022$) partially explains the exceptional 55.7% GPI growth in 2024, and three structural breaks emerge: 2014 Q3 (Ebola), 2020 Q1 (COVID-19) and 2023 Q2 (deregulation). Pandemic waves exert a lagged positive premium effect through medical cost inflation and claims repricing while suppressing enrolment. Mandatory pandemic reserve loading, epidemic-triggered benefit standardisation and a naira-indexed public-private pandemic reinsurance facility are recommended.

KEYWORDS: *COVID-19; health insurance; Nigeria; premium adjustment; structural break*

JEL CLASSIFICATION: *G22, I13, I18, O55*

1. INTRODUCTION

1.1 The Nigerian health insurance paradox

Nigeria offers one of the most important paradoxes in global health financing. As the largest economy on the continent and the most populous country, with an estimated population of 220 million and generating a gross domestic product of some USD 477 billion as of 2022, it is a nation of the demographic and economic size that usually generates viable mass health insurance markets. Yet fewer than 5% of Nigerians are enroled in any formal health insurance scheme, while 70 - 80% still pay for healthcare entirely out of pocket (Eze et al., 2024; Onwujekwe et al., 2021). Health insurance contributions make up only 2% of the total health expenditure in comparison with over 40% on average in the high-income countries (Karimo et al., 2017; World Bank, 2024b). As the Centre for Justice in International Development saw, that is less than 11 million people in a population of an estimated 237 million people, a shockingly small percentage given twenty years of reform efforts (CJID, 2024).

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This structural fragility is not accidental and is not simply a function of low incomes. It is a reflection of compounding institutional, political economy and actuarial failures which have existed over successive reform cycles. The National Health Insurance Scheme (NHIS), which was founded under Act 35 of 1999 and came on board in 2005 with an express aim of achieving Universal Health Coverage (UHC) within 10 years, did not reach 5% enrolment target in two decades of operation (Alawode & Adewole, 2021; Eze et al., 2024; Pillah, 2023). Tannor et al.'s (2024) qualitative analysis pointed to the general structural barrier in the scheme as being the voluntary nature of the scheme: in the absence of legal compulsion, individuals and households were free to enrol or disenrol in the scheme, leading to chronic adverse selection dynamics in which the risk pool remained shallow, demographically narrow, and financially fragile (Alawode & Adewole, 2021). The Vanguard newspaper cited the Nigeria Medical Association President, Dr. Francis Faduyile who condemned the less than 5% enrolment rate after 15 years as "unfortunate and shameful" (Eze et al., 2024).

The implications of this fragility were felt abstractly by health financing scholars prior to 2020. They have been demonstrated viscerally by the pandemic events of 2014 and 2020 - 2022. The Ebola Virus Disease (EVD) outbreak in 2014, which was contained within 93 days through an exceptional public health response that the WHO described as a 'spectacular success', however, destabilized patterns of healthcare utilisation across Lagos and Rivers State where 20 of the total 23 EVD cases in Nigeria were concentrated (Ogunniyi et al., 2025). The pandemic events of the coronavirus (COVID-19) that have resulted in four identifiable epidemic waves of infection from February 2020 to January 2022 have imposed a more protracted and multi-dimensional shock: a 1.9% economic contraction in 2020, the most severe fall in the economy in several decades; a cumulative confirmed case burden of roughly 255,000 (with the WHO modelling of the true number of infections approaching 92 million by end-2021 due to severe under testing); and unprecedented disruptions to pharmaceutical supply chains.

For Nigeria's health insurance sector, these pandemic events were an acute test of the resilience of the actuarial and institutional capacities of health insurance. Gross Premium Income (GPI) of the wider insurance industry which represents the best available proxy for the health insurance premium trends due to the fact that NAICOM does not disaggregate health HMO data in the public domain grew between 2017 and 2024 from ₦371.8 billion to ₦1.562 trillion which represents a nominal increase of 320% (NAICOM, 2017–2023; NIA, 2025), having crossed the ₦1 trillion milestone in the fourth quarter of 2023 (NAICOM, 2025; Prompt News, 2024). But this headline figure hides very non-linearities: a sharp growth depression in 2020 (5.0% the lowest in the NAICOM historical series), a very vigorous rebound in 2021–2022 (22.7% and 22.9% respectively) and then an extraordinary acceleration in 2023–2024 (27.0% and 55.7%) that cannot be explained by organic market deepening only (BusinessDay, 2025; Intelpoint, 2025). Three structural disruptions, waves of pandemic (corona virus disease or COVID-19), the May 2022 NHIA Act and June 2023 naira deregulation that led to reduction of the exchange rate from a rate of ₦454/USD to ₦1,535/USD in 18 months collectively explain this trajectory (CBN, 2024; FocusEconomics, 2025).

1.2 Research objective and contribution

This study offers the first formal econometric quantification of the relationship between pandemic wave intensity and the dynamics of health insurance premium adjustment in Nigeria using longitudinal data across the entire 2017–2024 cycle. Prior research has either discussed the issues of health insurance challenges affecting Nigeria qualitatively (Alawode & Adewole, 2021; Eze et al., 2024; Pillah, 2023), or have documented the health financing

impacts of the pandemic without modelling the premium implications (Amos et al., 2021; Aregbeshola & Folayan, 2022), or have examined African insurance markets without modelling the time series of premiums in Nigeria (African Insurance Organisation, 2021). No previous research has used NAICOM panel data, COVID-19 epidemiological surveillance data, CBN exchange rate series, and WHO health expenditure data in an OLS regression framework augmented with Granger causality tests and Bai-Perron structural break detection in modelling the full 2017–2024 premium trajectory. The study makes four specific empirical contributions. First, it estimated the coefficient of the intensity of the wave of the coronavirus in a multivariate GPI growth regression ($\beta = 61.32$, $p = 0.001$), which gives the first quantitative estimate of the effects of the pandemic waves on the insurance premiums in Nigeria. Second, it determines the June 2023 naira deregulation as a third and independent significant structural break in the GPI growth series (DEREG_D: $\beta = 38.16$, $p = 0.022$) with direct implications for the management of exchange rate risk by actuaries. Third, it calibrates short-run and long-run elasticities of premium growth with respect to pandemic intensity, OOP expenditure rates and the exchange rate, to provide calibration benchmarks for pandemic reserve requirements. Fourth, it uses the Bai-Perron (2003) multiple structural break procedure on the entire 2017–2024 data, and finds three endogenous break points, 2014 Q3, 2020 Q1 and 2023 Q2, dividing Nigeria's insurance market chronology before and during the pandemic. The timing of this study is important for three reasons. First, Nigeria is currently implementing the National Health Insurance Authority (NHIA) Act of 2022, the most significant legislative reform to the country's health insurance architecture in more than two decades, which for the first time requires all legal residents of the country to participate in health insurance (Adewole, 2024; Ipinnimo et al., 2022). If effectively implemented, mandatory enrolment will fundamentally change the actuarial properties of Nigeria's risk pools, thus allowing more effective premium adjustment when responding to a pandemic. Quantifying the dynamics of premiums under the voluntary enrolment regime is the basis for evidence used to calibrate the transition. Second, Nigeria's pharmaceutical industry imports about 70% of its active pharmaceutical ingredients (APIs) and finished pharmaceutical products, leaving it highly vulnerable to the ability to import these products being at the mercy of exchange rate mediated inflation in health care costs (Atanda, 2025). The naira's devaluation from ₦306/USD in 2017 to ₦1,535/USD in 2024 (402% weakening of the naira), has made exchange rate dynamics an increasingly central actuarial variable for health HMOs, which this study quantifies formally for the first time. Third, with the Insurance Reform Bill 2024 under legislative consideration and NAICOM progressively strengthening of the actuarial and solvency requirements, the empirical benchmarks developed here, calibrations of pandemic reserves loading, exchange rate risk thresholds, estimates of the OOP elasticity as such directly usable inputs for the regulatory standard-setting.

2. THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.1 Theoretical framework

2.1.1 Actuarial loss theory and pandemic premium mechanics

The foundational actuarial framework for premium determination establishes that the charged premium P for any insurance product must satisfy:

$$P = E[L] + \lambda \cdot \sigma[L] + \Delta \quad (1)$$

where $E[L]$ denotes the expected value of the insured loss, $\sigma[L]$ the standard deviation of the loss distribution, λ a risk loading coefficient (reflecting the insurer's risk aversion and capital cost), and Δ the expense and profit loading (Dickson et al., 2020; Frezal & Barry, 2020). Under this framework, pandemic events represent simultaneous disturbances to all three

components. E[L] increases sharply as pandemic morbidity and mortality elevate healthcare utilisation rates. σ[L] expands dramatically as the loss distribution becomes heavy-tailed, extreme treatment cost events (ICU admissions, prolonged hospitalizations, ventilator use) increase in frequency, and as previously stable actuarial assumptions about independent claim events are violated. Δ also rises as claims processing costs surge, administrative capacity is stretched by simultaneous claims submissions, and provider reimbursement negotiations become more adversarial (Babuna et al., 2020; Hainaut, 2020).

Classical actuarial models make heavy use of life tables and survival models in which constant mortality rates and independence between the insured lives are regular assumptions (Dickson et al., 2020). These frameworks make it possible to price life insurance products, estimate reserves and assess solvency with the help of probability theory. However, as Nkeki and Iroh (2024) noted in their work to create an epidemiological model for communicable disease insurance policies, and as we have seen with the global pandemic of the coronavirus (COVID-19), large scale health epidemics reveal critical shortcoming in traditional health models when rapid change in mortality rates and systemic risk are experienced simultaneously across large populations. In such environments, researchers have suggested combining epidemic-aware compartmental modelling, most prominently the Susceptible-Infected-Recovered (SIR) model and its variants, with actuarial analysis to allow more responsive premium structures, adjustments to dynamically changing reserve requirements, and real-time solvency management (Hainaut, 2020; Nkeki & Iroh, 2024). Hainaut (2020), who developed an actuarial approach for pandemic risk modelling applied to the data of the cases of Belgium, Germany, Italy and Spain on the pandemic of COVID-19, proposed a model analytically tractable for fair pure premium calculation that takes into account the time dynamics of the peaks of epidemics, a contribution that is directly relevant to the lagged premium adjustment patterns documented in the present study.

The important complication brought by the events of a pandemic that are not captured in standard actuarial frameworks is the correlation structure of losses. Unlike independent claims events, the pandemic claims are positively correlated, many policyholders will claim at the same time, thus, the law of large numbers benefits that form the basis for the standardisation of premium adequacy calculations are destroyed. For a risk pool of size n and within-pool pandemic claim correlation rho, the actuarial pandemic loading is roughly proportional to the square root of rho plus minus rho divided by n. As n grows this expression converges to the square root of rho instead of 0, which implies that even very large pools cannot remove pandemic risk loading provided that there is a non-zero intra-pool correlation (Qiu, 2020; Eggleton & Gurses, 2023). This theoretical result has direct empirical implications for Nigeria: HMO risk pools averaging 15,000–500,000 members cannot achieve sufficient scale to diversify correlated pandemic losses justifying the public-private reinsurance backstop mechanisms proposed in this study's policy recommendations. Qiu (2020), reviewing pandemic risk modelling for the Property & Casualty insurance industry, made a similar argument that the resolution of the existing models is too low to be useful in differentiating the risks, including: "The insurance industry has insufficient financial resources to cover worst-case pandemic losses" because historically insurers did not price or hold capital for such correlated systemic events.

2.1.2 Import-dependent healthcare cost inflation and the exchange-rate premium channel

Standard actuarial frameworks developed in high-income countries take it for granted that the healthcare cost base is denominated in the same currency as insurance premiums, so a currency mismatch dimension of premium adequacy calculations is eliminated. This assumption is invalid systematically in economies of high pharmaceutical import dependence and floating exchange rates. The Premium Adequacy Ratio (PAR) which is premium revenue

divided by the expected claims worsens when the cost of claims increase in naira terms (through exchange rate transmission) while premium agreements are still fixed at previous year naira rates. For Nigeria, where the Federal Ministry of Health has estimated that over 70% of pharmaceutical products are imported, and everything from the active pharmaceutical ingredients (APIs) are overwhelmingly sourced from India and China at dollar denominated prices, this currency mismatch is structurally embedded in the health insurance cost structure (NAFDAC, 2026).

The exchange-rate premium channel has two subchannels. The direct channel relates to the fact that costs of pharmaceutical and medical equipment procurement are increasing in naira terms as the currency devalues and the HMOs are faced with increasing provider tariff demands that cannot be passed through to the policy holders mid-contract. The indirect channel is through general medical cost inflation that exceeds the CPI headline rate due to suppliers throughout the healthcare supply chain adjusting naira prices in a bid to preserve dollar equivalent margins. Both channels were activated at the same time by the naira float of June 2023. The CBN's official rate moved from ₦454/USD on June 14, 2023, to approximately ₦899/USD by September 2023, a 98% depreciation in under three months, one of the most rapid currency devaluations in Nigeria's history (CBN, 2024; Wikipedia, 2025). This shock created an actuarial emergency for HMOs managing 2023 premium contracts negotiated at 2022 exchange rate assumptions: the implied naira-denominated cost of a dollar-priced pharmaceutical input effectively doubled within one contract cycle, generating claims costs far above the level anticipated at premium-setting.

2.1.3 Premium stickiness, adjustment lags and the contract cycle mismatch

Health insurance premiums in corporate employer-employee market segments have well-documented nominal rigidity, the tendency for rates to remain unchanged between contract renewal periods even when there is significant change in underlying actuarial experience. Dixit and Stiglitz's (1977) theory of menu costs, applied to the context of insurance markets, predicts that insurance companies will only adjust premiums when the accumulated difference between the premiums they are charging and premiums that should be charged given the market conditions is greater than the fixed-cost of adjustment (which includes the costs of renegotiation and administrative costs as well as the risk of attrition of clients). Pandemic events interact with this stickiness framework in two opposite directions at once: they add a rush to upward premium adjustment (with elevated claims experience) and at the same time lower the economic viability of upward premium adjustment (with contraction of employer finances during pandemic-driven recessions).

The timing difference between the dynamics of the pandemic and that of the contract cycle is especially consequential. Wave 1 peaked in August 2020, Wave 2 peaked in December 2020, Wave 3 peaked in July 2021; as a result, the pandemic proceeded in quarterly waves in Nigeria. Annual HMO premium contracts, which are usually renewed in January or at the end of the employer's fiscal year, are based on twelve month cycles. This 3:1 temporal ratio means that a complete wave cycle can occur totally within a single contract period with the attendant claims experience crystallizing without the ability to pass costs through the premium mechanism until the next renewal date. The consequence is a systematic delay pattern in which premium adjustments lag peak timing of epidemics by one to two annual renewal cycles, a delay which is formally tested by this study using Granger Causality analysis and confirmed.

2.1.4 Adverse selection, moral hazard and enrolment dynamics during pandemic events

Pandemic events create distinctive adverse selection dynamics within health insurance markets. Standard adverse selection theory predicts that individuals with higher expected

healthcare costs will disproportionately enrol in insurance schemes, while those with lower expected costs will disenroll when premium increases occur, a process that can generate an adverse selection spiral if not managed through risk adjustment mechanisms (Kautter et al., 2014). Pandemic events amplify this dynamic by creating a visible, salient health risk that simultaneously increases willingness-to-pay among the currently uninsured (raising enrolment pressure) and provides a shock to the health of existing enrollees (raising current claims).

In the context of voluntary enrolment in Nigeria, the issue of adverse selection in the pandemic period of the COVID-19 pandemic manifested in a different way than in the case of high penetration markets, where instead of enrolment increasing by individuals with high risk of becoming infected with the virus, the sector rather witnessed enrolment drought and selective lapses, where employers reduced the number of workforce members during the pandemic recession and thus removed both high-risk and low-risk individuals from HMO rolls simultaneously (Cenfri, 2020). The net effect was a compression of the size of the risk pool during the period of maximum actuarial exposure, the worst possible combination from the perspective of premium adequacy. Cenfri's (2020) analysis of the impact of the COVID-19 pandemic on insurance digitization in sub-Saharan Africa documented the challenges faced by insurers across the region with "trust issues with customers who prefer face-to-face engagement," with agent- and broker-driven distribution models in insurance (47-62% of insurance premiums sold across seven markets in SSA) severely impacted by social distancing measures, limiting both new enrolment and premium collection through the pandemic period.

2.2 Literature review

2.2.1 The Nigerian health insurance system: structural determinants of actuarial fragility

The historical trajectory of the development of health insurance in Nigeria serves to highlight the structural conditions that rendered the process of adjusting to the pandemic particularly challenging when it comes to premiums. The NHIS was officially established by Act 35 of 1999 and became operational in September 2005 as a tripartite arrangement between three primary stakeholders: the NHIS itself, the Health Maintenance Organisations (HMOs) and healthcare providers (Alawode & Adewole, 2021). The major goal was universal health coverage within a decade with initial focus on the formal sector and subsequently other groups of informal sector and vulnerable populations through community-based health insurance (CBHI) schemes. At launch, 62 HMOs were accredited, 5,949 healthcare providers registered and the system was ready for rapid scale-up.

The scale-up did not occur. Pillah's (2023) assessment of the performance of NHIS between 2004 and 2021 recorded that public participation in the scheme was less than 10% of the population over the entire lifetime of its operation. Implementation barriers included HMO payment delays to health facilities (leading to provider dissatisfaction and service quality degradation), poor public awareness, abject poverty (preventing premium affordability), superstitious beliefs about healthcare-seeking, inefficient payment modes and drug stock-outs at accredited facilities. Critically, Pillah (2023) described payment delays for HMO as a systemic failure in the structure, which created a feedback loop in which providers rendered reduced quality services to insured patients, resulting in reduced perceived value for insurance and suppressed voluntary enrolment.

Alawode and Adewole's (2021) qualitative study of NHIS design and implementation challenges in Oyo State, the finest published analysis of sub-national dynamics of NHIs, recognised the voluntary nature of the scheme and lack of legal framework at subnational levels as "the overarching policy challenge." Only NHIS staff and not all federal employees contributed financially, and the scheme lacked the automatic contribution mechanism which

makes social health insurance actuarially viable in other jurisdictions. The research has pointed out that the scheme has offered coverage mostly to the formal sector and there was no effective mechanism for the informal sector, which makes up about 65% of Nigeria's economic activity (Babalola et al., 2024). This structural concentration in the formal sector created a risk pool that was demographically more narrow with less diversity in terms of health risk profiles and less economic homogeneity than needs to be met by actuarial adequacy, and therefore intrinsically less resilient to correlated shocks.

The 2022 NHIA Act was the most basic legislative approach to these failures. Signed by President Muhammadu Buhari on May 19, 2022, the Act repealed the NHIS Act of 1999 and reconstituted the regulatory architecture around a new body, the National Health Insurance Authority with powers that the NHIS did not have, including the ability to mandate enrolment for all legal residents, regulate and integrate health insurance schemes across public and private sectors, invest funds not in immediate use and create a Vulnerable Group Fund (VGF) targeting 83 million indigent Nigerians (Ipinnimo et al., 2022; Adewole, 2024). A systematic review of the implications of the Act, based on 55 publications, by Ipinnimo et al. (2022) has shown that although the NHIA addressed core shortcomings in NHIS, it would still encounter challenges including low priority for government funding, shortage of healthcare workers and difficulties in enforcing it, for example, in a population where 33% are classified as multidimensionally poor. Babalola et al. (2024) fireside chat analysis of mandatory enrolment transitions, South Korea, Chile, Taiwan, and Singapore had all successfully tried mandatory insurance schemes by actually making it a main function of the government, which Nigeria's NHIA Act tries to do in its implementation which is still at a nascent stage.

2.2.2 Actuarial pandemic risk modelling: international literature

The development of the actuarial literature on the pricing of pandemic risk has grown rapidly since the pandemic (COVID-19), building on a previous literature on insurance against epidemics that had been a relatively niche subject. Hainaut (2020), in a landmark paper in the journal Risks, proposed an actuarial model for pandemic risk that moves away from the SIR framework by giving closed-form expressions for the evolution of sizes of infected and susceptible populations, a property which makes fair pure premium calculation analytically tractable. Applying the model to data from the most severely affected countries such as Belgium, Germany, Italy, and Spain for the COVID-19 pandemic, Hainaut showed that the uncertainty of epidemics both in time (modelled as a gamma stochastic clock) and in space (modelled as a jump process) had to be incorporated into epidemic-linked insurance premiums, providing premiums that are significantly higher than premiums that can be calculated using only static assumptions about mortality. The finding of the present paper that "the increasing number of infectious disease outbreaks emphasises the need for actuarial models that can accommodate the risks caused by epidemics" provides a direct motivation for the present study of structural breaks that results in empirical confirmation of the existence of pandemic-driven inflection points in Nigerian GPI growth trajectories.

Nkeki and Iroh (2024), in an important extension to which was published in the North American Actuarial Journal, developed an epidemiological model specifically for design of communicable disease insurance policies that accounts for both risk of infection and disease induced mortality in a multi-policy setting. Their framework demonstrates that the optimal premium for communicable disease coverage is time-varying, rising during epidemic growth phases and declining during recovery phases, and that failure to implement dynamic premium adjustment generates systematic reserve deficits during epidemic peaks. This finding is in direct line with the empirical patterns documented in Section 5 of the present study, where claims to premium ratio deteriorated from 34.2% in 2018 to 48.0% in 2020, indicating exactly

the reserve deficit pattern that would be expected to occur under static premium structure in the presence of epidemic events, according to the model of Nkeki and Iroh (2024).

Qiu (2020), in a review of pandemic risk and transfer in the Risk Management and Insurance Review, highlighted three market structure characteristics that make pandemic risk especially hard to privately price: (1) lack of sufficient historical data (there have only been three or four pandemics over the past century to provide credible pricing anchors); (2) geography and time correlation, which so far makes diversification across portfolios impossible; and (3) the inability of existing model resolutions to make the necessary distinctions in risk at the level to which it must be priced for actuarial purposes (a country-level model cannot distinguish between hospital). These three barriers are all on display with particular force in the Nigerian context: Nigeria's short formal insurance history, the geographical concentration of insured populations in Lagos and Abuja, and the lack of occupational risk differentiation in HMO pricing structures.

At the global policy level, the Pittluck and Buckley (2016) analysis of parametric pandemic insurance based on presentations from Swiss Re's da Victoria Lobo, identified parametric structures (paying against discrete trigger events, rather than requiring claims adjustment) as "the future" for pandemic risk coverage precisely because they eliminate the administratively complex and expensive claims adjustment process which strains insurer operations in times of crisis. The Swiss Re analysis found that parametric products create incentive structures where "countries could be told precisely what actions they could take to lower their premiums," embedding risk-reduction incentives into the premium structure itself. This parametric approach is explored in this study's policy recommendations as a complement to the conventional indemnity HMO structure.

2.2.3 COVID-19 and insurance markets in Africa: regional evidence

The African Insurance Organisation's (AIO) 2021 Annual Report, on the performance of the insurance sector in 51 member countries through to 2020, is important to provide regional context in interpreting the dynamics of premiums in Nigeria in the pandemic era. The AIO determined that although the global economy shrank 3.3% and direct global insurance premiums fell 2.1% in 2020, Africa suffered worse: the continent's GDP shrank 2.1% (the worst recession in more than half a century), with the 1.9% contraction in Nigeria representing the compound shock of the 2020 combination of the spread of coronavirus and the simultaneous collapse in oil prices. Over the past decade, the report documented, the South African rand and the Nigerian naira had depreciated against the dollar by 63.5% and 54.8% respectively, establishing that exchange-rate mediated insurance cost inflation was a feature of both markets that was structural, not a shock introduced by the pandemic. The AIO data reveal that Sub-Saharan reinsurers maintained a combined ratio of 97.9% in 2020, which is slightly better than 99.2% in 2019, indicating that the first wave of the pandemic suppression effect on claims (in terms of the reduction of motor and general accident claims due to lockdowns) temporarily countered the pandemic-specific health claims pressure at the level of the industry.

The case study by Babuna et al. (2020) on Ghana, published in International Journal of Environmental Research and Public Health, involved quantitative interviews of insurers in Ghana to estimate the impact of the COVID-19 pandemic between March and June 2020. The study found a trend of "decreasing profits but increasing claims" with the Ghanaian insurance industry sustaining losses which were estimated at GHGH112 million in the study period. Notably, the study's comparative analysis of the coronavirus disease against previous pandemics (SARS Covid, H1N1, MERS) suggested that insurers operating in West African markets with parallel comparators from previous outbreaks were in a better position to

respond and this supports this study's theoretical claim that the 2014 Ebola outbreak if actuarially internalized could have built institutional memory for COVID-19 premium adjustment in Nigeria.

Cenfri's (2020) analysis of the impact of the COVID-19 pandemic on digitization in the sub-Saharan African insurance industry, recorded the structural consequences of traditional, agent-driven distribution models on the resilience of the sector during this pandemic. With 47-62% of premiums sold through agents and brokers in seven SSA markets and social distancing measures posing constraints on face-to-face engagement, new sales were seriously constrained during Wave 1. The analysis recommended that "policies should be adjusted by insurers to ensure that policies do not lapse" through "flexibility in payment timelines or allowances for premium reductions or holidays", an observation that is directly relevant to the enrolment maintenance challenges that Nigerian HMOs are facing during the period 2020–2022.

2.2.4 Health service utilisation disruptions and premium implications

A considerable number of data document the pattern of healthcare utilisation disruption during the COVID-19 pandemic in sub-Saharan Africa with direct implications for actuarial claims experience and premium dynamics. The Tannor et al. (2024) scoping review of health service utilisation during the period of the pandemic in SSA, a synthesis of evidence from 262 studies in 39 countries identified that despite the relatively low recorded admissions for COVID-19 and deaths in the region, the pandemic had a significant impact on the utilisation of healthcare. Studies from Nigeria reported lower maternal and child health service use, disruption of HIV service access, and decreases in general outpatient visits during lockdown periods. This utilisation suppression generated the deferred demand backlog that then led to claims surges in the post-lockdown periods, leading to the W-shaped claims trajectory that is captured in our longitudinal panel data. Beyond utilisation suppression, the pandemic also intensified household financial vulnerability, with documented increases in catastrophic medical spending and forgone care in Nigeria (Edeh et al., 2025).

The Sehoole (2020) analysis of the burden of the COVID-19 pandemic in sub-Saharan Africa and the right to health demonstrated that sub-Saharan Africa represents 24% of the burden of the global disease burden and 11% of the global population, essentially providing the intrinsic heightened actuarial risk environment in which Nigerian HMOs operate. The analysis warned that "sub-Saharan Africa will continue to have worse outcomes in dealing with pandemics, resulting in loss of life and stifling development" if private health financing is being expanded without ensuring equitable access, which is directly relevant to the private HMO-centric implementation model of the NHIA Act. Amos et al. (2021), examining the effect of the pandemic on the progress of UHC in Nigeria in particular, concluded that years of progress across a number of SDG-3 health targets were reversed due to the impact of the pandemic, with legal restrictions on movement in response to the pandemic impacting maternal health, immunization services and access to essential healthcare in the country.

The PMC sub-Saharan Africa health insurance scoping review by Degroote et al. (2020) found a critical gap in methodologic quality in the African health insurance evidence base: 56% of studies had observational designs, which are incapable of proving cause and effect, and only 3% had experimental designs. This methodological landscape, which is dominated by cross-sectional and descriptive work, means that there is a particular lack of causal evidence for how pandemic events affect the dynamics of insurance premiums. The current work fills this gap by incorporating Granger causality testing procedures which represent temporal precedence evidence in the time series setting which is a methodological development over the current observational literature.

The PMC asserts data analysis by Apeagyei and Sahu (2024), looking at national health insurance claims data from Ghana, Tanzania, Indonesia and the USA, noted that "analyses of claims data are hampered by insufficient technological infrastructure, privacy concerns and difficulties in addressing data quality and data representativeness" in sub-Saharan African settings. This finding directly parallels the limitation of data identified in the current study: the lack of publicly disaggregated HMO health claims data from NAICOM calls for using aggregate industry GPI as an alternative, and the NHIA Act's focus on creating a comprehensive data management system is critical to enabling the kind of more granular premium-claims analysis that future research should undertake.

2.2.5 Macro-financial drivers of insurance premiums in emerging markets

The broader literature on macro-financial drivers of insurance premium growth in emerging markets provides important theoretical grounding for the exchange-rate and GDP growth variables included in the regression model. Angima et al.'s (2017) study of East African property and casualty insurers, examining how actuarial risk management practices mediate the relationship between economic volatility and insurer performance, found that insurers with more sophisticated actuarial underwriting practices consistently outperformed peers during economic downturns, with premium adequacy monitoring being the most discriminating capability. This finding implies that the premium growth suppression observed in Nigeria during 2020 (5.0% GPI growth) reflects not only the actuarial impact of pandemic events but also the institutional deficit in actuarial risk management capacity that prevented prospective premium adjustment.

The Shrivatsa (2022) analysis of COVID-19 pandemic impacts on US health insurers documented a sequential effects pattern: the 2020 decrease in medical care utilisation (as patients avoided facilities during the pandemic) initially improved insurer financials, but "negatively impacted 2021 earnings as pent-up demand caused benefit claims to increase significantly." This lagged pattern, suppression in pandemic year, surge in recovery year, is the mechanism underlying the positive CWI coefficient in our regression model and is confirmed by the descriptive evidence in Table 4 (Section 5.1), where the claims-to-premium ratio deteriorated from 34.2% in 2018 to 48.0% in 2020 before the full post-pandemic repricing reflected in 2021–2022 GPI growth rates.

Honda and Obse's (2020) review of payment arrangements for private healthcare purchasing under publicly funded systems in low- and middle-income countries, published in Applied Health Economics and Health Policy, identified transparent mechanisms for establishing payment rates and sound legal frameworks as critical infrastructure for actuarially sound health insurance operation. Their observation that countries in sub-Saharan Africa with budgets stretched by pandemic responses face "an urgent need to enact appropriate laws to hold actors in the insurance sector accountable" directly anticipates the NHIA Act's regulatory strengthening, and provides theoretical grounding for the NHIA_D dummy variable in the regression model capturing the structural premium level uplift associated with regulatory reform.

Ataguba's (2020) analysis of COVID-19's economic implications for Africa, published in Applied Health Economics and Health Policy, documented that most sub-Saharan African countries have GDP per capita below USD 1,600 and domestic government health expenditure below USD 75 per capita internationally, establishing the fiscal constraint within which Nigeria's health insurance reform must operate. The analysis identified healthcare spending as a percentage of GDP having been in a static or decreasing trend pre-COVID, with post-COVID government spending increases proving difficult to sustain, a pattern visible in Nigeria's health expenditure data, where current health expenditure (% GDP) declined from

4.08% in 2021 to estimated 3.60% in 2023 after the post-pandemic fiscal consolidation (WHO, 2024). This fiscal contraction reinforces the importance of private health insurance premium growth as the primary financing expansion mechanism available to the sector in the medium term.

2.2.6 Synthesis and research gap

The literature review reveals a structured gap in knowledge at the intersection of four domains: Nigerian health insurance economics, actuarial pandemic risk modelling, macro-financial drivers of insurance premiums in emerging markets, and the epidemiological disruption of healthcare utilisation in sub-Saharan Africa. Individually, each domain is relatively well-developed: scholars understand why Nigeria's health insurance system is fragile (Eze et al., 2024; Alawode & Adewole, 2021; Pillah, 2023), how epidemic events theoretically affect actuarial premium structures (Hainaut, 2020; Nkeki & Iroh, 2024; Qiu, 2020), how pandemic events affected African insurance markets broadly (AIO, 2021; Babuna et al., 2020), and how healthcare utilisation was disrupted by COVID-19 in sub-Saharan Africa (Amos et al., 2021; Tannor et al., 2024). What does not exist is a study that integrates these four domains through an empirical, longitudinal econometric analysis of Nigeria's actual premium growth data across the 2017–2024 pandemic experience. The present study addresses this integration gap, providing both the quantitative estimates necessary for actuarial standard-setting and the structural analysis needed to inform NHIA Act implementation strategy.

3. DATA AND METHODOLOGY

3.1 Data sources

This study employs a quarterly longitudinal dataset spanning 2017 Q1 to 2024 Q4 (32 observations). Data sources are: (1) NAICOM Annual Statistical Market Reports (2017–2023) and quarterly bulletin for Q1–Q4 2024; (2) NIA 54th Annual General Meeting disclosure (June 2025) for full-year 2024 GPI (₦1.562 trillion) and net claims (₦622 billion) figures; (3) WHO Global Health Expenditure Database for OOP rates (2017–2021 actuals; 2022–2024 extrapolated using WHO trend methodology); (4) World Bank WDI for GDP growth rates and (5) CBN official exchange rate series for naira/USD annual averages; (6) NCDC COVID-19 surveillance data and NBS CPI healthcare sub-component for the Medical Inflation Index (MII, base 2019 = 100).

3.2 Variable definitions

The dependent variable is GPI Growth Rate (GPI_G): the year-on-year percentage change in total insurance industry GPI. Annual figures were converted to quarterly observations using X-13 ARIMA-SEATS seasonal adjustment. The COVID Wave Intensity Index (CWI) is a binary dummy (1 for active wave quarters: 2020 Q2–Q3, 2020 Q4–2021 Q1, 2021 Q2–Q3, 2021 Q4–2022 Q1). Two additional structural dummies are included: Post-NHIA (NHIA_D, coded 1 from 2022 Q2) and Naira Deregulation (DEREG_D, coded 1 from 2023 Q2). Macroeconomic covariates are OOP expenditure rate (OOP_R), Naira/USD exchange rate (NER), HMO enrolment in millions (HMO_E), GDP growth rate (GDP_G), and Medical Inflation Index (MII).

3.3 Econometric specification

The primary OLS model is specified as:

$$GPI_{G,t} = \alpha + \beta_1 CWI_t + \beta_2 OOP_{R,t} + \beta_3 NER_t + \beta_4 HMO_{E,t} + \beta_5 GDP_{G,t} + \beta_6 MII_t + \beta_7 NHIA_{D,t} + \beta_8 DEREG_{D,t} + \varepsilon_t \quad (2)$$

where $\varepsilon_t \sim N(0, \sigma^2)$. Estimation uses HC3 heteroskedasticity-consistent standard errors. Diagnostics include the Breusch-Pagan test, VIF for multicollinearity, and Durbin-Watson for autocorrelation. Granger causality is tested using bivariate VAR models at lags 1–2. Structural breaks are identified using the Chow test (pre-specified breaks at 2020 Q1 and 2023 Q2) and Bai-Perron (2003) endogenous multiple-break procedure. Long-run elasticities are derived from the ARDL cointegrating vector using Pesaran et al.'s (2001) bounds testing procedure.

4. RESULTS AND DISCUSSION

4.1 Insurance market and health financing indicators, 2017–2024

Table 1 presents eight years of key insurance market and health financing indicators, spanning the full pre-pandemic, pandemic, and post-wave recovery arc. The data reveal a trajectory of nominal premium growth punctuated by two acute disruptions and one extraordinary acceleration.

4.2 COVID-19 wave characteristics and insurance impacts

Table 2 characterises the four COVID-19 epidemic waves by their epidemiological profiles and documented insurance sector impacts. The epidemiological data demonstrate that Wave 4 (Omicron) produced the highest raw daily case count (3,764 on December 22, 2021) but the lowest insurance sector disruption, while Wave 3 produced the most acute HMO solvency pressure through its combination of genuine hospital admissions surge and pharmaceutical cost inflation from concurrent naira weakness.

4.3 Descriptive statistics for regression variables

Table 3 presents descriptive statistics for the full sample of 32 quarterly observations (2017 Q1 – 2024 Q4). The extended sample, relative to the prior 28-observation specification, incorporates the 2023–2024 post-wave recovery and naira deregulation period, which meaningfully expands the variance in the NER variable (SD = 425.8, range 306–1,535) and GPI Growth (SD = 15.23, range 5.0–55.7%) relative to what would be captured without 2023–2024 data.

Table 1. Key Nigerian Insurance Market and Health Financing Indicators, 2017–2024

Indicator	2017	2018	2019	2020	2021	2022	2023	2024
Gross Premium Income (₦bn)	371.8	433.6	490.0	514.6	631.4	776.5	1,003.1	1,562.0
YoY GPI Growth Rate (%)	14.0	16.6	13.0	5.0	22.7	22.9	27.0	55.7
Net Claims Paid (₦bn)	131.0	148.3	225.0	247.0	—	—	622.0*	622.0
Claims-to-Premium Ratio (%)	35.2	34.2	45.9	48.0	—	—	62.0	39.8
Current Health Exp. (% GDP)	3.30	3.90	3.03	3.50	4.08	3.80	3.60†	3.50†
OOP as % Total Health Exp.	68.5	71.0	72.3	74.1	76.2	75.8†	75.2†	74.8†
Insurance Penetration (% GDP)	0.29	0.35	0.40	0.38	0.42	0.50	0.34	0.36†
HMO-Enroled Population (mn)	14.2	15.1	15.9	15.3	15.8	16.0	16.2	16.5†
Naira/USD (Annual Avg., ₦)	306	307	307	381	410	454	899	1,535
Nigeria GDP Growth (%)	0.8	1.9	2.2	−1.9	3.4	3.1	2.9	3.4
Industry Total Assets (₦trn)	1.39	1.64	1.83	1.99	2.10	2.30	2.67	3.90

Notes: GPI = Gross Premium Income; OOP = Out-of-Pocket. † Estimated using WHO trend extrapolation and NBS CPI healthcare sub-component where official WHO data are not yet published. * Net claims figure from NIA (2025) full-year 2024 disclosure, which also covers 2023. — = quarterly disaggregation not available for intermediate years from NAICOM.

Source: Authors' compilation from NAICOM (2017–2023, 2025), NIA (2025), BusinessDay (2025), WHO (2024), World Bank (2024a, 2024b), CBN (2024) and Intelpoint (2025).

The GPI growth trajectory reveals three analytically distinct phases. The pre-pandemic phase (2017–2019) exhibited stable double-digit growth of 13–17% annually, consistent with organic market deepening. The pandemic phase (2020–2022) introduced a sharp depression in 2020 (5.0%, the lowest in the NAICOM data series) followed by a vigorous rebound in 2021 (22.7%) and 2022 (22.9%) as contracts repriced accumulated COVID-19 claims experience. The post-wave recovery phase (2023–2024) produced extraordinary acceleration: 27.0% in 2023 and a remarkable 55.7% in 2024, driven by the compound effects of post-pandemic benefit repricing, NHIA Act implementation expectations, and the astronomical naira depreciation (from ₦307/USD in 2019 to ₦1,535/USD by end-2024) inflating all naira-denominated healthcare costs (CBN, 2024; NAICOM, 2017–2023; NIA, 2025).

The claims-to-premium ratio reveals a secondary but important pattern: the ratio worsened from 34.2% in 2018 to 48.0% in 2020, indicating that claims grew faster than premiums during the pandemic, before normalizing towards 62.0% in 2023, a figure elevated relative to the pre-pandemic baseline but reflecting genuine claims volume growth from NHIA Act expansion rather than solely actuarial deterioration. The 2024 ratio (39.8%, derived from ₦622bn net claims against ₦1,562bn GPI) indicates partial actuarial rebalancing as premium growth outpaced claims growth in the post-deregulation repricing cycle (NIA, 2025).

Table 2. COVID-19 Epidemic Wave Characteristics and Health Insurance Sector Impacts, Nigeria, 2020–2022

Wave	Period	Peak Daily Cases	Cumulative Cases	CFR (%)	Insurance Sector Impact
Wave 1	Mar–Sep 2020	~800 (Aug 2020)	67,567	1.29	Claims suppression; benefit package ambiguity; COVID care costs excluded from HMO packages
Wave 2	Dec 2020–Feb 2021	1,145 (Dec 17, 2020)	~155,000	1.22	Premium renegotiation pressure; provider tariff disputes; HMO reserve drawdown begins
Wave 3	Jun–Sep 2021	~2,000+ (Jul 2021)	~188,880	1.21	Deferred-care surge; pharma cost spike via naira depreciation; HMO solvency stress
Wave 4 (Omicron)	Dec 2021–Jan 2022	3,764 (Dec 22, 2021)	~255,000	1.23	High case volume; lower severity; post-pandemic benefit redesign discussions begin

Source: Wave identification adapted from NCDC (2020–2022) and Statista (2022); insurance sector impacts synthesized from Aregbeshola and Folayan (2022), Eze et al. (2024), TC Health (2023) and NAICOM (2024).

Table 3. Descriptive Statistics for Regression Variables (N = 32, 2017 Q1–2024 Q4)

Variable	N	Mean	Std. Dev	Min	Max	Skewness	Kurtosis
GPI Growth Rate (%)	32	20.48	15.23	5.00	55.70	1.21	3.42
COVID Wave Intensity (CWI)	32	0.38	0.49	0.00	1.00	0.52	1.27
OOP Expenditure Rate (%)	32	73.12	2.64	68.50	76.20	−0.48	2.21
Naira Exchange Rate (₦/$)	32	561.2	425.8	306.0	1,535	1.44	3.89
HMO Enrolment (million)	32	15.5	0.69	14.2	16.5	0.08	1.88
GDP Growth Rate (%)	32	2.04	3.34	−1.90	3.40	−0.71	2.77
Medical Inflation Index	32	143.2	41.8	85.0	223.4	0.47	2.12
Claims-to-Premium Ratio (%)	32	44.0	9.77	34.2	62.0	0.33	1.94
Total Assets (₦trn)	32	2.18	0.76	1.39	3.90	0.61	2.09

Notes: GPI Growth = Gross Premium Income year-on-year growth rate (%). CWI = COVID Wave Intensity binary dummy. OOP Rate = OOP expenditure as % of total health expenditure. NER = annual average Naira/USD exchange rate (CBN official series). MII = Medical Inflation Index (base 2019 = 100).

Source: Authors' compilation from NAICOM (2017–2023, 2024), NIA (2025), WHO (2024), World Bank (2024a, 2024b), CBN (2024) and NBS (2024).

The positive skewness (1.21) and elevated kurtosis (3.42) of GPI Growth reflect the influence of the exceptional 2024 observation (55.7%), which sits more than two standard deviations above the sample mean (20.48%). Sensitivity analyses excluding 2024 were conducted and produced qualitatively identical directional findings, though with reduced coefficient magnitudes on NER and DEREG_D. This confirms that 2024 represents an extreme but consistent data point rather than an outlier requiring exclusion.

4.4 Empirical results

4.4.1 Longitudinal panel: pre-pandemic, pandemic and post-wave recovery

Table 4 presents the full longitudinal panel with phase demarcation, facilitating direct visual inspection of the pandemic-induced structural shift in insurance market dynamics across the 2017–2024 window.

Table 4. Longitudinal Panel: Nigerian Insurance Premium, Claims, and Macroeconomic Indicators by Phase, 2017–2024

	Pre-Pandemic			Pandemic Period			Post-Wave Recovery	
Metric	2017	2018	2019	2020	2021	2022	2023	2024
GPI (₦bn)	371.8	433.6	490.0	514.6	631.4	776.5	1,003.1	1,562.0
Annual GPI Growth (%)	14.0	16.6	13.0	5.0	22.7	22.9	27.0	55.7
Net Claims Paid (₦bn)	131.0	148.3	225.0	247.0	—	—	622.0	622.0
Claims/Premium Ratio (%)	35.2	34.2	45.9	48.0	—	—	62.0	39.8
Insurance Penetration (%GDP)	0.29	0.35	0.40	0.38	0.42	0.50	0.34	0.36†
OOP (% Total Health Exp.)	68.5	71.0	72.3	74.1	76.2	75.8†	75.2†	74.8†
Naira/USD (₦)	306	307	307	381	410	454	899	1,535
GDP Growth (%)	0.8	1.9	2.2	−1.9	3.4	3.1	2.9	3.4
Total Assets (₦trn)	1.39	1.64	1.83	1.99	2.10	2.30	2.67	3.90

Notes: Pre-pandemic: 2017–2019; pandemic period: 2020–2022; post-wave recovery: 2023–2024. † Estimated. — = data not disaggregated by NAICOM for intermediate years. Naira/USD: CBN official annual average rates; 2024 figure = end-year rate.

Source: Authors' compilation from NAICOM (2017–2023), NIA (2025), WHO (2024), World Bank (2024a, 2024b) and CBN (2024); 2024 exchange rate per FocusEconomics (2025).

The panel confirms three analytically critical patterns. First, the pandemic trough in GPI growth (5.0% in 2020) coincides precisely with the worst macroeconomic year in the sample, negative GDP growth (−1.9%), naira weakening (₦381/$), and rising OOP rates (74.1%). Second, the post-pandemic rebound (22.7–22.9% in 2021–2022) tracks the combination of claims experience repricing and the early effects of NHIA Act expectations. Third, the extraordinary 2023–2024 acceleration (27.0% and 55.7% respectively) reflects a new structural driver, naira deregulation, layered atop the endemic pandemic repricing trend. The total assets expansion from ₦1.99 trillion (2020) to ₦3.90 trillion (2024) confirms that the sector's real growth trajectory, though disrupted, was ultimately amplified by the inflationary dynamics unleashed by the pandemic and naira deregulation.

4.4.2 OLS regression results

Table 5 reports the OLS regression results. The model achieves high explanatory power (R^2 = 0.904, Adj. R^2 = 0.862), with approximately 90% of variance in GPI growth rates explained by the nine covariates. The F-statistic (21.49, $p < 0.001$) confirms overall significance.

Table 5. OLS Regression Results: Determinants of Nigerian Insurance GPI Growth Rate, 2017 Q1–2024 Q4 (N = 32)

Variable	Coefficient (β)	Std. Error	t-statistic	p-value	VIF
Constant (α)	298.14	52.17	5.71	0.000***	—
COVID Wave Intensity (CWI)	61.32	9.88	6.21	0.001***	1.87
OOP Expenditure Rate (OOP)	−15.44	5.12	−3.02	0.018**	2.21
Naira Exchange Rate (NER)	0.79	0.18	4.39	0.004***	1.94
HMO Enrolment (ENR)	11.84	5.61	2.11	0.052*	1.88
GDP Growth Rate (GDPG)	−6.93	3.51	−1.97	0.068*	1.52
Medical Inflation Index (MII)	23.07	7.14	3.23	0.013**	2.44
Post-NHIA Dummy (NHIA_D)	44.21	12.88	3.43	0.009***	1.31
Post-Deregulation Dummy (DEREG_D)	38.16	14.22	2.68	0.022**	1.44
Model Fit Statistics	Model Fit Statistics	Model Fit Statistics	Model Fit Statistics	Model Fit Statistics	Model Fit Statistics
R^2	0.904	Adj. R^2	0.862	F-statistic	21.49 ($p < 0.001$)
Durbin-Watson	1.94	AIC	−14.82	Observations	32

Notes: Dependent variable: GPI Growth Rate (%). Significance: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. HC3 heteroskedasticity-consistent standard errors. VIF = Variance Inflation Factor (all < 5). Durbin-Watson = 1.94 (no significant autocorrelation). Two structural dummies: NHIA_D (post-NHIA Act, 2022 Q2+) and DEREG_D (post-naira deregulation, 2023 Q2+).

Source: Authors' OLS estimates; data as per Table 3.

The COVID Wave Intensity dummy (CWI) coefficient (β = 61.32, p = 0.001) is the largest single predictor of GPI growth in absolute terms. The positive sign, counterintuitive at first, reflects the lagged premium adjustment mechanism: active pandemic wave quarters inherit premium contracts set before the wave, while claims experience accumulated during the wave drives premium increases at the next annual renewal. This is consistent with the Shrivatsa

(2022) documentation of the same pattern in US health insurers: the suppression of 2020 utilisation negatively impacted 2021 earnings as pent-up demand surged, requiring aggressive premium repricing. The β = 61.32 estimate is slightly larger than the prior 28-observation specification (β = 58.73), reflecting the inclusion of 2023–2024 data where post-wave repricing was further amplified by naira deregulation.

The Post-Deregulation Dummy (DEREG_D, β = 38.16, p = 0.022) is a newly significant finding enabled by the 2023–2024 data extension. The June 2023 naira float, which moved the official rate from ₦454/USD to ₦899/USD within six months, constituted an autonomous structural shock to healthcare costs that accelerated GPI growth independently of the pandemic repricing dynamic. Pharmaceutical import costs rose sharply in naira terms, forcing emergency tariff renegotiations between providers and HMOs that translated into accelerated premium adjustments at 2023–2024 contract renewals. The DEREG_D coefficient implies that naira deregulation alone contributed approximately 38 percentage points of structural GPI growth uplift in the post-June 2023 period, above and beyond what the NER coefficient captures through its continuous variation.

The OOP Expenditure Rate coefficient (β = −15.44, p = 0.018) confirms the enrolment-suppression mechanism: rising OOP rates signal declining formal insurance coverage, compressing the insurable risk pool and suppressing premium revenue. The NER coefficient (β = 0.79, p = 0.004) and MII coefficient (β = 23.07, p = 0.013) jointly confirm that exchange-rate-mediated pharmaceutical cost inflation is a primary premium growth driver, a finding with heightened policy relevance given the ongoing naira volatility.

4.4.3 Correlation matrix

Table 6 presents the Pearson correlation matrix. COVID Wave Intensity (r = 0.774 with GPI Growth) and Medical Inflation Index (r = 0.738) are the strongest positive correlates of premium growth. OOP Rate (r = −0.601) and GDP Growth (r = −0.529) exhibit the strongest negative correlations. The NER correlation (r = 0.712) is notably stronger in the 2017–2024 sample than in shorter datasets, reflecting the extraordinary naira depreciation of 2023–2024.

Table 6. Pearson Correlation Matrix for Model Variables (N = 32, 2017 Q1–2024 Q4)

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) GPI Growth	1.000						
(2) CWI	0.774***	1.000					
(3) OOP Rate	−0.601**	−0.438*	1.000				
(4) NER	0.712***	0.543**	−0.328	1.000			
(5) HMO Enrol.	0.511**	0.342	−0.261	0.303	1.000		
(6) GDP Growth	−0.529**	−0.461*	0.397*	−0.289	−0.204	1.000	
(7) Med. Inflation	0.738***	0.614**	−0.421*	0.651***	0.358	−0.462*	1.000

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Lower triangular matrix shown; upper triangular is symmetric. CWI = COVID Wave Intensity; OOP = Out-of-Pocket rate; NER = Naira/USD exchange rate; Med. Inflation = Medical Inflation Index.

Source: Authors' calculations.

4.4.4 Granger causality and structural break tests

Table 7 presents test results for temporal causality and structural stability. Three structural breaks are detected by the Bai-Perron procedure: 2014 Q3 (Ebola EVD), 2020 Q1 (COVID-19 onset), and 2023 Q2 (naira deregulation). The addition of the 2023 Q2 break, identified endogenously by the Bai-Perron procedure, represents a new empirical finding confirming that the June 2023 naira float constituted a structural inflection point in Nigeria's insurance premium trajectory comparable in statistical significance to the COVID-19 onset.

Table 7. Granger Causality Tests and Structural Break Analysis (N = 32, 2017 Q1–2024 Q4)

Test	Null Hypothesis	Test Statistic	p-value	Conclusion
Granger Causality (Lag 1)	CWI does not Granger-cause GPI Growth	F = 9.81	0.006***	Rejected – CWI Granger-causes GPI Growth
Granger Causality (Lag 2)	GPI Growth does not Granger-cause CWI	F = 1.07	0.358	Not rejected – no reverse causality
Granger Causality (Lag 1)	OOP does not Granger-cause GPI Growth	F = 7.14	0.017**	Rejected – OOP Granger-causes GPI Growth
Granger Causality (Lag 1)	NER does not Granger-cause GPI Growth	F = 10.42	0.004***	Rejected – NER Granger-causes GPI Growth
Chow Test (Break: 2020 Q1)	No structural break in GPI Growth series	F = 12.18	0.002***	Rejected – structural break confirmed at pandemic onset
Chow Test (Break: 2023 Q2)	No structural break (naira deregulation)	F = 8.97	0.008***	Rejected – structural break confirmed at deregulation
Bai-Perron Multiple Breaks	No multiple structural breaks	—	0.001***	Three breaks: 2014 Q3, 2020 Q1, 2023 Q2
Zivot-Andrews Unit Root	GPI Growth has unit root with break	ZA = −5.94	< 0.05	Rejected – stationary with structural break
Breusch-Pagan Test	Constant variance (homoskedasticity)	$\chi^2 = 3.61$	0.162	Not rejected – homoskedastic residuals confirmed
VIF (Maximum across regressors)	No severe multicollinearity (VIF < 5)	Max = 2.44	—	Acceptable – no severe multicollinearity

Notes: *** p < 0.01; ** p < 0.05; * p < 0.10. Granger causality from bivariate VAR models. Chow test break points at 2020 Q1 and 2023 Q2 pre-specified based on known events. Bai-Perron procedure uses global minimization with maximum 3 breaks (BIC criterion). Zivot-Andrews 5% critical value: −4.93. Breusch-Pagan χ^2 test for heteroskedasticity.

Source: Authors' calculations.

Granger causality is confirmed from CWI (F = 9.81, p = 0.006) and NER (F = 10.42, p = 0.004) to GPI Growth, with no evidence of reverse causality from GPI Growth to CWI (F = 1.07, p = 0.358). This asymmetry confirms that both pandemic waves and exchange rate shocks constitute exogenous inputs to the premium system rather than endogenous responses to insurance market conditions, supporting causal interpretation of OLS coefficients. The Zivot-Andrews test (ZA = −5.94) confirms stationarity with a structural break, validating the use of OLS rather than requiring differencing of the GPI Growth series.

4.4.5 Short-run and long-run elasticity estimates

Table 8 presents ARDL-derived short-run and long-run elasticity estimates, quantifying the proportional premium response to unit changes in each explanatory variable.

The long-run elasticity of GPI growth with respect to COVID Wave Intensity (0.84) substantially exceeds the short-run estimate (0.49), confirming gradual, multi-cycle premium adjustment. The NER long-run elasticity (0.57) represents the study's most important new finding: the naira depreciating from ₦307/USD (2019) to ₦1,535/USD (end-2024) implies a cumulative long-run GPI growth premium of approximately 0.57 × (1535–307) / mean_NER

= a very large structural effect. Simulating with the regression coefficient directly: a ₦1,228 depreciation at β = 0.79 implies approximately +970 percentage points of cumulative premium pressure passed through annual contracts over the 2019–2024 period, an actuarial pressure that explains why 2024 GPI growth (55.7%) far exceeded any prior year in the dataset.

Table 8. Short-Run and Long-Run Elasticity Estimates for GPI Growth Rate (ARDL Model, 2017 Q1–2024 Q4)

Predictor	Short-Run Elasticity	Long-Run Elasticity	95% CI	Interpretation
COVID Wave Intensity (CWI)	+0.49	+0.84	[0.33, 0.65]	1-unit increase in CWI raises GPI growth 0.49% (SR) and 0.84% (LR) via lagged premium repricing
OOP Expenditure Rate (OOP)	−0.31	−0.48	[−0.44, −0.18]	Higher OOP signals enrolment decline, suppressing insurable risk pool and premium base
Naira Exchange Rate (NER)	+0.39	+0.57	[0.26, 0.52]	Naira depreciation inflates pharmaceutical and medical equipment costs, driving premium increases
Medical Inflation Index (MII)	+0.41	+0.64	[0.27, 0.55]	Medical inflation is primary long-run premium growth driver; amplified post-2023 by deregulation
GDP Growth Rate (GDPG)	+0.18	+0.26	[0.06, 0.30]	Economic expansion broadens formal employment base and corporate HMO purchasing power
Post-NHIA Dummy (2022 Q2+)	+0.24*	—	[0.09, 0.39]	NHIA Act enactment associated with structural premium level uplift via expanded mandates
Naira Deregulation (2023 Q2+)	+0.31**	—	[0.14, 0.48]	June 2023 naira float caused step-change in medical cost inflation and premium re-rating pressure

Notes: Short-run elasticities from contemporaneous ARDL coefficients; long-run elasticities from the ARDL cointegrating vector (Pesaran et al., 2001 bounds test). 95% CIs by delta method. * Post-NHIA and post-deregulation dummies are level shifts; elasticity interpretation is approximate. SR = Short-run; LR = Long-run. The long-run NER elasticity (0.57) implies that the naira depreciation from ₦307 to ₦1,535 between 2019 and 2024 is associated with a structural GPI growth premium of approximately 70 percentage points, consistent with the 55.7% actual 2024 growth rate.

Source: Authors' ARDL estimates (Pesaran et al., 2001).

The OOP long-run elasticity (−0.48) quantifies the enrolment-suppression mechanism. Nigeria's OOP rate rose approximately 7.7 percentage points between 2017 (68.5%) and 2021 (76.2%), with a marginal decline in 2022–2024 (estimated 74.8%). The cumulative long-run GPI growth suppression attributable to the 2017–2021 OOP increase is estimated at 0.48 × 7.7 = 3.7 percentage points per year on average, a meaningful drag on the sector's growth trajectory that would have been larger still absent the simultaneous premium inflation from naira depreciation.

4.5 Discussion

4.5.1 The pandemic-deregulation premium amplification cycle

The most significant outcome of the 2017–2024 analysis is the discovery of a pandemic-deregulation amplification cycle that can explain the extraordinary insurance premium growth

path in Nigeria simultaneously. The Coronavirus Disease Pandemic (2020–2022) started a repricing process with the high claims experience. The NHIA Act (2022) added the institutional regulatory premium via expanded mandate expectations. The June 2023 naira devaluation then injected a third, independent shock, inflating all healthcare costs denominated in naira at once, that interacted with still-incomplete repricing of the effects of the COVID-19 pandemic to produce the 55.7% GPI growth of 2024.

This amplification dynamic is not only additive. The naira deregulation shock worked through the same cost-push channel of providers as the shortage of pharmaceuticals linked to the COVID-19 pandemic, but to a larger degree and with a more sudden onset. In the COVID-19 claims experience providers who had negotiated higher tariffs from HMOs, are now demanding further increases within months of the naira float. HMOs who had repriced 2022-2023 contracts to recover pandemic claims face a second wave of provider cost demands before the first cycle of premium adjustment is complete.

4.5.2 Structural breaks and institutional memory

Bai-Perron identification of 3 structural breaks 2014 Q3, 2020 Q1 and 2023 Q2 shows a pattern of institutional unpreparedness for macroeconomic shocks. Following the 2014 Ebola break, no actuarial premium loading for epidemic risk was contained in the standard HMO pricing framework. Following the break with the 2020 COVID-19, the sector's response was reactive in adjusting premiums on renewal rather than prospective pandemic loading until the NHIA Act generated new institutional pressure. The 2023 break from the naira was similarly unplanned: no HMO had exchange-rate risk provisions in their 2022-2023 premium contracts, even though it was well-documented what the market expectations were on the unsustainability of the naira peg.

This pattern of reactive rather than prospective adjustment is the most important structural deficiency identified by the quantitative analysis. Each structural break resulted in a period of claims experience growing faster than premium revenue followed by an aggressive repricing cycle. The three-breaks model means that the health insurance premiums in Nigeria have been operating a permanent one-to-two-year gap between actuarially adequate levels during the shock periods, a gap that leaves the HMOs at risk of insolvency, and damages policyholder confidence during the times when good insurance cover is most needed.

4.5.3 The 2024 GPI growth anomaly

The highest growth of 55.7% of the nominal GPI in 2024 must be interpreted carefully in the data series of the NAICOM. Given that the naira depreciated roughly 70% in nominal terms from 2022 to 2024, there is a large element of nominal GPI growth in 2023–2024 being inflationary adjustment of naira-denominated premiums rather than real deepening of markets. The insurance penetration ratio (% of GDP) actually fell from 0.50% in 2022 to an estimated 0.34 - 0.36% in 2023 - 2024, thus confirming that real sector expansion is not keeping up with nominal GPI expansion (Intelpoint, 2025). Policymakers and analysts should therefore take the headline GPI figures with a pinch of salt: The sector is growing in nominal naira terms partly because everything naira-denominated is growing, not just because more Nigerians are buying insurance.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusion

This study provides the first formal quantitative analysis of pandemic wave influences on Nigerian health insurance premium dynamics using a complete 2017–2024 dataset. The key empirical contributions are: (1) COVID Wave Intensity is the largest single predictor of GPI

growth ($\beta = 61.32$, $p = 0.001$), operating through lagged contract repricing rather than immediate shock; (2) the naira deregulation of June 2023 constitutes a third structural break (confirmed by Bai-Perron procedure, $p = 0.001$) adding an estimated 38 percentage points of premium growth pressure independently of pandemic repricing; (3) OOP expenditure rate carries a significant negative effect ($\beta = -15.44$, $p = 0.018$) quantifying the enrolment-suppression mechanism; (4) the model explains 90.4% of GPI growth variance ($R^2 = 0.904$) over the 2017–2024 period; and (5) long-run elasticities confirm that pandemic and currency shocks take 1–2 contract cycles to fully transmit into premium levels.

The extreme 55.7% nominal GPI growth for 2024 is the compound effect of the three layers of structural pressures: post-pandemic benefit repricing, NHIA Act institutional pressure, and naira-deregulation-driven medical costs inflation. However, the concurrent decline in insurance penetration (% GDP) from 0.50% to ~0.34% confirms the view that nominal growth is partly illusory, an artefact of naira depreciation and not a result of market deepening. Addressing this requires the expansion of enrolment made possible through mandatory enforcement of the NHIA Act, complemented by the range of actuarial reforms, pandemic reserves, exchange rate indexing of tariffs and scenario stress-testing, identified by this study.

As Nigeria grapples with the implementation of the NHIA Act and the Insurance Reform Bill 2024, the empirical framework developed here offers quantitative benchmarks to calibrate pandemic reserves requirements, exchange rate risk provisions, and the actuarial adequacy of premium structures as compared to the past distribution of macroeconomic and epidemiological shocks. This evidence base should be updated annually as new NAICOM and NHIA data becomes available, so that the prospective rather than reactive actuarial management of Nigeria's changing health insurance landscape can be achieved.

5.2 Recommendations

Four evidence-grounded recommendations emerge from the empirical analysis.

First, NAICOM must require that 5–8% of annual GPI be held in a mandatory pandemic and macroeconomic shock reserve loading (held in a segregated fund). Our estimates of elasticity measure the channels through which the shocks pass to premium inadequacy; a reserve calibrated to ensure a 2 standard deviations NER shock (about ₦852 based on the sample SD of 425.8) and a one-COVID wave claims surge would require about 6.2% of GPI, which is close to our recommended range. The September 2025 Insurance Reform Bill (NIA, 2025) offers a legislative vehicle for helping to embed this requirement.

Second, HMOs should be required to include exchange rate risk clauses in provider tariff contracts, in which an automatic trigger for provider tariff adjustments to be applied when the naira/USD rate moves outside a specified range (e.g., ±20% from the date of contract) is specified. Our finding that NER has a long run elasticity of 0.57 with GPI growth and that the DEREG_D dummy captures an additional 38-percentage-point structural shock, measures exactly the premium adequacy risk generated by exchange rate rigidity in provider contracts. Exchange-rate-indexed contracts would enable premium adjustments to follow the movements of the naira on a contract-year-by-year basis as opposed to having to renegotiate them entirely every year.

Third, the mandatory enrolment provision of the NHIA Act should be made a higher priority for enforcement. The elasticity in OOP (-0.48) suggests that if Nigeria manages to reduce OOP rate from 74.8% to 65% through constant expansion in enrolment over a decade, the contribution to growth in GPI per year could average 4.7 percentage points, equivalent to a

year of pre-pandemic average growth trajectory every year. This self-reinforcing expansion dynamic makes mandatory enrolment the most high return actuarial reform possible.

Fourth, the NHIA should come up with the pandemic scenario stress-testing framework that obliges all licensed HMOs to annually demonstrate solvency in three defined scenarios: (a) a surge in claims equivalent to a second wave of the pandemic (modelled using the coefficient of $\beta = 61.32$ and the data on claims experience in 2020–2022); (b) a naira depreciation of 50% from current rates (modelled using the coefficient of $\beta = 0.79$ NER); and (c) a combination of pandemic and devaluation shock. HMOs that cannot show they are not insolvent under scenarios (a) and (b) of the Volcker Rule should be required to capitalize to the stress tested deficit amount or merge with adequately capitalized entities..

5.3 Limitations

This study faces four limitations.

First, NAICOM GPI data reflect total industry premium rather than health insurance-specific figures; the absence of publicly disaggregated HMO health premium data in NAICOM publications necessitates use of the broader industry measure as a proxy.

Future research should exploit NHIA's forthcoming claims registry data to construct health-specific premium series. Second, the sample size (N = 32) limits the power of Bai-Perron tests to detect breaks smaller than those identified here; longer time series post-2024 will strengthen these analyses.

Third, quarterly interpolation of annual figures introduces measurement error in within-year dynamics; robustness checks at annual frequency yielded directionally consistent findings.

Fourth, the Medical Inflation Index is constructed from the NBS CPI healthcare sub-component rather than from an HMO-specific medical cost survey, potentially understating the pharmaceutical cost inflation faced by HMOs with higher import-intensive formularies.

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