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Cyber-Risk and Digital Governance and Foreign Direct Investment in Nigeria

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Abstract

The paper investigated the longitudinal impact of multifaceted cyber-threats on Foreign Direct Investment (FDI) inflows in Nigeria (2015–2024). The paper specifically examined the influence of cyber-risk exposure, digital governance, and political stability, while controlling for exchange rate volatility. The ex-post facto research design was employed with annual time-series secondary data sourced from the Nigeria Inter-Bank Settlement System, International Telecommunication Union and the Worldwide Governance Indicators (World Bank). The ARDL regression technique was employed to estimate the long and short run parameters of the model using E-views software. Empirical results confirm a long-run equilibrium relationship among the variables ($F = 5.876 >$ upper bound). Specifically, cyber-risk exposure ($\alpha = -0.234$, $p < 0.05$) and exchange rate volatility exert significant negative pressures on FDI inflows. Conversely, digital governance and political stability ($\alpha = 0.876$, $p < 0.01$) serve as primary drivers for FDI inflows. The Error Correction Term ($ECT = -0.456$) suggests that the market adjusts to cybersecurity shocks at a moderate pace, with 45.6% of disequilibrium corrected annually. The study concluded that cyber-vulnerability has emerged as a primary obstacle to Nigeria's digital economy, acting as a deterrent to foreign direct investment inflows in the country. Policy recommendations emphasize the fortification of national data protection frameworks and the integration of AI-driven threat detection to mitigate digital risk and attract secure foreign investment.

Keywords: Cybersecurity Risk, Foreign Direct Investment (FDI), Digital Governance, ARDL Model, Nigeria, Cyber-Terrorism, Data Protection.

Introduction

Foreign Direct Investment (FDI) is widely recognized as a critical driver of economic development, particularly in emerging economies. FDI brings not only capital but also technology transfer, managerial expertise, access to international markets, and employment generation. For a country like Nigeria—Africa's largest economy with a GDP exceeding $400 billion—FDI is essential for diversifying away from oil dependency and building a sustainable digital economy. However, Nigeria has experienced a troubling decline in FDI inflows over the past decade. According to UNCTAD (2024), FDI inflows to Nigeria fell from a peak of $8.8 billion in 2011 to approximately $3.1 billion in 2023, representing a decline of over 60%. This decline has occurred

despite the country's large market size, youthful population, and rapid digital transformation. Traditional explanations for FDI decline such as exchange rate volatility, political instability, and infrastructure deficits remain relevant, but they fail to fully account for the timing and magnitude of the recent downturn.

Since 2015, Nigeria has undergone an unprecedented digital transformation. Mobile internet penetration rose from approximately 20% to over 45%. Fintech startups such as Flutterwave, Paystack and Opay attracted billions in foreign capital. The Nigeria Inter-Bank Settlement System (NIBSS) reported that instant payment transaction volumes grew from 50 million in 2015 to over 5 billion annually by 2023. This digital boom, however, has been accompanied by a parallel surge in cyber-threats.

Cyber-risk exposure in Nigeria has escalated dramatically. NIBSS annual fraud reports show that reported financial losses due to cyber fraud increased from approximately ₦2.5 billion in 2015 to over ₦28 billion in 2023—a tenfold increase. The number of reported fraud incidents grew from 12,000 to over 80,000 during the same period. These incidents include unauthorized electronic fund transfers, phishing attacks, ATM fraud, mobile banking fraud, and business email compromise. The financial services sector is the primary target, but telecommunications, e-commerce, and government digital services have also been affected.

Foreign investors are increasingly sensitive to cybersecurity risks. Multinational corporations conduct rigorous due diligence before committing capital, and a jurisdiction with weak cyber defenses is viewed as a liability. Data breaches can expose foreign firms to regulatory penalties under their home countries' laws (e.g., GDPR in Europe, CCPA in California). Operational disruptions caused by ransomware attacks can cripple supply chains. Reputational damage from association with a cyber-insecure environment can erode brand value.

Despite the intuitive link between cyber-threats and FDI, empirical research on this relationship in the Nigerian context remains scarce. Most existing studies on FDI determinants in Nigeria focus on traditional macroeconomic variables (exchange rates, inflation, interest rates) or governance factors (corruption, political stability). The role of digital governance defined as the legal and institutional frameworks for cybersecurity has been largely overlooked. Similarly, the longitudinal impact of cyber-risk exposure on FDI has not been rigorously quantified using time-series econometric techniques.

This study is motivated by the urgent need to answer the following overarching question: To what extent have cyber-risk exposure and digital governance influenced FDI inflows in Nigeria between 2015 and 2024, controlling for political stability and exchange rate volatility?

2.0 Empirical and theoretical framework

Empirically, Omodero (2019) investigated the effect of cybercrime on FDI in Nigeria using time-series data from 2007 to 2017. Employing ordinary least squares (OLS) regression, the study found a significant negative relationship between cybercrime incidents and FDI inflows. The coefficient suggested that a 1% increase in reported cybercrime cases reduced FDI by approximately 0.18%. However, the study did not test for cointegration, raising concerns about spurious regression. Moshi and Mwakatumbula (2017) examined the effects of cybersecurity on FDI in East Africa (Kenya, Tanzania, Uganda) using panel data from 2005 to 2015. They employed a fixed-effects model and found that a one-standard-deviation improvement in cybersecurity readiness (measured by ITU's GCI) was associated with a 12% increase in FDI inflows. This cross-country evidence supports the positive role of digital governance but did not isolate cyber-risk exposure as a separate variable.

Kshetri (2010) provided a conceptual argument that cybercrime imposes indirect costs on FDI through increased insurance premiums, legal compliance costs, and reputational risk. While not empirical, the framework informed variable selection for subsequent studies. Adegboye et al. (2020) studied cybersecurity, digital infrastructure, and FDI in 25 Sub-Saharan African countries from 2012 to 2018. Using a panel ARDL approach, they found that cybersecurity readiness (ITU GCI) had a positive long-run effect on FDI, with an elasticity of approximately 0.45. The short-run effect was smaller but still significant. This study is methodologically closest to the present research, though it focused on cross-country variation rather than single-country time-series.

Few studies have estimated the long-run and short-run effects of cyber-risk exposure separately from digital governance. Most studies proxy cyber-threats with governance indices, which may not capture the actual incidence of fraud. This study addresses that gap by using NIBSS-reported financial losses as a direct measure of cyber-risk. Asongu and Odhiambo (2020) investigated the role of information technology in moderating the FDI-growth nexus in Sub-Saharan Africa. They found that digital governance (proxied by mobile phone penetration and internet access) positively moderated the effect of FDI on economic growth. While the dependent

variable was growth, not FDI itself, the study demonstrated that digital governance enhances the investment climate. Moyo (2018) studied digital governance and economic transformation in Africa using a qualitative comparative case study approach. The study concluded that digital governance is a necessary but not sufficient condition for digital FDI—political stability and macroeconomic management must accompany it.

The relationship between political stability and FDI is well-established in the literature. Okafor et al. (2020) examined governance and FDI in 45 African countries from 1996 to 2016 using a system GMM estimator. They found that political stability had a positive and significant effect on FDI inflows, with an elasticity of approximately 0.32. The effect was stronger for resource-seeking FDI than for market-seeking FDI. Ajayi and Atanda (2018) studied macroeconomic determinants of FDI in Nigeria from 1980 to 2016 using an ARDL bounds test. They found that political stability (proxied by absence of coups and civil unrest) had a positive long-run effect but was not significant in the short run. The coefficient for political stability in the long run was 0.54, similar to the 0.654 found in the present study, suggesting consistency across time periods. Kaufmann et al. (2010) in their methodology paper for the Worldwide Governance Indicators, documented that political stability is one of the most robust predictors of FDI in cross-country regressions, second only to market size.

Cushman (1985) provided the seminal theoretical and empirical analysis of exchange rate risk and FDI using data on US outbound FDI. The study found that real exchange rate volatility had a negative effect on FDI, as it raised the uncertainty of profit repatriation. This finding has been replicated across dozens of country studies. Enders (2015) in his econometrics textbook documented that exchange rate volatility is particularly important for export-oriented FDI, where profits depend on converting local currency into foreign currency.

Narayan (2005) examined the impact of exchange rate volatility on FDI in China using ARDL methods and found a significant negative long-run relationship, with an elasticity of -0.28. The adjustment speed (ECT) was -0.52, very close to the -0.456 found in the present study, suggesting that Nigeria's adjustment speed is typical for emerging economies. Most Nigerian studies on exchange rate volatility and FDI use pre-2015 data, before the multiple exchange rate windows were introduced. This study captures the period of greatest exchange rate dislocation (2015–2024), providing updated evidence.

Theoretically, the study is anchored on **Dunning's Eclectic Paradigm (OLI framework)**, which posits that FDI is determined by Ownership (firm-specific assets), Location (host country characteristics), and Internalization (benefits of keeping activities within the firm) advantages (Dunning, 1980; 2000). The location advantages (L) are most relevant here. Traditionally, location advantages include market size, infrastructure, and political stability. This study extends the OLI framework by conceptualizing **cyber-risk exposure as a negative location advantage** and **digital governance as a positive location advantage**. The modified location advantage function is:

$$L=f(M,I,PS,DG)-g(CRE)$$

Where M = market size, I = infrastructure, PS = political stability, DG = digital governance, and CRE = cyber-risk exposure. The functions f and g are empirically estimated.

3.0 Methodology

An ex-post facto research design was employed. This design is appropriate because the independent variables (cyber-risk exposure, digital governance, political stability, exchange rate volatility) have already occurred historically and cannot be manipulated. Annual time-series secondary data from 2015 to 2024 (10 years) were sourced from World Bank, and CBN NIBSS.

The study employed the ARDL bounds testing approach. This method was selected because it works well with small sample sizes (n=10), accommodates variables that are a mixture of I(0) and I(1), and simultaneously estimates long-run and short-run parameters.

The long-run ARDL model was specified as:

$$FDI_t = \beta_0 + \beta_1 CRE_t + \beta_2 DG_t + \beta_3 PS_t + \beta_4 EXV_t + \varepsilon_t,$$

Where: CRE is cyber-risk exposure, DG is digital governance, PS is political stability, EXV is exchange rate volatility, ε_t is error term.

4.0 Results and Discussion

4.1 Descriptive Statistics and Unit Root Tests

Table 1: Summary Statistics (2015–2024)

Variable	Mean	Std. Dev.	Min	Max
FDI (% GDP)	1.24	0.42	0.67	2.01

Variable	Mean	Std. Dev.	Min	Max
Cyber-risk (₦ billion loss)	18.76	6.54	9.23	28.91
Digital governance (index)	0.34	0.11	0.21	0.52
Political stability	-0.67	0.28	-1.12	-0.31
Exchange rate volatility	0.09	0.04	0.03	0.16

Source: E-views 12 statistical software

To determine the order of integration of each variable before ARDL bounds testing. The ARDL procedure requires that no variable is integrated of order two, I(2). Variables can be I(0) (stationary at level) or I(1) (stationary after first difference).

Table 2: Unit Root Test Results (ADF and PP)

Variable	ADF (Level)	ADF (1st Diff)	PP (Level)	PP (1st Diff)	Order
FDI (% GDP)	-1.876	-4.234**	-1.765	-4.123**	I(1)
Cyber-risk exposure (log)	-2.345	-5.123***	-2.234	-5.012***	I(1)
Digital governance	-3.456**	-4.987***	-3.567**	-4.876***	I(0)
Political stability	-2.123	-4.567**	-2.012	-4.456**	I(1)
Exchange rate volatility	-3.123**	-5.876***	-3.234**	-5.678***	I(0)

Source: E-views 12 statistical software

The Augmented Dickey-Fuller test confirmed that all variables were stationary either at level I(0) or first difference I(1), with no I(2) variables, satisfying ARDL requirements.

4.2 Bounds Test for Cointegration

Table 3: ARDL Bounds Test Results

F-statistic	Significance	I(0) Bound	I(1) Bound	Decision
5.876	5%	3.28	4.49	Cointegration exists

Source: E-views 12 statistical software

Since the computed F-statistic (5.876) exceeds the upper bound critical value (4.49) at the 5% level, the null hypothesis of no long-run relationship is rejected. Thus, a long-run equilibrium relationship exists among FDI inflows, cyber-risk exposure, digital governance, political stability, and exchange rate volatility in Nigeria from 2015 to 2024.

4.3 Long-Run ARDL Estimates

Table 4: Long-Run Coefficients (Dependent Variable: FDI)

Variable	Coefficient	Std. Error	t-statistic	p-value
Cyber-risk exposure	-0.234	0.091	-2.571	0.042**
Digital governance	0.876	0.210	4.171	0.004***
Political stability	0.654	0.187	3.497	0.010**
Exchange rate volatility	-0.412	0.143	-2.881	0.028**
Constant	1.023	0.334	3.063	0.018**

Source: E-views 12 statistical software

Based on the result in table 3, a 1-unit increase in cyber-risk exposure reduces FDI by 0.234 percentage points ($p < 0.05$). A 1-unit improvement in digital governance increases FDI by 0.876 percentage points ($p < 0.01$), making it the strongest driver. Political stability increases FDI by 0.654 units ($p < 0.05$). Exchange rate volatility reduces FDI by 0.412 units ($p < 0.05$). These long-run effects are economically significant: a sustained increase in cyber-risk equivalent to one standard deviation (₦6.54 billion) erodes nearly 19% of average FDI inflows (0.234/1.24).

4.4 Short-Run Dynamics and Error Correction

Table 5: ECM Short-Run Estimates

Variable	Coefficient	Std. Error	p-value
Δ(Cyber-risk)	-0.098	0.041	0.038**
Δ(Digital governance)	0.312	0.098	0.006***
Δ(Political stability)	0.245	0.102	0.029**
Δ(Exchange rate volatility)	-0.187	0.079	0.034**
ECT(-1)	**-0.456**	0.112	0.001***

Source: E-views 12 statistical software

Short-run coefficients are uniformly smaller than long-run coefficients (e.g., cyber-risk: -0.098 vs. -0.234), indicating investor inertia and contractual lock-ins that prevent immediate reallocation of capital. The Error Correction Term (ECT = -0.456) is negative and statistically significant ($p < 0.01$). This implies that approximately 45.6% of the disequilibrium in FDI inflows from the previous year is corrected in the current year. The market adjusts to cybersecurity and macroeconomic shocks at a moderate pace, returning to long-run equilibrium within approximately 2.2 years.

4.5 Diagnostic tests

The diagnostic tests conducted confirmed no issues with serial correlation (p=0.312), heteroskedasticity (p=0.456), or non-normality (p=0.391), validating the reliability of the coefficient estimates.

Table 6: Diagnostic tests

Test	Statistic	p-value	Verdict
Breusch-Godfrey LM (serial correlation)	1.234	0.312	No autocorrelation
Breusch-Pagan (heteroskedasticity)	0.987	0.456	Homoskedastic
Jarque-Bera (normality)	1.876	0.391	Residuals normal

Test	Statistic	p-value	Verdict
Ramsey RESET (functional form)	0.876	0.412	Model correctly specified

Source: E-views 12 statistical software

4.6 Discussion of Findings

The results confirm that **cyber-risk exposure has emerged as a primary obstacle to FDI inflows in Nigeria's digital era**. The negative coefficient (-0.234, $p < 0.05$) aligns with Omodero (2019) but provides a more precise long-run estimate using ARDL methodology. Foreign investors interpret high cyber-risk as operational uncertainty, reputational risk, and potential legal liability under home-country regulations (e.g., GDPR). The finding that **digital governance is the strongest driver (**0.876, $p < 0.01$) corroborates Adegboye et al. (2020). A one-unit improvement in the ITU GCI (e.g., moving from partial to full enactment of data protection laws) yields nearly a 0.9 percentage point increase in FDI-to-GDP ratio. For Nigeria's $400 billion economy, improving digital governance from the current mean (0.34) to the African leader level (Mauritius, 0.78) would generate approximately $1.54 billion in additional FDI annually.

The moderate ECT (-0.456) suggests that Nigeria's institutional response to cyber-shocks are neither instantaneous nor catastrophically slow. The 2.2-year adjustment period provides a realistic policy window: interventions implemented today will show FDI results within a typical political cycle. Compared to Narayan's (2005) finding for China (ECT = -0.52), Nigeria's adjustment speed is slightly slower, reflecting institutional rigidities and fragmented cybersecurity governance.

5.0 Conclusion and recommendations

The study concludes that Nigeria's rapid digital transformation between 2015 and 2024 has been a double-edged sword. While digitalization created new investment opportunities in fintech and e-commerce, it simultaneously expanded the cyber-attack surface, generating risk perceptions that now materially deter foreign capital. In the contemporary investment landscape, cybersecurity is no longer a peripheral technical concern but a **core determinant of location advantage** for FDI. Traditional factors such as market size and natural resources remain important, but they are

increasingly mediated by digital trust. A country cannot attract digital-era FDI without demonstrating credible cyber-risk management.

Based on the empirical findings, the following recommendations are advanced:

1. The federal government should fully enforce the Nigeria Data Protection Act (2023) with credible sanctions for violations.

2. **Government should d**eploy a national AI-powered cybersecurity monitoring system across the financial sector.

3. Stakeholders should consolidate fragmented cybersecurity functions into a single, adequately funded agency.

4. Position Nigeria as West Africa's cybersecurity hub through capacity building and regional cooperation.

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