

LEASE OR BUY? AN NPV MODEL FOR AIRCRAFT FINANCING IN NIGERIA'S HIGH-COST AVIATION MARKET

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ABSTRACT

Nigeria's aviation industry operates in a macroeconomic environment characterised by high lending rates, exchange-rate volatility, and limited access to long-term local-currency finance. These conditions materially affect the relative financial attractiveness of leasing and debt-financed aircraft ownership. This study develops an Integrated Net Present Value–Sensitivity Analysis (INPV-SA) model to evaluate the 10-year financial feasibility of an operating lease versus debt-financed purchase of a Boeing 737 MAX 8 in Nigeria. The model incorporates lending rate, exchange-rate depreciation, maintenance costs, maintenance-reserve escalation, residual value, tax-shield utilisation, and the weighted average cost of capital, using publicly available financial and aviation data. The baseline results show a present-value cost of ₦197.8 billion for purchase compared with ₦158.3 billion for leasing, producing a differential NPV of –₦39.5 billion and indicating a financial advantage for leasing under the baseline assumptions. The estimated break-even lending rate is 18.7%; below this threshold, ownership becomes financially competitive, while above it leasing is preferred. Sensitivity results identify lending rate and exchange-rate depreciation as the dominant drivers of the financing decision. The two-way analysis further shows that the ownership threshold falls as currency depreciation intensifies. The study therefore provides a Nigeria-specific decision framework for airline managers, financiers, and policymakers assessing fleet acquisition under high-cost-of-capital conditions.

Keywords: Operating lease; aircraft acquisition; Net Present Value; cost of capital; exchange-rate risk; airline finance

Introduction

The lease-versus-buy decision is a fundamental capital-allocation problem for capital-intensive firms and is particularly important in commercial aviation, where aircraft acquisition requires substantial long-term financing. The financial attractiveness of ownership depends on the cost of capital, tax treatment, residual value, maintenance obligations, and the opportunity cost of capital tied up in the aircraft (Clark, 2017; Ross *et al.*, 2019; Brealey *et al.*, 2022). Leasing can reduce the initial capital commitment and transfer part of the residual-value and remarketing risk to the lessor, whereas ownership can provide terminal asset value and greater control over the aircraft. The preferred financing structure therefore depends on the interaction between financing costs and operating conditions rather than on the acquisition price alone.

Nigeria provides an important setting for examining this decision because airline expansion occurs alongside substantial financing constraints. The country has a large potential market for air transport, yet domestic carriers continue to face difficulties in maintaining and expanding modern fleets (National Bureau of Statistics [NBS], 2025; Federal Ministry of Aviation and Aerospace Development [FMAAD], 2025). Financing costs are a major part of this constraint. The Central Bank of Nigeria (CBN) monetary policy rate reached 27.25% in 2024, while commercial lending rates for prime borrowers were reported at approximately 25–32% (CBN, 2024). These conditions increase the cost of debt-financed aircraft ownership and make alternative financing arrangements more relevant to airline fleet planning.

The financing environment also interacts with exchange-rate risk. Aircraft, lease rentals, maintenance services, insurance, and many spare parts are substantially linked to foreign-currency costs. For airlines whose revenues are predominantly denominated in naira, naira depreciation can increase the domestic-currency cost of both aircraft ownership and lease obligations. Operating leases may nevertheless provide a financing advantage by reducing the initial capital burden and transferring some residual-value and remarketing responsibilities to the lessor (AerCap Holdings, 2024; IATA, 2024). Conversely, lower borrowing costs and improved access to long-term finance could strengthen the economic case for ownership.

Although the lease-versus-buy decision has been extensively examined in corporate finance, evidence specifically addressing aircraft financing in African markets remains limited. Existing research establishes the theoretical equivalence of leasing and secured borrowing under frictionless conditions, but real-world factors such as currency mismatch, country risk, thin secondary markets, financing constraints, and tax asymmetries can make the alternatives economically different (Myers *et al.*, 1976; Eisfeldt & Rampini, 2009). Nigerian studies have documented high financing costs and fleet constraints, but they have not developed a formal quantitative model that compares aircraft leasing and ownership under Nigeria-specific macroeconomic conditions.

This study addresses that gap by developing a deterministic Integrated Net Present Value–Sensitivity Analysis (INPV-SA) model for a Boeing 737 MAX 8. The model evaluates the 10-year present-value cost of operating lease and debt-financed purchase and identifies the financing conditions under which each option is preferred. It incorporates lending rates, exchange-rate depreciation, maintenance and maintenance-reserve escalation, residual value, tax-shield utilisation, and the discount rate. The analysis is designed to provide a transparent decision boundary that airline managers and policymakers can use when assessing fleet acquisition under changing macroeconomic conditions.

Literature Review

1 Theoretical Foundations of the Lease-versus-Buy Decision

The modern theory of leasing as a corporate-finance instrument stems from Modigliani & Miller's (1958) irrelevance propositions, which conclude that under a frictionless capital market, the way the asset is financed (debt, equity or leasing) does not affect firm value. Miller & Upton (1976) showed that if the lease and debt are perfect substitutes, the net effect

of leasing on the firm's total debt capacity is zero. Myers *et al.* (1976) developed the key framework for the lease versus buy decision that states the after-tax cost of debt-financed ownership, including depreciation tax shields, interest tax shields, and the expected residual value, should be compared with the after-tax cost of the lease payments.

The theoretical literature indicates several market imperfections can make leasing more attractive than ownership. Tax asymmetries may allow lessors with greater tax capacity to exploit depreciation benefits and reflect part of those benefits in lease pricing (Lewis & Schallheim, 1992). Financial constraints also encourage leasing because it can preserve borrowing capacity and reduce the financing burden associated with asset ownership (Eisfeldt & Rampini, 2009). In addition, information asymmetry concerning asset quality and residual values can affect the relative efficiency of leasing markets (Gavazza, 2011). These mechanisms are particularly relevant where airlines face restricted access to long-term finance and substantial uncertainty in asset values.

The economical aspects of leasing have had a significant impact on the aviation world over the last 40 years with the development of a specialised aircraft-leasing industry. Gritta *et al.* (1994) describe the secular trend towards lessor-owned fleets, which increased its share of the world's commercial fleet from about 2 per cent in 1980 to over 50 per cent in 2020. It is a structural shift that has been influenced by a number of factors including the reduced economies of scale in fleet management, maintenance management and remarketing, the Basel-driven regulatory capital incentives for banks that finance lessors and the diversification advantages that large lessors have across geographies, airlines and aircraft type (Littlejohns & McGairl, 2014).

2 Empirical Evidence from Emerging Markets

The empirical literature on airline leasing in emerging markets is also growing, but is not as extensive as the literature generated in the developed markets. Oum & Yu (1998) present a cross-country comparison of airline cost structures which systematically shows higher capital costs for carriers in developing countries. Morrell (2013) reviews fleet financing arrangements for a sample of Asian and African carriers, and concludes that more than 80 per cent of the fleet access in Sub-Saharan Africa is through operating leases, versus about 45 per cent in North America. Morrell says this differential is mainly due to a lack of deep local-currency capital markets and high-country risk premiums making asset-backed lending unprofitable for most African sovereign jurisdictions.

More recently, Flouris & Walker (2018) develop a framework for analysing the trade-offs between various fleet-financing options when the exchange-rate is uncertain, and apply it to a case study of a Turkish airline. Their model shows that, for carriers with most of their revenue in local currency, and most of their lease or debt obligations in hard currency, exchange-rate volatility can be the most important factor in the lease versus buy equation. Vasigh *et al.* (2018) comprehensively cover airline financial analysis, including a chapter on fleet planning, encompassing NPV analysis and a sensitivity analysis based on scenarios. But their system does not explicitly consider extreme interest-rate and exchange-rate scenarios, the Nigerian operating environment.

Adeniyi and Olatunji (2019) found that cost of capital is a major determinant of the financial viability of domestic airline operations in Nigeria, while Nwaogbe *et al.* (2013) identified financing constraints as a factor associated with inadequate air-transport capacity. However, these studies do not formally compare the present-value economics of leasing and ownership for aircraft acquisition. This leaves an important empirical gap for Nigerian airlines operating under high interest rates and exchange-rate volatility.

3 The NPV Framework in Aircraft Acquisition

The use of NPV in aircraft acquisition is a longstanding tradition. A very early application is provided in Clark (2017) which compares the present-value cost of lease versus

purchase of wide-body aircraft, based on airline-specific weighted average costs of capital. Gibson & Morrell (2004) take this approach further and add in the maintenance-reserve dynamics and show that the relative attractiveness of the lease option can be materially influenced by the way in which maintenance obligations are treated. In the case of operating leases, the lessee usually pays maintenance-reserve payments to the lessor on a monthly basis, with the payments held in escrow and released to the lessor at a time of a major maintenance event (C-checks and D-checks) (IATA, 2024). Purchase, however, means that the airline assumes 100% of the maintenance costs up front, but has the option to control when and how much maintenance is performed as needed for operations.

Several authors have investigated the sensitivity of the NPV comparison to the important input parameters. Vasigh *et al.* (2018) present the three most important parameters, namely the discount rate, residual value, and tax rate. When the type of the aircraft being considered is different from an airline's existing fleet, the benefits of fleet commonality and transition costs can be decisive in determining whether an airline chooses to lease or purchase the aircraft, hinting at factors that are not always considered and often under-emphasised in the lease versus purchase decision (Holloway, 2016). Belobaba *et al.* (2015) also place the fleet finance decision in the context of airline revenue management (ARM) and network planning because of the option value created by the flexibility of operating leases, in particular the freedom from residual value risk which such leasing affords.

The Nigerian Aviation Context

1 Macroeconomic Environment

The macroeconomic context that Nigerian airlines operate in has three structural characteristics that are directly relevant to the fleet financing decision and which are summarized as follows: Nigerian nominal and real interest rates are high and have been high for a long time; there has been a history of chronic naira depreciation against the United States dollar; and the domestic capital market is shallow and lacks a supply of long-tenor instruments. The focus of Nigeria's monetary policy has been on fighting inflation, preserving the exchange-rate of the naira, and ensuring the stability of the financial system. The Central Bank of Nigeria (CBN) has tightened its monetary policy rate from 18.75 per cent in January 2024 to 27.25 per cent by September 2024 due to the impact of the petrol subsidy removal and unification of exchange-rate regime, despite the persistence of the inflationary pressures (CBN, 2024). The rates of commercial lending which include credit-risk premium above the MPR range between 25 and 32 per cent for prime corporate borrowers, and rates borrowers with weaker creditworthiness pay more than 35 per cent (CBN, 2024). In comparison, the prime lending rate in the United States was around 8.5 per cent during the same period, and the London Interbank Offered Rate (LIBOR) replacement, the Secured Overnight Financing Rate (SOFR), was around 5.3 per cent (Federal Reserve Bank of New York [FRBNY], 2024).

There is significant devaluation of the naira-dollar exchange-rate, from about N460/1 USD in May 2023 (before the currency was floated) up to N1600/1 USD by mid-2025 at the Investors and Exporters window (CBN, 2025). This decline has been caused by a structural current account deficit in non-oil trade, low foreign direct investment inflows in all sectors other than extractive industries and occasional capital flight. This depreciation directly drives up the cost for airlines in naira terms, with a significant share of the operating costs (such as fuel, spare parts and insurance) being in the naira.

2 Regulatory and Institutional Framework

The Nigerian Civil Aviation Authority (NCAA) is the regulatory body for all aspects of air transport operations in Nigeria, ranging from airworthiness standards, operational certification, economic regulation etc. Nigeria is a party to the Chicago Convention and the Protocol on Matters Specific to Aircraft Equipment of the same Convention, which are signed by the International Institute for the Unification of Private Law, 2001. The registration and

enforcement of the security interests in aircraft under the Cape Town Convention have achieved a greater degree of legal security. The legal framework securing aircraft financing has been strengthened by the ratification of the Cape Town Convention on security interests in aircraft. Challenges in implementation include slow aircraft de-registration and export by the Cape Town registry in the case of airline default, which adds to the risk premium required by lessors and lenders (Goode, 2013).

The tax treatment of aviation assets in Nigeria is in accordance with the provisions of the Companies Income Tax Act (CITA) and the allowances available in the Nigerian tax regime are the capital allowance (the Nigerian equivalent of depreciation deductions) for qualifying capital expenditure. The rate of initial allowance is 15 per cent and the rate of annual allowance is 10 per cent on reducing balance for aircraft and ancillary equipment (Federal Republic of Nigeria, 2007). Many Nigerian airlines, however, are running at a loss because of the economic difficulty of domestic air transport, thus limiting the immediate benefit of depreciation tax shields of the aircraft purchase (Nigerian Civil Aviation Authority (NCAA), 2023). The lease versus buy analysis should take account of this tax-asymmetry as for tax purposes, global lessors are generally tax efficient countries, (Ireland, Bermuda, Cayman Islands) and will be able to enjoy the full depreciation benefit which may be passed on to the lessee in the form of lower lease rates.

3 Fleet Composition and Market Dynamics

There are about eight domestic airlines that fly in Nigeria with Ibom Air, Air Peace and United Nigeria Airlines being the three biggest by passenger volume as of the 2nd quarter of 2025 (FMAAD, 2024). Largest domestic carrier Air Peace has a mixed fleet of Boeing 737s, Embraer E195s and has accepted delivery of Airbus A320neo-family planes. The major aircraft types for the domestic fleet are narrow-body single-aisle models of 150 to 200 seats in which the Boeing 737 MAX 8 and the Airbus A320neo are the latest generation alternatives.

Most Nigerian carriers' fleets are accessed through international lessors under operating-lease arrangements. Morrell (2013) reports a high prevalence of leasing in developing aviation markets, reflecting the limited depth of domestic capital markets and the risk characteristics of aircraft finance. The Nigerian context therefore provides a useful setting for testing whether the observed reliance on leasing remains financially optimal under different interest-rate and exchange-rate conditions.

Taken together, the literature establishes the importance of financing cost, currency risk, residual value, and maintenance obligations, but it does not quantify a Nigeria-specific break-even condition for aircraft ownership versus operating lease. The present study fills this gap by integrating these variables into a deterministic NPV framework and estimating both a baseline ownership threshold and a two-variable decision boundary for Nigerian airline fleet acquisition.

Methodology

1 Integrated Net Present Value–Sensitivity Analysis (INPV-SA) Model

This study uses an Integrated Net Present Value–Sensitivity Analysis (INPV-SA) model to assess the financial viability of outright purchase versus operating lease for a Boeing 737 MAX 8 in Nigeria. The model combines discounted cash-flow valuation with deterministic sensitivity analysis. It evaluates the present value of relevant cash flows over a 10-year horizon and then varies key parameters systematically to identify the conditions under which purchase or lease is financially preferable.

The INPV-SA framework extends a conventional lease-versus-buy comparison by jointly considering lending rate, exchange-rate depreciation, maintenance costs, maintenance-reserve escalation, residual value, tax-shield utilisation, and the weighted average cost of capital. The Boeing 737 MAX 8 is used as the representative narrow-body aircraft because it is relevant to contemporary airline fleet planning and is included in the aviation-finance

literature and market data used to parameterise the model (Boeing Commercial Airplanes, 2024; Vasigh *et al.*, 2018).

The model proposed differs from the traditional lease versus buy analysis, which only considers the discounted cash flow, by applying a number of macroeconomic and operational factors such as the lending rate, the depreciation of the exchange-rate, maintenance costs, the residual value of the aircraft, and the weighted average cost of capital (WACC). Such integration can be used for identifying financing thresholds and better decision-making in uncertain economy (Vasigh *et al.*, 2018; Flouris & Walker, 2018). As one of the most popular narrow-body aircraft for commercial service, the Boeing 737 MAX 8 was chosen as the representative aircraft, and was frequently used in fleet planning studies (Boeing Commercial Airplanes, 2024).

2 Data Sources and Model Parameters

The model was calibrated on the basis of secondary data, which was available in public domain from various reputed aviation and financial organizations. The Central Bank of Nigeria (CBN) was the source of macroeconomic indicators such as lending rates and exchange rates. The cost of aircraft, aircraft rental rates, maintenance fees and aircraft residual value assumptions have been taken from Boeing Commercial Airplanes, the International Air Transport Association (IATA), Airline Monitor and the annual reports of the major aircraft leasing companies (Avitas, ISTAT 2024). The Nigeria tax and regulatory assumptions were based on the Nigerian Companies Income Tax Act (CITA), and the Nigerian Civil Aviation Authority (NCAA) publications. The basic parameters used in the analysis are shown in Table 1.

The purchase price of US\$55 million is intentionally higher than the US\$50 million aircraft market value used to determine the lease rate; the difference represents a conservative acquisition-price premium reflecting transaction, delivery, and financing-related costs rather than an assumption that the two values are identical. Applying the market value to the lease-rate calculation and the acquisition price to the ownership calculation therefore preserves the distinction between the asset's reference market value and the airline's effective purchase outlay.

Table 1. Baseline model parameters.

Parameter	Symbol	Baseline Value
Purchase price (USD)	p^{USD}	\$55,000,000
Monthly lease rate (% of MV)	λ	0.70%
Aircraft market value (USD)	V	\$50,000,000
Loan tenor	T	10 years
Baseline lending rate (naira)	r	27.25%
Exchange rate at inception	e_0	₦1,600/\$1
Annual naira depreciation rate	d	15%
Base annual maintenance cost	M_0	\$1,800,000
Maintenance escalation rate	g_m	5%
Maintenance-reserve base (lease)	R_0	\$1,200,000
MR escalation rate	g_r	5%
Residual-value fraction	α	0.35
Corporate tax rate	τ	30%
Tax-shield utilisability	δ	0 (tax-loss)
Discount rate (WACC)	w	22%
Redelivery cost	C^{rd}	\$3,000,000

3 Mathematical Formulation

Discounted cash flow analysis was used to determine the financial attractiveness of each acquisition strategy. Consistent with Myers *et al.* (1976) and Schallheim (1994), the decision criterion is based on the differential Net Present Value (ΔNPV):

$$\Delta NPV = NPV_{Purchase} - NPV_{Lease}$$

where

- $\Delta NPV > 0$ indicates that aircraft purchase is financially preferable;
- $\Delta NPV < 0$ indicates that operating lease is financially preferable.

Purchase Option

Annual loan repayment was estimated using the standard annuity financing model:

$$A = P \left[\frac{r(1+r)^T}{(1+r)^T - 1} \right]$$

Annual maintenance expenditure was estimated as

$$M_t = M_0(1 + g_m)^{t-1}$$

Residual aircraft value after the planning horizon was estimated as

$$RV = \alpha P_{USD} e_T$$

The present value of ownership is therefore

$$NPV_{Purchase} = - \sum_{t=1}^T \frac{A_t + M_t - \delta \tau D_t}{(1+w)^t} + \frac{RV}{(1+w)^T}$$

Lease Option

Annual lease payments were computed as

$$L_t = 12\lambda V e_t$$

where

$$e_t = e_0(1 + d)^t$$

Maintenance reserve contributions were estimated as

$$R_t = R_0(1 + g_r)^{t-1}$$

The lease option is expressed as

$$NPV_{Lease} = - \sum_{t=1}^T \frac{L_t + R_t}{(1+w)^t} - \frac{C_{rd}}{(1+w)^T}$$

This formulation is based on the well-known aircraft investment appraisal methods reported by Clark (2017), Gibson and Morell (2004) and Vasigh *et al.* (2018).

4 Sensitivity Analysis

Deterministic sensitivity analysis was used to assess the robustness of the model by systematically changing the principal financial parameters while holding the remaining parameters constant. One-way sensitivity analysis examined lending rate, exchange-rate depreciation, residual value, maintenance-reserve escalation, and discount rate. Two-way sensitivity analysis then examined the interaction between lending rate and exchange-rate depreciation, while scenario analysis compared baseline, optimistic, and stress macroeconomic conditions. No probability distributions or Monte Carlo simulation were used.

The break-even financing condition was defined as

$$\Delta NPV = 0$$

The break-even financing condition identifies the lending-rate and exchange-rate combinations at which the present-value costs of purchase and lease are equal. A positive differential NPV indicates that purchase is financially preferable, whereas a negative differential NPV indicates that operating lease is financially preferable. The sensitivity analysis therefore provides decision thresholds rather than probability estimates.

This suggests that purchase and lease have the same present value. Sensitivity analysis is a common technique used in capital budgeting and infrastructure investment models to evaluate the stability of the model when faced with uncertainties (Brealey *et al.*, 2022; Ross *et al.*, 2019; Damodaran, 2024).

Results

1 Baseline Financial Performance of Purchase and Lease Alternatives

The baseline analysis uses the parameter values reported in Table 1. Purchase has a present-value cost of ₦197.8 billion, compared with ₦158.3 billion for operating lease. The resulting differential NPV (purchase minus lease) is –₦39.5 billion, indicating that leasing is financially preferable under the baseline assumptions. The purchase alternative is dominated by the present value of debt service (₦162.4 billion), while the lease alternative has present-value lease payments of ₦119.7 billion. The ownership option receives a positive residual-value benefit of ₦8.9 billion, but this benefit is insufficient to offset the higher financing burden (Table 2).

Table 2. Baseline NPV results (in billions of naira).

Component	Purchase (₦B)	Lease (₦B)
PV of debt service / lease payments	–162.4	–119.7
PV of maintenance / MR contributions	–044.3	–032.8
PV of tax shield ($\delta = 0$)	000.0	N/A
PV of residual value	+008.9	N/A
PV of redelivery cost	N/A	–005.8
Total PV of cost	–197.8	–158.3
ΔNPV (Purchase – Lease)	–39.5	

Figure 1 presents the discounted lifecycle cost components. The purchase option has a larger financing component, whereas the lease option combines lower present-value lease payments with maintenance-reserve contributions and a redelivery cost. The baseline result therefore indicates that, at a 27.25% lending rate and 15% annual naira depreciation, the financing burden associated with ownership outweighs the terminal value benefit of the aircraft.

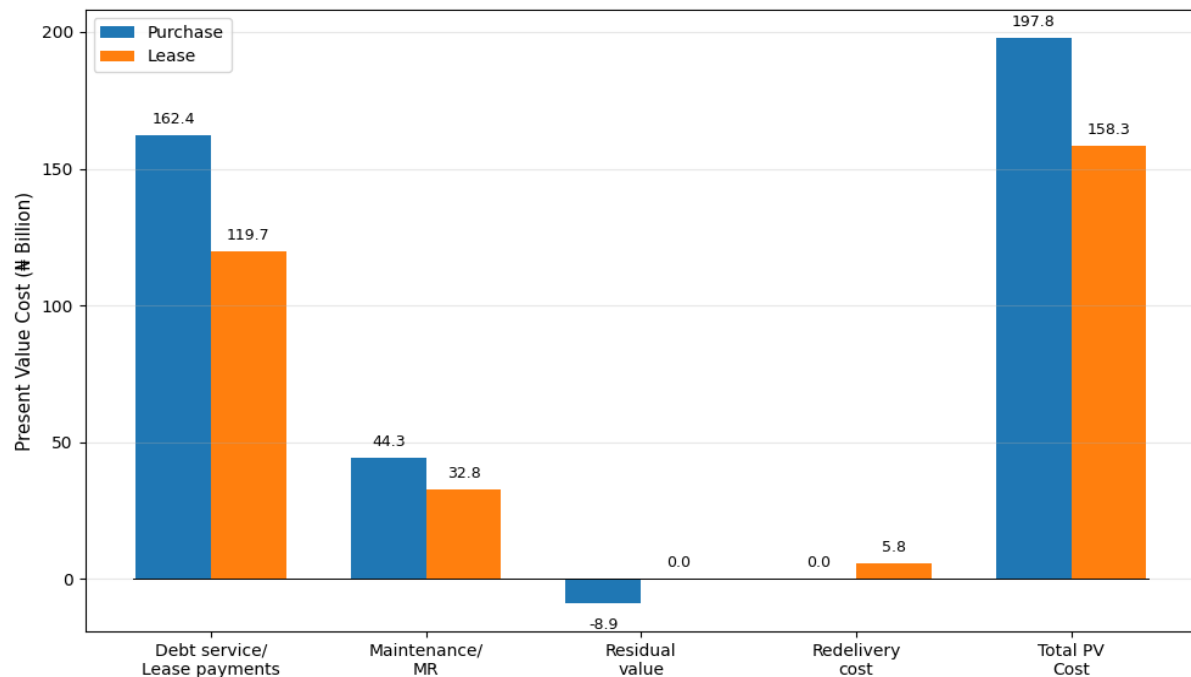


Figure 1. Comparison of discounted lifecycle cost components for purchase and lease financing.

The baseline finding is consistent with the broader lease-versus-buy literature, which shows that high financing costs and financial constraints can increase the attractiveness of leasing (Myers *et al.*, 1976; Eisfeldt & Rampini, 2009). It also accords with evidence that leasing is widely used by airlines in emerging markets where long-term capital is costly or limited (Morrell, 2013; Vasigh *et al.*, 2018). The contribution of the present analysis is to quantify this relationship for Nigeria rather than merely describe the prevalence of leasing. The findings also align with the findings of Adeniyi and Olatunji (2019) who also listed high financing costs as one of the major challenges facing profitability of airline operations and fleet expansion in Nigeria. Domestic carriers' lack of access to cheap, long-term financing has made it necessary for numerous operators to heavily depend on operating leases provided by international lessors. The present study, therefore, gives quantitative confirmation of the observed financing structure of Nigerian airlines.

2 One-Way Sensitivity Analysis

The one-way sensitivity analysis in Table 3 shows that lending rate and exchange-rate depreciation are the most influential variables in the financing decision. The estimated break-even lending rate is 18.7%. At 10% lending, the differential NPV is +~~₦~~8.2 billion, favouring purchase; at the baseline 27.25%, it falls to -~~₦~~39.5 billion; and at 35%, it falls further to -~~₦~~62.1 billion. For exchange-rate depreciation, the differential NPV changes from -~~₦~~18.3 billion at 5% depreciation to -~~₦~~71.4 billion at 30% depreciation. Residual value, discount rate, and maintenance-reserve escalation have smaller effects within the tested ranges. The relative importance of each variable in the variation of the differential NPV is shown in Figure 2 as a normalized percentage contribution. The effect of the lending rate on differential NPV is further shown in Figure 3, which shows the lending rate threshold to distinguish the ownership versus leasing decision regions.

Table 3. One-way sensitivity analysis: ΔNPV at selected parameter values (₦ billions).

Parameter	Low	Baseline	High	Break-Even
Lending rate r	+8.2 (10%)	-39.5 (27.25%)	-62.1 (35%)	18.7%
FX depreciation d	-18.3 (5%)	-39.5 (15%)	-71.4 (30%)	~8%
Residual value α	-46.2 (0.20)	-39.5 (0.35)	-28.1 (0.50)	N/A
Discount rate w	-44.8 (15%)	-39.5 (22%)	-33.7 (30%)	N/A
MR escalation g_r	-35.1 (2%)	-39.5 (5%)	-48.9 (10%)	N/A

Figure 2 ranks the sensitivity of differential NPV across the tested variables, while Figure 3 shows the relationship between lending rate and the financing decision. The results indicate a clear threshold effect: ownership becomes financially competitive when the lending rate falls below approximately 18.7%, whereas leasing becomes increasingly advantageous as financing costs rise. The exchange-rate results reinforce this conclusion because greater naira depreciation increases the relative cost of aircraft ownership and reduces the range of lending rates at which purchase is competitive.

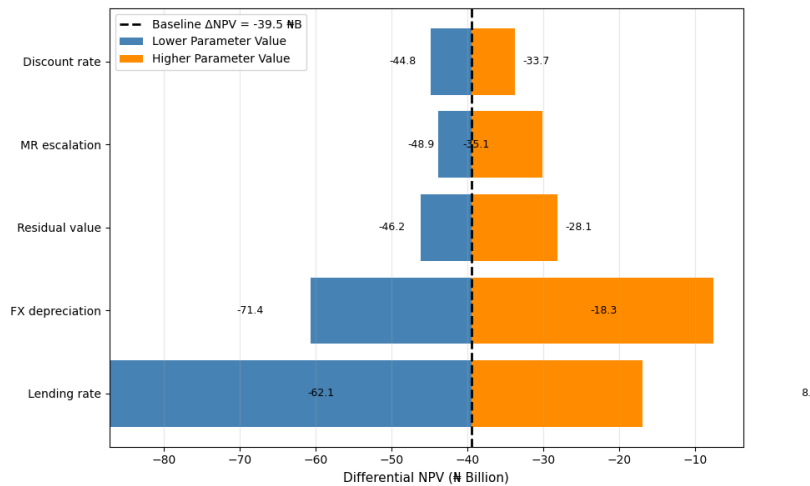


Figure 2. Tornado diagram showing the relative influence of key financial parameters on differential Net Present Value (ΔNPV).

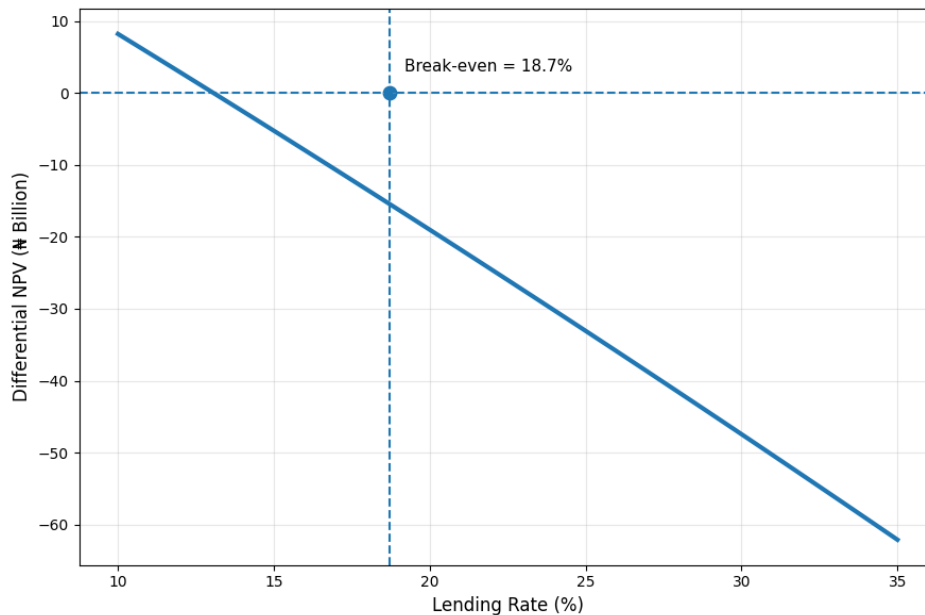


Figure 3. Relationship between lending rate and differential Net Present Value (ΔNPV).

These results are consistent with corporate-finance theory, which identifies the cost of capital as a central determinant of long-term investment decisions (Brealey *et al.*, 2022; Ross *et al.*, 2019). The importance of exchange-rate depreciation is also consistent with evidence that currency mismatch can materially affect aircraft-financing decisions in emerging markets (Flouris & Walker, 2018). In contrast to the relatively strong effects of lending rates and currency depreciation, the smaller changes associated with residual value, discount rate, and maintenance-reserve escalation suggest that these factors are secondary under the baseline Nigerian financing conditions.

The moderate effect of the residual value of the aircraft is also reflected in the previous studies by Gibson and Morrell (2004) which indicated that the aircraft's residual value contributes to a better ownership economics in moderate circumstances but does not compensate for high financing costs in adverse circumstances. Similarly, Clark (2017) found that residual value is only an economic consideration when financing rates are not high. The moderate impact of variations in the discount rate is in line with Damodaran (2024) which suggested that financing structure and borrowing cost have a more pronounced effect on investment appraisal than moderate variations in the discount rate. Therefore, measures to boost the efficacy of discount rate expectations are unlikely to change loan decisions without

broader measures aimed at improving macroeconomic stability. In summary, all the findings indicate that lowering borrowing cost and stabilising the exchange-rate would have the highest influence in promoting aircraft ownership by Nigerian airlines. On the other hand, growth of macroeconomic uncertainty will further deepen the industry's reliance on operating leases.

3 Two-Way Sensitivity and Decision-Boundary Surface

The two-way sensitivity analysis examines the joint effect of lending rate and exchange-rate depreciation on the acquisition decision (see Table 3). The estimated break-even lending rate is approximately 22% when annual depreciation is 5%, about 18.7% at the baseline depreciation of 15%, and approximately 13% when depreciation reaches 25%. Thus, the lending-rate threshold is not fixed: it falls as currency depreciation becomes more severe. The decision-boundary surface in Figures 4 and 5 illustrates this interaction and shows that financing cost remains the primary driver while exchange-rate depreciation shifts the ownership boundary downward.

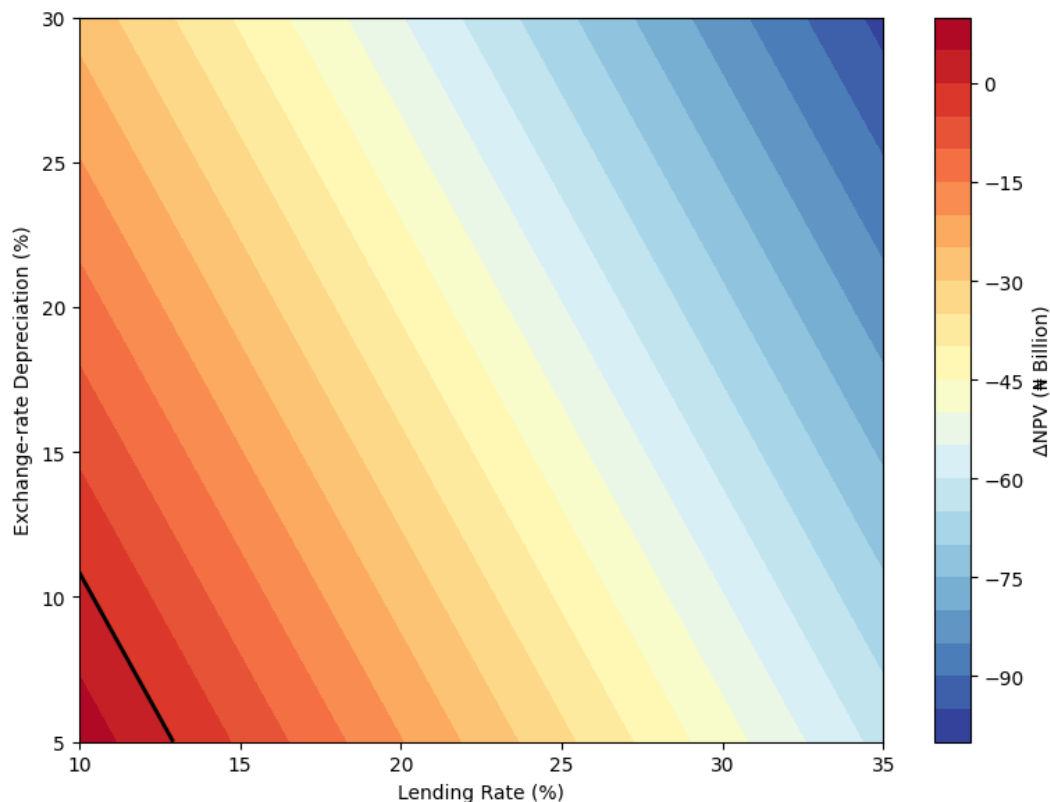


Figure 4. Two-way sensitivity analysis showing the interaction between lending rate and exchange-rate depreciation on differential Net Present Value (ΔNPV).

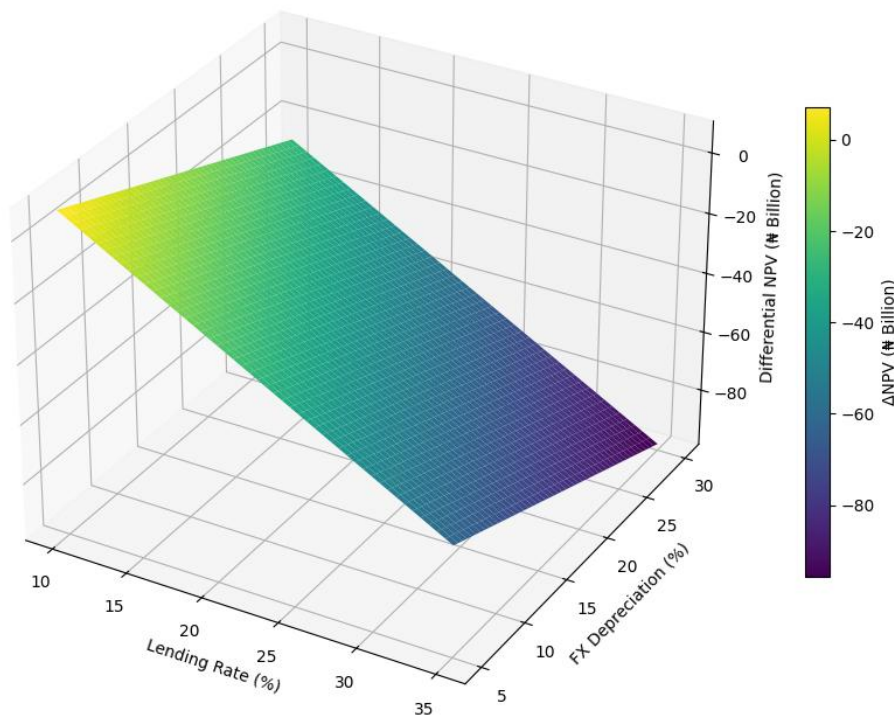


Figure 5. Three-dimensional decision boundary generated by the Integrated Net Present Value-Sensitivity Analysis (INPV-SA) model

The two-way results support the view that aircraft financing decisions should be evaluated using interacting financial and macroeconomic variables rather than isolated indicators (Belobaba *et al.*, 2015; Vasigh *et al.*, 2018). For Nigerian airlines, the interaction is particularly important because aircraft-related obligations are strongly linked to foreign-currency costs while a substantial share of domestic airline revenue is generated in naira. The analysis therefore provides a practical basis for updating the financing decision as lending and exchange-rate conditions change.

Residual value improves the economics of ownership, but the sensitivity results indicate that it does not compensate for very high financing costs and rapid currency depreciation within the ranges examined. This finding is consistent with aircraft-finance research showing that terminal asset value can strengthen ownership economics but may be insufficient to offset adverse financing conditions (Clark, 2017; Gibson & Morrell, 2004).

From a corporate-finance perspective, the findings suggest that the ownership threshold should be treated as a moving decision boundary rather than a permanent rule. Airline managers should therefore reassess lease-versus-buy decisions when lending rates, exchange-rate expectations, or the airline's foreign-currency revenue exposure change. Airlines with stronger foreign-currency earnings may face a different effective exchange-rate risk from carriers whose revenues are predominantly domestic.

In terms of corporate finance theory, the results extend the theory of Myers *et al.* (1976) which posits a static threshold for financing, to show that, in emerging markets, the financing threshold is dynamic. The investment frontier is constantly changing, and, as a result, the managers of airlines should constantly update their investment portfolio, taking into account the evolution of monetary and foreign-exchange conditions. The findings also have implications for financial planning of the airlines. The foreign currency gains from international operations and/or cargo flights could offer better protection against exchange-rate fluctuations than airlines with only domestic operations. Thus, the nature of financing decisions

should take into account the revenue mix and foreign-exchange risk exposure of the airlines concerned as well as the macroeconomic indicators.

4 Scenario Analysis

The scenario analysis in Table 4 evaluates the model under baseline, optimistic, and stress conditions. In the baseline case, purchase costs ₦197.8 billion in present-value terms compared with ₦158.3 billion for lease, giving a differential NPV of –₦39.5 billion. Under the optimistic case, the gap narrows substantially to –₦3.8 billion as the lending rate falls to 15% and exchange-rate depreciation falls to 8%. Under the stress case, the differential widens to –₦83.6 billion as the lending rate rises to 35% and depreciation reaches 25%. Leasing is therefore preferred in the baseline and stress cases, while the optimistic case approaches cost parity. To compare visually the financing options under each macroeconomic scenario, Figure 6 illustrates the discounted lifecycle cost of purchase and leasing over the three scenarios of scenario analysis.

The scenario results demonstrate that the preferred financing structure can change materially with macroeconomic conditions. Lower lending rates and slower currency depreciation substantially improve the economics of ownership, whereas adverse financing and exchange-rate conditions strengthen the case for leasing. The model therefore supports periodic reassessment of fleet-financing decisions rather than a fixed preference for one acquisition mode.

Table 4. Scenario analysis: summary of results.

Metric	Base Case	Optimistic	Stress
Lending rate	27.25%	15%	35%
FX depreciation	15%	8%	25%
Residual value α	0.35	0.40	0.25
PV Purchase (₦B)	–197.8	–108.4	–312.6
PV Lease (₦B)	–158.3	–104.6	–229.0
Δ NPV (₦B)	–39.5	–3.8	–83.6
Preferred option	Lease	Near parity	Lease

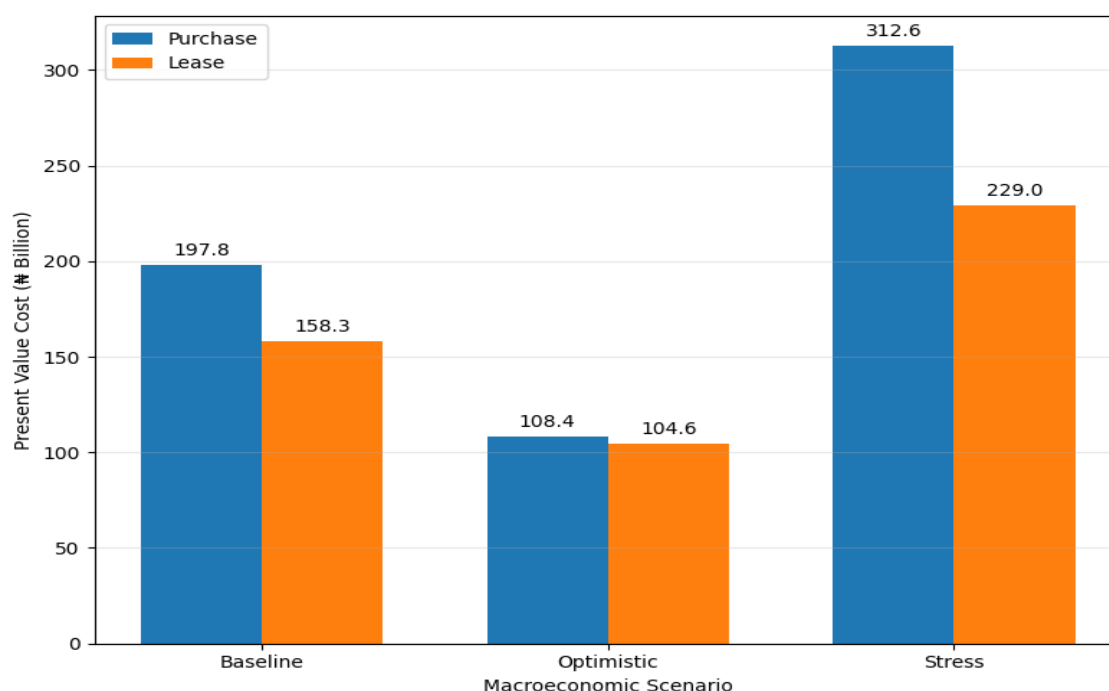


Figure 6. Comparison of purchase and lease costs under baseline, optimistic, and stress scenarios.

The scenario findings are consistent with capital-budgeting research emphasising the importance of macroeconomic conditions and country risk in long-term investment decisions (Ross *et al.*, 2019; Brealey *et al.*, 2022; Damodaran, 2024). They also reinforce Nigerian evidence that interest rates and financing constraints affect airline profitability and fleet expansion (Adeniyi & Olatunji, 2019; Nwaogbe *et al.*, 2013).

Furthermore, the present findings are consistent with those of Morrell (2013) and Littlejohns and McGairl (2014) who found that airlines in developing economies generally favor operating leases because they allow them to shift residual-value risk, maintain liquidity, and minimize exposure to financial uncertainty. The present study goes beyond these observations to quantify the macroeconomic thresholds for economic competitiveness of ownership in the Nigerian context. The scenario analysis further indicates the potential of public policy to influence the nature of aircraft finance choices. Even in the best of circumstances, it is shown that the reduction of the effective rate of lending below the estimated break-even rate of 18.7% would stimulate increased aircraft ownership, allow airlines to have more positive balance sheets and reduce the need for foreign lessors. This could be done via aviation-specific financing schemes, export credit guarantees, development finance schemes and/or government-supported leasing programs.

Implications of the Study

The findings have three principal implications. First, airline managers should treat the 18.7% lending rate as a benchmark rather than a permanent rule and should recalculate the lease-versus-buy decision whenever financing rates or exchange-rate expectations change. Second, policymakers and development-finance institutions should design airline financing facilities, guarantees, or credit-enhancement mechanisms capable of reducing the effective cost of long-term aircraft debt toward or below the 18.7% ownership threshold identified by the model. Third, financing programmes should incorporate foreign-exchange risk management because the two-way analysis shows that stronger naira depreciation lowers the lending-rate threshold at which ownership is competitive. These measures would improve the usefulness of the model as a decision-support framework while preserving the distinction between private financing decisions and public policy objectives. Theoretically, the study extends conventional lease-versus-buy analysis by integrating financing cost, currency depreciation, maintenance, residual value, and tax-shield utilisation within a single deterministic framework.

Model Limitations and Future Research

The study has several limitations. First, the model is deterministic and represents uncertainty through sensitivity and scenario analysis rather than probability distributions or Monte Carlo simulation. Future studies can use Monte Carlo methods to estimate probability distributions for NPV outcomes and confidence intervals around financing thresholds. Second, the model does not value the real-option flexibility associated with lease renewal, early return, or renegotiation. Third, the analysis evaluates a single aircraft acquisition and does not model fleet-level portfolio effects, network planning, or revenue management. Finally, the model does not explicitly incorporate the accounting effects of IFRS 16, which may influence reported leverage, creditworthiness, and borrowing costs even when accounting treatment does not change underlying cash flows.

Conclusion

This study shows that, under the baseline Nigerian financing conditions examined, operating leasing is financially preferable to debt-financed ownership of a Boeing 737 MAX 8 over a 10-year horizon. The estimated 18.7% lending-rate threshold marks the point at which ownership becomes competitive, while greater exchange-rate depreciation lowers that threshold further. The results therefore indicate that financing cost and currency stability are central to fleet-acquisition strategy in Nigeria. The INPV-SA framework provides a practical tool for reassessing lease-versus-buy choices as macroeconomic conditions change.

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