

Internal Control System and the Performance of Public Organizations in Nigeria: Exploring the Challenges and Prospects

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Abstract

This article paper investigated the nexus between internal control system and management of public organizations in Nigeria while exploring the gains, banes and prospects for improved organizational performance. One of the gains of an effective control system is that it ensures the separation of duties to avoid conflicts of interest and reduce the chances of financial mismanagement. Be that as it may, problems such as difficulty in setting quantitative standard, too many controls, inconsistent controls to name but a few have been some banes in the internal control system of FMC Owerri and Umuahia. A descriptive survey research design was used to elicit firsthand information from the respondent in Federal Medial Centres, Owerri and Umuahia totaling three hundred and twenty (320). The data for the study were from the primary-questionnaire and secondary sources while the null hypothesis was tested using the simple regression analysis technique. The findings of the study show that outsourcing has improved internal control system in FMC, Owerri. For FMCs, Owerri and Umuahia, reason being that the regression test result figures for both organisations show that the null hypotheses (Ho) were rejected because the Sig. Value of 0.000 is less than the tolerable value of significance of the study which is 0.05. Therefore, the alternative hypothesis was upheld. The study recommends among others that a self-evaluation be performed on the organisation's internal control because it can help identify possible deficiencies before problems arise and will lead to the implementation of more effective controls. This self-evaluation can often be done by performing a "walk-through" which is simply the act of tracing a transaction through agency records and procedures. The walk through will help provide an understanding of process and control design, particularly with respect to controls that may help prevent or detect fraud, a determination of whether controls have been designed effectively and actually placed in operation, and help identify points in the organizational processes where errors might occur.

INTRODUCTION

Every organisation, be it a private or public entity has primary responsibility of developing and maintaining an effective internal control system and this rests with an organization's management. With increased significance placed on the control environment, the focus of internal control has changed from policies and procedures to an overriding philosophy and operating style within the organization. Emphasis on these intangible aspects highlights the importance of top management involvement in the internal control system (Chukwuka, 2015). If the internal control system is not a priority for management, then it will not be one for people within the organization either (Prince, 2019). Internal controls are put in place to keep organization on course towards profitability goals and achievement of its mission and to minimize surprise along the way. They enable management to deal with rapidly changing economic and competitive environment, shifting customer demands and priorities and restructuring for future growth. Internal controls promote efficiency, reduce risks of asset loss and help to ensure the reliability of financial statements and compliance with laws and regulations (Coso, 2021 cited in John, 2020).

Caso (2018) pointed out that the success of an organization lies in the initiation and implementation of an effective internal control system and further asseverated that "because internal controls services have many component and purposes, there are increasing calls for better internal control systems. Internal control is looked upon more and more as a solution to a variety of potential problems. Internal control system term was adopted by the Anglo-Saxons ("Internal Auditing") and refers to the unit of Internal Control which aims at the evaluation of the sufficient functioning of the internal control system, that is the secondary functions (Controls) and suggests that there is room for improvements in cases where weaknesses are being discovered (Financial Postman magazine, 2023 cited in Patience, 2014). From the above definition, it can be adduced that internal control are systems comprising of the control environment, control procedures and it includes all the policies adopted by the directors and management of an entity to assist in achieving their objective for efficient conduct of its business, including adherence to internal policies, the safeguarding of assets, the prevention and detection of fraud and error, the accuracy and completion of the accounting records and timely preparation of reliable financial information.

An effective internal control system benefits an organisation by preventing the incidence of poor financing and by helping employees to work effectively and in harmony in their operations to enhance performance (Agwor & Akani, 2017). Organisations also recognize the importance of internal control system, which is viewed as useful tools in safeguarding the overall achievements of a company's objectives and assist the government in decreasing the danger of risk associated with its entity to ensure survival, growth and to attain high level of performance (Mahadeen, Al-Dmour, Obeidat & Tahini, 2016). Successful organizations ensure that they attain and consolidate continued survival in a competitive environment, thus successful organizations set performance measures that focus attention that identifies and communicates the success, support organization learning and provide a basis for assessment and reward (Brown, 2021).

In view of the benefit of internal control systems in public organizations which are established by the government to provide accessible, timely and quality service delivery, they still experience low levels of performance, in terms of low levels of innovations, poor controls, conflict of interest, double-billing, irrational prescription, slow asset accumulation, inefficiency and fraud cases (Annual report, 2009/2018). The unsatisfactory performance of Public sector administration in Nigeria has been debated to have a weak internal control system which has prevented them from having a clear direction in the management of resources at their disposal. The absence of sophisticated and interrelated system designed to check one process on another has led to ineffectiveness of several organisations as evidenced in the work of (Ailawadi, Dant & Grewal, 2016). The effect of this is that public trust has been dampened in the integrity of government institutions which is evidenced in corruption cases and fraud. Weak internal control activities such as improper segregation of duties (authorization and approval is done by the same individual) have prevented the MDAs from achieving their optimum performance. Despite the establishment of internal audit department, public officers still perpetrate fraud as most of the internal auditors fail to perform their duties as a result of threat to their independence. This implies that internal auditors will not have a thorough assessment of organization's transactions which can influence performance.

It is against this backdrop that this paper intends to investigate the nexus between internal control and the management of public organisations making bare the gains, banes and prospects, since there is paucity of empirical evidence which has been put forward by various researchers to explain why fraudulent acts exist in public organisations in Nigeria in spite of the existing internal control.

REVIEW OF RELATED LITERATURE

Internal controls

Internal control, as defined from the APC (Auditing Practices Committee, 1980), is an independent examination and certification from an inspector appointed by the business to control the finances according to the legal framework established each time. Furthermore, according to Miller and Bailley (1989), internal control is a systematic review and a subjective investigation of one element and encompasses the verification of the specific information as these are determined from the general practice. The internal control helps the company to achieve its goals using a systematic approach of assessing the effectiveness of handling dangers (Institute of Internal Auditors 2019). In addition, based on the ASOBAC (Committee on Basic Auditing Concepts, 1973), internal control is a systematic procedure which will lead to evaluate the degree of correlation between those established criteria and the real results of the business.

Internal control, as defined from the Hellenic Institute of Internal Auditors (HIIA, 2023) is an independent, objective, adequately designed and organized procedure, which through the technical and the scientific approaches; assess how adequately the system of internal control functions. From the foregoing definitions, it is clear that the internal control is not just a one sided tool for controlling the order and rightness of certain situations, but it is a method of detecting the value added up to a company, achieving the index of effectiveness and profitability of the company (Nagy & Cenker, 2021, Goodwin, 2023). Besides, the purpose of

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this control is the intentional, the programmed and focused effect of the company on the current situation, so as this situation to be reformed in the future and become the one that ought to exist (Mcnamee & Mcnamee, 2021). The deviation between the already achieved and the programmed situation can also become possible through controlling the parameter of correct handling of danger situations.

Bounton and KellerWalter (2021) claimed that the objective purpose of Internal Control is, on the one hand, the allowance of specific and high level of services offered towards the management, and on the other hand, the allowance of assistance towards the members of the organization for the most effective practicing of their duties. The Internal Control Systems are being implemented in businesses as tools that add up value to the company. In this way, we can achieve a systematic approach towards the most effective operation of the organization, as a unity (Schleifer & Greenwalt, 2021). Finally, as mentioned by the COSO report (Committee of Sponsoring Organizations of the Treadway Commission, 2021), internal control is defined as a procedure which offers fundamental security to the business concerning the credibility of financial affairs. The report defines internal control and describes a framework for internal control. But the difference of this report is that it also provides criteria for the management to utilize so as to evaluate controls.

Aldridge and Colbert (2023) see internal control as a process is affected by an entity's board of directors' management and other persons designed to provide reasonable assurance regarding the achievements of objectives in the following categories; efficiency and effectiveness of operations, reliability of financial reporting and compliance with applicable laws and regulations. The first category addresses an entity's basic objectives, including performance and progressing goals and safeguarding of resources. The second category relates to preparations of reliable published financial statements. The third deals with complying with the laws and regulations to which the entity is subject to (Lower, 1998). Internal Controls (IC) are to be an integral part of any organization's financial and business policies and procedures. They are adopted by management to ensure that the organization conducts business in an orderly and efficient manner (KPMG Forensic, 2023). Consequently Knechel et al (2007) argues that they provide the framework through which management uses the resources at its disposal to achieve the organization's goals. According to Romanian Banking Literature (2021) internal controls consists of couple of measures at management's disposal intended to ensure the organizations proper functioning, correct management of its assets and liabilities and true recording in accounting evidences.

A broader definition provided by Furrugia (2021) views IC as the plan of organization and the coordinated procedures used within an entity to; safeguard its assets from loss by fraud or errors, check the accuracy and reliability of accounting data which management uses in decision making, and promotion of operational efficiency and encourage adherence to adopted policies in those areas in which the accounting and financial departments have direct or indirect responsibilities. Chamsers (2021), Cosserrat (2019), Ridley and Chambers (1998) defined internal control systems as comprising of the internal control environment and control of procedures. They further state that the internal control systems includes all the policies and procedures (internal controls) adopted by the directors and management of an entity to assist in

achieving their objective of ensuring as far as practicable, the orderly and efficient conduct of the business, including allowance to internal policies, the safe guarding of assets, the prevention and detecting of fraud and error, the accuracy and completeness of the accounting records and timely preparation of reliable financial information. The control environment sets the tone of an organization influencing the control cautiousness of its people (Gauthoier, 2021). It is a foundation for all other components of internal control providing discipline and structure. Effectively controlled entities strike to have competent people, instill an enterprise wide attitude of integrity and control consciousness, and set a positive tone at the top (Tener, 2023). They establish appropriate policies and procedures often including a written code of conduct which foster shared values and teamwork in pursuit of the entity's objectives (Mautz and Wijan 1981).

In evaluating the effectiveness of the internal control environments, Coopers and Lybraud (2023) argued that there was need to consider whether the following control objectives are met; management conveys the message that integrity and ethical cannot be compromised, the organization structure provides a moral framework for planning, directing, and controlling operations, management ensures that appropriate responsibility and delegation of authority is assigned to deal with goals and objectives and the Board of Directors and audit committee are sufficiently independent from management to construct a challenge to management decision and take an active role in ensuring that an appropriate "tone at the top exists". Control activities are policies and procedures that help ensure that management directives are carried out. They help ensure that necessary activities are taken to address risks to achievements of the entity's objectives. Control activities occur throughout the organization at all levels and all functions (Junner, 2023). They include arrange of activities; authorization, verifications, reconciliations, review of operating performance security of assets and segregation of duties (Ernst and Yong, 2021). Information flow is essential to effecting control, information about an organization's plan, control environment, risks, control activities and performance must be communicated up, and access an organization (Ruttrman Working Group, 2023). Reliable and relevant information flow both internal and external sources must be identified, captured, processed and communicated to the people who need it in a form and time frame that is useful (Chambers 2021). Information systems produce reports, containing operational financial and compliance – related information that makes it possible to run and control an organization (Coseo, 2021).

History on Internal Controls

The history internal controls is linked to the financial system in the ancient Hellenistic Egypt which has existed for a long of time There was a dual administration in Hellenistic Egypt, with one set of bureaucrats charged with collecting taxes and another with supervising them. The system is constructive such that it monitors financial appropriations with accounting and auditing. Internal Controls provides an additional reference tool for all employees to identify and assess operating controls, financial reporting, and legal or regulatory compliance systems of internal control, contributions are to be made to enhancing an organization's ability to meet its objectives and reducing the potential liability from fines and penalties that could be imposed for violations. Internal control play an important role in preventing and detecting fraud and protecting the organization's resources both physical (e.g. machinery and property) and intangible (e.g. reputation or intellectual property such as trademarks).

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At the organization level, internal control objectives relate to the reliability of financial reporting, timely feedback on the achievement of operational or strategic goals, and compliance with laws and regulations. At the specific transaction level, internal control refers to the actions taken to achieve a specific objective. Policies and procedures management uses to achieve the following goals can be defined as internal control.

- Ensure that financial information is reliable and complete - Internal controls checks that management has complete, timely and correct information that includes report business operations, in order to plan, monitor and recording of accounts.
- Internal controls helps in the promotion of efficient and effective operations – an environment is provided for staffs and managers to ensure maximization of efficiency and effectiveness in their operations.
- Safeguard assets - well established internal controls protect assets from accidental loss or loss as a result of fraud.
- Achievement of goals and objectives - Internal controls system provide a mechanism for management to monitor the achievement of operational goals and objectives.

There are many definitions of internal control, as it affects the various stakeholders of an organization in various ways and at different levels of aggregation. The concepts of corporate governance also heavily depend on the necessity of internal controls. Internal controls ensure that processes operate as designed and that risk responses (risk treatments) in risk management are well carried out. In addition, there needs to be in place circumstances ensuring that the aforesaid procedures will be performed as proposed. That is, right attitudes, integrity and competence, and monitoring by managers (Brewer, 2023)

Several key points should be made about this definition: People at every level of an organization affect internal control. Internal control is, to some degree, everyone's responsibility. Within an organization, administrative employees at the various department levels are primarily responsible for internal control in their departments. Effective internal control helps an organization achieve its operations, financial reporting, and compliance objectives. Effective internal control is a built-in part of the management process (i.e. plan, organize, direct, and control). Internal control keeps an organization on course toward its objectives and the achievement of its mission, and minimizes surprises along the way. Internal control promotes effectiveness and efficiency of operation, reduces the risk of asset loss, and helps to ensure compliance with laws and regulations. Internal control also ensures the reliability of financial reporting (i.e. all transactions are recorded and that all recorded transaction are real, properly valued, recorded on a timely basis, properly classified, and correctly summarized and posted). Internal control can provide only reasonable assurance, not absolute assurance, regarding the achievement of an organization's objectives. Effective internal control helps an organization achieve its objective; it does not ensure success. There are several reasons why internal control cannot provide absolute assurance that objectives will be achieved. This includes cost-benefit realities, collusion among employees, and external events beyond an organization's control.

Internal Control Systems

The traditional accounting professional definition of internal control hinged on financial reporting and compliance aspect of control, however COSO, (2023) describes internal control system as a process involving board of directors, management, and other personnel created as a means of ensuring that the organization's objectives can be achieved. The objectives are categorized as; effectiveness and efficiency of operations, reliability of financial reporting, compliance with the relevant laws and regulations. According to the Australian Auditing Standard AUS 402 (ISA 400), control environment is distinguished from control procedure in that the former represents the general management attitude, awareness and actions as far as it concerns internal control whereas the later refers to what management has put in place as guidelines to control information and transaction procedure so as to achieve the organization's objectives. Since organizations differ in management philosophy, structure and size the wider outlook of control elements will always reflect the above differences, (COSO, 2023). Organizational culture determines control through self-discipline and internal monitoring (Ezzamel et al., 2022). According to COCO (2021), 'top down, command and controlled' organizations emphasize formal controls while those that are down sized and empowered will adopt informal controls.

According to (Kirsty, 2017) an internal control system is an organization's confidence in its ability to perform or undertake a particular behavior. He further asserts that a system of internal controls potentially prevents errors and fraud through monitoring and enhancing organizational and financial reporting processes as well as ensuring compliance with pertinent laws and regulations. The Basel Committee on Banking Supervision, as well as by the National Bank of Romania (Regulation no. 17/2019) claim that internal controls represent a continuous process which takes part of the board of directors, senior management and all levels of personnel, and whose aim is to ensure that all the established goals will be achieved. Williams (2017) says that some things considered to be good are not always enough for information. Internal controls have to give the possibility to check quality. Shelton and Whittington (2017) concurs that sometimes even the quality of an information is not enough, if it is uncompleted; that is why internal control needs to ensure that all elements are taken into consideration during their processing and the information always need to be geared to the pursued aim. He concludes that its availability is not enough to take possession of the information because sometimes it might be too late and that is why internal control has to avoid such situations and ensure the procurement of information is availed in a suitable time. The International Organization of Supreme Audit Institutions (INTOSAI), focuses more on a series of actions that permeate an entity's activity rather than one event or circumstance where by these actions occur throughout an entity's operations on an ongoing basis.

Components of an internal control system

Antecedents of internal control procedure strength include; organizational ethical environment, Risk management training and internal audit activities. The ethical environment refers to how top management is committed to the morally acceptable behaviors which are based on honesty, integrity and self-discipline. Victor and Cullen (1987) similarly, COSO (2021) identifies

control environment factors, risk assessment, control activities, information and communication and monitoring as interrelated components of a control system. Control environment is being more emphasized over control activities by writers like Cary and Stringer (2021), also COSO (2023) and CoCo (2021). This is a shift from traditional control procedures that are put forward to monitor in real time or after the event, which puts greater importance on setting control around people. It is believed that people with strong set of belief are able to do their own, do the right thing for the institutions they work for without necessarily being directed to do so.

Control environment encompasses integrity and ethical values, management philosophy and operating style, accountability and human resource practices and is considered to be an important control element. Ethical environment can be enhanced by leadership and or management's firm adherence to punishing those who violate the code of ethics. Control activities are top down reviews, functional or activity management, information processing, performance indicators, segregation of duties and physical controls. Crosschecking or authorization as control activities are portrayed as being of reducing importance. Risk control involves systematic procedures put in place to identify and measure risk associated with the institution's continuity and strategies for controlling and monitoring it. Risk assessment focuses on cost versus benefit approach to control and is not just the risk of fraud or misstatement of reports (Mills, 2022). COSO (2023) recognizes information and communication as separate control environment. Information sharing enables employees to get right and timely information thus developing a feedback and organizations where information sharing is encouraged decision making and performance is highly enabled. Employees take ownership of information and can easily identify and put right their own and their team's faults.

Common weaknesses of internal control systems

Albrecht (2021), outlines twelve most common internal control weaknesses, in order of frequency as; Too much trust in employees, lack of proper procedure for authorization, lack of personal financial information disclosure (for bank frauds), lack of separation of transaction authority from custodian of assets, absence of independent checks on performance, lack of adequate attention to detail, failure to separate asset custody from accounting for assets, failure to separate accounting duties, absence of clear lines of authority, relaxed or absence of audit activities or reviews, no conflict of interest statement required and lack of adequate documents and records.

A view held by Buckoff (2021), and supported by literature by Mac Arthur, Waldrup and Fane (2023) is that lack of segregation of duties, lack of independent reconciliation on cash received and deposited and performing incompatible roles greatly facilitates internal fraud. The conditions for fraud to occur include an incentive to commit fraud (pressure), good reason for justifying fraudulent behavior (attitude) and an opportunity to commit fraud Albrecht et al (2021), it is pointed out that opportunity is easy to control by establishing strong internal system unlike pressure and attitude which are human factors that are usually beyond direct influence of management.

Elements of Internal Controls

Internal control is a multifaceted concept and has been defined in various ways in management control literature. Dawson (2019), provide one of the narrower definitions of IC and they view IC as a part of the overall management control system comprising of the measures taken by an organization to avoid errors and irregularities while operations are in progress. Anthony (2023) suggests that it is not solely a procedure or policy that is performed at certain Point in time but rather a continually operating and integrated system at all levels within an organization which consists of five interrelated components i.e., Control environments, risk assessment, control activities, information and communication; and monitoring. Doyle et al (2007) concurs that it is generally felt that all the following five components must be present for an internal control system to be considered as effective.

Control environment

The control environment is the foundational context within which the other aspects of internal control operate (Konrath, 2019). The philosophy and management style, organizational structure, methods of imposing control, assignment of authority and responsibility are all key aspects of the control environment (Jones, 2007). Beneish et al (2017), defines the control environment as the tone of an organization and the way it operates. He further says that it concerns the establishment of an atmosphere in which people can conduct their activities and carry out their control responsibilities effectively. Likewise, COSO (2023) looks at the ethical environment of an organization to encompass aspects of upper management's tone in achieving organizational objectives, their value judgments and management styles. The control environment represents the control atmosphere for the entity and is the foundation for the other components (Nicolaisen, 2023).

Bates (2020) considers the factors relating to the control environment to include the integrity, ethical values, and competence of employees and management, management's philosophy and operating style, the manner in which authority and responsibility are assigned, the organization and development of employees, and the attention and direction of the board of directors towards organizational success. ISA400 clearly looks at the control environment to represents management's overall attitude, awareness and actions regarding internal controls. Lou (2017) concurs that higher level administrators of an organization are responsible for establishing the appropriate control environment.

Risk assessment

Risk assessment is the process used by an organization (management) to decide how it will deal with the risks that pose a threat to achieving its objectives (Furrugi, 2021). It entails the identification and prioritization of objectives, the identification of risks and assessment of their likelihood and impact. Consequently Jones (2007) looks at risk assessment as the identification, evaluation and management of risks. He further notes that risks can relate, to financial statement fraud or to the misappropriation of assets.

Control activities

Control activities are the policies and procedures implemented by an organization to ensure that management's directives are carried out. These activities are often grouped into the three categories of objectives to which they relate, namely, operations, financial reporting, and compliance (Shelton & Whittington, 2017). He further argues that these control activities include a range of activities as diverse as approvals, authorizations, verifications, reconciliations, reviews of operating performance, security of assets and segregation of duties, segregation of duties and authority.

Information and communication

According to Britnell (2020), Information and communication refer to the systems put in place by an organization to identify, capture, process and report relevant and reliable information in a timely manner so that people can carry out their responsibilities effectively. In addition, these systems deal with both internally and externally generated/required data and flows both vertically and horizontally in the organization. Gaskill (2022) looks at information and communication component as the identification, capture, and communication of pertinent information in an appropriate form and timeframe to accomplish the financial reporting objectives. Open channels of communication are necessary to allow information to flow throughout the entity and into the financial statements and therefore management should discuss the identification, capture, and flow of financial information in its report (Richard & Janet 2022).

Monitoring

This refers to the process of assessing the quality of a system's performance over time (Jones, 2017). It entails the activities and procedures designed to assess the effectiveness of the internal control system in achieving the entity's financial reporting objectives (Coffin, 2019). Monitoring activities may be ongoing or may be separate evaluations and it is important given the complex and dynamic environments faced by most organizations (Henle 2017). It seeks to ensure that systems are performing as intended. However this is accomplished through ongoing monitoring activities, periodic evaluations or a combination of the two (COSO, 2023).he further contends that these activities permeate the entire organization, at all levels and in all functions.

Relationship between internal control and organizational performance

Coso (2021), provided a criteria against which effectiveness of internal controls can be assessed. Internal control can be judged effective if the entity's operations objectives are being achieved; published financial statements are being prepared, reliable and applicable laws and regulations are being complied with. While internal control is a process, its effectiveness is a state or condition of the process at a point in time. Accordingly, the effective functioning of components of internal control provides a reasonable assurance regarding achievement of one or more of the stated categories of objectives to ensure high levels of organizational performance. Efficiency and effectiveness of operations have been taken to mean efficiencies

and effective use of its resources including personnel, accurate information for decision making and safeguarding of assets and records (Aren & Lwebbecke, 2023).

One of the five interrelated components of an internal control system is a control environment factor. It refers to the integrity, ethical values and competence of the entity's people (COSO, 2014). Internal control should be viewed in a broader context for example it should as well be reorganized as a function of people's ethical values as it is of standards and compliancy mechanisms (CoCo, 2016). Wells (2020), illustrate practical fraud occurrences discovered by competent accountants within organizations and what the accountants say about how they detect fraudulent transactions. Internal control system helps an organization to achieve its objectives such as its efficiency and effectiveness, reliable financial reporting and compliance with regulations COSO (2023). Controls serve the systems goals, they interact with the system and its environment thus directing the energy of the system toward fulfillment, in the same way changes in the environment are easily noticed and adapted to (CoCo, 2021). ACMAD (2023), recognizes that internal controls can enhance the productivity and competitiveness of organizations.

Theoretical Framework

The Systems Theory was propounded by an Austrain born Cacadian biologist called Ludwig Von Bertalanffy in the year 1956 and it holds the assumption real systems are open to, and interact with their environments, and that they can acquire qualitative new properties through emergence, resulting in continual evolution. This theory was adopted for the study to explain the concept of internal control and organizational performance. The system theory is the trans-disciplinary study of the abstract organization of phenomena, independent of their substance, type, or spatial or temporal scale of existence. It investigates both the principles common to all complex entities, and the (usually mathematical) models which can be used to describe them (Littlejohn, 2020). The Internal Control System is all the methods and procedures followed by the management in order to ensure, to a great extent, as much successful cooperation as possible with the director of the company, the insurance of the capital, the prevention and the detection of fraud, as well as the early preparation of all the useful financial information (Papadatou, 2017: Meigs, 2018). For purposes of this study the systems theory approach was used as a guiding theory because it explains how the existence of any fault in a system can affect the functioning of the whole system. This theory illustrates the need for well-functioning systems if efficiency is to be maximized in execution of duties. This study was approached from a systems perspective, analyzing and trying to link the different aspects of the internal controls systems and how these should interlink to create efficient positive outcomes in organizational performance.

METHODOLOGY

Causal research design was adopted for the study due to the fact that the researcher was able to determine the cause and effect relationship between the dependent and independent variables of the study. The Taro Yamane (1945) formula was used to select a representative sample of three hundred and fifty eight (358) was drawn from a population of 3487 (three thousand four hundred and eighty seven thousand) which includes all the senior staff and Junior Staff at the

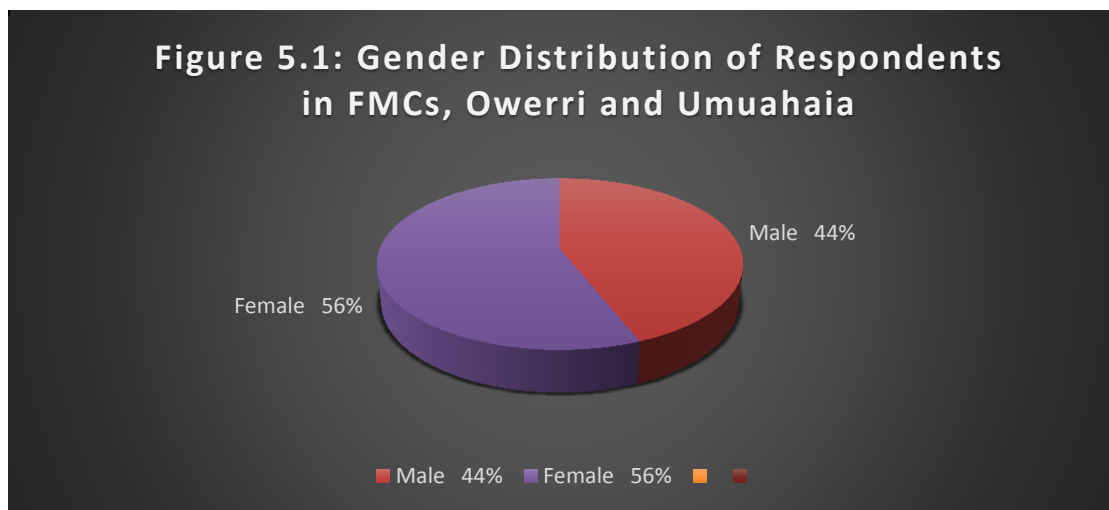
Federal Medical Centres, Owerri and Umuahia. The reason for selecting these hospitals, that is FMCs Owerri and Umuahia was that they are the oldest Federal Medical Centres in the Southeast, Nigeria. The stratified and purposive sampling technique were used because the researcher used his judgment based on the experience of the respondents to pick members of the sample from the two strata or categories of employees that will be useful to the study. The hypotheses were tested using the Simple Regression Analysis.

DATA PRESENTATION AND ANALYSIS

Demographic/Personal Data Analysis of Respondents

Gender Distribution of Respondents

The study determined the gender distribution of the respondents in both organisations in order to establish if there is gender balance. The findings were as indicated in Figure 4.1.

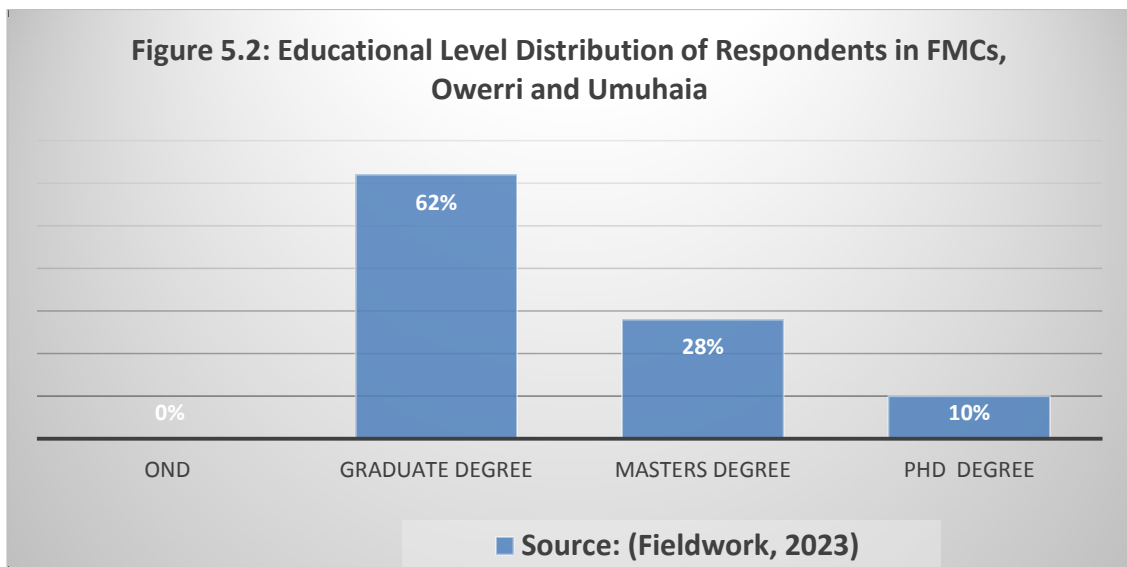


Source: (Fieldwork, 2023)

From the findings as indicated in Figure 5.1, majority (56%/178) were female respondents with (44%/142) being males respondents from a total population of 320. This implies there were more female than male respondents involved in the study. Besides the perception of female of what outsourcing means has a different meaning of how the female colleagues in the same organization see it. Though the meaning of outsourcing as understood by the male staff grave credence on the authenticity of job.

Respondents Level of Education Distribution

The study further found it of paramount to determine the respondents' level of education in order to ascertain if they were well equipped with the necessary knowledge and skills in their respective areas of specialization. From the study findings as seen in figure 4.2, majority (62%) indicated that they had university first degree, followed by 28% of the respondents who indicated that they had masters' qualification with few (10%) indicating that they have PhD and 0% have diploma. The findings therefore indicate that the respondents have the capacity, skills and management acumen to conduct outsourcing decision activities successfully in their organizations. This finding is as observed by Williamson (2021) that those with higher education or specialized skills are more successful as they have more knowledge and have modern managerial skills making them more conscious of the reality of activities in the organisation.



5.3 Department Distribution of Respondents

According to the analysis of the findings in figure 4.4, majority (72%) of the respondents indicated that they are in the clinical department while 28% are from the non-clinical department. This implies that most of the information needed to carry out the research are elicited from the clinical department not ruling out the fact that the information from the non-clinical department also aided the study.

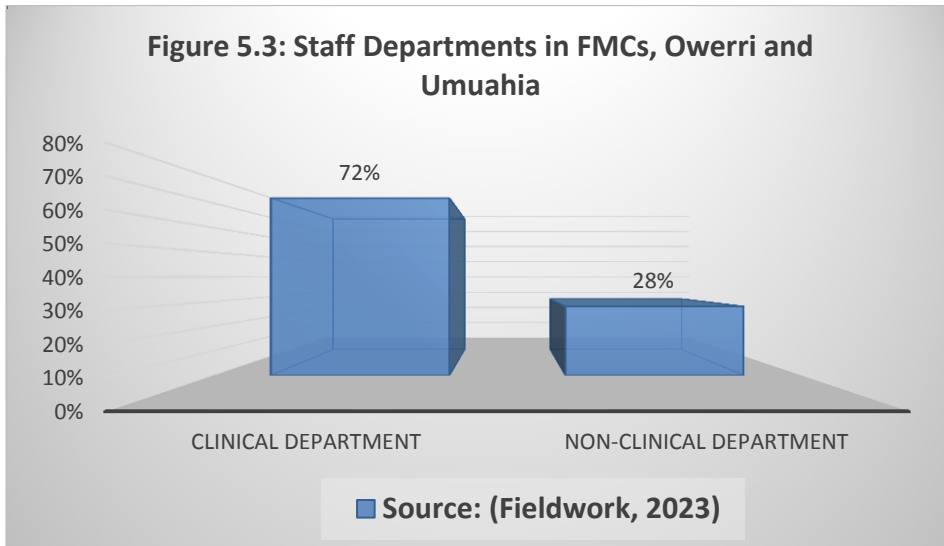


Table 5.1: Opinion of Respondents if Outsourcing affects Internal Control Systems in FMCs, Owerri and Umuahia.

Q1. The organization has a written mission statement that guide the activities and behavior of staff.	N 320	1.00	3.00	4.378	.869
Q2. The policies of the organization are reviewed and up to date	320	1.00	55.00	3.722	.636
Q3. Outsourcing has improved the familiarity of responsible persons in your department with the organization-wide policies related to personnel management, use of information and regulatory compliances.	320	1.00	55.00	4.422	1.049
Q4. Are sufficient training opportunities provided to improve employee work related competencies in accordance with @ work programmer?	320	1.00	3.00	3.441	1.080
Q5. Are responsibilities divided among staff members thereby maintaining appropriate segregation of duties?	320	1.00	55.00	4.167	.997
Q6. Are employees sufficiently trained to performed assigned roles and responsibilities to support the payroll processing (tine reported, on-line time entry etc.)Security staff are quick to respond to emergency situations.	320	1.00	55.00	4.167	.997

Q7. Outsourcing has improved process performance and the accuracy of financial reporting which management may rely on to make informed decisions.	320	1.00	55.00	3.986	1.180
Q8. Outsourcing has improved operational efficiency by removing unnecessary or duplicate steps in a procedure or process.	320	1.00	5.00	3.944	.964
Q9. Outsourcing has enhanced accountability by ensuring that clear protocols as to how data is transmitted, recorded and reported are outlined.	320	1.00	5.00	4.300	1.116
Outsourcing and Internal Control	320	1.00	5.00	3.986	1.026

Source: (SPSS, 2021)

Results from the study show that most staff slightly agree that outsourcing has improved process performance and the accuracy of financial reporting which management may rely on to make informed decisions with a mean of 3.956 and outsourcing has improved operational efficiency by removing unnecessary or duplicate steps in a procedure or process with mean of 3.944. Both mean score are more than 2 which represents agree in our likert scale. The above findings agree with studies by Jonathan (2017) where he noted that there are several factors that organizations have to put into considerations before outsourcing. One of the factors is Downtime. This directly impacts on performance and customer satisfaction since the staff skills determined the response time to breakdowns. The staff strongly agree that the organization has a written mission statement that guide the activities and behavior of staff. a mean of 4.378, outsourcing has improved the familiarity of responsible persons in your department with the organization-wide policies related to personnel management, use of information and regulatory compliances with a mean of 4.422, while employees are trained to perform assigned roles and responsibilities to support the payroll processing (tine reported, on-line time entry etc.) with a mean of 4.167, and finally outsourcing has enhanced accountability by ensuring that clear protocols as to how data is transmitted, recorded and reported are outlined with a mean of 4.300.

The above all translate to agree in our likert scale. Organisations through outsourcing are able to increase the speed of internal control policy implementation so that employees are not left guessing how to perform their duties or which procedure to follow. This tallies with Greaver, (2022) stating that Outsourcing helps in the reduction of errors by defining protocols and procedure to reduce employee mistake and make improvements as needed.

However the managers were not sure whether responsibilities divided among staff members maintains appropriate segregation of duties with a mean of 3.444. Generally for if outsourcing has improved process performance and the accuracy of financial reporting which management may rely on to make informed decisions, staff of the organizations slightly agreed with a net score of 3.985 which is slightly near 4 which translates to agree. The findings are in line with Mike, (2014) who pointed out that outsourcing is usually cost-effective and it enhances internal

control systems which are designed to identify and assess various risks that an organization may face. These risks can range from operational, and financial to compliance-related risks.

Test of Hypothesis

Table 5.2. Model Summary of Regression Test Result in FMC, Owerri

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.632 ^a	.515	-.004	1.42073

a. Predictors: (Constant), Outsourcing
(Source, SPSS, 2021)

In Table 5.2, the R-value represents the correlation between the dependent and independent variable. A value greater than 0.4 is taken for further analysis. In this case, the value is .632, which is good. R-square shows the total variation for the dependent variable that could be explained by the independent variables. A value greater than 0.5 shows that the model is effective enough to determine the relationship. In this case, the value is .515, which is good. Adjusted R-square shows the generalization of the results, that is, the variation of the sample results from the population in multiple regression. It is required to have a difference between R-square and Adjusted R-square minimum. In this case, the value is .505, which is not far off from .515, so it is good. Therefore, the model summary table is satisfactory to proceed with the next step.

Table 5.3. Anova Table for Regression Test on Outsourcing and Internal Control in FMC, Owerri

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.354	1	.354	17.5	.002 ^b
	Residual	377.456	165	2.018		
	Total	377.810	166			

a. Dependent Variable: Outsourcing and Internal Control Management in FMC Owerri

b. Predictors: (Constant), Outsourcing

Source:(SPSS,2021)

P-value/ Sig value: Generally, 95% confidence interval or 5% level of the significance level is chosen for the study. Thus the p-value should be less than 0.05. Table 5.3 shows .002. Therefore, the result is significant. **F-ratio:** It represents an improvement in the prediction of the variable by fitting the model after considering the inaccuracy present in the model. A value is greater than 1 for F-ratio yield efficient model. In the above table, the value is 17.5, which is good.

These results estimate that as the p-value of the ANOVA table is below the tolerable significance level, thus there is a possibility of rejecting the null hypothesis in further analysis.

Table 5.4: Anova Table for Regression Test on Outsourcing and Internal Control in FMC, Owerri

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.333	.216		10.816	.000
	Outsourcing	-.041	.097	-.031	-.419	.002

a. Dependent Variable: Internal Control Management in FMC Owerri

Source: (SPSS,2021)

Hypothesis One:

H_a: Outsourcing has improved internal control system in Federal Medical Centre FMC, Owerri.

H_o: Outsourcing has not improved internal control system in Federal Medical Centre FMC, Owerri.

Decision rule:

If Sig. is < 0.05, the null hypothesis is rejected. If Sig. is > 0.05, then the null hypothesis is not rejected. If a null hypothesis is rejected, it means there is an impact. However, if a null hypothesis is not rejected, it means there is no impact/relationship.

Conclusion:

The Null hypothesis (H_o) is rejected because the Sig. Value in Table 5.4 greater than the tolerable value of significance of the study which is 0.05. The implication is that the alternative hypotheses (H_a) is upheld. This means that outsourcing has improved internal control system in FMC, Owerri.

Test of Hypothesis in FMC, Umuahia

Table 5.5: Model Summary of Regression Test Result in FMC, Umuahia

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.513 ^a	5.9	5.15	1.43877

a. Predictors: (Constant), Outsourcing

Source:(SPSS,2021)

In Table 5.5 above, the R-value represents the correlation between the dependent and independent variable. A value greater than 0.4 is taken for further analysis. In this case, the

value is .513, which is good. R-square shows the total variation for the dependent variable that could be explained by the independent variables. A value greater than 0.5 shows that the model is effective enough to determine the relationship. In this case, the value is 5.9, which is good. Adjusted R-square shows the generalization of the results, that is, the variation of the sample results from the population in multiple regression. It is required to have a difference between R-square and Adjusted R-square minimum. In this case, the value is 5.9, which is not far off from 5.15, so it is good.

Therefore, the model summary table is satisfactory to proceed with the next step.

Table 5.6: Anova Table for Regression Test on Outsourcing and Internal Control in FMC, Umuahia

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.358	1	.358	17.3	.001 ^b
	Residual	345.701	167	2.070		
	Total	346.059	168			

a. Dependent Variable: Financial Control Management in FMC Umuahia

b. Predictors: (Constant), Outsourcing

Source: (SPSS, 2021)

P-value/ Sig value: Generally, 95% confidence interval or 5% level of the significance level is chosen for the study. Thus the p-value should be less than 0.05. In the table 5.6, it is .001. Therefore, the result is significant. **F-ratio:** It represents an improvement in the prediction of the variable by fitting the model after considering the inaccuracy present in the model. A value is greater than 1 for F-ratio yield efficient model. In the above table, the value is 17.3, which is good.

These results estimate that as the p-value of the ANOVA table is below the tolerable significance level, thus there is a possibility of rejecting the null hypothesis in further analysis.

Table 5.7. Coefficients Test on Dependent variable (Internal Control) in FMC, Umuahia

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.339	.232		10.091	.000
	Outsourcing	-.042	.101	-.032	-.416	.001

a. Dependent Variable: Financial Control Management in FMC Umuahia

Source: (SPSS, 2021)

Hypothesis:

H_a: Outsourcing has improved internal control system of Federal Medical Centre (FMC), Umuahia

H_o: Outsourcing has not improved internal control system of Federal Medical Centre (FMC), Umuahia

Decision rule: If Sig. is < 0.05, the null hypothesis is rejected. If Sig. is > 0.05, then the null hypothesis is not rejected. If a null hypothesis is rejected, it means there is an impact. However, if a null hypothesis is not rejected, it means there is no impact/relationship.

Conclusion: The Null hypothesis (H_o) is rejected because the Sig. Value of 0,000 in Table 5.7 is less than the tolerable value of significance of the study which is 0.05. The implication is that the alternative hypotheses (H_a) is upheld. This means that Outsourcing has improved internal control system in FMC, Umuahia.

CONCLUSION AND RECOMMENDATIONS

The study found out that outsourcing has effect on internal control system in Federal Medical Centres, Owerri and Umuahia. The hypotheses was tested differently using the data collected from the two hospitals. Based on FMC, Owerri Regression test figure in Table 4.4, the null hypothesis (H_o) is rejected because the Sig. Value in Table 4.3 is less than the tolerable value of significance of the study which is 0.05. The implication is that the alternative hypothesis (H_a) is upheld. This means that Outsourcing has improved internal control system in FMC, Owerri. For FMC Umuahia, Table 4.7 regression result figures show that the null hypothesis (H_o) is rejected because the Sig. Value of 0.000 is less than the tolerable value of significance of the study which is 0.05. The implication is that the alternative hypotheses (H_a) is upheld because the result shows that outsourcing has a significant relationship with the internal control in FMC Umuahia. That is to say that outsourcing has improved internal control in the organisation.

The null hypothesis was rejected which supports the assertion by Isaksson and Lantz (2019) that that there is a significant positive relationship between outsourcing and internal control systems of organizations. This implies that if more efforts are put towards a stronger internal control system, there will be better performance of the company. He further also proved that the costs of operation are reduced by internal control systems that enable it to gain more profits hence there is a positive relationship. Also from the questionnaire responses, it was stated that outsourcing has effect on the internal control systems and that the performance of organisation cannot be effective and efficient without internal control systems and fair presentation of financial statement may never be possible if the board and senior management are not committed to providing a well-planned internal control system.

As in any other scholarly empirical research, recommendations are drawn heavily from the limitations of the focal study as well as findings of the study (Chenhall, 2019; Creswell, 2014). With this statement in mind, the following recommendations were made:

- Segregation of duties is a basic, key internal control and one of the most difficult to achieve. At the most basic level, it means that no single individual should have control over

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two or more phases of a transaction or operation. It is used to ensure that errors or irregularities are prevented or detected on a timely basis by employees in the normal course of business. Segregation of duties provides two benefits: 1) make a deliberate fraud more difficult because it requires collusion of two or more persons, and 2) make it much more likely that innocent errors will be found.

- Performing a self-evaluation of your internal control can help identify possible deficiencies before problems arise and will lead to the implementation of more effective controls. This self-evaluation can often be done by performing a “walk-through” which is simply the act of tracing a transaction through agency records and procedures. The walk through will help provide an understanding of process and control design, particularly with respect to controls that may help prevent or detect fraud, a determination of whether controls have been designed effectively and actually placed in operation, and help identify points in the organizational processes where errors might occur.

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Government Bond Duration Model and Immunisation Strategy in the Nigerian Bond Market

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Abstract

This paper examined government bond duration model and its immunisation strategy's application in the Nigerian bond market for the period 2001 to 2020. The specific objectives of the study were to ascertain whether short-term, long-term maturity bonds and inflation rate have significant impact on mean yield rate of government bonds in the Nigerian bond market. The Auto-Regressive Distributed Lag Model (ARDL) was used to estimate the model and test the data collected, followed by a detailed analysis and interpretation of all results. The findings of this study showed that short-term maturity bond (STMB) and inflation rate has significant negative relationship with mean yield rate of government bonds while long-term maturity bond (LTMSB) has a significant positive relationship with mean yield rate of government bonds. This study recommended that portfolio managers and investors of bonds need to study the behaviour of inflation rate, market risk (bond duration) and the term structure of bonds if they are to immunise their bond investment.

Keywords: Bond, Government Bond, Bond Duration, Immunisation Strategy, Interest Rate Risk, Inflation Rate

INTRODUCTION

In the field of finance, effective risk management is crucial, particularly when dealing with fixed-income securities like government bonds. Interest rate fluctuations due to inflation can greatly impact the value of these bonds, making it essential for investors to utilize reliable tools for assessing and mitigating risk. One such tool is the government bond duration model, which measures a bond's price sensitivity to interest rate changes.

Bonds are key instruments in public development finance (CDFA, 2021). The practice of bond finance dates back to the 19th century, with the introduction of tax exemptions in the nation's first federal tax code. A bond essentially represents a debt or loan issued by a governmental entity, which is then bought and traded by investors. The funds raised through bond issuance are typically used to finance capital projects. However, when bonds are issued on behalf of

non-governmental borrowers, the proceeds are usually lent to these entities. The borrower then repays the loan, including the scheduled principal and interest payments on the bonds. Throughout the bond's term, bondholders receive interest payments, which are often exempt from federal, state, and local income taxes. This tax-exempt status makes certain bonds an attractive investment option for many investors (CDFA, 2021).

Wang and Han (2021) describe bonds as debt securities issued as part of a borrowing arrangement, where the issuer is obligated to make specified payments to bondholders on predetermined dates. Bonds are distinguished among various debt securities in both the money and capital markets, particularly as prominent long-term debt instruments in the capital market. The development of a strong bond market is crucial, as it enables direct financing for local enterprises, enhances market liquidity, and reduces systemic risk. Consequently, ensuring the accurate pricing of bonds in the bond market is essential for promoting its sustainable growth (Wang & Han, 2021).

Omoriegbe, Arowoshegbe, and Okunbor (2011) argue that the Nigerian bond market has experienced considerable growth in recent years, driven by increasing investor participation and government efforts to deepen financial markets. As the market continues to mature, investors are confronted with various challenges, including interest rate volatility and credit risk. In this context, understanding the government bond duration model and Immunisation strategy is critical for effective portfolio management. These tools help investors assess and manage interest rate risk, thereby strengthening the resilience and performance of their bond portfolios in the Nigerian market (Omoriegbe, Arowoshegbe & Okunbor, 2011).

In Nigeria's financial sector, government bonds play a pivotal role in raising funds and managing debt. For investors and policymakers, understanding bond duration and immunisation is essential in shaping risk management strategies and market dynamics. Studies like Ogilo (2014), Ndinda (2012), Mishkin and Eakins (2012), Irabor and Omigie (2023), and He and Wang (2024) highlighted the importance of duration modeling and immunisation strategies in managing government bond portfolios. For instance, Ogilo (2014) and Ndinda (2012) emphasised the role of government bonds as fixed-income securities, offering investors predictable cash flows over a set period. Additionally, Mishkin and Eakins (2012) underscore the significance of bond market development in enhancing financial intermediation and supporting economic growth. Also, Irabor and Omigie (2023) emphasizes the need for investors or bond users to efficiently use bond duration to manage inflation risk and reinvestment risk to give value to money invested and the expected returns. He and Wang (2024) proposed a maturity immunisation portfolio strategy to address interest rate fluctuations in the bond market. They identified key flaws in this approach while offering recommendations to help investors maintain income stability and minimize losses resulting from changes in interest rates.

Eke, Adetiloye, Adegbite, and Okoye (2017) underscore the importance of robust institutional and structural frameworks for bond market development, particularly emphasizing the role of government initiatives and policy reforms. Their research provides valuable insights into the

Irabor. Government bond duration model and immunisation strategy

challenges and opportunities related to the duration and immunisation of government bonds in the Nigerian market.

This study recognizes several challenges in managing government bond duration and immunisation in the Nigerian market. These include interest rate risk, where fluctuations can lead to uncertain returns and affect market stability; default risk, which raises concerns about the issuer's ability to repay debt, potentially undermining investor confidence and market liquidity; market risk, which involves difficulties in selling bonds without significant price reductions during market volatility; callability risk, which introduces uncertainty regarding bonds being called before maturity, complicating risk assessments; and reinvestment risk, where effectively managing cash flows and reinvestment income is critical in a fluctuating interest rate environment (Irabor & Omigie, 2023).

The existing literature on government bond duration and immunisation in the Nigerian bond market reveals several gaps that need to be addressed. Firstly, while the importance of bond duration and immunisation strategies for managing interest rate risks is recognized, there is a lack of detailed analysis on how these strategies are specifically applied in the Nigerian context. This study aims to provide a more comprehensive exploration of these strategies, particularly in relation to the unique characteristics of the Nigerian bond market.

Secondly, most studies focus predominantly on government bonds, with limited comparative analysis of corporate bonds. Understanding the differences in the duration and immunisation strategies used for government versus corporate bonds is crucial, as these instruments may have different risk-return profiles and market dynamics. This research seeks to bridge this gap by offering a comparative analysis of both bond types.

Another gap relates to the examination of risk factors such as interest rate risk, default risk, and reinvestment risk. While some studies acknowledge these risks, they often lack an in-depth exploration of how these factors specifically impact the Nigerian bond market. This study aim to address these risk factors more thoroughly, enhancing the understanding of their implications for bond investors.

Additionally, the impact of inflation on reinvestment risk has not been sufficiently explored. Although inflation's effect on bond yields is mentioned, its role in influencing reinvestment strategies and the overall management of bond portfolios needs further investigation. This research will delve into how inflation affects reinvestment risk, providing insights for investors on managing this challenge in a fluctuating interest rate environment.

Furthermore, while several studies highlight the challenges of managing bond portfolios, they often fall short in offering practical, actionable recommendations for investors, particularly in the context of fluctuating interest rates. This study aims to fill that gap by providing targeted recommendations for investors, grounded in empirical analysis, to help them effectively manage risks and optimize returns.

Finally, there is limited discussion on how government policies and institutional frameworks can support bond market development and enhance the effectiveness of bond duration and

immunisation strategies. This study will explore the role of policy reforms and institutional structures in strengthening the resilience of the bond market and fostering investor confidence.

This study has been able to acknowledge the significance of government bonds in the Nigerian financial market, and thus aims to address these gaps by providing a comprehensive exploration of specific strategies and challenges in managing government bond portfolios. Furthermore, it seeks to deepen the examination of various risk factors such as interest rate risk, default risk, and reinvestment risk, enhancing the study's relevance. The lack of comparative analysis in previous studies prompts this study to focus on comparing government and corporate bonds, examining differences in duration and immunisation strategies, and offering insights into their respective risk-return profiles and market dynamics. Consequently, this study aims to explore government bond duration models and immunisation strategies within the Nigerian bond market.

The primary objectives of this study are to:

1. Investigate the relationship between debt maturity and government bond yields; and
2. Analyse the impact of inflation rates on government bond yields and reinvestment risk.

LITERATURE REVIEW

This section is on review of related literature on government bond, immunisation strategy and bond markets, both in Nigeria and other parts of the globe.

Conceptual Review

Government Bonds

There are two primary categories of tax-exempt bonds: government bonds or securities, commonly referred to as gilts, and qualified private activity bonds. Government bonds are designed to fund essential infrastructure projects that serve a broad range of public needs, such as highways, schools, bridges, sewers, jails, parks, and government buildings. The repayment of these bonds is typically secured through taxes imposed on the general public. Importantly, private entities are largely restricted from significant usage, operation, control, or ownership of facilities financed through government bonds (CDFA, 2021).

A government bond represents a debt instrument in which investors lend money to a government in exchange for a predetermined interest rate. Governments utilize these bonds to generate capital for new projects or infrastructure, while investors benefit from a fixed return on their investment, typically paid at regular intervals. In the United States, these bonds are known as Treasuries; in the United Kingdom, they are referred to as gilts. In Nigeria, they are commonly called "Federal Government Bonds" or "FG Bonds." These bonds are issued by the Nigerian government to raise funds for various purposes, including infrastructure financing, budgetary needs, and debt management. FG Bonds are a crucial component of the Nigerian bond market, attracting investments, supporting economic growth, and assisting in managing government debt. Investors in FG Bonds usually receive regular interest payments until the bond reaches its maturity date, at which point the principal amount is repaid (Lengyel, 2023).

Irabor. Government bond duration model and immunisation strategy

Although all investments carry some degree of risk, government bonds issued by stable and well-established economies are generally considered low-risk. When purchasing a government bond, investors lend a specified amount of money to the government for an agreed-upon period. In return, the government pays a fixed interest rate, known as the coupon, at regular intervals, making bonds a form of fixed-income investment. Upon the bond's maturity, the initial investment, or principal, is returned to the investor. Maturity dates for bonds can vary significantly, ranging from less than a year to 30 years or more (Irabor, 2022)

Immunisation Strategy

The immunisation strategy is an investment approach designed to protect assets from interest rate risk. This strategy aims to create a bond portfolio with minimized risk, ensuring that changes in interest rates do not negatively impact the value of the firm (Wang & Han, 2021). Two key aspects of interest rate risk are crucial to understand in the context of immunisation. First, when interest rates fluctuate after a bond has been purchased, two types of risks arise. The first is price risk, which relates to how interest rate changes affect the bond's final price. The second is coupon reinvestment risk, which occurs when the coupons are reinvested at interest rates different from the bond's original yield to maturity. These risks generally move in opposite directions when interest rates change. For example, an increase in interest rates causes bond prices to decrease while simultaneously increasing the yield on reinvested coupons, and the opposite is true when interest rates decrease. Effective immunisation requires balancing these opposing effects to ensure that interest rate changes do not affect the asset's future value (Wang & Han, 2021).

The concept of immunisation was first introduced by F.M. Redington in 1952, an actuary working for a life insurance company. Redington demonstrated that if the duration of an asset portfolio matches the duration of its liabilities, interest rate changes would affect the value of assets and liabilities equally. The immunisation strategy involves two key steps. First, aligning the duration of assets and liabilities in the portfolio ensures they share the same sensitivity to interest rate changes, which can be represented by the formula: $\sum D_i \times w_i = \sum D_j \times w_j$

where D_i is the duration of bond i , w_i is the portfolio share of bond i , D_j is the duration of liability j , and w_j is the share of liability j .

Second, ensuring the present value of assets and liabilities are matched helps mitigate the impact of interest rate fluctuations on the portfolio. According to He & Wang (2024), the immunisation strategy involves matching the maturity of assets and liabilities to minimize the risk associated with interest rate changes. To determine the weight of each bond in a portfolio, one must first calculate the duration of each bond. This strategy can be applied to ensure that the value of a portfolio of assets changes in proportion to a specific set of liabilities, thereby maintaining the equity portion of capital. If interest rates increase, bond prices will decline, but reinvested earnings will rise. Conversely, if interest rates decrease, bond prices will increase, and reinvested earnings will fall.

Research on the government bond duration model and immunisation strategy in the Nigerian context is relatively scarce but growing. However, studies on duration modelling and portfolio

immunisation in emerging markets provide valuable insights applicable to the Nigerian bond market. For instance, Adebisi and Olayemi (2020) examined the application of duration measures in managing interest rate risk in Nigerian government bond portfolios, highlighting the importance of accurately estimating bond durations. Similarly, Ogunmuyiwa and Oladejo (2018) explored the effectiveness of immunisation strategies in mitigating interest rate risk in emerging market bond portfolios, emphasizing the need for proactive risk management approaches.

Bond Duration and Interest Rate Risk

According to John Hancock Investment (2022), bond duration is a key indicator of how much a bond's price is likely to change in response to shifts in interest rates. This concept is based on the inverse relationship between bond prices and interest rates when interest rates rise, the prices of existing bonds generally fall. Duration is used to gauge a bond's or bond fund's sensitivity to these interest rate changes, often referred to as interest-rate risk, and is typically expressed in years. Essentially, for every 1% change in interest rates, the price of a bond is expected to move in the opposite direction by approximately 1% for each year of its duration. Therefore, a bond with a 5-year duration will experience greater price fluctuations due to interest rate changes compared to a bond with a 3-year duration, but less so than a bond with a 10-year duration. (Lengyel, 2023)

Investors can also use duration as a hedging tool to mitigate interest rate risk. By matching the duration of their assets with the duration of their liabilities, investors can reduce the impact of interest rate fluctuations on their portfolios. This strategy, known as duration matching or immunisation, aims to create a balance where the change in the value of assets offsets the change in the value of liabilities, minimizing the overall interest rate risk (Reilly & Brown, 2012).

Kumari (2024) explains that bond duration also functions as a risk management tool for investors, providing a form of protection against interest rate fluctuations. By aligning their investment holding period with the Macaulay duration of their bonds, investors can stabilize the value of their investments despite changes in interest rates, thereby reducing the impact of such changes. Over time, they adjust their portfolio by initially investing in long-term bonds and gradually shifting to short-term bonds as they approach their investment goal. The research highlights that employing a strategic bond immunisation strategy, particularly through duration matching, is effective in managing risks in bond investments. By aligning the investment time horizon with the Macaulay duration and regularly adjusting the portfolio, investors can achieve stable returns, mitigate risks, and successfully meet their financial objectives (Kumari, 2024).

Bond duration measures how sensitive a bond's price is to interest rate changes. Studies have found that the duration of Nigerian corporate bonds is typically longer than that of government bonds, reflecting the higher risk associated with corporate bonds (Adeniyi, Adeniyi & Ogundele, 2018). The longer duration of corporate bonds also increases their sensitivity to changes in interest rates, making them more risky investments. In general, bonds with longer duration are more sensitive to changes in interest rates than those with shorter duration, as such investors need to understand the duration of a bond in order to properly assess the risk

associated with investing in it. In the Nigerian bond market, the duration of corporate bonds has been found to vary significantly, depending on the type of bond, the issuer, and the maturity date.

Interest rate risk is a significant concern for corporate bond investors, as fluctuations in interest rates can impact the value of fixed-income securities. In Nigeria, the interest rate environment has been highly volatile in recent years, with the Central Bank raising and lowering rates in response to economic and financial developments (Oyewunmi et al., 2017). Studies have found that interest rate of corporate bonds typically have higher risk than government bond due to their higher default risk (Adeniyi et al., 2018). Bond duration is crucial for assessing how bond prices respond to fluctuations in interest rates. Bonds with longer durations are more sensitive to interest rate movements, whereas those with shorter durations experience less impact. Researchers such as Smith (2018) and Kwan (2019) have explored the relationship between bond duration and interest rate risk in the context of the Nigeria bond market.

Reinvestment Risk and Inflation Rate

Reinvestment risk is a critical issue for bond investors, as it involves the possibility that future cash flows from bond investments may need to be reinvested at lower interest rates than those of the original investment. This risk is especially relevant in the context of corporate bonds in Nigeria, where research has indicated that the reinvestment risk associated with corporate bonds is greater than that of government bonds. The elevated risk is largely due to the higher likelihood of default linked with corporate bonds, as noted by Oyewunmi et al. (2017). Additionally, the inflation rate significantly impacts the actual return on bond investments, particularly within the corporate bond sector. Research indicates that inflation can have a negative impact on the returns of Nigerian corporate bonds. This occurs because higher inflation tends to lead to higher interest rates, which, in turn, result in lower returns on corporate bonds, as demonstrated in studies by Adeniyi et al. (2018). Furthermore, the impact of reinvestment risk and inflation rate on corporate bond investments in Nigeria has been explored in depth in studies conducted by Adeyemi (2020) and Okonkwo (2017). These studies shed light on the intricate relationship between these factors and their implications for investors in the Nigerian corporate bond market. It is thus necessary and essential for investors to understand and manage reinvestment risk and monitor inflation rates by making informed decisions regarding corporate bond investments in Nigeria.

Immunisation Strategy and Process

Investors employ immunisation strategies to protect their portfolios from interest rate risk or fluctuations. By aligning the duration of their portfolio with the duration of their liabilities, investors can reduce exposure to interest rate changes. In the Nigerian bond market, immunisation has proven effective in mitigating risks associated with bond investments. For instance, Adeyemi et al. (2015) found that such strategies significantly decreased the risk of losses due to interest rate variations. Additionally, Oyewunmi et al. (2017) highlighted the success of immunisation strategies in managing the interest rate risk of corporate bonds in Nigeria. Immunisation, as discussed, is a risk management tactic that aims to shield bond portfolios from interest rate volatility by matching the duration of assets and liabilities. Okafor

(2016) also explored the processes and effectiveness of immunisation in the Nigerian bond market.

Theoretical Framework

This study adopts the Duration Matching Principle and Redington's Immunisation Model as its theoretical framework, both of which are key concepts in fixed-income portfolio management that offer complementary methods for reducing interest rate risk. The duration matching principle, introduced by Macaulay (1938), suggests that aligning the duration of assets with liabilities effectively manages interest rate risk. By matching durations, investors aim to minimize the impact of interest rate fluctuations on portfolio value. This principle is particularly relevant in the Nigerian bond market, providing a practical approach for both corporate bond issuers and investors to manage such risks. However, the principle is not without criticism, particularly its assumption of a parallel shift in the yield curve and the difficulties associated with accurate interest rate predictions.

Redington's immunisation model complements the duration matching principle by also considering reinvestment risk. This model emphasizes matching the duration of assets with liabilities while optimizing returns through strategic reinvestment (Redington, 1952). It is widely applicable, particularly for financial institutions, pension funds, and insurance companies, and provides valuable guidance for managing interest rate risk in bond portfolios. Nonetheless, it has its limitations, including its assumption of a static interest rate environment and challenges in accurately estimating duration and reinvestment assumptions.

In the context of the Nigerian bond market, this study proposes that integrating the Duration Matching Principle with Redington's Immunisation Model offers a robust strategy for managing interest rate risk in corporate bond portfolios. By aligning the duration of government bonds with liabilities and incorporating reinvestment strategies, market participants can enhance portfolio stability and optimize returns. While each approach has its strengths and weaknesses, their combined application provides a comprehensive framework for risk management and portfolio optimization in fixed-income investing, guiding bond issuers and investors in Nigeria through periods of interest rate volatility.

Empirical Review

Simões, Oliveira, and Bravo (2021) conducted an empirical analysis on the effectiveness of different immunisation strategies designed to fund multiple liabilities, which are fixed in terms of timing but fluctuate in size due to inflation-related factors, such as consumer prices or wage levels. Their approach utilised a minimax strategy that incorporated the M-Absolute as a measure of interest rate risk. The study aimed to assess whether inflation-linked bonds (ILBs) offer better inflation protection in asset liability management (ALM) strategies for multiple liabilities of variable size, compared to nominal bonds. They analysed data from two sources: daily closing prices of U.S. Treasuries and U.S. inflation-linked bonds over the period 2000 to 2018. Performance was evaluated over 3-year and 5-year investment periods, using actual bond data rather than simulations, while also considering the impact of transaction costs on immunisation strategies and optimal investment choices. The findings indicate that ILB-based

Irabor. Government bond duration model and immunisation strategy

strategies outperform their nominal bond counterparts and remain effective even in low-interest-rate environments. These insights are significant for structuring ALM strategies, especially for institutions such as pension funds and life insurance companies.

Irabor and Omigie (2023) conducted an empirical analysis on corporate bond duration model and immunisation strategy in the Nigerian bond market for the period 2001 to 2020. The Auto-regressive Distributed Lag Model (ARDL) regression method was employed to examine the data. Their findings from the estimation show that corporate bond market was immunised against re-investment risk in the short-term in which bond investment risk was mitigated / protected against inflation risk. The study recommends that there is the need for bond users to efficiently use corporate bond duration to manage inflation risk and reinvestment risk to give value to money invested and the expected returns.

Nie, Wu, Wang, and Chen (2021) conducted an empirical analysis of the duration strategy in bond investment, focusing on the application of Macaulay duration. This measure assesses the time required for a bond's future cash flows to equal its current market price, accounting for the prevailing interest rate. It involves calculating the present value of each cash flow, weighting these values by the time until payment, and then summing them to determine the average time needed for the bond's cash flows to be repaid. By evaluating the duration of individual bonds, such as a four-year duration for one bond and a 1.96-year duration for another, investors can better understand the timing of cash flow receipts. The study also explores how immunisation strategies can be used to mitigate the effects of interest rate changes, providing insights into duration calculation methods and how this knowledge can help investors hedge against risk.

Wang and Han (2021) explored bond pricing and immunisation strategies in bond investment, analyzing factors that influence bond pricing in the market. They examined the risk aversion strategy of immunisation, focusing on duration. Through sensitivity analyses under different scenarios varying yield rates, coupons, and their increase at specific rates, they discovered that different yield rates and coupons have a linear relationship with bond prices, while increasing coupons at a fixed ratio creates a nonlinear relationship. Their study proposed an asset allocation strategy that includes a specific ratio of zero-coupon government bonds and corporate bonds, which effectively protects investors from risk. This paper explores the universality and practical importance of asset allocation by focusing on bond pricing, duration calculation, and immunisation strategies. Through sensitivity analysis and the application of an immunisation strategy, the paper proposes a specific bond allocation within an asset portfolio to help investors mitigate risks. Their discussion was divided into three key areas: bond pricing, modified duration, and the immunisation strategy. First, sensitivity analysis was used to examine the effects of yield and coupon rates on bond prices under different growth conditions. Second, the concept of modified duration is introduced to simplify the calculation of bond price changes in response to changes in yield. Specifically, the percentage change in bond price was determined by multiplying the modified duration by the change in yield. Finally, their paper demonstrates, through empirical analysis, that when an investor matches the duration of their bond portfolio to the duration of their liabilities, they can protect the portfolio from minor interest rate fluctuations. However, the immunisation strategy has some limitations, including the need for re-balancing, duration constraints, and the assumption of a flat term structure of

interest rates. Despite these limitations, it suggests that a bond portfolio can still be constructed using the immunisation strategy.

Nkwede, Uguru, and Nkwegu (2016) investigated the development of Nigeria's corporate bond market and the impact of macroeconomic factors on this development. They analyzed corporate bond market capitalization as the dependent variable and various macroeconomic factors as independent variables using time series data spanning 33 years (1980-2013). Their analysis, using descriptive statistics and ordinary least squares regression, found that several key macroeconomic factors—such as exchange rate, savings, inflation rate, banking sector development, interest rate, fiscal balance, bond yield, and foreign direct investment—significantly influence the growth of Nigeria's corporate bond market. However, these factors do not consistently drive growth, with savings and exchange rates standing out as particularly significant during the study period.

METHODOLOGY

This study utilized secondary data, specifically longitudinal time series data, to analyze the Nigerian bond market over a 20-year period (2001 to 2020). The aim was to observe changes in government bond transactions and examine how the duration model technique could be used to regulate these transactions, aligning with Thomas' (2022) definition of longitudinal studies which involve data collection at various moments, this approach enables researchers to observe and monitor changes as they occur over time.. This method is in line with Sharma's (2019) and Sedgwick's (2014) work on ex-post facto research, where the researcher cannot alter the independent variables because they have already occurred. As an ex-post facto study, it relied solely on secondary data concerning debt maturity, market mean yield rate (government bonds), and inflation rate, all of which are time series data from 2001 to 2020.

Data for both the dependent and independent variables were sourced from the Nigerian Stock Exchange Fact Book, the Statistical Bulletin, Annual Reports of the Central Bank of Nigeria (CBN), the Debt Management Office of Nigeria (DMO), and other relevant secondary sources.

3.1 Model Specification/Underpinning Theory

A multivariate linear regression model was developed and used to achieve the study's objectives, specifically in the context of government bonds.

Model: Government Bond Model

The model specification based on the dynamic capability theory is stated functionally as follows;

$$\text{MYRGB} = f(\text{STMB}, \text{LTMB}, \text{IFR}) \dots\dots\dots (1)$$

While this can also be rewritten in an econometric or equation form stated as:

$$\text{MYRGB}_t = \beta_0 + \beta_1\text{STMB}_t + \beta_2\text{LTMB}_t + \beta_3\text{IFR}_t + U_t \dots\dots\dots (2)$$

This is the simple ARDL model;

Where;

MYRGB = mean yield rate of government bonds

STMB = short-term maturity structure of bonds

LTMB = long term maturity structure of bonds

IFR = inflation rate

U = stochastic disturbance term or error term

Apriori expectation is $\beta_1 > 0$, $\beta_2 > 0$, and $\beta_3 < 0$ - - - - - (3)

In simple terms, as the short-term maturity structure of bonds (STMB) increases, the mean yield rate of government bonds (MYRGB) will also increase ($\beta_1 > 0$) meaning that shorter-term bonds are expected to have higher yields. Similarly, as the long-term maturity structure of bonds (LTMB) increases, the mean yield rate of government bonds (MYRGB) will also increase ($\beta_2 > 0$) indicating that longer-term bonds are expected to offer higher yields. On the other hand, as the inflation rate (IFR) increases, the mean yield rate of government bonds (MYRGB) is expected to decrease ($\beta_3 < 0$) suggesting that higher inflation rates may lead to lower yields on government bonds. These expectations are based on the assumption that changes in the maturity structure of bonds and inflation rates will have predictable effects on the mean yield rate of government bonds.

β = sensitivity/elasticity (that is, the coefficient of the variables)

Inflation rate, a macro-economy variable used instead of interest rate in the model specified above is a measure of the reinvestment risk of bond, according to Fishers hypothesis that interest rate was found to be directly proportional to inflation rate (Blanchard, 2000). In other words, one of the pillars of neoclassical monetary theory is that nominal interest rates rise in lockstep with expected inflation, while the real rate remains unaffected. Inflation is an important factor to consider when investing in government bonds. Studies have found that inflation has a negative effect on the returns of Nigerian government bonds, as higher inflation leads to higher interest rates, which in turn leads to lower returns on bonds (Adeniyi *et al.*, 2018).

Data Estimation Method

In this study, data are estimated using an econometric technique called the Auto-regressive Distributed Lag Model (ARDL). This technique also captures the short run and the long run effect or impact of the independent variables. This was accomplished using the econometric computer program E-view 9. The choice of this data estimating technique is dependent on the accurate estimations that can be produced by applying the technique. To enhance the outcomes in order to comply with the natural rule of thumb of 30 and above more frequent data observations as attainable in statistics generally, the study's yearly data collection was adjusted to quarterly intervals of observations. That is, for the central limit theorem to hold true, the sample size must be equal to or larger than 30. The mean and standard deviation of a population may be predicted by a sufficiently large sample (Simply, 2022).

DATA ANALYSIS AND INTERPRETATION OF RESULTS

This section is organized into three parts: the unit root test, the co-integration tests, and the ARDL analysis. The unit root test is presented first, followed by the co-integration tests, and then the ARDL analysis.

Stationarity Test Using the KPSS Method (Kwiatkowski-Phillips-Schmidt-Shin)

Table 1: Unit Root Test Results

Variables	Levels			First Difference			Order of Integration
	KPSS Test Statistic (5%)	Critical Value (5%)	Inference	KPSS Test Statistic	Critical Value (5%)	Inference	
MYRGB	0.050	0.146	Stationary	-	-	-	I(0)
STMB	0.147	0.146	Non-Stationary	0.131	0.146	Stationary	I(1)
LTMB	0.315	0.146	Non-Stationary	0.101	0.146	Stationary	I(1)
IFR	0.125	0.146	Stationary	-	-	-	I(0)

Source: Author's calculations using E-Views 9 (2024)

The unit root test results indicate that the mean yield on government bonds (MYRGB) and the inflation rate (IFR) are stationary at levels, meaning they are integrated of order zero, I(0). On the other hand, the short-term maturity structure of bonds (STMB) and the long-term maturity structure of bonds (LTMB) are stationary only after differencing once, indicating they are integrated of order one, I(1).

Since the variables are a mix of I(0) and I(1), analyzing their dynamic relationships at their levels without adjustment could lead to inaccurate regression results. This mixture of integration orders justifies the use of the Auto-Regressive Distributed Lag (ARDL) approach, which is particularly suitable for such cases. Additionally, the KPSS test results show that the P-values are all below the 0.05 threshold, allowing for the rejection of the null hypothesis that unit roots are present in all variables. This finding confirms that the variables are stationary at their respective integration orders.

Having established the integration orders, the next step is to investigate whether a long-term relationship exists among the variables. The ARDL bounds test for co-integration is used to explore the presence of such a long-term relationship, given the mix of I(0) and I(1) variables.

ARDL Bounds Test for Co-integration

Table 2: ARDL Bounds Test for Co-integration

- **Included Observations:** 78
- **Null Hypothesis:** No long-run relationships exist

Test Statistic	Value	k
F-statistic	1.127216	4

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	2.45	3.52
5%	2.86	4.01
2.5%	3.25	4.49
1%	3.74	5.06

Source: Author’s calculations using E-Views 9 (2024)

The ARDL Bounds Test for Co-integration shows that the computed F-statistic (1.127) is lower than the critical value at the 5% significance level (2.86). Therefore, we cannot reject the null hypothesis, which suggests that there is no long-run relationship among the variables. This indicates that the variables are not co-integrated, implying that a short-run relationship exists. As a result, the study will proceed with ARDL modeling for further analysis.

Auto-regressive Distributed Lags (ARDL) Modeling Analysis

The regression analysis was performed using Auto-regressive Distributed Lags (ARDL) techniques based on quarterly observations. The extract of the regression results is presented in the following table:

Model: Government Bond Duration and Immunisation

Table 3: Regression Result Extract

Dependent Variable	Independent Variables	Coefficient	T-Ratio	Prob. Value
MYRGB (Y)	Constant (C)	-0.404150	-0.216742	0.8291
	STMB (X1)	-0.016074	5.938777*	0.0000
	LTMB (X2)	1.158233	6.878235*	0.0000
	IFR (X3)	-0.660429	-3.635523	0.0005
R² = 0.95, Adjusted R² = 0.94, F-Statistic = 107.98, Durbin Watson (DW) = 2.3				

Source: Author’s calculations using E-Views 9 (2024)

Note: The asterisk (*) next to the T-Ratio indicates that these values are significant at the 5% level.

The regression results indicate a high coefficient of determination ($R^2 = 0.95$), meaning that approximately 95% of the variation in the dependent variable (mean yield of government bonds, Y) is explained by the independent variables (short-term maturity structure, X1; long-term maturity structure, X2; and inflation rate, X3). The significant T-Ratios for the independent variables confirm that they are statistically significant, suggesting that changes in these variables are strongly associated with shifts in the dependent variable. The high R^2 also demonstrates that the model effectively explains the variability in the dependent variable. This high value indicates that the independent variables (X1, X2, and X3) explain **95%** of the

variance in government bond yields, demonstrating that the model has strong explanatory power.

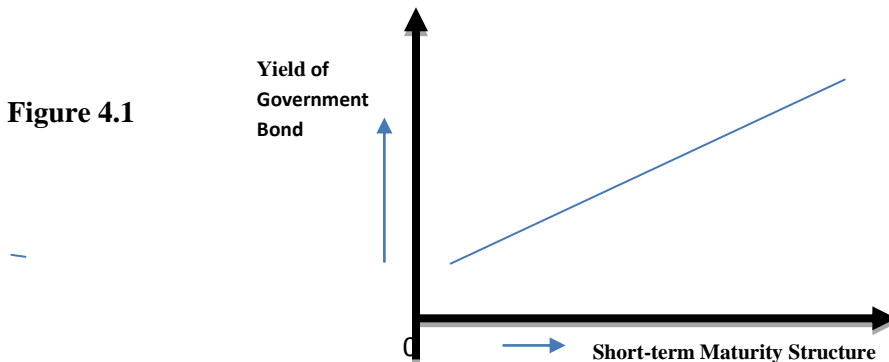
The adjusted R^2 (0.94) indicates that 94% of the changes in the mean yield of Nigerian government bonds are explained by the short-term maturity structure, long-term maturity structure, and inflation rate. The F-statistic (107.98), which tests for the existence of a linear relationship between the dependent and independent variables, shows that there is a statistically significant relationship between the mean yield of government bonds (Y) and the explanatory variables (X1, X2, X3). The F-statistic is greater than the critical F-value of 9.55 at the 5% significance level, indicating the presence of a linear relationship. Even after adjusting for the number of variables, **94%** of the variation in bond yields is still explained by the model, which suggests that the model remains robust even after accounting for potential overfitting.

However, this suggests that the relationship between the dependent and independent variables may not be purely linear. The findings imply that bond duration is better analysed using non-linear regression models, which allow for a more accurate representation of the data through mathematical functions.

Analysis of Maturity Structure Coefficients

The coefficients for short-term and long-term maturity structures provide insights into bond duration. For short-term maturity, a coefficient of -0.016074 indicates that a 1% increase in short-term bond maturity will increase overall yield of government bonds by approximately 0.02%. The T-value of 5.938777 confirms that this positive relationship is statistically significant at the 5% level.

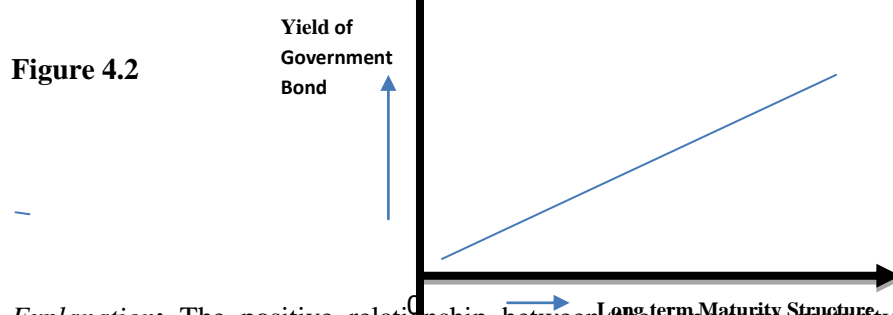
The above explanation is shown graphically below:



Explanation: The short-term maturity structure of bonds (STMB) has a significant positive relationship with the mean yield of government bonds. This positive relationship is statistically significant, as indicated by the T-ratio (5.94) and the very low p-value (0.0000), which suggests that short-term bonds are associated with lower yields. The implication is that investors may prefer short-term bonds during times of uncertainty or rising interest rates. The positive relationship implies that shorter-term bonds offer lower yields due to lower risk and shorter

duration, which generally attracts investors who prefer liquidity and less exposure to interest rate fluctuations.

For long-term maturity, the coefficient of 1.158233 suggests that a 1% increase in long-term maturity would result in a 1.158233% increase in the mean yield of government bonds. The T-ratio of 6.878235 further confirms that this positive relationship is statistically significant at the 5% level. This is represented graphically below:



Explanation: The positive relationship between the long-term maturity structure of bonds (LTMB) and government bond yield (GBY) is statistically significant, similar to the short-term maturity structure. The relationship is highly significant, as evidenced by the T-ratio (6.878235) and the low p-value (0.0000). The implication is that long-term bonds typically carry higher yields to compensate investors for the additional risks associated with holding bonds for a longer duration, such as interest rate risk. This positive relationship confirms that investors demand a premium for committing capital over a longer period.

Inflation Rate (X3) – IFR

The coefficient for inflation rate is -0.660429, with a T-ratio of -3.635523 and a p-value of 0.0005. This indicates a statistically significant negative relationship between inflation and bond yields, where a 1% increase in inflation leads to a **0.66% decrease** in bond yields. The implication is that while inflation is often expected to push yields higher, this negative relationship suggests that under certain conditions, inflation can depress bond yields. This could occur if inflationary expectations are already reflected in bond prices or if government interventions are keeping yields low. High inflation could also signal an economic downturn, causing reduced investor confidence and lower yields on bonds.

Immunsation of Bonds

Government bonds can only be immunised when the reinvestment risk (inflation rate risk) is equal to the duration of the bonds. The regression results indicate that the coefficients for short-term (0.02) and long-term (1.16) maturity structures differ significantly from the inflation rate coefficient (-0.66), suggesting that government bonds are not immunised in either the short-term or long-term, which is in contrast as in the case of the previous work by Irabor & Omigie, (2023) on corporate bond duration and immunisation strategy in the Nigerian bond market whereby there was immunisation in the short-term.

Durbin Watson Test: The Durbin Watson (DW) statistic of 2.3 suggests that the model is free from auto-correlation issues in the residuals, meaning the model's errors are independent, which is crucial for ensuring the reliability of the regression results, as its value falls within the acceptable range of 1.5 to 4, satisfying the Ordinary Least Squares (OLS) statistical criterion.

In summary, the regression analysis shows that short-term bonds and inflation have a negative effect on bond yields, while long-term bonds have a positive effect. The model fits the data well, with no issues of auto-correlation, and provides clear insights into how these economic factors influence the mean yield of government bonds.

CONCLUSION AND RECOMMENDATIONS

This research examined the influence of inflation and bond maturity structures on Nigerian government bonds, employing the Auto-regressive Distributed Lag (ARDL) model to analyse quarterly data from 2001 to 2020. The study focused on key macroeconomic variables, including bond duration, inflation, and bond maturity structures, with the goal of understanding their effects on bond yields. Methodologically, unit root tests, co-integration tests, and ARDL analysis were utilised to evaluate both short-term and long-term relationships among these variables. The findings demonstrated that both short-term and long-term maturity structures have a significant positive effect on government bond yields. Conversely, inflation exerted a negative influence on yields, indicating the reinvestment risks posed by rising inflation. Although the ARDL bounds test did not establish a long-term co-integrated relationship between the variables, it suggests that bond yields are primarily driven by short-term dynamics. Furthermore, the Durbin-Watson statistic revealed no evidence of autocorrelation, reinforcing the robustness of the results. Overall, bond duration and maturity structures are critical determinants of government bond yields in Nigeria, yet the study underscores the considerable threat inflation poses to bond investments, as government bonds lack protection against inflation in both the short and long term.

In light of the findings, the following recommendations are proposed for stakeholders such as investors, financial analysts, and policymakers in the bond market:

- It is essential to monitor both short-term and long-term bond maturity structures while considering inflation in investment strategies since Nigerian government bonds are susceptible to risks over both time horizons. Implementing risk mitigation strategies, such as bond immunisation, will help safeguard returns.
- There is a need to prioritise the stabilisation of inflation and interest rates to foster a stable economic environment since these macroeconomic variables exert a significant influence on bond yields. This will help yield more predictable returns for investors and contribute to overall economic stability.

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