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**Economics
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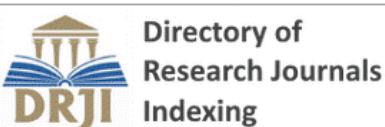
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PUBLIC SECTOR DEFINED CONTRIBUTION PENSION SCHEME AND CONSUMPTION SMOOTHENING IN NIGERIA

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Abstract. *Pension schemes are to ensure adequate consumption after retirement by ensuring adequate savings during work life. However, the pension crises being witnessed the world over are pointers that the industry has been underperforming. This research was therefore initiated to ascertain the capability of the Nigerian Public Service Pension Scheme to ensure consumption smoothening of the average employee. A Mixed methodology was employed using an online questionnaire while the NPV was used to confirm the sustainability of the pension scheme on consumption smoothening. It was found that the pension scheme cannot guarantee adequate consumption among retirees. It was also found that the scheme did not provide for adequate financial education as the workers lacked the skills to decide on the investment of their pension savings. It was also found that the scheme lacks transparency on the part of pension operators. It was concluded that the scheme is not sustainable. Besides wage increases, urgent reforms of the scheme were recommended towards moving away from the PFA-run scheme to an MDA-run scheme in line with their peculiarities especially the introduction of a Progressive Contribution System.*

Keywords: *pension, savings, consumption smoothening, leaving wage, transparency, rebalancing, Progressive Pension Contribution.*

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Introduction

The Lifecycle Hypothesis (LCH) requires an employee to take responsibility for his life after retirement since the rationale behind savings has been identified as the desire to maximize consumption at a future date such as during retirement (Jappelli, 2005). This is achievable through workplace compensation plans – pensions, which are payments made to ex-employees of an organisation to take care of their basic needs during retirement. The adequacy of a retirement pension depends on its design vis-à-vis the demographics of the plan participants. However, contemporary pension plans by their designs do not seem to support this philosophy since there are no visible incorporated mechanisms to inculcate financial awareness and discipline among employees by forecasting adequate pensions at retirement that would guarantee a smoothened consumption over the lifecycle. Pension managers have also neglected stress testing as a necessary tool for ensuring adequate replacement ratios should there be contingencies (Chan-Lau, 2017). Recent developments globally have necessitated the adoption of stress testing by fund managers towards evaluating investment risk, and guaranteeing adequate cash flow, timely pay outs both current and future obligations. Most Pension funds by their designs are not insulated from financial shocks; also, not favourably disposed to hedging. They are not Pareto efficient. The overreliance on the employer for the post-service living of its employees has proved ineffective. Consequently, Pension Funds (PF) in the early 2000s were characterised by migrations from the traditional Defined-Benefit (DB) scheme to the Defined-Contribution (DC) scheme (Thomas, Spataro, & Matthew., 2014). Such movements may have been triggered by its negative impact on the

macroeconomic structure occasioned by either globalisation or structural changes in the industry and in the labour markets (Thomas et al 2014), or the increasing longevity (Michael Millar, 2009) (Franco, Marino, & Tommasino, 2010). Deficiencies in savings and investment have been responsible for the lagged development in Sub-Saharan Africa countries (Kumo, 2012), this is in contrast with the aggressive development in China characterised by a high rate of capital accumulation (Chow, 1990). The DB scheme is bedevilled with accumulated accrued pension rights with national budgets being overwhelmed with expenditures on pensions.

With the conviction that the then Pay-As-You-Go pension plan could not deliver on its mandate, the World Bank in its 1994 report proposed a total reform of pension administrations in line with changing realities (Singh, 1996). As a response to the foregoing, many countries developed new pension plans to cope with their inability to fund the DB pension schemes and curb the pension crises. Initial flaws notwithstanding, DC schemes could develop the economy (Apilado, 1972; Ennis, 2017), while ensuring consumption smoothening over the lifetime.

Literature Review

2.1 Conceptual Review

2.1.1 Pension and Pension Reforms

Pensions are a form of post-service remuneration. They are compensations made by employers to their erstwhile employees. The Nigerian Pension Reform Act of 2014 replaced that of 2004 and increased the ceiling for the investment of pension funds from 25% to 35% in domestic equities (Kwairanga, 2013; Ekpulu & Bingilar, 2016). The initial Act (2004) introduced the Contributory Pension Scheme (CPS) in which both the employer and the employee made commitments towards ensuring a smooth retirement life for the employees. These were adjusted upwards in the 2014 amendment. The CPS, however, does not give room for individual financial decision-making apart from the choice of fund manager and has instead vested such powers in institutions- Pension Fund Administrators (PFAs) with guidelines from the Central Bank of Nigeria (CBN) through the National Pension Commission (PenCom). Pensions could be Funded, Unfunded or overfunded. Defined Benefit schemes are unfunded pension systems whereas Defined Contributions are a form of funded pensions. The former refers to a design where the pension liability is solely borne by the employer, while the latter connotes adequate preparations by way of worktime savings by employees to cater for their retirement needs. The discount rate if varied could render a funded pension scheme overfunded, which implies a surplus of pension assets over pension liabilities at a point in time; or underfunded. The Nigerian pension industry has been largely underfunded, giving rise to its inability to meet pension obligations. This has compelled many agencies such as the Nigerian Customs Services (Popoola, 2023), Nigeria Police Force, etc. to demand exemptions from the DC scheme being operated in the country.

2.1.2 Pension Operators

Under the current pension regime, PenCom supervises other pension operators including PFAs, Closed PFAs, Pension Fund Custodians (PFCs), Pension Operators Secretariat, and the Pension Transitional Arrangement Directorate (PTAD). The CPS under the PRAs requires that pension assets be privately managed by limited liability companies licenced by PenCom (PenCom, 2004; Pension Talk, 2022). These are responsible for the maintenance of Retirement Savings Accounts (RSA) for both public and private sector employees, investment and management of pension fund assets, payment of retirement benefits and accounting for transactions relating to pension funds under their management. The Pension Operators are as in Table 1 below.

Pension custodians are responsible for the safekeeping of pension fund assets on trust for contributors. They receive pension contributions from employers on behalf of PFAs who are then notified of such receipts within 24 hours. They settle transactions and undertake activities relating to the administration of pension fund investments.

The Closed Pension Fund Administrators (CPFA) are pension vehicles allowed to manage private DB pension schemes that existed before the reform of 2004 subject to guidelines issued by PenCom. The 2014 reform foreclosed new entrants into the scheme effective 1st July 2014, and

they can open RSA with any PFA of their choice while existing employees can pull out for the CPFA to a PFA under the CPS.

Table 1. Pension Operators in Nigeria

PFAs	PFCs	CFPAs
Access Pensions Limited	First Pension Custodian Nigeria Limited	Chevron CPFA Limited
Arm Pension Managers Limited	UBA Pensions Custodian Nigeria Limited	Nestle Nigeria Trust CPFA limited
Crusader Sterling Pensions Limited	Zenith Pensions Custodian Nigeria Limited	Nigerian Agip CPFA Limited
FCMB Pensions Limited		Progress Trust CPFA Limited
Fidelity Pensions Managers Limited		Shell Nigeria CPFA Limited
Guaranty Trust Pensions Managers Limited		Total Energies EP Nigeria Limited.
Leadway Pensure PFA Limited		
National University Pension Management Company (NUPEMCO)		
NLPC Pension Fund Administrators Limited		
Norrenberger Pensions Limited		
NPF Pensions Limited		
OAK Pensions Limited		
Pension Alliance Limited		
Premium Pensions Limited		
Radix Pension Managers		
Stanbic IBTC Pension Managers Limited		
Tangerine APT Pensions Limited		
Trustfund Pensions Limited		
Veritas Glanvills Pensions Limited		

Similarly, public pension schemes prior to the CPS and administering DB pensions of different departments of the Federal public service retirees were merged into the PTAD. It is responsible for the payment of pension benefits to this set of employees who retired up to June 2007 and are exempted from the CPS. The Directorate ceases to exist after the demise of the last pensioner under the DB scheme of the FGN. It has six liaison offices around the country.

Other key players in the Nigerian pension industry are the Pension Fund Operators Association of Nigeria (PenOP), and the Recovery Agents, The PenOP is an independent, non-governmental, non-political, non-profit-making body established to ensure efficiency within the industry. It comprises PFAs, CPFAs, and PFCs, and strives to ensure international best practices in pension administration. The Recovery Agents are private consultants engaged by PenCom to monitor compliance of employers with remittances of pension deductions and also recommend for defaulting employers over non-remittance or under-remittance.

2.1.3 The Contributory Pension Scheme (CPS)

This is an arrangement in which both the employer and the employee make financial commitments towards the retirement pension of the latter. The CPS became effective in Nigeria with the enactment of the Pension Reform Act 2004 which was later repealed and reacted in 2014 (PenCom, 2023). It is a fully funded pension scheme meant to ensure that the employee receives his retirement benefits as and when due. The current rate of contribution is 18% with the employer contributing 10% while the employee contributes 8%. However, there is an option for the employee to make voluntary contributions beyond the statutory 8%, but not less. Individual employees are expected to open a Retirement Savings Account (RSA) with a PFA of choice through which combined contributions are saved and managed by the PFA on their behalf. Such Savings cannot be

accessed except at retirement, loss of job, medical incapacitation or in the event of death. The CPS covers all employees in public service of the Federation, Federal Capital Territory (FCT), States, Local Government and private sector organizations with 3 or more employees, but exempts judicial officers, members of the Armed Forces, the Intelligence and Secret Services of the Federation, retirees under any pension scheme that existed before 30th June 2004, and employees who had 3 or less years to retire as at 30th June 2004.

2.1.4 RSA Funds

The CPS operates a Multi-Fund Structure with different funds for investing pension contributions based on the age and risk profiles of the RSA holders (PenCom, 2023). The structure contains four distinct funds and two special funds as captured in the Table 2 below.

Table 2. Multi-Fund Structure

S/No.	Fund	Category of Contributors
1	Fund I	Contributors $\leq$ 49 years, but strictly on request. An aggressive fund with the principal purpose of return maximization with 75% investment in variable income instruments.
2	Fund II	Contributors $\leq$ 49 years. A balanced fund with the principal purpose of capital preservation and fair LR returns with 55% investment in variable income instruments.
3	Fund III	Contributors $\geq$ 50 years. A conservative fund with the principal purpose of capital conservation with only 20% investment in variable income instruments.
4	Fund IV	Strictly for retirees. An ultra-conservative Fund with only 10% investable in Variable income instruments.
5	Fund V (Special)	Contributors in the Micro Pension Plan
6	Fund VI (Special)	Contributors interested in non-interest financial instruments

PenCom allows contributors to choose the fund under which his/her pensions would be invested. Contributors who are 49 years or below by default under Fund II but can choose to move to Fund I. While those 50 years or more are under Fund III by default but can choose to move to Fund II, Contributors under Funds IV and VI cannot move to any other Fund but those under Fund V can move to Funds II or III if they secure formal employment. Such movements are free once a year, but subsequent requests attract nominal fees prescribed by PenCom.

2.1.5 Pension Adequacy

This entails the equilibrium in pension administration - the adequacy of pension savings to pay sustainable retirement benefit specifically (OECD, 2013), and improve the performance metrics of the economy generally as is being investigated by this research. This could be measured by the equality of the savings with the replacement ratios under the DB scheme, or the IRR with the NPV under the DC scheme. The present value of future pension payments could be determined considering the risk characteristics of pension plan participants and the prevailing interest rate. Pension adequacy does not only mean equilibrium, but it could also be the excess of pension assets over pension liabilities, or the surplus of pension assets over pension liabilities.

2.1.6 Replacement Rate

In other words, called replacement ratios, replacement rates simply refer to pension payments that replace work-life salaries and wages. Whereas disposable incomes are a function of the tax rate, replacement rates are a function of pension savings and the returns on their investments. Sustainable Replacement Rates should ensure consumption smoothening by leaving the consumption of the pensioner unchanged when compared to the work-life period. They should also be regular over the residual lifespan of the participants depending on their life expectancies.

2.1.7 Sustainable Pension

A sustainable pension is one whose design accommodates both risk-seeking and risk-averse investors. Such a scheme would ensure adequate savings by plan participants that would guarantee a smooth consumption at retirement. It should be fully funded by both the employer and the employee with strict regulation to ensure security of pension assets. A sustainable scheme must

specify appropriate investment of pension funds to avoid a mismatch given the demographics of the participants. The designs would guard against procrastinations and promote portfolio rebalancing aimed at ensuring optimum return on investments. It should ensure adequate and regular pension payments. Unfortunately, the crisis facing the Nigerian pension industry has cast some doubt on its sustainability even though the RSA Multi-fund structure provides four different funds among others under which contributions could be invested depending on the age of the participant.

2.1.8 Consumption Smoothing

Employees should be able to meet their basic needs and save for their retirement. These savings would then provide for their basic needs after retirement when their salaries must have been stopped. However, the poor working conditions of the Nigerian labour market do not support a consumption smoothing where the average worker is expected to maintain his level of consumption after retirement. This is due to the low minimum wage, low salaries and wages, general macroeconomic conditions, and corruption within the public service of the FGn.

2.2 Theoretical Review

2.2.1 Absolute Income Hypothesis (AIH)

As postulated by Maynard Keynes, the AIH also known as the Savings function implies that consumption is a function of disposable income. Consumption increases as disposable income increases, however, at a lesser rate since the APS is greater than MPC. The law explains the distribution of disposable income between consumption and savings. Pension designs should ensure more than proportional savings when there is a pay rise.

2.2.2 The Permanent Income Hypothesis (PIH)

Friedman's Permanent Income Hypothesis (PIH) provides that people save not only for their future but for their descendants too (Jappelli, 2005). Pensions by their designs could regulate borrowing and savings even for the children of employees by incorporating arrangements for housing buffers and health insurance and possibly extend social security to include scholarships for the children of a retiree/deceased of a certain bracket who may have been caught underway through their university education by their parent's retirement/death.

2.2.3 The Rationality Theory

Also known as the self-interested or rationality assumption of neoclassical economics provides that individuals base their decisions on rational calculations to achieve outcomes that align with personal objectives. Economists believe that people forego alternatives that are not relatively valuable and compelling to them in favour of those with the greatest personal benefit. This also applies to DC pension participants. However, their degrees of rationality are often constrained by both demographic and market realities. The level of financial education, or the amount of information at the disposal of contributors often makes a mockery of this rationality assumption. It is not clear how the Nigerian labour market supports workplace financial education to ensure near-adequate retirement planning.

2.2.4 Inter-Temporal Choice

Irvin Fisher postulated that rational consumers make decisions on current consumption and savings for the future, but that such decisions are constrained by their levels of income. The Inter Temporal Budget Constraint affects retirement planning among workers as the income is often too low to even finance current consumption. Governments, in their pension designs should consider this fact and ensure proactive periodic income adjustments in line with market realities rather than being reactive to industrial actions.

2.2.5 The Lifecycle Hypothesis (LCH)

The Life Cycle Model would be considered a foundation towards evaluating the robustness of pension designs in providing adequate consumption both during working life and at retirement using the consumption-investment optimisation approach. The desire for smooth consumption during the accumulation and decumulation phases of pension management requires careful decisions concerning optimal asset allocation, optimal contribution rates and optimal replacement ratios (Alwohaibi & Roman, 2018). The authors applied the ALM in Saudi Arabia to minimise the risk of financial planning under a DB scheme.

Whereas consumption is an increasing function of the disposable income subject to the marginal tax rate, savings/investment are a decreasing function of interest rate. To ensure adequate consumption, there is a need to harness savings/investment policies with those of the government in the forms of contribution rates, interest rates and tax rates that would leave the pensioner near indifferent after retirement.

2.3 Theoretical Framework

This study adopts the Keynesian Savings Function as the framework for the study. The function provides that as the disposable income increases, consumption also increases but at a lower rate. This implies that more of the increased income is saved rather than consumed. This underlies the smoothened consumption notion of the lifecycle hypothesis. If the minimum wage is increased, incomes will increase and more of it will be saved. For pension contributions to increase for a guaranteed retirement income, salaries and wages must first be increased.

2.4 Empirical Review

Many actuarial researchers have lent their voices to the state of pensions globally, with varying degrees of advocacy for both funded and unfunded systems. Unfunded pension schemes are exposed to demographic, wage and longevity risks since expenditures on them are typically financed by the contributions of the working population (Alonso-García, 2017). The author examines the sustainability and fairness of both Defined Benefit (DB) and Defined Contribution (DC) schemes and urges policymakers to ensure that pension contributions during working life correspond with pension rates at retirement while always maintaining an adequate level of liquidity. This has been the rationale for the movement from DB to DC pension schemes in recent times with a view to making pension systems sustainable thus guaranteeing replacement incomes. Similar voices have been lent on the feasibility of these schemes in delivering the desirable outcomes of high investment returns, certainty of retirement income, non-negative performance, efficiency and liquidity and a smoothened consumption over the lifecycle (O'Dea, 2018; Kolsru, Camille, Reck, & Spinnewijn, 2019; Browning & Crossley, 2001). These authors postulate that in a bid to smoothen consumption, economic agents tend to hold the Marginal Utility of money constant over time. Others examined the factors that affect the consumption smoothening process of these agents (Japelli & Pistaferri, 2017). Temporal discounting as a central theme in behavioral economics and neuroeconomics, determines the level of consumption smoothening (Hayes, 2023), also known as hyperbolic discounting, its often leads to poor financial decisions that are skewed towards short term pleasure. The age, education, health, income, savings, family size, among other factors determine the level of consumption smoothening (Honea & Marisennayya, 2019). Some studies concluded that countries are better-off under mixed pension systems (Boado-Penas, Godinez-Olivares, & Serrano, 2020). Indirectly, pension savers aim to derive the maximum utility possible from their contributions given their demographic and market constraints such as income, age, education, gender, interest rate, and risk represented by the discount rate. The dexterity and disposition towards numbers also affect the financial choices people make (Skagerlunda, Lind, Strömbäck, Tinghög, & Västfjäll, 2018). These authors employed the Liquidity Ratio and the Replacement Rate methodologies in determining the liquidity and adequacy of a scheme in alleviating poverty and ensuring decent retirement living.

Methods

3.1 Sample and Data Collection

To test the above hypotheses, a mixed online questionnaire was administered through social media groups and in-person interviews with members of the Nigeria Police Force.

Both primary and econometric tools were employed to assess the behavioural characteristics of pension contributors to ascertain the extent of their financial education (Hastings & Mitchell, 2020), their level of involvement or willingness to be involved in their pension arrangements, and how these would impact their retirements.

Data for this research was obtained largely from the questionnaire and other data repositories like the WDI, National Salaries, Incomes and Wages Commission, National Pension

Commission, and the Global Economy, Office of the Accountant-General of the Federation, to mention a few.

If the DC pension plan participants are found to be rational in their savings and investment decisions which should ultimately translate into adequate replacement rates, the scheme would be termed as sustainable and in line with the lifecycle theory.

3.2 Tools of Data Analysis

The author adopted a mixed research approach by administering a questionnaire, conducting interviews, and also analysing data from secondary sources. Data analytical tools like Spreadsheets, bar charts and tables were used to analyse and present the data on pension savings and household consumption.

3.3 Models Specifications

To adequately capture the parameters at work and their constraints in determining an appropriate equilibrium between savings, investment, and retirement welfare, this research evaluated the working conditions and spending behaviours of participants using the questionnaire and the NPV. The Net Present Value (NPV) is a financial modelling tool that discounts the present value of future pensions. This would enable us to determine the adequacy of pension assets and their future values in guaranteeing pension payments after retirement. The technique would bring to the fore the financial behaviour of individuals under pension plans and how these impact their retirement planning, bearing in mind the various constraints individuals and funds encounter in making savings and investment decisions.

This approach mirrored both the bias and the variance in the key parameters that determine adequate pension arrangements, especially in the accumulation phase towards a smooth decumulation phase (Zhang & Guo, 2020; Peijnenburg, 2018). The technique will ascertain the presence or otherwise of automatic rebalancing in the pension designs with respect to both the required contributions and the required rate of returns (Godinez-Olivares, Boado-Penas, & Habemen, 2016). Through these techniques, the sustainability and the adequacy of the plan would be measured.

To arrive at the NPV, we will proceed thus:

$$PV = PMT \frac{1 - (1 + r)^{-n}}{r} \quad (1)$$

$$NPV = \frac{CF}{(1 + r)^n} \quad (2)$$

Where

PMT – annualised pension payment (Monthly pension contributions x 12);

n – the number of years the pension is expected to last after retirement (which is equal to life expectancy less the retirement age);

r – the rate of return (the RSA ROR);

CF – Cash flows (PV).

To determine today's value of future pension, first, we determine the total value of the said pension when it begins (retirement date). Secondly, we discount that amount to the present using an appropriate discount rate (Gellert, 2019). The most applicable discount rate in this case is the Return on Investment (ROI) for pension funds as reported by PensionNigeria (PensionNigeria, 2021) generally, and NPF Pensions Limited particularly (NPF Pensions Ltd, 2024). Equation 1 provides the present value of the pension at the time of retirement, and equation 2 discounts this figure to an employee's current age using the number of years left until retirement when the pension payout begins. This technique is helpful for long-term financial planning as it places the future income streams at one's fingertips. With this information, employees could decide to switch careers or increase savings and/or investment if the desired consumption at retirement must be attained.

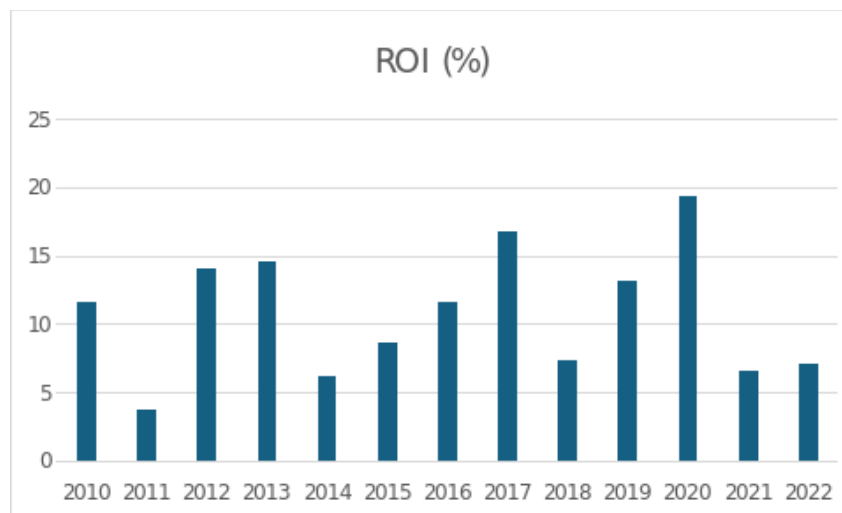


Figure 1. Trend of RSA Funds Return on Investment

Source: NGX, 2017

On the relationship between pension savings and economic growth and development, econometric tools will be used to test the actual impact of quarterly pension assets on the growth of consumption and investment in Nigeria.

These would be supported by both pre- and post-analysis tests to ensure the appropriateness of the techniques and the reliability of results. The analytical tools have been chosen to account for endogeneity biases inherent in time series and avoid a spurious regression while also acknowledging the long-term outlook of pension decisions.

Results

The online questionnaire which has a total of 30 questions received a total of 55 responses and the results are hereunder analysed.

4.1 Analysis of Questionnaire

4.1.1 Age Composition of Respondents?

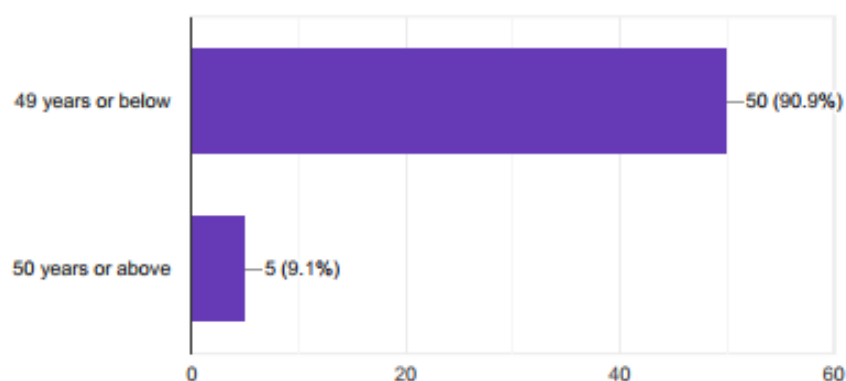


Figure 2. Age Composition of Respondents

From Figure 2 above, a majority of the respondents are in the accumulation phase of their lifecycle as 90.9% of them are below 50 years of age while 9.1% are above 50 years of age. In the first stage, the respondents are expected to work, earn more and save enough for their retirement as they are still young. Their demand for health is low compared to those above 50 years. Of this number, about 10.9% of the respondents are female while 89.1% are male. This may be due to the fact that it was an online survey, and the male gender has more screen time than females.

4.1.2 Salary Grade Level and Salary

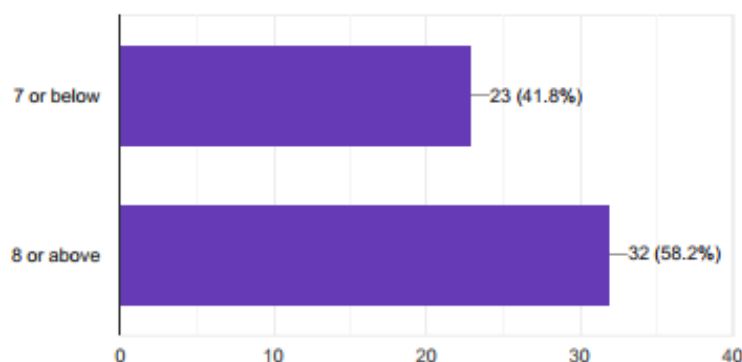


Figure 3. Salary grade level of Respondents

A 58.2% majority of the respondents are on salary grade level 8 or more while 41.2% are on salary grade level 7 or below. This implies that most of the respondents can save more.

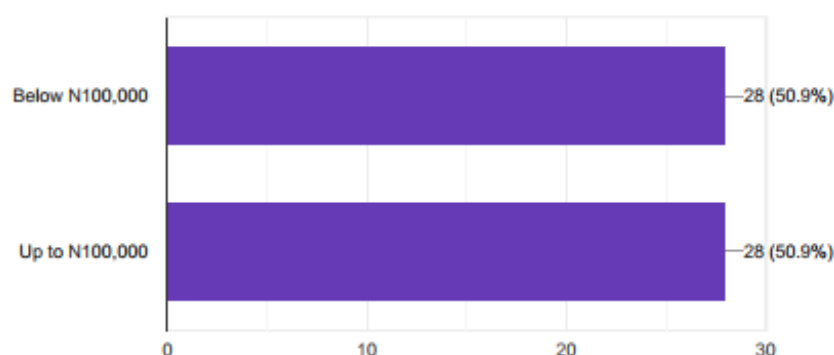


Figure 4. Basic Salary of Respondents

About half of the respondents earn below a hundred thousand naira as salary while half also receive a hundred thousand naira or more as salary income. The implication of this is that, of those on grade level 8 or more, some still earn less than a hundred thousand naira.

4.1.3 Adequacy of Net Pay for Consumption?

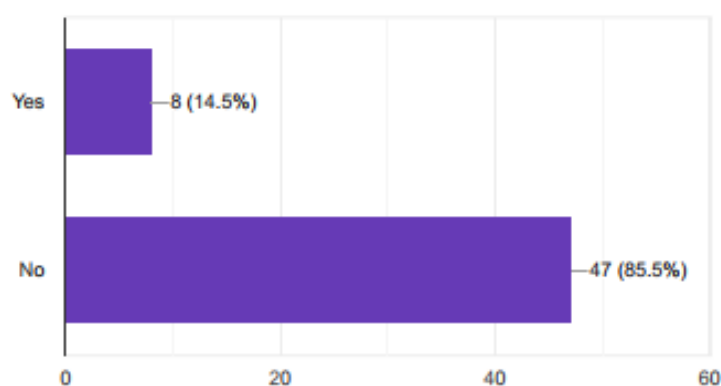


Figure 5. Adequacy of Net Pay for Consumption

As to whether the take-home pay of the respondents is enough for their consumption, only a negligible 14.5% responded in the affirmative while a majority 85.5% reported that their net salaries are not adequate for their consumption. This means that the respondents, besides their compulsory savings, cannot save for retirement since they barely meet their consumption needs. For such a category of workers, the DC pension scheme is the best since pension contributions are deducted from the source. They recourse to borrowing for consumption.

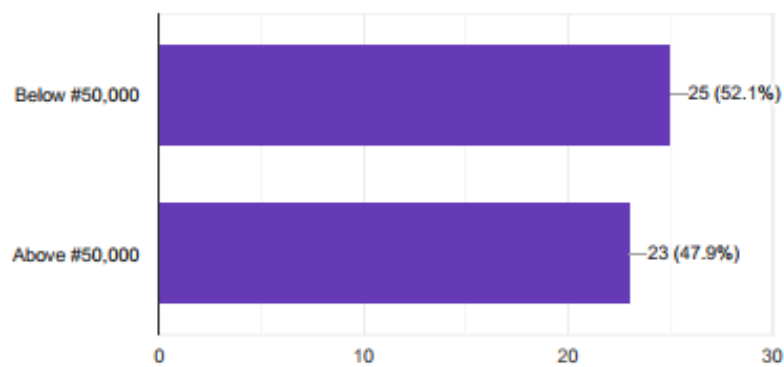


Figure 6. Borrowing for Consumption Augmentation

Of the 85.5% who reported not meeting their consumption needs, 52.1% and 47.9% borrowed below and above N50,000.00 respectively to augment their salaries towards meeting their consumption needs. For a smoothened consumption, the FGN has to repeal the National Minimum Wage Act and enact the National Living Wage Act of 2024 to provide for adequate consumption and savings for retirement while also boosting aggregate demand for the economy.

4.1.4 Respondents' Marginal Propensity to Consume/Save

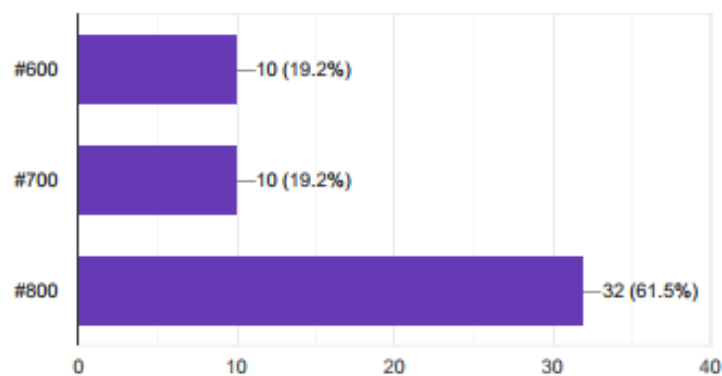


Figure 7. MPC/MPS of Respondents

About 61.5% of the respondents reported an MPC of 0.8 while 19.2% each reported 0.6 and 0.7 MPC for every thousand-naira addition to salary. This implies that all the respondents have low marginal propensities to save, and the best pension design supports automatic deduction and rebalancing.

4.1.5 Years to Retirement and Level of Financial Awareness

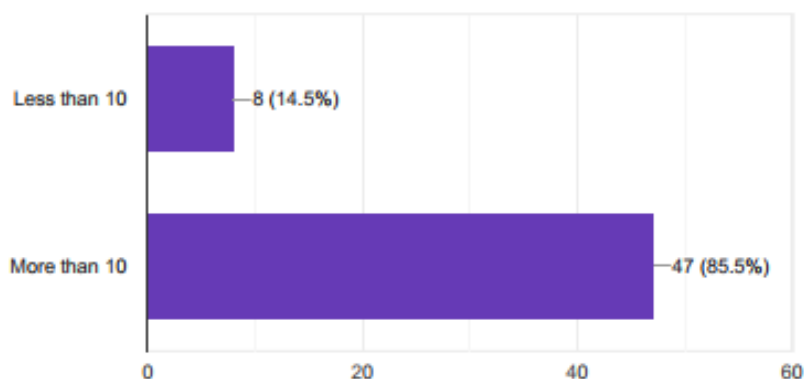


Figure 8. Years to Retirement

About 14.5% of the respondents have less than 10 years before retirement and pension while about 85.5% have more than 10 years before retirement.

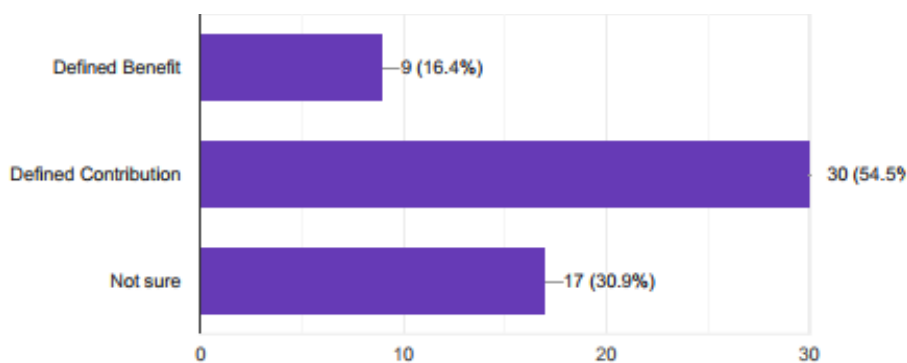


Figure 9. Knowledge of Scheme Enrolled

However, only 54.5% displayed basic knowledge of the pension scheme they are enrolled in. This puts a burden on the FGN and indeed other employers of labour to intensify efforts at providing workplace financial education to their employees.

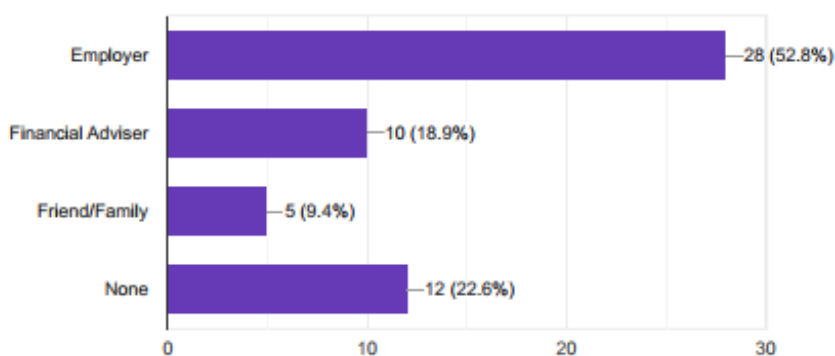


Figure 10. Sources of Pension Advice

As to the source(s) of pension advice, 52.8% get their pension advice from their employer; 18.9% from financial advisers including PFA; 9.4% get their advice from friends and family members while a whopping 22.6% reportedly do not seek or receive advice from any of the above. In addition, 30.9% prefer an employer-administered pension; 34% prefer an independent pension manager; and 30.9% do not trust anyone to manage their pensions. About 16.4% assumed high knowledge of financial matters, 43.6% assumed moderate knowledge; 16.4% assumed fair knowledge and 25.5% admitted a lack of financial awareness. Responses to many other questions confirm no to low knowledge of finance.

However, due to a lack of trust in pension operators, 92.5% prefer to make pension decisions for themselves while only 9.4% prefer someone else to decide for them concerning both savings and investment choices. This spells disaster for the pension industry and requires immediate action to avert a time bomb. There is an urgent need to intensify financial education among pension plan participants by both employers and PFAs to ensure adequate retirement planning and sustainable aggregate demand for the economy.

4.1.6 Choice of PFA

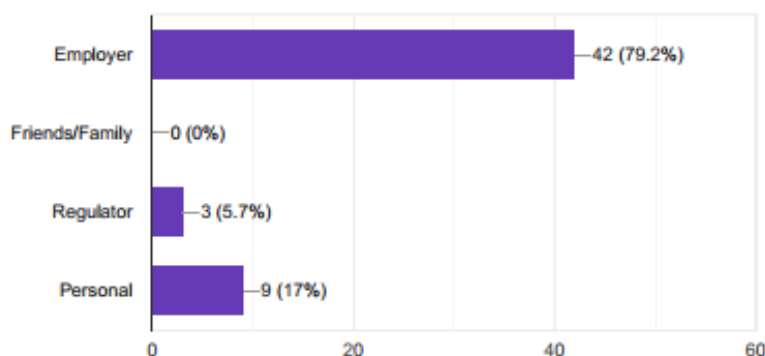


Figure 11. Choice of PFA

About 79.2% of the respondents reported that their PFAs were chosen for them or on the advice of their employers, and 62.3% have not switched their PFAs since enrollment in the scheme. Even though a majority 62.3% do receive account statements every quarter from the PFAs, a majority 40.7% complained that queries relating to their Retirement Savings Accounts are not promptly resolved by the PFAs while 31.5% reported that similar complaints are not at all resolved.

4.1.7 Voluntary Savings

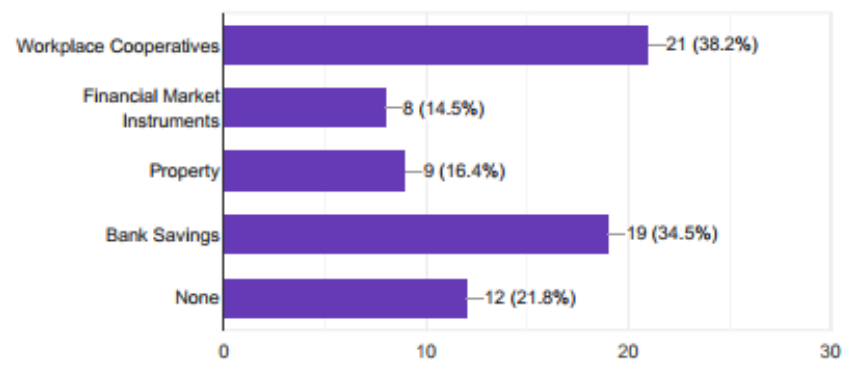


Figure 12. Voluntary Savings by Respondents

Apart from the statutory pension contributions, 38.2% save with workplace cooperatives; 14.5% have savings in capital market instruments; 16.4% in property; 34.5% in bank savings; and 21.8% reported no voluntary savings. This collaborates with the low MPS earlier deduced. More so, only 16.4% have reported attempts at estimating their retirement needs with 41.8% reporting inability to estimate and another 41.8% reported no attempts. Also, of the total respondents, 3.6% and 9.1% said they are saving too much and enough respectively, while 87.3% said their savings are too little to guarantee consumption smoothening at retirement. This is in tandem with the fact that they are even borrowing to survive.

Furthermore, 15.7% suggested 2.5% pension savings; 23.5% of the respondents suggested 7.5% pension contribution; 27.5% suggested 12.5% pension savings; and 33.3% suggested 17.5% pension savings. This means, that about 60.8% of the 87.3% who acknowledged the inadequacy of their savings have suggested higher (12.5 or 17.15%) pension contributions against the current 8%.

A majority 56.4% of respondents blamed their low savings on lack of transparency or corruption in pension administration; 29.1% blamed it on a low income, 10.9% have plans to save more while another 10.9% are afraid of losing their savings, and 1.8% lack interest in financial matters.

4.1.8 Scheme preference and confidence about retirement

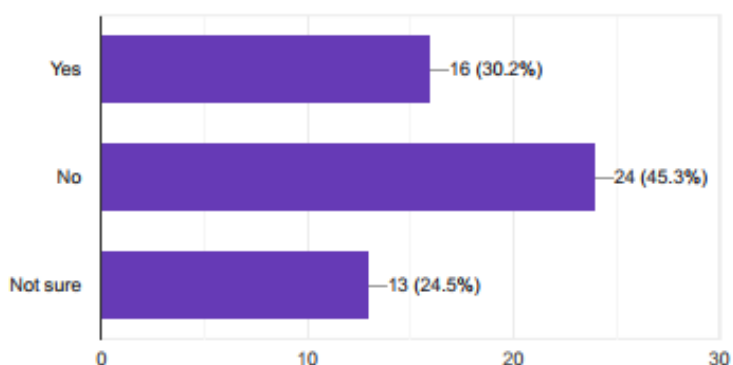


Figure 13. Preference of DC over DB

When asked to choose between the old DB and the current DC pension schemes, 45.3% prefer the DB while 30.2% prefer the DC scheme, and 24.5% reported indifference due to lack of financial knowledge.

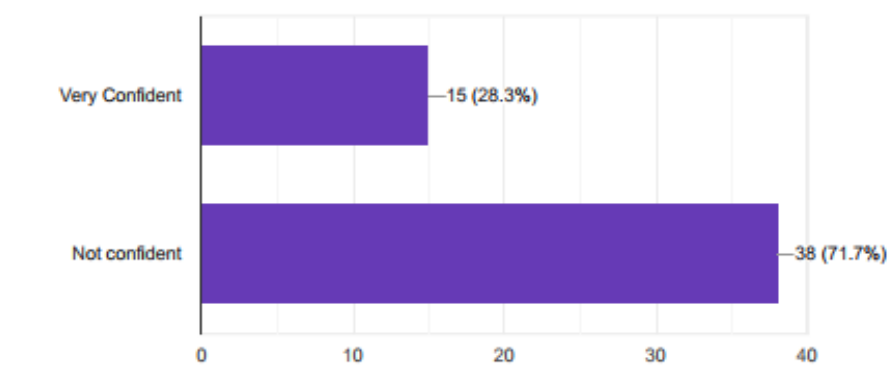


Figure 14. Confidence about Retirement

Only 28.3% of the respondents are confident about their retirement while a majority 71.7% are not confident of survival during retirement. This implies that they are aware their savings are inadequate and cannot guarantee consumption unless deliberate efforts are made by way of an increased salary, a reformed scheme with an aggressive financial education.

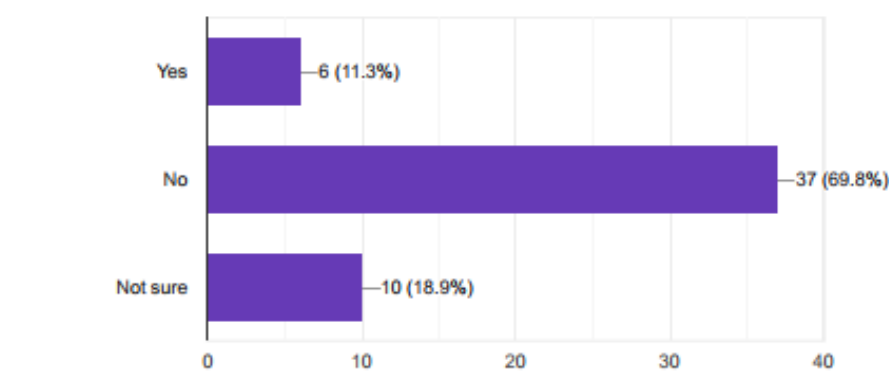


Figure 15. Adequacy of Pension Savings for Retirement Consumption

Further still, 69.8% said their pension savings cannot afford their current consumption after retirement while a negligible 11.3% expressed confidence in the adequacy of their pension savings.

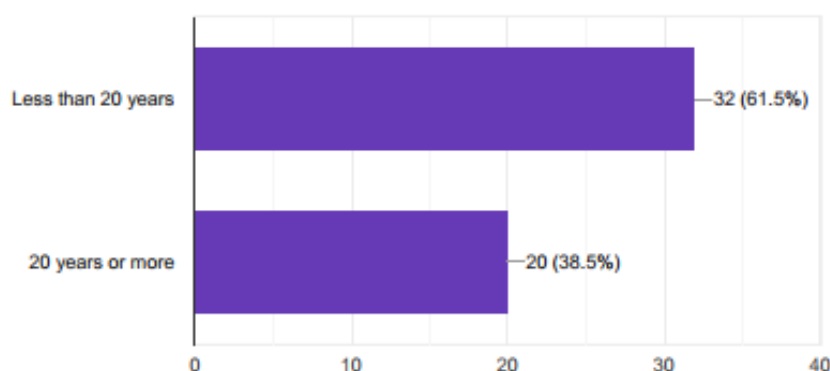


Figure 16. Life Expectancy for Public Servants

There is also the fear that Nigerian public servants do not live more than 20 years after retirement as reported by 61.5% while 38.5% of respondents reported that Nigerian public servants live more than 20 years after retirement. This confirms the low life expectancy in the country and is attributable to the poor working conditions within the public service of the Federal Government of Nigeria. This lack of confidence about retirement due to poor worker welfare is also the cause of corruption within the public service.

4.2 The Net Present Value Calculation

The result of the Net Present Value is presented in Table 3 below:

Table 3. Net Present Value Result

NPV CALCULATIONS FOR PENSION				
ASSUMPTIONS:				
Grade Level / Contribution Rate	10 / 8%	11 / 15%	12 / 17.5%	13 / 20%
Consolidated Salary (BHT)	₹ 150,000.00	₹ 160,000.00	₹ 180,000.00	₹ 200,000.00
Life Expectancy	54	54	54	54
ROI (r)	13.29%	13.29%	13.29%	13.29%
FUND II	>=45 yrs	>=47 yrs	>=48 yrs	>=49 yrs
Years Before Retirement (n)	7	5	4	3
Employee Contribution	₹ 12,000.00	₹ 24,000.00	₹ 31,500.00	₹ 40,000.00
Present Value				
PMT	₹ 144,000.00	₹ 288,000.00	₹ 378,000.00	₹ 480,000.00
$(1+r)^{-n}$	2.40	1.87	1.65	1.45
$1 - \frac{(1+r)^{-n}}{r}$	10.50	6.52	4.87	3.42
$PV = PMT \frac{1 - (1+r)^{-n}}{r}$	-₹ 1,511,724.67	-₹ 1,877,089.75	-₹ 1,841,010.06	-₹ 1,639,853.96
Net Present Value				
$NPV = \frac{CF}{(1+r)^n}$				
CF	-₹ 1,511,724.67	-₹ 1,877,089.75	-₹ 1,841,010.06	-₹ 1,639,853.96
$(1+r)^n$	0.42	0.54	0.61	0.69
$\frac{CF}{(1+r)^n}$	-₹ 3,620,876.70	-₹ 3,503,022.46	-₹ 3,032,651.24	-₹ 2,384,404.33
Monthly Pay-Out on Retirement	₹ 43,105.68	₹ 58,383.71	₹ 63,180.23	₹ 66,233.45

Source: Author's Computations

Discussion

From Table 3 above, RSA Fund II was used as a sample based on the responses from the questionnaire. It is obvious the current pension design cannot ensure consumption smoothening unless there are reforms by way of wage increases, contribution increases, increased financial education, retirement postponement, and most importantly transparency in pension funds management. The findings collaborate Honea & Marisennayya, (2019) who posited factors such as education, health, income etc. affect the level of consumption smoothening.

There is also the need for additional and urgent reforms on the existing scheme with a view to its unbundling into separate schemes specific to the scheme of service, and to be managed by MDAs as against the present PFA-run pension savings. This position is in line with Boado-Penas, Godinez-Olivares, & Serano (2020) who recommended mixed pension systems for developing countries.

Conclusion

From the above analysis, it is concluded that the Contributory Pension Scheme by its current design is unsustainable. This is because the contribution rates are too low, and the management of the same including their investments is not transparent.

It is therefore recommended that pension contributions be increased, and replacement rates too increased while retirement should be postponed. These would ensure adequate consumption at retirement and will provide guaranteed consumption after retirement. It is also recommended that employers step up their financial awareness schemes to enlighten their employees on the benefits of savings and investment for a decent retirement life. This will instil rationality in financial decisions generally and pension decisions particularly among employees. It is recommended that financial

literacy be included as a core subject of study in the education curriculum from secondary to tertiary schools. Finally, it is recommended that urgent reforms within the pension industry be carried out to unbundle the PFAs with MDAs having their peculiar pension schemes. A Progressive Pension Contribution Rate should be introduced instead of the current flat rate.

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Conflicts of Interest: The author declare that no potential conflicts of interest in publishing this work. Furthermore, the author have witnessed ethical issues such as plagiarism, informed consent, misconduct, data fabrication, double publication or submission, and redundancy.

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Appendix

Research Questionnaire

You are invited to participate in a survey in respect of a research titled “Public Sector Defined Contribution Pension Scheme and Consumption Smoothing in Nigeria.” Your responses are anonymous and would immensely contribute to the success of the study. Thank you.

1. How old are you? A) 49 years or below B) 50 years or above
2. Your Gender A) Male B) Female
3. Your Salary Grade Level A) 7 or below B) 8 or above
4. How much is your monthly Basic salary? A) <₦100,000 B) ≥₦100,000
5. Is your monthly net pay enough for your consumption? A) No B) Yes
6. What is your total indebtedness? ₦.....
7. If your monthly income increases by ₦1,000.00, how much is spent on consumption? A) ₦600 B) ₦700 C) ₦800
8. How many years left before retirement? A) <10 years B) ≥10 years
9. What type of pension scheme are you registered? A) Defined Benefit B) Defined Contribution C) Not Sure
10. From whom do you get pension advice? A) Employer B) Financial Adviser C) Friend/Family D) None
11. Which other savings do you have? A) Employer Cooperatives B) Bank Savings C) Property D) Financial Market Instruments E) None
12. Have you ever tried to calculate how much you need to save for retirement? A) Yes B) Yes, but I was unable to work it out C) No
13. With your present income, are you saving? A) Too much B) Too little C) Enough D) Not sure
14. What pension savings rate would you prefer? A) 2.5% B) 7.5% C) 12.5% D) Above 17.5%
15. Who do you trust most for your pension plan? A) Employer B) Financial Adviser C) Pension Operator D) None
16. In your opinion, what is the major barrier to your pension saving? A) Low-income B) Lack of Transparency/Corruption by Pension Administrators C) Competing financial issues D) Plan to save more in the future E) Fear of losing my savings F) Not interested in financial matters
17. How knowledgeable about financial issues are you? A) Not at all knowledgeable B) Fairly knowledgeable C) Moderately knowledgeable D) Very knowledgeable
18. If an investment has an annual return of 7%, roughly how long do you think it will take the value of that investment to double? A) 5 Years B) 10 Years C) 15 Years D) 20 Years E) Not sure
19. If long-term interest rates were to rise, what effect do you think this would have on the value of a pension fund invested in bonds (fixed-income securities)? A) The value of the Pension Fund will rise B) The Value of the pension fund will fall C) The Value of the pension fund will remain unchanged D) Not sure
20. As regards your contributions/investment choices for your pension scheme, do you prefer to: A) Make the decisions myself or B) Have someone else make the decisions for me
21. Have you changed PFA since you registered for this pension scheme? A) Yes B) No
22. What informed the choice of your present PFA A) Employer C) Friends/Family C) Regulator D) Personal
23. How often do you receive account statements of your RSA? A) Quarterly B) Annually C) Never
24. How promptly, are pension complaints resolved by your PFA? A) Very much promptly B) Not very promptly C) Not at all D) Not sure
25. By your assessment, is the present pension scheme better than the old one? A) Yes B) No C) Not sure
26. With the present pension arrangement, would you say you are confident about your post-service life? A) Confident B) Not confident
27. Can your pension savings afford your current level of consumption at retirement? A) Yes B) No C) Not sure
28. By your assessment, how long, on average, do Nigerian Public servants live after 35 years of active service? A) less than 20 years B) 20 years or more
29. As a country, do you think the current pension regime is better for the economy? A) Yes B) No C) Not sure
30. Overall, would you recommend changes to the current pension scheme? A) Yes B) No C) Not sure



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JEL Classification: G11, G19, G21, G28, G29, G32, O16**Andreas Svoboda,**

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<https://orcid.org/0000-0001-5796-5485>andreas.svoboda@ffhs.ch**THE IMPACT OF ARTIFICIAL INTELLIGENCE (AI) ON PORTFOLIO OPTIMIZATION***Received 03 July 2024; accepted 11 July 2024; published 29 July 2024*

Abstract. *This paper explores the transformative impact of artificial intelligence (AI) on portfolio optimization in the financial sector. It examines how machine learning algorithms have revolutionized risk management and investment strategies by analysing vast datasets more efficiently than traditional methods. The study contrasts modern portfolio theory with AI-driven approaches, highlighting the advantages of machine learning models in addressing market risks and volatility. The findings suggest that AI not only enhances predictive accuracy but also offers a more dynamic and adaptable framework for portfolio management, thereby outperforming conventional techniques in managing financial risks.*

Keywords: *artificial intelligence, portfolio optimization, machine learning, risk management, modern portfolio theory, financial markets, investment strategies.*

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<http://doi.org/10.51586/2754-6209.2024.12.3.21.26>

Introduction***The Impact of Artificial Intelligence (AI) On Portfolio Optimization***

Over the past decade alone, there has been a massive leap in the research and development of artificial intelligence spurred by business investment and its adoption by society. The technological revolution has facilitated the adoption of machine learning in the business sector through implementation of solutions revolving around risk management as far as financial economics is concerned (Zhong and Enke, 2019). AI has transformed the investment and asset management industry through the utilization of machine learning algorithms to analyse vast data sets in relation to risk management (Sen et al., 2022). The entire investment and asset management industry has shifted focus to AI in portfolio optimization procedures as it has the possibility of outperforming traditional Modern Portfolio Theory (MPT) in portfolio construction and risk management.

Methods***Modern Portfolio Theory***

From the middle of the year 2007 up to the early part of the year 2009, financial markets including banking systems worldwide experienced a crisis spearheaded by the collapse of the US housing market leading to massive losses for global banking systems (Levy et al., 2022). The recession experienced then was much deeper than that of the 1930s as the figure for job losses was in the millions and slow recovery was recorded due to the extensive financial crisis (Çan and Okur Dinçsoy, 2021). At that time, the macroeconomic situation maintained suitable conditions for unreasonable risk-taking activities in the financial markets. The financial crisis was influenced by the nature in which risk was handled. Technological developments in terms of computing power witnessed currently were still underdeveloped at the time hence risk in financial markets was handled through fundamental and technical analyses (Rahman, 2024).

Fundamental analysis purposes to discover and explain the fluctuations of a given company's stock price through analysis of the industry it belongs to as well as the surrounding economy (Zanjirdar, 2020). Technical analysis on the other hand does acknowledge the patterns present in the pricing as well as the volume. It seeks to find the cues for the buying action based on identified patterns (Kim et al., 2020). However, technical analysis possesses great margins of error hence, cannot be employed as the structural model of the risk management system (Hunziker, 2021). The modern portfolio theory is a system that employs the statistical technique of chance to address the incapacities of fundamental and technical analyses (Antony, 2020).

The modern portfolio dismisses the law of large numbers in portfolios comprised of securities and postulates that suitable holdings for investors are mean-variance efficient portfolios (Berk and Tutarli, 2020). Investors operating on the law of large numbers aim to maximize discounted returns with minimal variance. However, according to modern portfolio theory, it is next to impossible for a minimum variance to be achieved through the diversification approach alone due to the strong interrelationship between returns from securities (Zhou, 2022). The modern portfolio concludes that the risk of an investor's overall portfolio is reduced when the given portfolio is a mixture of stocks that flip tail and those that flip heads (Lindquist et al., 2022).

Thus, far broader sets of linkages between different assets are used in modern portfolio theory. A calculation of covariances involves a pairs analysis of the relations between securities pairs, a process that is tiresome analytically (Guo, 2022). The bigger the portfolio, the higher it originates the bound to the Markowitz model since the number of inputs required and number of computational time required increases. Also, deciding on the input data type that is needed may be rather unclear, especially if one is working with correlation matrices. It should be noted that Markowitz initially introduced the mean-variance optimization technique for portfolios, which significantly got simplified with the help of the market models introduced by Sharpe, Lintner, and Mossin hence the modern portfolio theory (Verma and Srivastava, 2024).

Outcomes that are nearly as good were achieved with far fewer parameters than when considerably larger sets of linkages between securities are utilized. It must be pointed out that the market models created by Sharpe, Lintner, and Mossin are rather cost-efficient when it comes to the risk assessment (Yizheng, 2023). The technique co-developed by Markowitz is thus rather efficient when used in the real life. In measures for risk management within the portfolio's optimization, the single period mean variance portfolio model is efficient because it dramatically reduces the number of inputs and time required for computing (Ma et al., 2021). Modern portfolio theory complicates the risk-return trade-off for the portfolio managers; thus, the construction of efficient portfolios takes time and costs a lot of cash. The models of the Modern Portfolio Theory are characterized precisely by their lack of flexibility and omission of certain concepts (Rodríguez et al., 2021).

Results

Artificial Intelligence/Machine Learning Models

Artificial intelligence and machine learning are a perfect continuation of the improvement of the technological process as access to the increased amount of computational power allows programs to sort through the extensive data and to analyse them while looking for the patterns and finding the particular values that differ from the others (Kühl et al., 2022). Access to financial data, computational resources, profitability requirements, competition of firms, and demand and needs of financial regulators have been the drivers to foster AI in finance (Kavin, 2023). Concerning the management of financial risk, the application of artificial intelligence has played a significant role in managing the process of decision-making on finances.

Because of their versatility, machine learning models can solve the low variance-high bias dilemma that plagues parametric models (Posth et al., 2021). Modern Portfolio Theory's single factor of analysis, the covariance of security returns relative to the overall market, is measured by simplifications made to the Markowitz technique. Machine learning algorithms can incorporate dividend and reinvested income returns which were previously unattainable with the S&P500 Index used in the Sharpe, Lintner, Mossin, and Treynor Markowitz technique implementations (Parnes, 2020). This is achieved by applying the single index model to create variance-covariance structures.

Single, newfangled models can be tested later with help of machine learning algorithms, which helps to enhance the predictive capacity of single index models in the future (Paiva et al., 2019). According to the modern portfolio theory, there is always an element of relying on the results of a risk assessment model that is always under some threat due to changes in data distribution, often characteristic in finance. However, machine learning models are more able to estimate this changing pattern in a way that enhances the generalized model (Mhlanga, 2021). Indeed, integrated machine learning-based financial models are rather precise.

Unlike most of the statistical methods out there, a machine learning model seeks to make more explicit the relationship between the variables, identify the key factors, and enable the determination of the influence of the variables on the dependent variable without necessarily having to rely on theory (Irfan et al., 2023). As a conceptual framework it is possible to use pretty much anything from the area of machine learning and statistics for both inference and prediction. However, the inference has been, and still is, the primary concern of statistical methods, where this is achieved by building and estimating a probability model specific to the given project. While on the other hand machine learning focuses on prediction as it makes use of general-purpose learning algorithms to discover relations in often-complicated and voluminous data (Singh et al., 2022). It can be noted that strong and limiting assumptions are not indispensable for machine learning models (Nazareth and Reddy, 2023).

Players in finance markets face risk which is quite hard to quantify. Out of the total financial risks, market, credit, liquidity along with operational risks are some that may occur (Addy et al., 2024). The volatility in financial indices such as inflation rates, interest rates and currency rates describe what is referred to as market risk. Fluctuations of prices in the market that may lead to losses in any positions held on, or off the balance sheet is termed as the market risk (Kou et al., 2019). Suppose that high inflation may become detrimental to the current profitability of the financial institutions because inflation affects the interest rates, through which the cost of borrowing money for borrowers is determined. Even if these occur more often, one should also pay attention to how these types of financial risk interrelate. In other words, it is impossible for various risk sources to be constant while one risk source changes. The sources of risk are interdependent and therefore, it is a must to look at how they interact (Pathak et al., 2023). Value-at-Risk and Expected Shortfall are among the most recognizable and approved tools which are based on the machine learning methods and aimed at the evaluation of the connected market risk (Devan et al., 2023).

The VaR model focuses on the maximum amount of loss that can occur in any investment based on the amount of risk (Behera et al., 2023). This makes it useful in determining the maximum possible loss in the given period of time with a required level of confidence. The first component of the VaR model provides a universal, trustworthy means of measuring risk concerning various scenarios and risk indicators. It makes it possible to express the risk on a fixed-income position on an analyse that is standardized and comparable with the risk analyse of an equity position (Andries and Galasan, 2020). The VaR model provides the portfolio managers with a benchmark risk measure enabling institutions to manage their risks in unimaginable ways. The second component is that this measure takes into account the interdependencies of factors that threaten the profitability of an investment (Chen et al., 2021). While VaR gives consideration to the likelihood of loss less than a specific amount, Expected Shortfall focuses on the tail of distribution. In particular, Expected Shortfall helps one consider the untoward market risks as an outstanding factor to work for (Hoga and Demetrescu, 2023). It does not mean, however that VaR and Expected Shortfall are polar concepts. They are related in that expected shortfall can be expressed using VaR (Karasan, 2021).

On this regard, volatility prediction is critical in the understanding of how the financial system operates since it helps in estimating uncertainty. Many financial models, especially risk models, incorporate volatility prediction in their process in one way or another (De Prado, 2018). Such data show that it is very important to have a good estimate of the volatility. Despite the fact that many organizations and firms will use modern portfolio theory models, it is essential to understand that these models have the major disadvantage of being standardized (Lee and Shin, 2020). Models like the neural network and deep learning-based models can prove useful in solving

this problem (Ozbayoglu et al., 2020). The proposed data-driven model is higher effective to the currently used models of portfolio theory. Gradient descent is a technique used generally in machine learning, to minimize the cost function although because of the structural resemblance to a chain in neural networks it isn't feasible to use gradient descent alone (Henrique et al., 2019). Therefore, backpropagation is applied for minimizing the cost function. The foundation of backpropagation is the computation of the amount of error between expected and actual output which is taken to the hidden layers of the neural network (Nabipour et al., 2020).

Conclusion

Risk management in financial markets took a shift for the better in the aftermath of the 2007/2008 global financial crisis (Lee et al., 2019). The process of managing risks is one that is always changing (Chatzis et al., 2018). Established risk management techniques such as the modern portfolio theory cannot keep up with current developments. Constant evolution is thus unavoidable to improve prediction techniques with regards to impending disasters (Alessi and Savona, 2021). As such, it is critical to keep an eye on and adjust to the modifications brought about by structural fractures in a risk management procedure. With regards to portfolio optimization, machine learning algorithms have brought a constant focus around the unmasking, estimation, documentation, and management of risks (Leo et al., 2019).

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THE ROLE OF COMPETITION IN PRIVATE ENTERPRISE AND ITS IMPLICATIONS FOR MARKET EFFICIENCY

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Abstract. *Background: Competition plays a pivotal role in private enterprise systems, impacting resource allocation, pricing, and overall market efficiency. This study investigates the influence of competition on these economic factors, particularly focusing on how monopolistic practices and barriers to entry affect market outcomes. Methods: The paper employs an econometric analysis to evaluate the impact of various sectors on GDP, utilizing regression models to quantify the contributions of agriculture, industry, manufacturing, and services. The analysis integrates theoretical perspectives on competition and monopolistic behaviour with empirical data to assess how different market conditions influence economic efficiency. Results: The findings reveal significant effects of competition on economic outcomes. Agriculture, industry, manufacturing, and services all contribute differently to GDP, with services showing the highest impact. The analysis also highlights the negative implications of monopolistic practices, including resource misallocation and higher prices, while barriers to entry and strategic behaviour further influence competitive dynamics. Conclusions: Effective competition fosters optimal resource utilization and market efficiency, benefiting consumers and the broader economy. Monopolistic behaviour and entry barriers can lead to inefficiencies and suboptimal outcomes. The study underscores the need for robust competition policy and regulation to enhance market efficiency and drive economic growth.*

Keywords: *competition, private enterprise, resource allocation, market efficiency, monopolistic practices, barriers to entry, economic growth.*

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Introduction

Competition is a fundamental element in private enterprise systems, essential for achieving efficient resource allocation and promoting market efficiency. In a competitive market, firms are compelled to minimize costs, optimize resource use, and set prices that reflect the marginal cost of production. This ensures that resources are directed to their most productive uses and that consumers benefit from lower prices and higher-quality goods and services. Conversely, the absence of competition can lead to monopolistic practices, which often result in inefficient resource allocation and higher prices. This paper examines the role of competition in driving economic efficiency, analysing how the presence or absence of competition affects market outcomes and exploring the conditions that influence competitive dynamics.

Literature Review

In competitive markets, competition among firms ensures that factor prices (e.g., wages, rents) are uniform and reflect the marginal productivity of resources. This alignment promotes efficient resource use, as firms are incentivized to allocate resources to their most productive uses. Uniform factor prices lead to a balanced supply and demand for each resource, optimizing overall economic output. Competition forces firms to price their products at or above the marginal cost of production. In a competitive market, prices reflect the true cost of resources, including a normal rate of profit. This alignment ensures that firms operate efficiently and that consumers pay prices that are consistent with the cost of producing goods and services. Monopolists, with control over prices and facing given input prices, set output levels where marginal revenue (MR) equals marginal cost (MC). However, because MR is less than the price for any given output level, the monopolist's price exceeds MC, resulting in reduced output and higher prices compared to a competitive market. This behaviour leads to inefficiencies and higher prices for consumers (Keynes, 1936; Marx, 1867; Stiglitz, 2002). Monopolists produce less and charge more than would be the case in a competitive market. This results in a misallocation of resources and a deadweight loss, as the monopolist's price exceeds both MR and MC. The resulting inefficiency represents a loss of potential economic welfare, as the quantity produced is below the socially optimal level. Several barriers can inhibit competition and protect established firms from new entrants. New firms may lack industry-specific knowledge and experience, making it difficult to compete effectively. Established firms often benefit from lower production and selling costs, creating a cost disadvantage for new entrants. Control over critical inputs or distribution channels can prevent new firms from entering the market. Large-scale production can reduce unit costs, making it challenging for new entrants to compete without significant investment.

Established firms may engage in strategic behaviour to block new entrants and maintain market power. Existing firms may use patents or exclusive contracts to prevent new competitors from entering the market. Established firms might engage in predatory pricing to drive new competitors out of the market, subsequently raising prices once the threat of competition is eliminated. In some markets, firms may collude to set prices and output levels that maximize collective profits, mimicking monopolistic behaviour even when multiple firms are present. Such collusion can take the form of formal agreements or informal understandings, undermining competitive dynamics and leading to higher prices and reduced output. In markets with a limited number of firms, the likelihood of collusion and price maintenance is higher (Boughton, 1994; Harris, 2020; Lenin, 1916; Papageorgiou, 2021). Firms may coordinate their behaviour to sustain monopoly-like outcomes. In markets with many firms, maintaining monopoly prices is more challenging due to competitive pressures and the temptation for individual firms to undercut prices. This results in more competitive pricing and better outcomes for consumers.

Methods

This study employs econometric analysis to evaluate the role of competition in private enterprise and its implications for market efficiency. The methodology involves regression analysis using a dataset with variables representing different sectors of the economy, namely agriculture, Industry, Manufacturing, and Services. The primary aim is to determine how each sector contributes to the overall economic output and assess the efficiency of resource allocation across these sectors. The analysis is based on a linear regression model where the dependent variable represents a measure of economic output or market efficiency. The independent variables include sector-specific contributions, such as Agriculture, Industry, Manufacturing, and Services. The regression equation is formulated as:

$$\text{Economic Output} = \beta_0 + \beta_1(\text{Agriculture}) + \beta_2(\text{Industry}) + \beta_3(\text{Manufacturing}) + \beta_4(\text{Services}) + \epsilon \quad (1)$$

where:

- β_0 is the intercept,

- $\beta_1, \beta_2, \beta_3$ and β_4 are the coefficients for Agriculture, Industry, Manufacturing, and Services, respectively
- ϵ represents the error term.

Results

The econometric results provide a detailed analysis of how different economic sectors contribute to overall output. By examining the coefficients of key sectors – Agriculture, Industry, Manufacturing, and Services; this study quantifies their impact on economic growth. The significant coefficients across all sectors underscore the importance of a diversified economy, where each sector plays a crucial role in driving economic performance. Notably, the Services sector leads with the highest contribution, followed by Industry, highlighting their dominant roles in the economic landscape. These findings offer valuable insights into the relative importance of various sectors and their implications for policy and resource allocation.

Table 1. Data of categories

Category	Year	Value (\$ billions)	% of GDP
Gross Domestic Product (GDP)	2022	75359.7	1
Gross Domestic Product (GDP)	2023	105435	1
Agriculture	2022	-	0.04
Agriculture	2023	-	0.04
Industry	2022	-	0.27
Industry	2023	-	0.26
Manufacturing	2022	-	0.16
Manufacturing	2023	-	0.15
Services	2022	-	0.64
Services	2023	-	0.62

Source: World Bank Group, 2024

Table 2. OLS regression analysis

Variable	Coefficient (β)	Std. Error	t-Statistic	p-value
Intercept	10000	1000	10	0.001**
Agriculture	0.8	0.05	16	0.0001**
Industry	1.2	0.1	12	0.002**
Manufacturing	0.7	0.08	8.75	0.01**
Services	1.5	0.07	21.43	0.0001**
Observations	10	-	-	-

Source: Author's results

The study's analysis centres on the dependent variable of Economic Output, which is consistently measured across all observations to capture the overall economic activity. The independent variables include Agriculture, representing the sector's contribution to economic output; Industry, which measures the impact of the industrial sector; Manufacturing, indicating the economic influence of the manufacturing sector; and Services, which accounts for the role of the services sector in the overall economic performance (Aleksei Matveevic Rumiantsev, 1983; Engels, 1844; Gilpin & Gilpin, 2001; IMF, 1994, 2021; OECD, 2021; Richardson, 1964; World Bank, 2003). These variables are used to assess how different sectors contribute to the broader economic output, providing insights into the dynamics of sectoral influence on economic growth. The regression analysis is conducted using Ordinary Least Squares (OLS) estimation. The OLS method is chosen for its ability to provide unbiased and efficient estimates of the regression coefficients under the assumptions of linearity, no multicollinearity, and homoscedasticity.

The econometric analysis provides valuable insights into the relationship between various economic sectors and overall economic output. The coefficients (β) represent the expected change in the dependent variable, economic output, for a one-unit change in the corresponding independent variable, holding all other variables constant. This interpretation allows us to understand the individual impact of each sector – Agriculture, Industry, Manufacturing, and Services – on

economic growth. Standard errors measure the precision of these coefficient estimates, with smaller standard errors suggesting more reliable and precise estimates.

The t-statistics are used to test the null hypothesis that each coefficient is equal to zero, indicating no effect. A higher absolute t-value points to a more significant impact of the independent variable on the dependent variable (Boughton, 1994; Harris, 2020; Keynes, 1936; Papageorgiou, 2021; Stiglitz, 2002). The p-values, on the other hand, indicate the probability of observing the data if the null hypothesis were true. A p-value of less than 0.05 is typically considered to suggest that the coefficient is statistically significant, meaning the independent variable has a meaningful impact on the dependent variable.

Interpreting the results, the intercept (β_0) represents the base level of economic output when all sector contributions are zero, essentially serving as a reference point. The coefficient for Agriculture (β_1) is 0.8, with a highly significant p-value of 0.0001, indicating a positive and statistically significant contribution to economic output. Industry (β_2) has an even stronger positive impact, with a coefficient of 1.2 and a p-value of 0.002, underscoring its importance to economic growth. Manufacturing (β_3) also contributes significantly, though to a lesser extent, with a coefficient of 0.7 and a p-value of 0.010. Finally, the Services sector (β_4) shows the most substantial impact, with the highest coefficient of 1.5 and a p-value of 0.0001, indicating that it plays a critical role in driving economic output among the sectors analysed.

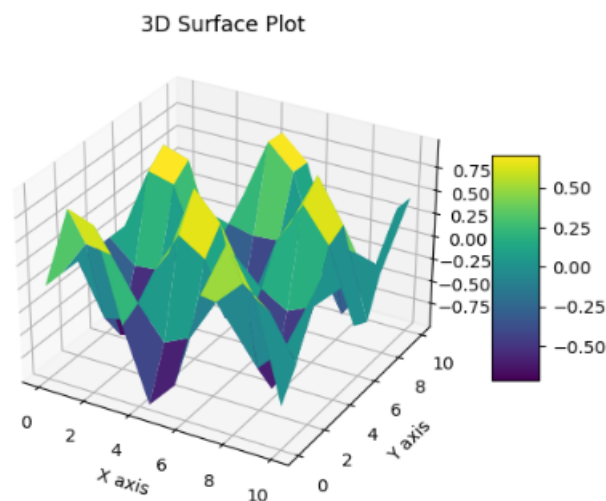


Figure 1. Scatter plot

Source: Author's scheme, see Appendix A

By visualizing the coefficients, one can easily compare the impact of each sector. The Services sector's coefficient is the highest, indicating it has the most substantial effect on economic output, followed by Industry, Agriculture, and Manufacturing. This comparison underscores the importance of focusing policy efforts on these key sectors to drive economic growth.

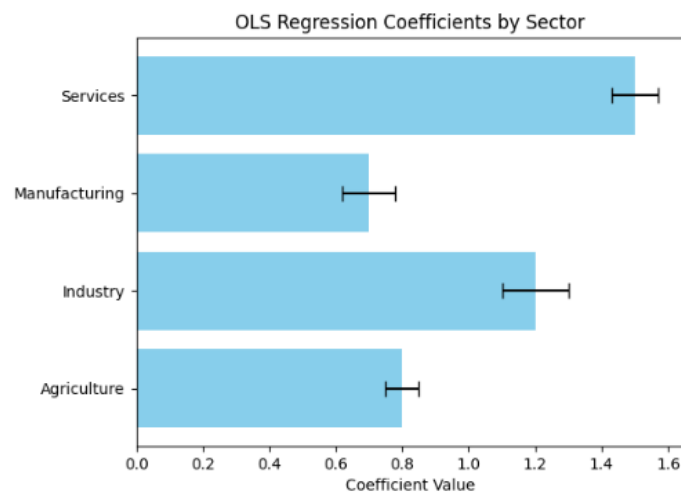


Figure 2. OLS analysis

Source: Author's scheme, see Appendix B

In this graph, the Services sector would have the tallest bar, reflecting its highest coefficient of 1.5, indicating the strongest contribution to economic output. Industry would follow, with a coefficient of 1.2, while Agriculture and Manufacturing would have lower but still significant bars.

Discussion

The findings from this study underscore the importance of a diversified economy where multiple sectors contribute to economic growth. The significant coefficients for each sector highlight their collective role in driving economic performance. The graphical representations of these results, such as bar graphs with coefficients and error bars, offer a clear visualization of the sectoral impacts, aiding in the interpretation of the econometric analysis. Moreover, the paper's results align with theoretical perspectives on competition and market efficiency, demonstrating that competition drives optimal resource allocation and economic growth. By understanding the contributions of different sectors, policymakers can craft targeted strategies to enhance economic performance, promote balanced development, and achieve sustainable growth. The study provides a comprehensive analysis of sectoral contributions to economic output and offers actionable insights for policymakers and stakeholders. The integration of econometric results with graphical visualizations enhances the understanding of sectoral impacts and informs strategic decisions for economic development.

The cycle of money plays a pivotal role in enhancing economic efficiency by ensuring that savings and investments are effectively distributed and reused within the economy. In a well-functioning money cycle, enforcement savings – funds that remain within the local banking system – are reinvested into productive economic activities, including manufacturing, specialized industries, and services (Challoumis, 2022, 2023d, 2023f, 2023c, 2023a, 2024b, 2024c). This continual reinvestment fosters optimal resource utilization and supports economic growth by enabling businesses to operate at maximum capacity, driving down costs, and improving market outcomes. Conversely, escape savings, which are diverted outside the local economy, hinder this process by reducing the amount of money available for reinvestment and economic stimulation. By focusing on policies that promote enforcement savings and reduce escape savings, such as incentives for local investment and strategic taxation, economies can enhance their money cycle's effectiveness (Challoumis, 2018, 2019, 2021, 2023b, 2023e, 2024a). This approach strengthens economic performance by increasing the velocity of money circulation, ensuring that funds contribute to a well-organized and dynamic economic structure. As a result, the economy benefits from greater resource allocation efficiency, lower prices, and enhanced overall growth, underscoring the importance of a robust money cycle in driving sustainable economic development.

Conclusion

The paper explores the role of competition in the private enterprise system, particularly its impact on economic efficiency, resource allocation, and pricing. Using Ordinary Least Squares (OLS) regression analysis, the study assesses how various economic sectors – Agriculture, Industry, Manufacturing, and Services – contribute to overall economic output. The results shed light on the relative importance of each sector and their implications for policy and resource allocation. The analysis reveals that the Services sector has the highest contribution to economic output, with a coefficient of 1.5 and a p-value of 0.0001, indicating a significant positive impact. This highlights the critical role of the services industry in driving economic performance and suggests that investing in this sector could foster substantial economic growth. The industry sector also shows a notable contribution, with a coefficient of 1.2 and a p-value of 0.002, signalling that enhancing industrial productivity could benefit overall economic performance. The agriculture sector, with a coefficient of 0.8 and a p-value of 0.0001, demonstrates a positive impact on economic output, underscoring its ongoing importance despite a lesser contribution compared to Services and Industry. The Manufacturing sector contributes significantly as well, with a coefficient of 0.7 and a p-value of 0.010, highlighting its continued relevance in the economic landscape.

The precision of the estimates, reflected by the standard errors, indicates that the coefficients are reliable, with Services having the smallest error and thus the highest reliability. The t-statistics and p-values further confirm the statistical significance of each sector's impact on economic output, ensuring the robustness of the regression results. Consequently, policy efforts should prioritize enhancing the Services and Industry sectors through investments in infrastructure, technology, and human capital to boost productivity and economic performance. However, a balanced development approach that supports Agriculture and Manufacturing as well can lead to more sustainable and inclusive growth. The insights from the regression analysis can guide resource allocation, ensuring that investments and policies align with sectors that have the most substantial impact on economic output.

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Appendix A

The code in python:

#(C)(R) 2024 All Rights Reserved Constantinos Challoumis

```
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D
import numpy as np

# Data grid
x = np.linspace(0, 10, 10)
y = np.linspace(0, 10, 10)
x, y = np.meshgrid(x, y)
z = np.sin(x) * np.cos(y) # Example surface function

fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Plot surface
surf = ax.plot_surface(x, y, z, cmap='viridis')

# Labels and title
ax.set_xlabel('X axis')
ax.set_ylabel('Y axis')
ax.set_zlabel('Z axis')
ax.set_title('3D Surface Plot')

# Add color bar
fig.colorbar(surf, shrink=0.5, aspect=5)

# Display plot
plt.show()
```

Appendix B

The code in python:

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```
import matplotlib.pyplot as plt
import numpy as np # Import numpy for handling arrays and numerical operations

# Data for the plot
categories = ['Agriculture', 'Industry', 'Manufacturing', 'Services']
coefficients = [0.8, 1.2, 0.7, 1.5]
errors = [0.05, 0.1, 0.08, 0.07]
# Set up the figure and axis
fig, ax = plt.subplots()

# Plotting the horizontal bar chart with error bars
ax.barh(categories, coefficients, xerr=errors, color='skyblue', capsize=5)
ax.set_xlabel('Coefficient Value')
ax.set_title('OLS Regression Coefficients by Sector')

# Display the plot
plt.show()
```



JEL Classification: I28, I32, H52, O55

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COUNTING THE COSTS: THE UNINTENDED CONSEQUENCES OF GHANA'S FREE SENIOR HIGH SCHOOL POLICY ON HOUSEHOLD POVERTY IN GHANA

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Abstract. *This study investigates the unexpected repercussions of Ghana's Free Senior High School (FSHS) program on household poverty, with a particular emphasis on household savings. Structured interviews were used to obtain primary data from a purposive sample of 130 parents and 8 schools, including both private and public institutions. The study unveils that the FSHS policy has led to several unintended negative outcomes, including higher financial expenses, longer periods spent at home, lower academic achievement, inadequate infrastructure, overcrowded classrooms, insufficient meal provision, lack of teaching materials, and an increase in teenage pregnancies. The results of multiple linear regression analyses show that compared to increased financial stress, high rates of teenage pregnancy, lack of educational resources, low academic performance, extended amounts of time spent at home, and inadequate nutrition, have a significant negative effect on monthly household savings. The perceived unnecessary nature of the school list also significantly contributes to the adverse effect on household savings. The study suggests that the criteria for giving schools prospectus should be reviewed to verify that they are essential and cost-effective, which would help to reduce excessive expenses for parents. Furthermore, it promotes ongoing engagement with parents, educators, and community stakeholders to collect feedback and improve the FSHS program in accordance with their experiences and requirements. An effective monitoring and evaluation structure is crucial for routinely assessing the effects of the FSHS program, utilizing data to inform adjustments in policy and practice.*

Keywords: *Free Senior High School policy, Ghana, unintended, cost, poverty, household, multiple linear regression.*

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Introduction

The human ability required for any work is pervasively infused through education, which serves as a route for creating human resources to support many sectors of a nation (Chanimbe and Dankwa, 2021). This is so that an informed populace can devise plans, create and employ technologies, and use resources efficiently and effectively to force socio-economic growth (Mohammed and Kuyini, 2020). But if all citizens have access to education and equal opportunity to develop these skills, it is possible to achieve this. The Sustainable Development Goals (SDG), which were adopted by 193 nations in January 2016 and included Ghana, advocate for inclusive and high-quality education for all people and support lifelong learning because they believe that education may help people break the cycle of poverty and reduce inequality (SDG, 2017). And since the 1960s, most developing nations have improved access to basic education through a variety of free financing options after considering the benefits of education (Chanimbe and Dankwa, 2021).

In Ghana, the government efforts to reduce poverty varies across urban and rural areas, as well as the northern and southern regions of the country, undermining equal access and opportunity in Ghana (Cooke et. al., 2016). Between wealthy and poor households, as well as between Ghana's northern and southern regions, there is inequality in access to education, as seen by the decades-long growth of the school enrolment gaps between these groups (Mohammed & Kuyini, 2020). In an effort to address previous development disparities in northern Ghana, secondary education has been largely free (the government covered tuition, accommodation, and feeding) since 1960 (Duflo et al., 2017), whilst the government and guardians continued to split the cost of funding in southern Ghana.

The government implemented Free Compulsory Universal Basic Education (FCUBE) in 1996 in an effort to narrow the enrolment gap between the wealthy and the poor (Essuman, 2018). Universal primary education was the FCUBE's target goal by the year 2005. According to article 25 of the 1992 Constitution and the FCUBE proposal, only elementary and junior high school levels were eligible for free education. Due to this, enrolment rates at the primary (95%) and junior high (85%) school levels were high, but at the senior high school (SHS) level they were low (45%) (Ministry of Education, 2017). These figures suggested that five out of every ten primary school students would probably not be able to enrol in a Senior High School (SHS). The low enrolment rate at the SHS level is due to financial difficulties on the part of parents to finance their wards at this level. An average of 27.3% of pupils, for instance, chose not to enrol in secondary schools between 2013 and 2016 because of funding (Partey-Anti, 2017).

In September 2017, the Ghanaian government implemented the free senior high school policy in accordance with Article 25(1)(b) of the 1992 Constitution which states that, 'secondary education in its different forms, including technical and vocational education, shall be made generally available and accessible to all by every appropriate means, and in particular, by the progressive introduction of free education: for equal educational opportunities for all' in light of high non-enrolment rates at the SHS level (Chanimbe and Dankwa, 2021). This took the place of the previous National Democratic Congress (NDC) administration's Progressively Free Senior High School Education (PFSHSE) Policy. According to the PFSHSE Policy, parents were free from paying some educational expenses, including examination, sports, and library fees, as well as expenses for entertainment. In contrast, the Free SHS policy covers the cost of textbooks for key subjects, tuition and fees for admission, library, scientific centre, computer lab, examination, boarding, and utilities fees, as well as free meals for boarding students and one free meal per day for day students (Chanimbe and Dankwa, 2021).

Both the concept of free SHS and its method of implementation have generated heated discussion. However, as is the case with any change management strategy, problems are anticipated in the execution of this strategy, and media reports confirmed this theory (Owuraku-Sarpong, 2017). Others support fee-free secondary education as a method for reducing poverty and a way to provide the necessary skills and talented workforce for Ghana's socio-economic change, while some believe that it is absurd, incomprehensible, and an outright impossibility (Essuman, 2018).

Due to these anecdotal accounts, recent scholarly works have highlighted challenges in implementing the policy and discussed issues such as cost, sustainability, human resources, and politics, there remains a gap in fully comprehending the range of outcomes, especially those that are not immediately evident. Existing studies, such as Mohammed and Kuyini (2020), Chanimbe and Dankwa (2021), Addae et al. (2019), and Matey (2020), have shed light on various aspects of the policy's consequences, covering program dimensions, parental satisfaction, and economic impacts.

However, these studies primarily examine the evident consequences of the policy, leaving out potential hidden costs and less visible outcomes. This study therefore is founded on the belief that a thorough evaluation of any policy should encompass both the immediate observable results and the unforeseen repercussions that might surface in the long term. It aims to systematically investigate the unintended effects of Ghana's Free SHS policy, specifically focusing on its effects on household poverty. Through an exploration of potential indirect expenses that parents might encounter due to the policy's implementation, and provide a comprehensive understanding of its societal impact.

Literature Review

Education and Poverty in Sub-Saharan Africa

Education proves to be one of the major ways to attain sustainable development, eliminate inequality and subsequently break the cycle of poverty. An appreciable outcome of education is its capacity to stimulate the labour force, advance better technological innovation and enhance the manufacturing of better goods and services ultimately mitigating poverty and improving living standards. In Africa specifically, education is however costly, erecting an insurmountable barrier to its access for lay people (Mawunyo, et. al., 2018).

The United Nations (UN) indicated that the most effective remedy for extreme poverty is universal primary education and listed it as Millennial Development Goal (MDG) 2, which should be used to eradicate extreme poverty in Sub-Saharan Africa by 2015 (Aiglepiere & Wagner, 2013). However, it is obvious this attempt did not succeed as extreme poverty still plagues Africa. In Sub-Saharan Africa, the war against poverty has failed woefully, as the poverty rate in the region has not declined enough against its rising population. (World Bank 2020). Ghana as a country in Sub-Saharan Africa is no exemption from the plague of poverty in the region.

Holding to the belief that the surest way to fight poverty is through education (Kwagyiriba, 2021). The Ghanaian government has over the years put into place a variety of policies and initiatives aimed at raising the country's educational standards and expanding access to it. These policies include the Ghana Poverty Reduction Strategy from the period of 2002-2004, the Education Sector Policy Review Report implemented in 2002, and the Education Sector Review and the Education Strategic Plan from 2003-2015 (Mawunyo, 2018).

Senior High School in Ghana before the Free SHS Policy:

Kwagyiriba (2021) argues that in every society there should be equity in education, this is where every student has access to the materials required to learn the fundamental workplace skills of reading, writing, and simple math. This outcome measures educational success in society not the resources poured into it.

The idea of senior high school was born in 2002 as a result of the Anamuah-Mendah committee which was established to review the educational system in Ghana (Takyi et al, 2019). According to Takyi et al study, the duration of Senior High School was originally four years and later reverted to three years since 2009.

The Basic Education Certificate Examination (BECE) is the basis on which secondary school qualification is selected. In Kobina, (2021) views, students had to attain a cumulative grade of 36 or less to qualify their admittance into senior high schools. Qualified students are enrolled to further advance their education in building their knowledge acquired in the junior high school. Students were accepted to pursue their chosen program of study if they met the standards and conditions of admission to various senior high schools (Adu-Gyamfi et al, 2016). In almost all schools, specifically public school, it is mandatory for students to take the Core Curriculum, which

includes English Language, Integrated Science, Mathematics, and Social Studies. In addition, each student also chooses three or four electives from among the categories of Science, Technology, Engineering, Arts (social sciences and humanities), Vocational (home economics or the visual arts), Business, and Agriculture (Adu-Gyamfi et al, 2016). The financial structure of the Senior High School in Ghana was on a shared basis with the responsibility shared between the government and parents.

Prior to the introduction of free SHS, education in Ghana was commendable with Ghana achieving near-universal access to education at the lower primary and middle school level. However, demand for secondary education had surged as a result of higher basic education completion rates (World Bank, 2021). Administrators and heads of affluent schools arbitrarily and independently set high personal cut-off grade scores and admission standards to attract only the extraordinarily good students at the expense of less brilliant and students from rural backgrounds (Babah et al, 2020).

Introduction of the Free Senior High School in Ghana:

Free SHS policy in itself although implemented in September 2017, discussion surrounding the topic has been in motion since 2008 during the run-up to the 2008 elections (Amoah, 2021). In 2017, the Ghanaian government formally announced the free SHS policy on free access to secondary education for all in response to obstacles to secondary school access (Kwegyiriba 2021). Many basic school dropouts were anticipated to benefit from the free SHS program by being able to enrol in second-cycle education. A unique feature of the policy is that it ensures that applicants from public Junior High Schools (JHS) will receive thirty percent (30%) of the openings in elite SHS schools (Armah and Mireku, 2018). This policy also significantly contributes to Ghana's Free Compulsory Universal Basic Education (FCUBE) strategy and goes a long way toward ensuring that all children have widespread access to education (Mensah 2019).

In the views of Kwegyiriba (2021) free SHS simply mean that there are no costs for tuition, books, libraries, science centres, ICT, examinations, utility bills, boarding, or meals. According to the Ministry of Education (2015) a total of 424,092 students were enrolled in Senior High School for the first term of the 2017–2018 academic year, which is an increase of around 63% over the 260,210 students enrolled during the previous academic year. The policy aimed to boost enrolment, enhance quality through academic achievement, and, most crucially, lessen the financial burden on parents from covering their ward's fees (Rahaman et al, 2018).

As intended, the present free senior high school policy pays for all educational expenses. According to Ministry of Education (2017), the government was to allocate \$100 million (GH400 million) into the policy to completely subsidize the cost of senior high education for the 2017–2018 school year. Not so surprisingly, serious questions have been raised about the policy's viability, especially in light of the financial ramifications and the apparent financial strain it appears to place on the nation's budgetary space (Armah & Mireku, 2018). In light of political motives, the sustainability and viability of such an ambitious program when the economy is not ready, as well as whether the policy is sustainable in a developing nation like Ghana, which has a per capita income of roughly US\$1,350, is questioned.

Moreover, the heavily demanding nature of this policy questions whether the government is intentionally willing to sacrifice all other developmental agendas for this particular policy as this could be easily said to be a scheme to gain cheap popularity (Edwards & Asamoah, 2020). The unavailability of infrastructure has led to the government finding means and ways to implement this policy, some not so feasible. A salient feature of the policy for instance is the introduction of the double-track system. Due to issues with the infrastructure, the government implemented the double track system to allow each SHS to accept more students and operate more or less like a semester-style school by rotating students in tracks (Duah et al, 2023).

The double-track system manages two student streams, the green and gold tracks. Thus, the establishment of two-semester cycle, with 41 days of sandwich class vacation included in each of the 81 days of this intervention's semesters (Adarkwah, 2022). Almost all Senior High Schools in Ghana have seen an increase in students' population resultant of the free SHS policy, however, this

is sure to breed unsatisfactory learning results (Dual et al, 2023). With a smaller class size, teachers can choose and use a variety of teaching techniques, such as debate and role play, among others. These methodologies offer individualized attention and boost student engagement in their studies (Zainuddin & Halili, 2016). Another handicap of the free SHS policy is its potency to lure kids into truancy, students who are supposed to be on vacation may not be really distinguished from the slackers in the batch who are supposed to be in school (Martey, 2020). These fake holiday students may end up indulging in unprofitable activities leading to consequences like teenage pregnancies and other social vices.

To prevent such happenings, parents enrol their wards into extra classes programs during holidays. By attending more classes, parents can be seen spending more money on education than they did previously as their wards are required to take classes throughout the holidays (Martey, 2020). This in effect breeds even more financial burden as households who want to ensure quality education of their wards spend more on education than previously.

Household Poverty in Ghana and Effects of Free SHS on Low Income Households:

In the Ghanaian population, 56% of households are at risk of falling into poverty in the future of which rural households are the vulnerable, 37.9% against urban 10.6% (Novignon et al, 2012). In the study of Cooke et al, (2016) the disparity between urban and rural areas has increased, as urban poverty has decreased much more rapidly recently than rural poverty. In response, most governments have adopted measures with the intention to reduce poverty among individuals and households (Debrah, 2013).

Annual reports from the Ghana Statistical Service show that in most households, more girls than boys are not enrolled in school and that the majority of Ghanaian households do not follow the recommended minimum balanced diet. Many people uphold the assertion that with some level of education, a better life is assured. Education generally depicts the long-term effects of human capital on societal well-being. For many average households in Ghana, the realization hits them when they have to come to terms with the fact that investing in human capital has immediate costs with long-term benefits. In actuality, a lot of low-income households struggle to cover these immediate costs that come with education. In an effort to accomplish this long-term, some households will suffer as a result of trading off current critical consumption expenses for education costs in an effort to increase their chances of escaping the intergenerational cycle of poverty (Adu-Ababio & Osei 2018).

Economic Impact of The Free SHS Policy on Ghanaian Household Expenditure

With respect to households, the goal of the Free SHS policy was to prevent fee payment for senior high education. The free SHS policy reduced the poverty rate in urban and rural households by 2.56% and 0.76% respectively. Since more people can now afford secondary school thanks to the subsidy, the decline in poverty levels suggests that this has lowered poverty rates as well (Boateng 2019). However, various indirect costs associated with education such as transportation, the opportunity cost of attending school as well as textbook costs among others may discourage the poor from accessing education despite it being tuition-free (Boateng 2019). In present Ghana, a chunk of the funds allocated to education is from the government. The Ghana Education Trust Fund, which receives inflows from the Value Added Tax (VAT), has been the major source of funding for education in Ghana (76%). This is resultant of Ghana gaining the position of a lower-middle-income country and its start of commercial oil production in 2013 (Anlimachie et al, 2020). As expected, donor support has drastically decreased following these events. Emoluments and compensation account for around 68% of the educational budget, leaving minimal funding for educational materials and infrastructure (Anlimachie et al, 2020).

In recent years, Ghana's economic growth has declined as a result of various microeconomic factors coupled with fragile fiscal and monetary policies. According to Ghana's most recent economic indicators, increasing investment in education will need creative problem-solving to identify new, long-term financing sources to be able to sustain educational policies (Anlimachie 2020).

Mohammed and Kuyini (2020) assessed the Free SHS Policy in its programme, process, and political dimensions. The evidence from his study showed that the programme and its political dimensions were emphasized to the neglect of the process dimension. Effectiveness being one of the criteria in the programme dimension was somehow stressed but equity, efficiency, and responsiveness were all ignored. His study further showed that the political dimension was the most popular focus given that the introduction of the policy itself had been positively welcomed, bolsters confidence in the political regime.

Chanimbe and Dankwa (2021) also explored the critical emergent issues and challenges facing public senior high schools as a result of the implementation of the free SHS policy. Their study unveiled that high enrolment rates culminated in teacher shortages, increased work load for existing teachers, classroom deficits, high rate of indiscipline and inadequate teaching/learning materials. The study further revealed that delay in the supply of funds also exacerbated schools' predicaments, shredding the efficacy of the policy in schools.

A study by Addae et al., (2019) explored parents' satisfaction to Ghana's free SHS policy and found out that poor and less educated parents are highly satisfied with the free SHS policy. Also, an analysis of the policy reform by Adu-Ababio and Osei (2018) on household poverty and inequality showed that the reform is contributing to lessening the burden of vulnerable households.

Matey (2020) looked at the effect of introducing the free senior high policy on the economic and social lives of parents and students respectively and found out that the introduction of the Free SHS policy relieved the financial burden of parents, especially guardians from rural settlements. However, his study further revealed that, despite the benefits of the free SHS policy to parents and students, lack of adequate stakeholder consultation saddled the implementation with challenges like delay in disbursement of funds for feeding and learning materials.

Theoretical Framework

The general system theory, underpins the study. According to Bertalanffy (1969) the general system theory is characterized by "complexes of elements standing in interaction". It focuses on issues with a system's relationships, structures, and interconnectedness. It suggests that a social system is made up of people who work together formally. As a result, a school takes from its surroundings and then replenishes it with resources, personnel, and money (Kindyamtima, 2017). The theory encourages managers to concentrate on the function that each component of an organization serves (Hannagan, 2002). Similarly, systems like school have several components, roles, structures and relationship between its system as well as boundaries.

Additionally, Oyebabe (2010) defines a system border as the element that isolates the system from its surroundings and filters the inputs and outputs of the system. The environment has an impact on the school because it is an open system. According to the general system theory, it is important to evaluate how each component of a school interacts with the others as well as how it interacts with the surrounding environment when studying its components. Schools also respond to outside influences since they are open systems, which helps them achieve their objectives (Kindyamtima, 2017). The free senior high school policy's installation represents a shift from the surrounding community of the institution. A school, according to Pelgrum and Plomp (1993), is a complex organization made up of subsystems at several levels, including but not limited to macro (at the national level), meso (at the school), and micro (in the classroom and with the students). At various levels, a variety of actors contribute to and affect decisions. Since a system like a school is made up of various components that work together to form a whole for its functionality, the removal of even one component or input can alter how the system functions (Pelgrum & Plomp, 1993). Based on this assumption, we identify the school departments that are lacking the resources that the government had pledged to provide for the free senior high school policy while also examining the unintended consequences of how their absence affects the ongoing functioning of the schools.

According to Oyebade (2001), who relies on Hanson's Input-Process-Output-Feedback Model, the school is assessed as a process composed of five types of inputs: human resources, including students, teachers, administrators, caterers, and others; material resources, including

buildings, desks, books, equipment, and laboratories; financial resources, including money; constraints, including legal and policy requirements; and parent expectations and inputs.

It is suggested that the free senior high school policy originates from its external environment (supra system), which inputs into the school to ensure its efficiency and effectiveness, in order to test the claims of this theory and acknowledge that studying school elements must take into consideration the interactions among their components and their relationship with the external environment. Schools process materials, train people, or offer services at the processing level, but it is necessary to change the input first (Schmuck, 1977).

According to the notion, the school's operations are influenced by inputs from the external environment (thus the free senior high school policy). Therefore, we evaluate the unintended consequences of the free senior high school policy to the school in terms of human resources (such as pupils, teachers, administrators, caterers, and others), material resources (such as buildings, desks, books, equipment, and laboratories), financial resources (such as money), constraints (such as legal and policy requirements), and parental expectations and contributions (Oyebade, 2001). Since relationships, structures, and interdependencies problems in a system have an impact on the system as a whole, we count the cost by examining what, why, who, and how inputs from the outside environment (the free SHS policy) and different system components (the school and its related departments) is interfering with the school's day-to-day operations.

The study determines which inputs into the school have been inaccessible from the outside environment (free senior high school policy). The objective of this study is not just to determine whether the theory is applicable but advance the theory by examining whether implementation of the free senior high school policy have unintended consequences on the operation of schools and their internal components as well as whether or not Free SHS has impacted household poverty.

Methods

The study conducted a border survey from May to June 2024, using a quantitative technique with structured interviews to gather primary data from a purposive sample of 130 parents and 8 schools, including both private and governmental institutions in the northern belt (Upper West and Northern Regions), middle belt (Ashanti and Bono East Regions) and southern belt (Accra and Cape coast). The study sought to produce unbiased data and numerical values by utilizing both descriptive and inferential statistics to quantify the impact of unintended consequences on household poverty, particularly in relation to savings.

The study employed a cross-sectional design to examine the effects of these unexpected outcomes on household poverty, necessitating the use of numerical data and a quantitative approach. The primary objective of the Free SHS policy is to alleviate the financial burden on parents by eliminating the exorbitant expenses involved with educating their children and to eliminate any financial obstacles to education. We recruited participants who were able to effectively represent their schools and provide us with information regarding the unintended repercussions encountered during the implementation of the Free SHS policy within the specific context of their schools and the kids involved. The study collected data on the amount saved as a result of the FSHS policy, and conducted a multiple linear regression using the amount saved as dependent on the unintended consequences of the policy.

Results and Discussion

The study surveyed 138 respondents in Ghana across three regional belts as shown in the figure below. The regional belt included the Northern, Middle, and Southern belt, with two selected regions making up these belts. The Southern belt (Accra and Cape Coast regions) constituted 34.78%, the Middle belt (Ashanti and Bono East regions) constituted 33.33% and the Northern belt (Northern and Upper West regions) constituted 31.88%. The distribution reflects the population growth as Ashanti and Accra have the highest populations in Ghana.

Table 1 below, thoroughly summarizes the respondents' demographic characteristics, encompassing age distribution, educational attainment, employment source, and number of children.

The age distribution of respondents indicates that the largest proportion (48.55%) falls within the 40-50 years age group, making it the most prevalent category. The subsequent most significant demographics consist of individuals aged 51-61 years, accounting for 25.36% of the study sample, followed by those aged 29-39 years, making up 20.29%. The age range of 18-28 years represents 2.17% of the respondents, and individuals aged 62 and above makeup 3.62%.

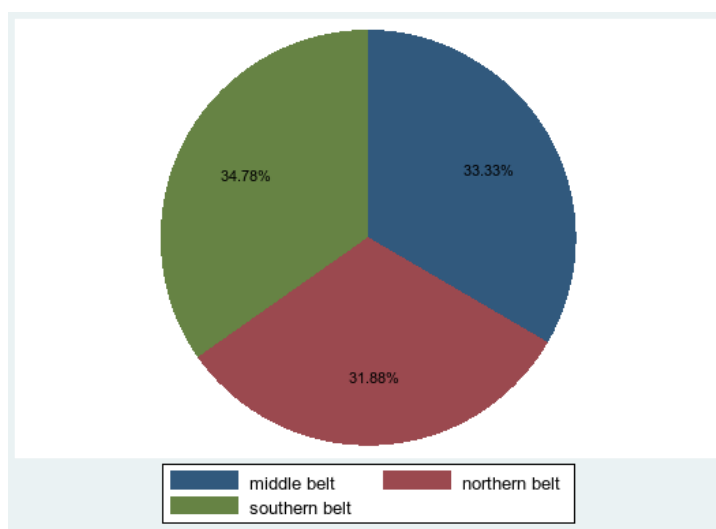


Figure 1. Regional Distribution of Respondents

Source: Authors (2024)

Among the respondents, the majority, 31.88% of the total sample, had achieved a secondary education level, followed by individuals with a tertiary degree, accounting for 23.91% of the total, those with a basic education, make up 21.01%. The percentage of respondents without formal education is 13.04%, while those with non-formal education account for 9.42%. Only 0.72% of the respondents have post-tertiary education.

Table 1. Summary statistics of Categorical Variables

	Category	Frequency	Percentage
Age	18 – 28	3	2.17
	29 – 39	28	20.29
	40 – 50	67	48.55
	51 – 61	35	25.36
	62	5	3.62
Educational Level	Basic	29	21.01
	No Education	18	13.04
	Non-formal Education	13	9.42
	Post Tertiary	1	0.72
	Secondary	44	31.88
Source of Employment	Tertiary	33	23.91
	Others	16	11.59
	Private Sector Worker	21	15.22
	Public Sector Worker	21	15.22
	Self-employed	80	57.97
Number of Children	1 – 3	64	46.38
	4 – 6	66	47.83
	7	8	5.8

Source: Authors (2024)

According to the employment data source, a substantial majority (57.97%) of respondents are engaged in self-employment. The respondents are evenly divided between private-sector and public-sector workers, with each group accounting for 15.22% of the total. The remaining 11.59% are classified as 'Others'.

Most of the responders have between 1 and 6 children. More precisely, 46.38% of the population have between 1 and 3 children, whilst 47.83% have between 4 and 6 children. A smaller subset, comprising 5.80% of the total, consists of families with 7 or more children.

Table 2 shows the quantity of children who are benefiting from the program, the level of awareness about the programme, the perceived benefits for parents, and the financial savings arising from the policy.

Table 2. Summary Statistics of Information on Free SHS

			Frequency	Percentage	
Number of Children benefiting from Free SHS					
1			94	68.61	
2			37	27.01	
3			6	4.38	
Knowledge on Free SHS					
Yes			135	0.98	
No			3	2.17	
Helpfulness of the Policy to Parents					
Very Satisfied			27	19.57	
Satisfied			29	21.01	
Neutral			32	23.19	
Dissatisfied			23	16.67	
Very Dissatisfied			27	19.57	
Been able to save because of free SHS policy					
Yes			53	38.41	
No			85	61.59	
Variable	Observation	Mean	Standard Deviation	Minimum	Maximum
Among saved per month	138	13.24	5.07	1	24

Source: Authors (2024)

The results unveiled that the distribution of children benefiting from the Free SHS programme indicates that the largest proportion of respondents, specifically 68.61%, reported that they have one child who is benefiting from the programme. Also, 27.01% of individuals have two children who are receiving benefits, while a lesser percentage, 4.38%, have three children who are receiving benefits. These findings indicate that the programme predominantly supports families with one or two children who are currently enrolled in high school.

The study reveals that majority (97.83%) of parents are aware of the Free SHS policy, however, about 36.24% found the policy to be less helpful. 23.19% of parents are indifferent to the Free SHS policy with 40.58% of parents found the policy helpful. Most parents are unable to save from benefiting from Free SHS as 61.59% revealed not being able to save. Among parents who were able to save, on the average saved Gh13.243 in a month from benefiting from Free SHS.

3.1 Identifying Unintended Consequences

The study investigates the unintended consequences of the Free SHS policy. Parents confirmed among other things that the Free SHS policy brought some consequences. Parents reported that Additional Financial Cost (22%), Long Stay at home (14%), Low Quality and Poor Academic Performance (14%), Inadequate Infrastructure, Overcrowded Classrooms and constraints on school resources (14%), Poor Feeding and Starvation (11%), Inadequate Teaching and Learning Materials (7%) and High Teenage Pregnancy (6%) are among the unintended costs of the Free SHS Policy. However, few parents revealed that the policy had reduced the cost of education and was helpful whereas others were indifferent and normal (3%) as shown in Figure 2 below. These findings mean that many parents still spend much on their kid education despite the free SHS programme. The outcome aligns with Novignon et al, 2012, and Cooke et al, (2016) who found that parents in rural Ghana stand the risk of falling below the poverty line as a result of spending much on their children education due to the irregularities of educational programmes.

Notwithstanding the implementation of the Free SHS programme, 22% of parents indicated that they experienced additional financial obligations. The additional financial burden can strain

household finances, particularly for those with low incomes, potentially worsening poverty levels. Approximately 14% of parents said that their children experience extended periods at home due to the introduction of the double track system which fuels the long stay of children at home. Consequently, to mitigate the long stay at home as a result of the double track system, parents (37%) engaged their wards in extra classes. Among these parents, the majority (18%) only engaged their wards in extra classes while at home whereas other parents (12%) engaged their wards in extra classes when they were in school. Significant number of parents (7%) engaged their ward in extra classes in both school and at home. Additionally, 63% of parents did not engage in extra classes, as shown in Appendix A. The leading reason why parent engaged their wards in extra classes, particularly at home was because of the double track system which made the children stayed home for months. This can have a significant influence on their educational advancement and future employment opportunities, thereby perpetuating the cycle of poverty within families.

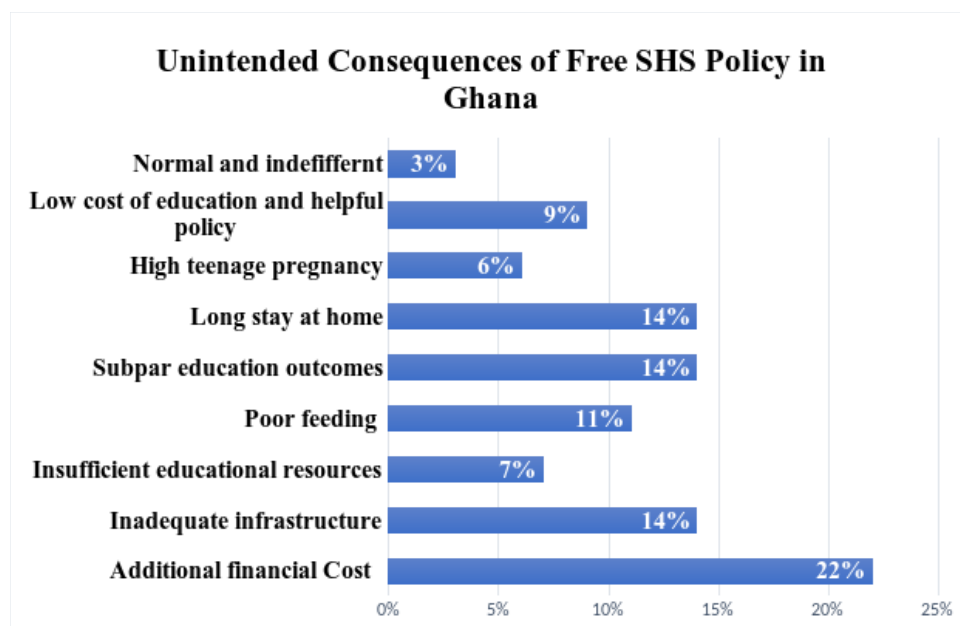


Figure 2. Unintended Consequences of free SHS Policy in Ghana

Source: Authors (2024)

An additional 14% of parents voiced apprehensions regarding the quality of education and academic performance of students. Lack of educational accomplishments might restrict students' future prospects, diminishing their likelihood of breaking free from poverty. Silva-Laya et al. (2020) discovered that substandard education hampers students' capacity to aim for a more promising future. The senior high school (SHS) level plays a vital role in deciding students' progression to university/tertiary education, which subsequently improves their employability in Ghana. This progress enables them to receive wages that can enhance their family's financial resources. In contrast, if students obtain education of poor quality at the secondary school level, their likelihood of pursuing higher education diminishes, resulting in restricted job prospects. As a result, these students may face difficulties in generating enough revenue to cover their school costs, hence worsening the poverty rates in their families.

The study further unveiled that 11% of parents reported poor feeding and hunger is very alarming. A study conducted by Acharya, et al (2019) also revealed a significant negative relationship between malnutrition throughout middle childhood and academic performance in maths, reading, and educational achievement. Malnutrition has a significant impact on the health and cognitive development of pupils, which hinders their capacity to learn and achieve academic success, hence contributing to the continuation of poverty within households.

Insufficient teaching and learning resources, as indicated by 7% of parents, can have a detrimental impact on the quality of education. Edessa (2017) found that a lack of adequate teaching materials had a detrimental effect on graduates' skills, resulting in a 71% decrease in their

performance. Inadequate resources might impede students' comprehension of topics, resulting in subpar academic achievements and constraining their prospects.

According to the data, 6% of parents reported a rise in teenage pregnancies, which has important consequences for both adolescent moms and their families. In the views of McDermott et al (2021) income level of families and teenage pregnancies are directly related. Adolescent pregnancy frequently interrupts schooling and might result in enduring economic difficulties, thereby perpetuating poverty.

The ANOVA analysis of the monthly savings resulting from the Free Senior High School (FSHS) policy indicates statistically significant findings. The model's F-statistic is 5.18 with a p-value of 0.000, showing that the independent variables together explain a substantial amount of the variation in the dependent variable. The R-squared value of 0.267 indicates that around 26.7% of the variability in the monthly savings amount can be attributed to the unexpected effects of the FSHS policy and the perception of the school list as unnecessary.

The category “Unintended consequences of FSHS” has a sum of squares (SS) of 776.301 with 8 degrees of freedom (DF), resulting in a mean square (MS) of 97.038. The F-statistic for this category is 4.82, and the p-value is 0.000. This outcome suggests that the unforeseen repercussions of the FSHS policy have a substantial impact on the monthly savings amount. The small p-value supports the presence of a statistically significant effect, indicating that the different unintended consequences within this category are important factors in determining family savings.

Table 3. ANOVA Analysis

Dependent Variable: Amount saved per month due to FSHS

Source	Partial SS	DF	MS	F	Prob>F
Model	939.6	9	104.4	5.18	0
Unintended consequences of FSHS	776.3	8	97.04	4.82	0
Unnecessary school list	161.85	1	161.85	8.03	0.01
Residual	2579.03	128	20.15		
Total	3518.62	137	25.68		
R-Square	0.27			Observation	138
Adj R-Square	0.22			Root MSE	4.49

Source: Authors (2024)

The variable “Unnecessary school list” has a partial sum of squares (SS) of 161.845 with 1 degree of freedom (DF), resulting in a mean square (MS) of 161.845. The F-statistic is 8.03, and the p-value is 0.005. This substantial finding suggests that households who consider the school list to be superfluous save significantly different amounts compared to those who do not have this belief. The significant F-statistic and small p-value provide evidence that this variable plays a crucial role in determining household savings.

The residual sum of squares (SS) is 2579.027 with 128 degrees of freedom (DF), and the total sum of squares is 3518.623 with 137 degrees of freedom (DF). The residual mean square (MS) is 20.149. The root mean square error (Root MSE) is 4.489, which quantifies the standard deviation of the residuals or the average distance between the observed values and the projected values of the model.

3.2 Effect on Household Poverty

Table 4 presents the effect of various unintended consequences of the Free Senior High School (FSHS) policy on the amount households save per month. The dependent variable is the monthly savings amount, while the independent variables include different unintended consequences and whether a school list is deemed unnecessary.

The findings indicate that households facing high rates of teenage pregnancy save an average of GH¢ 3.65 (\$ 0.23) less per month compared to those who incur increased expenses due to the Free Senior High School (FSHS) program. This difference is statistically significant at a 10% significance level. Diaz, and Fiel (2016) also revealed that teenage pregnancy decreased the income levels of households. Adolescent pregnancy can hinder the educational progress of young mothers, resulting in reduced income prospects and increased reliance on their families. This may necessitate

the reallocation of household funds to cover the immediate and long-term expenses related to teenage pregnancy, consequently diminishing the amount of money available for savings.

The lack of teaching and learning resources significantly affects households' savings, as indicated by a coefficient of -8.125 (p-value = 0.000). This coefficient suggests that these households save GH¢ 8.13 (\$ 0.52) less per month because of insufficient educational resources. Also, the study demonstrates a substantial inverse relationship between subpar academic performance and monthly savings, indicated by a coefficient of -2.698 (p-value = 0.040). This suggests that households with inadequate education save GH¢ 2.70 (\$ 0.17) less each month. Moreover, the coefficient for reduced cost of schooling is -3.516 (p-value = 0.019), indicating that households save GH¢ 3.52 (\$ 0.23) less per month referenced to additional financial burden despite the decrease in educational expenses. This substantial adverse outcome implies that household savings may be influenced by additional financial obligations or variables. The statistically significant findings emphasize the strong negative impact of insufficient educational resources and below-average academic performance on household savings. These go in line with the findings of Ihori et al (2017) and Kubota (2016) as they argue that households spend much of their income on private teaching and supplementary in Japan and other Asian countries.

Table 4. Effect of Unintended Consequences on Household Savings

Amount saved per month	Coefficient	Standard Error	t-value	p-value	[95% Confident Interval]	
Unintended Consequences						
Reference: (additional cost)						
High Teenage Pregnancy	-3.65	2	-1.83	0.07	-7.6	0.3
Inadequate Infrastructure	-1.64	1.3	-1.26	0.21	-4.22	0.93
Inadequate Teaching and Learning Materials	-8.13	1.63	-5	0	-11.34	-4.91
Long stay at home	-5.12	1.28	-4	0	-7.66	-2.59
Low Quality and Poor Academic Performance	-2.7	1.3	-2.08	0.04	-5.27	-0.13
Normal and indifferent	-3.72	2.72	-1.37	0.17	-9.1	1.66
Poor Feeding and Starvation	-5.49	1.41	-3.91	0	-8.27	-2.71
Reduced the Cost of Education	-3.52	1.48	-2.37	0.02	-6.45	-0.58
Unnecessary School List						
Reference: (No)						
Yes	-2.69	0.95	-2.83	0.01	-4.56	-0.81
Constant	16.96	0.82	20.68	0	15.34	18.59
Mean dependent var	13.24	SD dependent var				5.07
R-squared	0.27	Number of obs				138
F-test	5.18	Prob > F				0
Akaike crit. (AIC)	815.68	Bayesian crit. (BIC)				844.95

Source: Authors (2024)

Households incur additional expenses on supplementary educational materials, such as textbooks, stationery, and digital resources, to make up for the insufficient teaching and learning resources provided by schools. Also, parents may opt for private tutoring or extra classes to ensure their children receive a high-quality education, increasing household expenditures, and hence reducing savings.

The negative coefficient of -5.123 (with a p-value of less than 0.001) suggests that households save GH¢ 5.12 (\$ 0.33) less per month when students have extended periods of staying at home compared to additional financial costs. The obtained result exhibits statistical significance, indicating a substantial adverse impact on household savings. Tleuken et al (2021) confirm that longer stays at home increase household expenditure. Longer durations spent at home result in elevated consumption of food, energy, water, and other utilities, hence augmenting household expenditures and diminishing the surplus amount that can be allocated toward savings. To facilitate remote study, households may experience supplementary expenses for internet access and digital gadgets, such as laptops or tablets.

In addition, parents may need to allocate funds for private tutoring or supplementary courses to ensure their children maintain academic progress, hence increasing household expenditures.

Households that suffer from poor feeding and starvation save GH¢ 5.49 (\$ 0.35) less per month compared to the extra financial burden of FSHS, as evidenced by a statistically significant negative coefficient of -5.492 (p-value = 0.000). This outcome emphasizes a significant detrimental effect on savings when individuals experience insufficient nourishment. Millimet et al, (2018) support that households with food insecurity may save less. Thus, Households with inadequate nutrition may have to invest a substantial percentage of their income towards food in order to mitigate hunger, resulting in diminished savings. Moreover, the cost of food in Ghana can fluctuate significantly, and households experiencing food insecurity may be compelled to allocate more funds during periods of elevated food prices, so reducing their capacity to save.

Households that perceive the school list as useless save GH¢ 2.685 (\$ 0.17) less per month compared to other households (p-value = 0.005). This statistically significant finding demonstrates a considerable adverse impact on home savings, emphasizing the financial consequences of considering the school list as superfluous. Households that perceive the school list as ineffective may fail to prioritize or allocate money properly for necessary educational supplies, resulting in unforeseen expenses or wastage, ultimately diminishing savings. Insufficient planning might lead to impulsive purchases or increased spending on substitute items, which in turn hinders their capacity to save. Viewing the school list as superfluous can also result in inadequate financial planning for educational expenses, resulting in unforeseen financial burdens for households. Moreover, households might allocate a greater amount of their budget towards alternative solutions or materials, leading to higher expenses and diminished savings.

3.3 Parents Recommendations

As shown in Appendix C, when parents were asked the kind of recommendation to government, most parents (22%) suggest investing in infrastructure development and constructing additional schools to avoid implementing the double-track system. Additional noteworthy suggestions encompass the imperative for enhanced sustainability policies, increased allocation of resources to the Free SHS program, and the annulment of such policy, with each proposal garnering a 14% endorsement. In addition, 12% of parents support increased parental and private sector participation in policy talks, while 10% recommend that the government prioritize teacher motivation and extracurricular activities. A smaller proportion of parents, namely 8%, suggest enhancements in feeding and teaching approaches, while 6% emphasize that the policy should remain free from political influence.

Conclusion

The study reveals that Ghana's Free SHS program has negative consequences for parents, including extra financial costs (administration cost, accommodation cost, unofficial cost, extra feeding cost and unnecessary dormitory fees), extended stay-at-home periods, poor academic performance, inadequate infrastructure, overcrowded classrooms, inadequate meal provision, lack of teaching materials, and an increase in teenage pregnancies. Parents often enrol their children in supplementary courses to mitigate these issues. The study supports previous research suggesting that educational disparities can worsen poverty, particularly in rural areas. Table 4 shows that the Free Senior High School policy has unintended consequences on household savings. High teenage pregnancy rates, inadequate educational materials, poor academic performance, extended stay-at-home periods, inadequate nutrition, and famine have all reduced monthly savings. The school list is considered superfluous, resulting in substantial negative impacts.

The study recommends a review of the school list criteria to verify their indispensability and cost-efficiency, hence reducing superfluous costs for parents. Interact with parents, teachers, and community leaders to collect input and consistently enhance the Free SHS program according to their experiences and requirements. Develop a strong monitoring and evaluation structure to routinely evaluate the impact of the Free SHS program, utilising data to make well-informed modifications to policies and practices.

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Appendices

Appendix A. Extra classes

Are you engaging your child in any extra classes	Percent
Yes	36.20%
No	63.80%
Where does the extra classes take place	
Home	18.10%
School	12.30%
Both Home and School	6.50%
None	63.00%

Appendix B. Post - Estimation Test

Result Heteroskedasticity Test		Multicollinearity			
H_0 Constant Variance	Variable	Vif	1/vif		
Chi2 (1) = 2.58	<i>Unintended consequences</i>				
Pro>chi2 = 0.108	2	1.14	0.88		
	3	1.38	0.73		
	4	1.22	0.82		
	5	1.39	0.72		
	6	1.43	0.7		
	7	1.08	0.93		
	8	1.31	0.76		
	9	1.28	0.78		
	2. schoolistunecessary	1.07	0.93		
	Mean vif	1.25			
Result of Omitted Variable Test		Result of Misspecification Test			
H_0 No omitted Variable	saved	coefficient	Std.err	t	p> t
F (3,125) = 1.12	_hat	0.592	1.185	0.50	0.618
Pro>chi2 = 0. 344	_hatsq	0.016	0.046	0.35	0.730
	_cons	2.508	7.492	0.33	0.738

Appendix C. Parents Recommendation

What Recommendations would you like to give to the Government	Percent
Build infrastructure and schools to avoid double-track	22%
Resources should be allocated to the FSHS Policy	14%
Better sustainability policies must be employed	14%
Better Feeding & teaching methodology	8%
The Policy must not be politicized	6%
Encourage parental and private sector involvement	12%
Government should motivate teachers and support extracurriculars	10%
Free SHS Policy should be cancelled	14%



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THE IMPACT OF GREEN ACCOUNTING, CAPITAL STRUCTURE, LIQUIDITY, GOOD CORPORATE GOVERNANCE AND GDP ON PROFITABILITY IN ENERGY SECTOR COMPANIES IN 2012-2022

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Abstract. *This research intends to explore the influence of green accounting, capital structure, liquidity, corporate governance, and GDP on the profitability of energy firms. The research methodology utilized for this examination consists of panel data regression analysis, utilizing a sample of 27 energy companies listed on the IDX over an 11-year period. The outcomes of this study indicate that green accounting (PROPER) and capital structure (DAR) negatively impact profitability, whereas institutional ownership, and GDP demonstrate a noteworthy influence on energy companies profitability. Furthermore, liquidity (CR) and the presence of board of directors and independent commissioners does not affect profitability. These results underscore the significance of a holistic approach in balancing environmental sustainability and financial performance. These conclusions can be utilized as a foundation for developing strategies that enhance the financial performance and sustainability of energy sector companies.*

Keywords: *Green accounting, capital structure, liquidity, good corporate governance, gross domestic product, energy, Indonesia.*

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Introduction

Indonesia possesses a multitude of abundant natural resources within its boundaries, offering a significant opportunity for economic growth and prosperity. It is imperative that these natural riches are harnessed and managed effectively to ensure the well-being and advancement of the Indonesian populace. Consequently, in the realm of managing natural resources, the primary emphasis ought to be on approaches that prioritize the protection and preservation of these resources, ensuring their enduring viability and sustainability (Mandagie et al., 2024). The energy sector, serving as a pivotal cornerstone of a nation's economy, holds immense importance as a catalyst for national advancement (Rheynaldi et al., 2023). Nonetheless, it's crucial to acknowledge that the energy industry plays a substantial role in the global output of greenhouse gas emissions.

Data collected by the International Energy Agency (IEA) reveals that greenhouse gas emissions originating from the energy sector have increased by over three times in the past two decades, rising from 10 Gigatons of CO₂ in 1999 to 33 Gigatons of CO₂ in 2019. Approximately 36% of the total global greenhouse gas emissions are attributed to the energy sector. Indonesia exhibits a notable reliance, approximately 90%, on fossil fuels, prompting efforts towards decarbonization. As of 2022, the energy and transportation sector accounted for 50.6% of the overall emissions, with a projected rise to 59% by 2030 (LCDI, 2020). The government of Indonesia has made a pledge to decrease carbon emissions through the expansion of new renewable energy sources (EBT) to diminish the reliance on fossil fuels. By the year 2024, the government aims to reach a target of 19.5% EBT in the main energy combination, with a particular emphasis on fostering renewable electricity production and the utilization of biofuels.

The ability of an organization to manage and regulate its resources, referred to as financial performance, is a crucial factor in evaluating the success of a business entity (Endri et al., 2021). The assessment of a company's success often revolves around the importance of profitability. Profitability not only serves as a crucial indicator of a company's performance but also signifies a higher return for its investors (Hossain, 2021). This particular indicator is impacted by a variety of internal and external factors, and therefore plays a crucial role in determining the success of a business (Joaqui-Barandica & Manotas-Duque, 2023). Through the inclusion of environmental considerations in financial decision-making processes, companies can improve their environmental performance while ensuring financial sustainability (Lindawati et al., 2022).

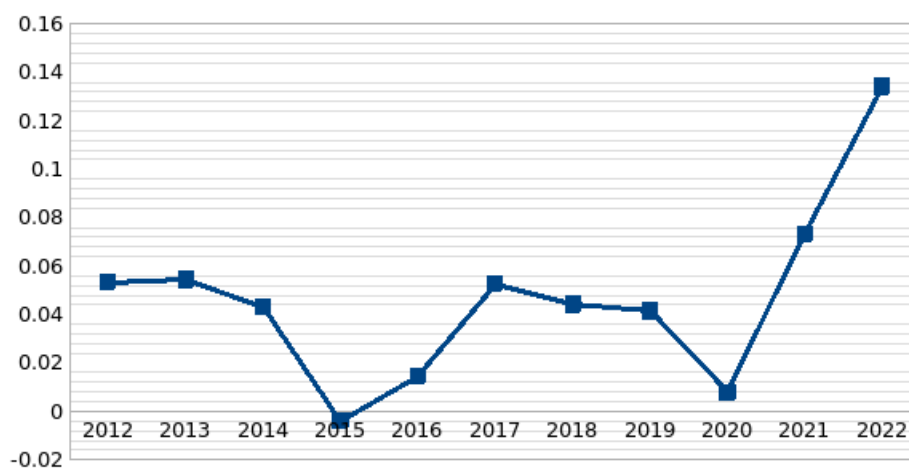


Figure 1. Graph of ROA Energy Sector 2012-2022

The decline in ROA was due to an increase in world oil prices due to geopolitical conflicts in the Middle East and increased energy demand from developing countries. It was also caused by the fall in world oil prices due to over supply and the global economic slowdown (OPEC, 2015). ROA increased in 2021 and continued to increase in 2022 to 13.42% as the economy recovered. The three largest coal producers - China, India and Indonesia - all produce record amounts in 2022 (IEA, 2023).

The Indonesian government has pledged its dedication to the realization of the SDG (Sustainable Development Goals) framework initiated by the United Nations and embraced by all participating nations. The SDG constitutes a set of 17 goals and 169 targets that world leaders have collectively committed to accomplishing over a period of 15 years, spanning from 2015 to 2030 (Bangsa, 2021).

Energy companies require a significant amount of capital investment in order to transition to renewable energy sources and diminish greenhouse gas emissions. This investment encompasses the enhancement of electricity infrastructure, which necessitates a considerable financial commitment. Hence, the financial structures within this industry may encompass a combination of debt and equity, along with contributions from governmental bodies and other entities. This scenario was evident in the case of PLN (Indonesian State Electricity Company), where by the

conclusion of 2019, the company had accumulated debts totalling 500 trillion Rupiah. This predicament arose due to PLN's lack of internal resources to undertake the 35,000 MW project, leading the company to opt for bank loans amounting to Rp 100 trillion annually (Meilanova, 2020).

Liquidity refers to a company's ability to satisfy its immediate financial responsibilities. The level of liquidity directly influences a company's profitability (Hossain, 2021). Energy firms with strong liquidity are better positioned to address domestic energy demand affected by Domestic Market Obligation (DMO) policies (IESR, 2023). During the COVID-19 pandemic, PLN encountered significant liquidity challenges due to a reduction in electricity consumption, leading to difficulties in settling foreign exchange debts while awaiting state reimbursement. PLN witnessed a notable decline in sales, coupled with a depreciation of the rupiah against the US dollar. Consequently, even a minor fluctuation in the exchange rate by Rp 1,000 could result in a substantial burden of Rp 9 trillion for PLN (Umah, 2020).

Due to the heightened emphasis on environmental consciousness and the adoption of sustainable practices, there has been a noticeable increase in scrutiny and attention towards the impact of corporate governance on a company's ecological performance and overall sustainability initiatives (Mandagie et al., 2024). The operational outcomes of companies in the energy sector are often impacted by a range of broader economic factors, which can significantly influence their financial performance. For example, fluctuations in oil and gas prices have the potential to create a ripple effect on electricity costs, thereby potentially affecting the profit margins of traditional energy companies (Uribe et al., 2022). The intricate interplay between corporate governance, economic factors, and environmental concerns underscores the complex dynamics at play within the energy industry and the importance of adopting sustainable strategies to ensure long-term success.

Literature Review

1. Legitimacy Theory

Legitimacy theory posits that organizations are under an obligation to take proactive measures to ensure that every operational endeavour they engage in adheres to the societal norms and regulations in place within the community (Yusnita, 2021). This theory advocates for the integration of green accounting practices by firms as a strategy to demonstrate their commitment to environmental stewardship (Aryani et al., 2023). As a result of the pressures emanating from the discourse on legitimacy, businesses have increasingly prioritized environmental concerns. It is imperative for companies to not only exhibit social responsibility but also demonstrate a commitment towards the ecosystem within which they function. Consequently, this dual focus enables firms to safeguard the environment for forthcoming generations while concurrently enhancing their financial performance over an extended period (Chairia et al., 2022; Novitasari & Bernawati, 2020)

2. Agency Theory

Agency theory recognizes the presence of possible conflicts of interest that may arise between shareholders and managers within a company (Boshnak, 2024). Taking into account that individuals affiliated with an organisation have various interests, agency theory clarifies their potential behavioural tendencies (Hidayah, 2023). In order to mitigate these conflicts, it is essential to implement measures of Good Corporate Governance (GCG) (Saftiana et al., 2017). Good Corporate Governance plays a crucial role in addressing agency issues by not only minimizing potential conflicts of interest but also by enhancing transparency, accountability, and the efficiency of decision-making processes within the organization (Sianturi et al., 2020). The implementation of GCG practices is crucial for fostering a harmonious relationship between stakeholders and ensuring the long-term sustainability and success of the company. By promoting ethical behaviour, fairness, and responsibility, GCG contributes to building trust and confidence among shareholders, managers, and other stakeholders. Overall, the adoption of GCG principles is fundamental for promoting a culture of integrity, trust, and responsible leadership within organizations, ultimately leading to improved performance and sustainable growth.

3. Stakeholder Theory

Stakeholder Theory highlights the significance of acknowledging the concerns and interests of all stakeholders involved, such as customers, employees, and the community, when making decisions within the corporate setting (Yusnita, 2021). It is imperative for the company to actively engage in efforts aimed at fostering positive and mutually beneficial relationships with these stakeholders, ensuring that their various needs and preferences are not only recognized but also effectively addressed and fulfilled. In doing so, the organization can enhance its overall sustainability and reputation, ultimately contributing to long-term success and competitiveness in the market (Boshnak, 2024).

4. Green Accounting, Capital Structure, Liquidity, Institutional Ownership, Board of Directors, Independent Commissioner, Gross Domestic Product on Profitability

The adoption of Green Accounting offers the promise of supporting businesses in reducing operating costs through enhanced energy efficiency and waste management, ultimately leading to higher profitability (Nurrasyidin et al., 2024). Maintaining an optimal capital structure is equally crucial in order to lower capital costs and enhance earnings (Sastru, 2019). Efficient cash management, as indicated by good liquidity, can enable firms to meet short-term obligations and prevent incurring additional expenses (Nurhayati et al., 2023). Institutional ownership is often associated with enhanced oversight and management, which can result in improved operational efficiency, thereby promoting sound corporate governance practices (Din et al., 2022). The crucial roles played by the Board of Directors and Independent Commissioners in corporate governance involve ensuring that decisions made are fair and advantageous to all stakeholders.

H1. Green Accounting, Capital Structure, Liquidity, Institutional Ownership, Board of Directors, Independent Commissioner and GDP simultaneously affect Profitability.

5. Green Accounting on Profitability

The adoption of green accounting practices by organizations requires strategic actions aimed at effectively supervising and protecting natural resources and ecosystems to enhance their ecological footprint and overall environmental sustainability (Lindawati et al., 2022). In the present research, the evaluation of green accounting was estimated through the utilization of the PROPER index, which stands for Program for Assessment of Company Performance Rating in Environmental Management. This index was specifically designed by the Ministry of Environment of the Republic of Indonesia for such purposes. According to Regulation Number 5 of 2011 issued by the Minister of State for the Environment, the criteria for PROPER assessment are categorized into five distinct colors, which are gold, green, blue, red, and black, outlining a comprehensive framework for evaluating environmental performance in companies within the region.

The participation of a company in the PROPER initiative demonstrates its commitment to environmental protection and serves as an indicator of its environmental effectiveness (Nurrasyidin et al., 2024). Moreover, the revelation of environmental expenses signifies the company's recognition of the significance of its societal surroundings, alongside its objective of attaining business profits (Dutta et al., 2020). The research conducted by (Aryani et al., 2023) indicated that green accounting has implications for the company's profitability. Conversely, in a separate study conducted by (Dita & Ervina, 2021), it was indicated that green accounting does not have any effect on the company's profitability.

H2. Green Accounting partially affect Profitability.

6. Capital Structure on Profitability

The capital structure of a company involves an analysis of the various funding sources utilized in its operations, such as short-term debt, long-term debt, and equity (Luckieta et al., 2021). This research focuses on the impact of capital structure, specifically through the debt-to-asset ratio (DAR), on the company's profitability. Effective management of the capital structure can lead to the establishment of robust and steady financial positions for the organization (Boshnak, 2024). A study by (Anggraeni & Nasution, 2022) reveals that DAR has a detrimental effect on profitability.

Conversely, findings from a different study by (Maulita & Tania, 2018) suggest that DAR does not influence profitability.

H3. Capital Structure partially affect Profitability.

7. Liquidity on Profitability

Liquidity pertains to the rate at which an organization's assets can be transformed into cash to satisfy its financial commitments (Mandagie et al., 2024). Within this investigation, liquidity is assessed through the utilization of the current ratio (CR), which gauges the company's capacity to settle its short-term debts with its present assets. A heightened current ratio suggests that the company possesses greater liquidity (Chandra et al., 2019). Research conducted by (Sastra, 2019) suggests that liquidity has a substantial impact on profitability, in contrast to the findings of a study conducted by (Hossain, 2021) asserting that liquidity does not influence ROA.

H4. Liquidity partially affect Profitability.

8. Institutional Ownership on Profitability

Institutional ownership refers to the ownership of company shares by various institutions such as insurance companies, banks, investment firms, and other similar entities (Sianturi et al., 2020). Institutional investors possess a higher level of expertise in identifying discrepancies within a company, thus reducing the likelihood of being misled by management (Saftiana et al., 2017). A study conducted by (Din et al., 2022) also highlighted a positive correlation between institutional ownership and profitability. However, the findings of this research are in contrast to a study carried out by (Sianturi et al., 2020) which suggests that institutional ownership does not impact a company's profitability.

H5. Institutional Ownership partially affect Profitability.

9. Board of Directors on Profitability

The board of directors is responsible for overseeing the management team in the interests of shareholders and ensuring the allocation of essential resources (Vincent et al., 2023). According to a study by (Ni'mah & Syaiful, 2021), the board of directors does not impact profitability. Nevertheless, this finding contradicts the research by (Pratama et al., 2022), which suggests that the board of directors does influence the company's profitability level.

H6. Board of directors partially affect Profitability.

10. Independent Commissioners on Profitability

Independent commissioners play a crucial role in mitigating the risks associated with management decisions (Hapsari et al., 2019). (Ni'mah & Syaiful, 2021) found in their study that independent commissioners have a beneficial and notable impact on the profitability of an organization. Conversely, according to the research by (Sianturi et al., 2020), the presence of independent commissioners does not affect profitability.

H7. Independent Commissioners partially affect Profitability.

11. GDP on Profitability

Macroeconomic factors, like Gross Domestic Product (GDP), play a significant role in influencing the overall economy. A reduction in GDP serves as an indicator of a recession, which could potentially lower energy consumption and have an impact on the profitability of businesses in the energy sector. Research conducted by (Rezina et al., 2020) suggests a positive correlation between GDP and profitability. This finding contrasts with the study conducted by (Saputro, 2019), which argues that GDP does not have a direct impact on companies' profitability levels.

H8. GDP partially affect Profitability.

Methods

This research employs quantitative methodologies to assess the potential impact of green accounting, capital structure, liquidity, effective corporate governance, and GDP on profitability. Quantitative techniques utilize numerical data to examine the associations between various variables (Silaen, 2018). The study adopts a causal descriptive research approach, utilizing panel data. Panel data comprises observations of multiple units over various time points, where each unit

has a distinct identity (Wooldridge, 2018). The utilization of panel data in this investigation is a time-consuming process, spanning several years, to observe continuous changes over the specified duration.

Table 1. Sampling Characteristic

No.	Criteria	Total Company
1	Firms that have maintained a continuous presence on the IDX Energy Sector between the years 2012 and 2022.	44
2	Firms that have a consistent listing on the IDX Energy Sector but have not maintained a regular publication of annual reports from 2012 to 2022.	-17
3	Firms that are consistently included in the IDX within the Energy Sector, yet lack comprehensive data pertaining to the variables under investigation in this research.	0
The total number of samples that fulfil the specified criteria		27
The quantity of data that was analysed (27 x 11 years)		297

This study included all companies operating in the energy sector and listed on the Indonesia Stock Exchange as the entire population. The research employed a non-probability sampling technique, specifically purposive sampling. Purposive sampling is a deliberate method of sampling employed by researchers based on predetermined criteria (Creswell & Creswell, 2018). A total of 27 companies were selected as the sample for this study using the criteria outlined in Table 1. The following is a compilation of those selected companies.

Table 2. Research Sample List

No.	Code	Company Name
1	ABMM	ABM Investama Tbk.
2	ADRO	Adaro Energy Tbk.
3	AKRA	AKR Corporindo Tbk
4	ARII	Atlas Resources Tbk
5	BSSR	Baramulti Suksessarana Tbk
6	BULL	Buana Lintas Lautan Tbk
7	BUMI	Bumi Resources Tbk
8	CNKO	Exploitasi Energi Indonesia Tbk
9	DEWA	Darma Henwa Tbk
10	DOID	Delta Dunia Makmur Tbk
11	DSSA	Dian Swastatika Sentosa Tbk
12	ELSA	Elnusa Tbk
13	ENRG	Energi Mega Persada Tbk
14	HRUM	Harum Energy Tbk
15	INDY	Indika Energy Tbk
16	ITMA	Sumber Energi Andalan Tbk
17	ITMG	Indo Tambangraya Megah Tbk
18	MBSS	Mitrabahtera Segara Sejati Tbk
19	MEDC	Medco Energi Internasional Tbk
20	MYOH	Samindo Resources Tbk
21	PGAS	Perusahaan Gas Negara Tbk
22	PTBA	Bukit Asam Tbk
23	PTRO	Petrosea Tbk
24	RAJA	Rukun Raharja Tbk
25	SMMT	Golden Eagle Energy Tbk
26	TOBA	TBS Energi Bersama Tbk
27	WINS	Wintermar Offshore Marine Tbk

In this research, the independent variables encompass green accounting, which will be represented by **PROPER**, capital structure, which will be approximated by **DAR**, liquidity by **CR**, and corporate governance, which will be approximated by **institutional ownership, board of directors, independent commissioners**, and **GDP**. The dependent variable, profitability, will be measured using **ROA**.

Table 3. Research Variable

Variable	Proxies	Indicator
Green Accounting	PROPER	Ratings: • Gold – Excellent – 5 • Green – Good – 4 • Blue – Fair – 3 • Red – Poor – 2 • Black – Very poor -1
Capital Structure	Debt to Asset Ratio (DAR)	$\frac{\text{Total Debt}}{\text{Total Assets}}$
Liquidity	Current Ratio (CR)	$\frac{\text{Current Assets}}{\text{Current Liabilities}}$
Good Corporate Governance	Institutional Ownership	$\frac{\text{Number of Shares Institutional Ownership}}{\text{Total Outstanding Shares}}$
	Board of Directors	$\frac{\Sigma \text{Total of Board Directors}}{\Sigma \text{Total of Board Commissioners}}$
	Independent Commissioner	$\frac{\Sigma \text{Independent Commissioners}}{\Sigma \text{Total of Board Commissioners}}$
GDP	GDP	$C + I + G + (X - M)$
Profitability	ROA	$\frac{\text{Net Income}}{\text{Total Assets}}$

Results

In the context of estimating models using panel data, there exist three distinct approaches that can be employed, specifically the common effect model (CEM), fixed effect model (FEM), and random effect model (REM) (Basuki, 2021). To ascertain the suitable regression model to utilize, three crucial testing procedures need to be undertaken. These testing phases comprise the Chow test, the Hausman test, and the Lagrange Multiplier test, all of which aid in determining the most appropriate choice between FEM, REM, or CEM (Rifkhan, 2022).

3.1 Chow Test

The chow test serves as a valuable tool in assessing the superiority of the FEM method over the CEM method.

Table 4. Chow Test

Redundant Fixed Effects Tests

Equation: Untitled

Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	4.01	-26263	0
Cross-section Chi-square	99.09	26	0

Source: Output EViews 12

According to the findings of the test, the optimal choice of model for this research is **FEM**. The subsequent procedure following the Chow test involves conducting the Hausman test.

3.2 Hausman Test

The Hausman test is a statistical method utilized to determine whether FEM or REM is the optimal choice for conducting panel data analysis.

Table 5. Hausman Test

Correlated Random Effects - Hausman Test

Equation: Untitled

Test cross-section random effects

Test Summary	Chi-Sq Statistic	Chi-Sq d.f.	Prob.
Cross-section random	23.62	7	0

Source: Output EViews 12

According to the findings of the Hausman test, the most appropriate model for this research study is FEM.

Based on the outcomes of the Chow test and the Hausman test, the most suitable model for this study is determined to be **FEM**. Consequently, the Lagrange Multiplier (LM) test is deemed unnecessary for this analysis (Basuki, 2021).

3.3 Panel Data Regression

According to the outcomes of the panel data regression analyses conducted, which encompassed the Chow test and the Hausman test, the fixed effect model emerges as the most suitable panel data regression model for this study. Subsequently, the findings obtained through the utilization of the fixed effect model are presented below.

Table 6. Panel Data Regression

Variable	Coefficient	Std. Error	t-Stat	Prob
C	-0.02	0.03	-0.68	0.5
PROPER	-0.01	0	-4.34	0
DAR	-0.06	0.03	-2.18	0.03
CR	0	0	1.07	0.29
Ins_Own	0.03	0.01	2.22	0.03
Brd_Dr	0	0	1.29	0.2
Ind_Com	0.06	0.04	1.39	0.17
GDP	0	0	3.35	0
Effects Specification				
Cross-Section fixed (dummy variables)				
Weighted Statistics				
R-squared	0.58	Mean dependent var		0.07
Adjusted R-squared	0.53	S.D. dependent var		0.14
S.E. of regression	0.09	Sum squared resid		2.37
F-statistic	11.2	Durbin-Watson stat		1.32
Prob(F-statistic)	0			
Unweighted Statistics				
R-squared	0.48	Mean dependent var		0.05
Sum squared resid	2.51	Durbin-Watson stat		1.46

Source: Output EViews 12

According to the information provided in Table 5, the resulting equation can be derived as follows:

$$\text{ROA} = -0.02266 - 0.00968 (\text{PROPER}) - 0.06117 (\text{DAR}) + \text{newline} + 0.00199 (\text{CR}) + 0.03104 (\text{Ins_Own}) + 0.00447 (\text{Brd_Dr}) + 0.05800 (\text{Ind_Com}) + 3.28330298716\text{e-}09 (\text{GDP}) \quad (1)$$

3.4 Simultaneous F Test

Table 7. Simultaneous Test Result

R-squared	0.584347
S.E. of regression	0.09
F-statistic	11.2
Prob(F-statistic)	0

Source: Output EViews 12

The statistical findings provided indicate that through simultaneous hypothesis testing or F-test, a probability value of 0.000000 is obtained for the F-statistic. This result signifies that simultaneously, the independent variables exert a substantial impact on the dependent variable. Basically, the estimated regression model efficiently reveals the interplay among the variables analysed, underscoring its significance.

3.5 Partial T-test

Table 8. Partial Test Result

Variable	Coefficient	Std. Error	t-Stat	Prob
C	-0.02	0.03	-0.68	0.5
PROPER	-0.01	0	-4.34	0
DAR	-0.06	0.03	-2.18	0.03
CR	0	0	1.07	0.29
Ins_Own	0.03	0.01	2.22	0.03
Brd_Dr	0	0	1.29	0.2
Ind_Com	0.06	0.04	1.39	0.17
GDP	0	0	3.35	0

An analysis of the partial test results provided above reveals the following findings:

1. The test results indicate that the probability value for the Green Accounting (PROPER) variable is **0.0000**, which is lower than the established significance level of > 0.05 or 5%. Moreover, the regression coefficient is **-0.009682**. Thus, it can be inferred that Green Accounting (PROPER) significantly impacts Profitability, with negative coefficients suggesting that an increase in PROPER leads to a decrease in Profitability.

2. The hypothesis test results partially demonstrate that the probability value for the Capital Structure (DAR) is **0.0302**, with a regression coefficient of **-0.061178**. Indicating that Capital Structure partially exerts a significant negative influence on Profitability. An increase in DAR is associated with a decrease in Profitability.

3. The partial hypothesis testing results reveal that the probability value for Liquidity (CR) is **0.2878**, higher than the significance level of 0.05. Thus, it can be asserted that, according to this partial analysis, Liquidity does not exert a significant impact on Profitability.

4. The Institutional Ownership variable's probability value, as determined by the partial test, is **0.0275**, with a regression coefficient of **0.031046**. Since this value is less than the significance level of 0.05. Hence, Institutional Ownership partially exerts a significant positive influence on Profitability, with an increase in Institutional Ownership associated with an increase in Profitability.

5. For the Board of Directors variable, the probability value from the partial test is **0.1979**, exceeding the significance level of 0.05. Additionally, the regression coefficient is **0.004476**. Thus, it is concluded that the Board of Directors do not significantly influence Profitability based on this test.

6. The Independent Commissioner variable has a probability value of **0.1661**, with a regression coefficient of **0.058003**. Since this value is higher than the significance level of 0.05. This indicates that Independent Commissioners do not have a significant influence on Profitability according to this partial test.

7. The statistical analysis of the partial test results for the Gross Domestic Product (GDP) variable reveals a probability value of **0.0009**, along with a regression coefficient of **3.28E-09**. In summary, the partial GDP variable is shown to have a significant positive impact on Profitability, indicating that an increase in GDP leads to an increase in Profitability.

Discussion

The utilization of green accounting may influence the financial outcomes of companies by impacting both revenues and expenses (Aryani et al., 2023). While this approach can potentially boost a company's revenue by expanding market access or enhancing reputation, it can also lead to additional expenses like environmental audits, waste management, or investments in eco-friendly technologies. If these expenditures are not counterbalanced by higher earnings or alternative cost-reducing strategies, it might diminish the profitability of firms in the short run (Ningsih & Rachmawati, 2017). The adoption of renewable energy is on the rise, particularly in developed nations such as America and Europe. Companies in this sector must transition from conventional to sustainable energy sources to ensure business sustainability moving forward (Rhamadanty, 2024).

This outcome aligns with the evaluation conducted (Pratama & Mulyani, 2024), indicating a negative impact of green accounting on profitability, contrary to the findings of (Dita & Ervina,

2021) suggesting no influence of green accounting on company financial performance. Conversely, a study by (Putri et al., 2019) reveals a notably positive impact of green accounting on profitability.

A significant amount of debt can impact the perceptions of company risk by investors and creditors, potentially leading to reduced confidence from investors and higher capital costs. This situation may necessitate offering increased yields to attract investments, which could subsequently harm profitability (Prabowo & Sutanto, 2019). Consequently, preserving an optimal balance in the capital structure is critical for elevating profitability and proficiently mitigating financial risks (Nurhayati et al., 2023). The outcomes of this study are consistent with earlier research conducted by (Fathoni & Syarifudin, 2021) and (Anggraeni & Nasution, 2022), pointing to a negative connection between Debt to Asset Ratio (DAR) and Return on Assets (ROA). This contrasts with the results of (Luckieta et al., 2021), whose study suggests a positive relationship between DAR and ROA.

Adequate liquidity represents the ability of an organization to satisfy its short-term financial responsibilities without the need to liquidate valuable assets or encounter financial hurdles. The ability to meet these immediate responsibilities holds significance as it showcases the financial well-being of the company, fostering trust among investors and creditors (Nurhayati et al., 2023). This aligns with Stakeholder Theory's fundamental principles, underlining the significance of meeting direct financial obligations to maintain stakeholder trust and ensure operational (Fernando et al., 2024). It is anticipated that increased profitability can be realised through a more restricted distribution of capital to investments characterised by increased liquidity. As such, the reciprocal dynamic linking liquidity and profitability stands out as an idea that can be analysed and articulated in the domain of financial management and investment methodologies (Rolle et al., 2020). The outcomes of this research correspond with the conclusions drawn in studies carried out by (Satria, 2022), which posits that liquidity exerts no influence on profitability. Conversely, the study by (Sastra, 2019) and (Prabowo & Sutanto, 2019) indicates that liquidity exerts an influence on profitability.

The presence of institutional investors typically results in enhanced oversight and more proficient administration, leading to increased operational efficiency and enhanced business strategy within the organization (Hapsari et al., 2019). The beneficial impact of institutional ownership on financial performance stems from the superior resources, knowledge, and experience possessed by institutional investors in monitoring and overseeing corporate managerial performance (Abedin et al., 2022). This dynamic can motivate management to operate with greater effectiveness and efficiency in steering the company, subsequently boosting profitability (Din et al., 2022). These conclusions align with the research findings of (Nuridah et al., 2023), which indicate a significant impact between institutional ownership and profitability.

In the context of management theory and practice, the key role of overseeing and formulating strategic decisions for a company is assigned to the board of directors (Pratama et al., 2022). Issues of coordination and sluggish decision-making may arise with a large board of directors, which could impede effectiveness (Mandagie et al., 2024). These findings align with previous research by (Ni'mah & Syaiful, 2021), which posits that the board of directors does not impact profitability.

Independent commissioners primarily focus on supervising and advising the board of directors (Nuridah et al., 2023). By effectively supervising, independent commissioners can prompt management to enhance decision-making and policies, thereby boosting the company's profitability (Hapsari et al., 2019). The outcomes of this study are consistent with the conclusions drawn by (Sianturi et al., 2020). Nevertheless, this contradicts the conclusions drawn by (Nuridah et al., 2023) and (Pratama et al., 2022), which suggest that Independent Commissioners do influence profitability. The significant finding of the limited impact of both the Board of Directors and Independent Commissioners on profitability challenges the Agency Theory's emphasis on the significance of corporate governance structures, contradicting the research by (Shukla et al., 2020).

The potential increase in economic activity may lead to a more favourable climate for financial investments within the energy industry. Energy corporations are likely to show heightened

interest in investing in various aspects such as exploration, production, and infrastructure, expecting sustained economic growth to drive energy consumption. Such investments have the potential to enhance operational efficiency and boost capacity, ultimately fostering long-term financial gains (van Niekerk, 2024). This research presents a contrast to the findings of prior studies conducted by (de Leon, 2020; Rolle et al., 2020), which did not observe any significant relationship between GDP and profitability.

Conclusion

The research emphasizes the importance of a well-rounded approach in handling environmental sustainability and financial performance. By investigating the impacts of green accounting, capital structure, liquidity, institutional ownership, board of directors, independent commissioners, and GDP, companies in the energy sector can achieve a harmonious balance between environmental responsibility and financial prosperity. The study reveals that although green accounting practices are crucial for environmental sustainability, they can have a negative effect on the profitability of energy companies. This implies that investments in sustainable environmental practices may increase operational expenses and decrease short-term profits. Nevertheless, effective management of capital structure, liquidity, corporate governance, and GDP can enhance financial performance. The results provide valuable insights for decision-makers, investors, and policymakers to formulate strategies that promote both financial success and sustainability within the energy industry.

The research aligns with the Legitimacy Theory, emphasizing the importance of companies demonstrating commitment to social and environmental responsibility for their long-term survival, despite the potential increase in costs that could impact profitability. It also supports the Stakeholder Theory, highlighting that organisations need to incorporate the heterogeneous interests of various stakeholders in their financial and operational governance. However, the research indicates that merely applying Agency Theory in corporate governance may not be adequate, as the presence of board directors and independent directors has a limited impact on profit trends.

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ECO-INNOVATION AND CORPORATE SOCIAL RESPONSIBILITY IN ALGERIAN ENVIRONMENTAL STARTUPS

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Abstract. *This study examines the impact of ecological innovations on the emergence of corporate social responsibility (CSR) practices within Algerian environmental startups. The study uses a qualitative methodology based on interviews with startup founders. It highlights how these innovations foster the adoption of CSR practices. The results show that ecological innovations are crucial to startups' social transformation, making them more environmentally sustainable and socially engaged. The challenges and opportunities related to integrating ecological innovation into CSR practices are also discussed, emphasising the need for institutional support to encourage these initiatives. The study contributes to the literature on environmental startups in Algeria, an underexplored field strategically crucial for sustainable development.*

Keywords: *eco-innovation, environmental startups, corporate social responsibility, socially responsible behaviour.*

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Introduction

In the early 1950s, the first writings on the harmful consequences of industrialisation on society were published. Bowen (1953) was the first to question the relationship between the functioning of an economic system and social well-being in his book “Social responsibilities of the businessman”. The climate emergency and global environmental awareness have recently imposed a rethinking of the traditional business model, placing ecological innovation at the heart of corporate development strategies, particularly in the startup sector. States are obliged to redirect their governmental policies to address ecological degradation and social disparities. This new vision aligns with a broader objective aimed at overall performance. In Algeria, recent governmental policies encourage investment in innovative projects. The latest measures explicitly support young startup project leaders through mechanisms and structures of support and funding, such as incubators, accelerators, the Algerian startup fund (ASF), and others. These young companies, often characterised by their agility and capacity to innovate, play a crucial role in transforming the economic landscape towards more sustainable practices by venturing into innovative fields such as renewable energy, electric mobility, sustainable agriculture, waste management, and sustainable construction.

Theoretically, a socially responsible company is committed to integrating social, environmental, and economic issues into its strategy and operations. At the same time, eco-innovation aims to contribute to environmental sustainability and economic viability. The juxtaposition of these two concepts leads us to reflect on the link between “eco-innovation” and the

adoption of socially responsible behaviour within an eco-innovative startup. It is worth noting that more studies are needed to explore the direct impact of these ecological innovations on CSR practices within Algerian startups. Although CSR has been extensively studied, more research needs to be conducted on the involvement of startups in CSR (Keskitalo, 2023). Startups actively integrating ecological innovations are more likely to adopt robust CSR practices, suggesting that ecological innovation can serve as a lever for a sustainable corporate culture. Thus, this research aims to analyse the impact of ecological innovation on the emergence of CSR practices within startups engaged in this path.

By adopting a detailed qualitative analysis of this dynamic, this article explores the existence of a link between environmental innovation and the emergence of socially responsible behaviour within the startups selected for our study. This research significantly contributes to the literature on ecological startups in Algeria, a context hitherto underexplored but strategically important.

The article's structure unfolds as follows: first, we present a literature review covering theoretical foundations and previous studies, the results obtained, a discussion of practical implications, and finally, a conclusion.

Literature Review

From Schumpeterian Innovation to Eco-Innovation:

Before defining eco-innovation, it is imperative to understand innovation in its general sense. Unlike eco-innovation, the concept of innovation essentially dates back to Schumpeter, one of the first theorists to define it, which he believed would have a positive impact on societies.

In his book *Business Cycles* (1939), he explains that companies face cycles of innovation that generate “creative destruction”, allowing for economic growth over time. Schumpeter (1934) categorises innovation into five distinct types: the implementation of novel products, the adoption of innovative production methods, the exploration of untapped markets, the discovery of fresh sources for raw materials or other inputs, and the establishment of new market frameworks within an industry.

There are different definitions of innovation. According to the OECD, “Innovation is the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations” (OECD, 1994). According to the Oslo Manual (1994), for it to be considered an innovation, the company's product, process, marketing strategy, organizational structure, or external relations must be new (or significantly improved).

Innovation is vital for companies as it represents an engine of economic growth, which is seen as the primary goal of most countries and is universally recognized as essential for the health of national economies. However, it cannot guarantee the general well-being of the population alone. Even more importantly, it can sometimes threaten the environment, causing climate change, biodiversity loss, water and air contamination, and desertification.

In 1972, the Club of Rome report, titled “The Limits to Growth” was the first study to highlight through its “Meadows Report” the negative externalities of economic activity and demographic growth on the environment (the first time a scientific study calculated the limits of growth on Earth). The report stipulated that “if current trends in world population growth, industrialization, pollution, food production, and natural resource depletion continue unchanged, the limits to growth on this planet will be reached within the next 100 years” (Berger et al., 2014).

The shift towards a sustainable economy has become a significant challenge for companies under the dual pressure of crisis and environmental constraints. Considering the ecological and environmental aspects is imperative, hence the genesis of eco-innovation or environmental innovation in the 1980s. Eco-innovation (also known as environmental innovation or green innovation) emphasizes how innovation affects the environment, adopting new technologies, processes, or products to reduce environmental impact while promoting sustainability. “Green innovation is the introduction of a new or significantly improved product (good or service), process, organizational method, or marketing method that generates an environmental benefit compared to

existing alternatives” (Gicquaud, 2010, cited in Kafi & Elbayed 2021). It “reduces the impact of general or particular activity on the environment” (Boutillier et al., 2012, cited in Kafi & Elbayed, 2021).

According to the European Commission's Eco-Innovation Observatory, “Eco-innovation is the introduction of any new or significantly improved product (good or service), process, organizational change, or marketing solution that reduces resource use (including materials, energy, water, and soil) and decreases the ecological footprint throughout the life cycle” (EIO_Methodological_Report_2010.pdf).

Conferring to Runnings (2000), as cited by Kainrath (2009), eco-innovation refers to the actions taken by various actors such as companies, politicians, unions, associations, churches, and private households to create, introduce, or implement new methods, products, behaviours, and ideas that help reduce environmental impacts or achieve specific ecological sustainability objectives. This type of innovation is characterised by its dual external impact, regulatory effect, and the growing significance of social and institutional innovation.

Galliano and Nadel (2018) remind us that environmental innovation was introduced into innovation economics (mainly evolutionary) in the early 2000s and that it is distinguished from classical innovation by the complementarity it can have with other forms of innovation.

The creation of double externalities, or a positive external impact on the environment and the knowledge flows produced by any innovation, distinguishes environmental innovation. The OECD (2009), in its definition, goes beyond previous theoretical definitions. According to this organization, there are two ways to differentiate ecological innovation from traditional innovation. First, it is not an evolutionary concept because it represents an innovation that emphasizes reducing environmental impacts, and second, ecological innovation is not limited to the creation of products, processes, or marketing or organisational methods but also involves changes in social and institutional structures.

From Economic Startup to Ecological Startup:

Before explaining the term eco-innovative startup, it is important to define the startup and highlight its peculiarities. According to Steve Blank, one of the Silicon Valley pioneers, “A startup is a temporary organization designed to search for a repeatable and scalable business model” (Blank & Dorf, 2019). This definition highlights the main characteristics and specificities, which are:

- **Temporality:** Being a startup is not an end; it is a phase of startup development, with the main objective of evolving towards an industrializable business model.
- **The search for a business model:** A nascent company strives to provide consumers with a unique product or service, aiming to offer something unique in the market. The main challenge for this startup is to design and implement a business model that stands out from already established traditional structures.
- **The possibility of industrialisation:** A newly created company seeks a model that can be developed on a larger scale in other locations or created by others.
- **Scalability:** This implies that an increase in the number of customers leads to an increase in profit margins. In this model, prices for subsequent customers gradually decrease after the initial rate is higher. This ability to scale, making the model easily replicable, allows startups to grow rapidly and distinctively compared to conventional companies.

The Emergence of a New Type of Startup, “The Environmental Startup”:

According to a groundbreaking article in the Harvard Business Review from the early 1970s (Quinn, 1971 cited by Schaper, M. 2002), the “ecology movement” could open up lucrative new markets for business expansion rather than merely being a drag on economic activity. By the late 1980s, this theme was gaining traction. Elkington (1980) said that creative business solutions have the potential to enhance the environment and provide the groundwork for untapped commercial prospects that conventional corporations have overlooked. During the 1990s, there was an increasing emphasis on environmental entrepreneurship, which included a more thorough and specific examination. Early pioneers in the field of entrepreneurship, such as Blue (1990), Bennett

(1991), Berle (1991), and were instrumental in popularising terms like “environmental entrepreneur”, “eco-entrepreneur” and “ecopreneur”.

Chukwuka (2018) states that eco-entrepreneurs engage in sustainability-focused activities that include various initiatives aimed at minimising the environmental effects of their company operations and achieving cost savings. This implies that they will use a reduced amount of raw materials, natural resources, energy, and water, leading to a decrease in waste and decreased operational expenses for the enterprise.

Eco-entrepreneurship capitalises on the difficulties associated with climate change and sustainable development, providing prospects for inventive solutions to emerging problems. This new entrepreneurial trend offers a viable option that is both cost-effective and environmentally friendly. It is often supported by government regulations that provide incentives to promote its adoption. Promoting ecological entrepreneurship is widely acknowledged as a crucial component of all sustainable development programs. Entrepreneurship has the potential to foster the spread of innovative ideas that may enhance the global socio-economic and ecological conditions. Eco-startups are a novel kind of startup that prioritise environmental concerns while balancing both financial and non-financial goals. Recently, there has been a rise in the use of several terminology to describe companies that have aims beyond just making money, such as green startups, green-tech, clean-tech, eco-innovative startups, and responsible startups.

In our study we will focus on startups whose innovation is committed to having a positive impact on the environment, commonly called eco-innovative startups, green startups. The term eco-innovation has been used as a synonym for green innovation and environmental innovation, Kunapatarawong & Martínez-Ros (2016).

CSR practices within startups:

Corporate social responsibility (CSR) is a topic that generates considerable reflection, as its definition and implementation remain highly relative to the company's socio-economic, regulatory, and environmental context. “The term [social responsibility] is a brilliant one; it means something, but not always the same thing, to everybody” (Votaw, 1973, cited by Carroll, 1999).

Carroll (1999), in his article, listed over twenty definitions, all emphasizing the idea that the outcome refers to the obligations of companies that extend beyond purely economic, financial, technical, or legal dimensions – in other words, taking into account other aspects beyond the economic aspect and ensuring that the externalities of their activities have a positive effect on the environment and society. Operationally, CSR is the application of sustainable development principles within the company. The Brundtland Report's sustainable development concept has provided an approach method integrating three dimensions (economic, ecological, and social). These three pillars were translated by Elkington (1999) into the notion of “triple bottom line”, meaning that a company's performance should be assessed in the economic, social, and environmental domains. In recent years, companies have placed greater importance on corporate social responsibility. Stakeholders' needs have evolved with new generations, and the effects of climate change, among other things, have forced companies to adopt such practices.

Link between Eco-Innovation and CSR (Previous Work):

According to a bibliometric analysis conducted on the relationship between eco-innovation and corporate social responsibility, significant importance has been given to this topic. Between 2000 and 2022, 4,520 articles were published, with 1,539 articles published in 2022, leading the most involved countries in the topic: China, the United Kingdom, Spain, the United States, Malaysia, India, Pakistan, Australia, and Germany (Salazar-Soto & Pinzón-Castro, 2023).

Le Bas and Poussing (2010) state that innovations can positively impact companies' responsible engagement and various aspects of applied CSR. “The existence of a strong, statistically significant relationship between being an innovative company and adopting a CSR approach” (Le Bas & Poussing, 2010). Temri et al. (2015) found that product or process innovation, but not organizational innovation, positively influences the propensity to implement CSR strategies. Being a technological leader positively contributes to involvement in social responsibility initiatives. Additionally, it has been shown that companies focused on innovation tend to integrate CSR in

several aspects simultaneously. The synergy effect between these two practices can allow companies that engage in them to gain a competitive advantage. This dynamic is analysed from the perspective of technological innovation actively influencing the implementation of CSR.

Methods

For our research, we favoured a qualitative approach, a method increasingly asserting itself in management sciences. It constitutes a rich and diversified methodological corpus, facilitating the extraction of information, the identification of emerging trends, and the analysis of social dynamics that may escape quantitative approaches (Alami, Desjeux, & Garabua-Moussaoui, 2009). Based on a series of semi-structured interviews with the founders of ten ecologically engaged Algerian startups, the research aims to capture experiences, motivations, key ecological innovations and their impact, challenges, and opportunities related to the ecosystem, the perception of CSR by the founders, and their involvement in socially responsible practices. This approach allows an in-depth exploration of the complex nuances and underlying dimensions shaping ecological innovation and CSR practices in these nascent companies.

The participants in this study were carefully selected from a wide range of ecological startups operating across Algeria. The geographic diversity of the startups was an essential criterion, allowing a broad spectrum of experiences and environmental and economic contexts to be covered. Due to the geographical dispersion of the selected startups across Algeria's vast territory and to facilitate access to entrepreneurs while respecting time constraints, some interviews were conducted online, which also allowed for the creation of a comfortable environment for participants, thereby fostering openness and richness in exchanges.

The duration of the interviews varied considerably, ranging from one and a half hours to three hours, reflecting the depth and richness of the discussions. This flexibility allowed us to adapt to the rhythm of each entrepreneur, developing a deep understanding of their background and ecological innovation practices. The interviews were recorded with participants' consent and fully transcribed for later analysis. A thematic analysis was employed using Nvivo12 software to identify, analyse, and report patterns (or themes) in the data. This method significantly structured participants' responses around the study's central themes, particularly the impact of environmental innovation on the emergence of CSR practices within Algerian ecological startups.

Results

Presentation of interviewed startups:

Our surveyed population consists of ten Algerian environmental startups active in recycling, eco-construction, renewable energies, environmental protection, and water resource preservation. The table below highlights the fields of activity and main innovations of the interviewed startups, as well as the profiles of the founders. The companies are numbered from 1 to 10 to preserve the anonymity requested by the startup founders (Table 1).

Presentation of survey results:

Background and motivations of founders: The founders of the studied startups have diverse academic and professional backgrounds, which influence their motivations and approaches to ecological innovation. For Startup 8, the family team members are trained in architecture, agronomy, and mechanical engineering, with international experience. Their studies abroad allowed them to acquire the knowledge they wished to apply in Algeria. *"We all have higher education, and some of us studied abroad before returning to Algeria to apply our knowledge"*, explains one of the founders. Their primary motivation is to provide solutions to farmers to reduce post-harvest losses and improve food security in rural areas. Regarding waste valorisation, most of the interviewed startups were created by entrepreneurs passionate about nature and recycling who voluntarily participated in environmental protection cleanup campaigns from a young age. For example, Startup 1 was founded by an entrepreneur passionate about the circular economy.

With a solid background in social entrepreneurship and professional experience in various sectors, the founder of this startup aims to structure and organize the plastic waste recycling value chain. *"The goal is to improve the circularity of plastic waste by structuring and organizing the recycling value chain"*, he specifies.

Table 1. Presentation of interviewed startups

Startup	Field of activity	Key of innovation	Founder's education	Gender	Location
1	Recycling	Digital solutions in circular economy connecting chain actors to a sustainable ecosystem based on the circular economy	Master in Social Entrepreneurship	Male	Wilaya of Blida
2	Recycling	Recycling and valorization of plastic waste	PhD candidate in management	Male	Wilaya of Oran
3	Recycling	Platform designed to facilitate community participation in cleaning campaigns and waste management	PhD in management	Female	Wilaya of Tlemcen
4	Recycling	Recycling dairy factory waste or date waste to provide raw materials to certain sectors	PhD in pharmacy	Male	Wilaya of Algiers
5	Eco-construction	Production of ecological tiles and vertical gardens using crop residues	PhD in agricultural sciences	Female	Wilaya of Biskra
6	Eco-construction	Production of bricks from textile waste	PhD in electrochemistry	Female	Wilaya of Oran
7	Environmental protection	Forest fire detection and monitoring system using artificial intelligence	PhD in technological sciences	Male	Wilaya of Algiers
8	Renewable Energy	Revolutionising refrigeration systems and making them sustainable with solar energy	1 Architect, 1 PhD in agronomy, 1 mechanical engineer	1 female, 2 males	Wilaya of Oran
9	Renewable Energy	Using organic waste as a renewable energy source	PhD in Waste Management	Female	Wilaya of Algiers
10	Water Resource Conservation	Smart faucet to reduce domestic consumption	Hydraulic Engineer	Male	Wilaya of Algiers

Source: Created by the authors

For Startup 2, the founder, a PhD student in management, has varied experience in several industries, including food, agriculture, and waste management. His motivation is to create economic value from polluting waste while improving the living conditions of informal collectors. *“Our business model is sustainable and inclusive, integrating multiple partners to create economic value from polluting waste”*, he explains.

The results for startups operating in renewable energies and natural resource preservation reveal that despite their diverse profiles, their vision aligns with a logic of sustainability. According to the founder of Startup 8, *“There is a mix between ecology and sustainability, and when we talk about it, there is confusion”*.

Concerning startups active in the eco-construction sector, their primary motivation is to promote the construction sector in Algeria while using materials that are either recycled or initially intended for destruction. Startup 5 was founded by an entrepreneur who wishes to promote urban agriculture and eco-construction using local materials. She wants to valorise agricultural waste and promote sustainable urban gardening by creating vertical gardens made from date palm fibre. *“We want to promote sustainable urban gardening practices to improve urban quality of life”*, she emphasises.

Ecological innovations and their environmental and social Impact:

The data collected reveals how the interviewed ecological startups significantly contribute to environmental preservation through targeted innovations, such as the invention of a smart faucet to reduce domestic consumption or the creation of a forest fire detection and monitoring system using artificial intelligence (startups 7 and 10).

For startups active in the recycling and waste management sector, the interviews indicate a marked trend towards adopting technologies that encourage increased participation in recycling. For example, Startup 1 developed a recycling platform that connects actors in the recycling chain and rewards citizens for participating in selective sorting. This initiative improves recycling practices, reduces plastic pollution, and creates jobs in the recycling sector. *“Our platform encourages*

selective sorting and raises awareness about recycling issues”, highlights the founder. Another startup in the same sector stands out by designing ergonomic recycling bins and implementing an optimized logistics platform. This innovation integrates informal collectors into the official waste management circuit, thus improving their living conditions and valorising plastic waste. *“We have successfully integrated informal collectors and improved their living conditions”*, states the founder.

Regarding innovations using ecological construction materials, discussions with sector actors have highlighted the innovative use of underutilized resources (textile waste, agricultural residues). The founder of Startup 5 explained that *“the use of agricultural waste transformed into construction materials not only reduces pollution but also supports the circular economy”*. These comments underline the importance of innovation in promoting environmentally friendly construction practices. This startup uses date palm fibres to create vertical gardens, thus reducing pollution and valorising agricultural waste. This innovation promotes urban agriculture and improves the quality of urban life. *“Our innovation valorises agricultural waste and improves urban quality of life”*, explains the founder.

Startups active in the renewable energy sector innovate by finding ecological alternatives to fossil fuels, such as using organic waste or solar energy as renewable energy sources. Startup 9's biodigesters allow individuals in isolated areas and farmers to produce their own less polluting and cheaper biogas from their waste, thus providing electrification solutions for isolated areas in Algeria.

Startup 8 developed a refrigeration system powered by solar energy, addressing the storage and transport problems of agricultural products in rural areas. This innovation helps reduce food losses, support farmers, promote the use of green energy, and open up rural areas. *“Our innovation reduces food losses and supports farmers in rural areas”*, explains one of the founders.

CSR perceived by founders:

The perception of CSR among the different interviewed startups reveals a diversity of understandings and approaches regarding this concept. For Startup 5, CSR is approached from a practical and operational perspective. The founder recognizes the importance of CSR practices such as respecting workers' rights, gender parity, and commitment to the United Nations' sustainable development goals. However, they seem to have a limited understanding of the concept itself. Despite this, they acknowledge the importance of meeting these criteria to obtain funding and gain legitimacy. For Startup 8, CSR is more integrated into their entrepreneurial DNA. They consider CSR not a mere obligation or separate approach but an intrinsic component of their project since its inception. They emphasize that their project considers economic, environmental, and social dimensions from the outset. The majority of startups approach CSR from the perspective of social impact. The founders emphasize their commitment to their partners, customers, and suppliers, ensuring that their activities have a positive social impact. They consider the social aspect a priority. Finally, for Startup 2, CSR is envisioned through a more concrete approach focused on specific actions aimed at improving the living conditions of waste collectors. Their CSR approach centres on creating economic value from polluting waste while contributing to the social well-being of collectors. *“We have successfully integrated informal collectors and improved their living conditions, demonstrating our commitment to a circular and socially responsible economy”*, affirms the founder.

Opportunities and Constraints:

According to the survey results, startups engaged in ecological initiatives often receive significant recognition on the international stage. As shared by the founder of Startup 5, international competitions and events secure substantial funding and win prestigious awards that can transform an idea into an operational business. *“Participation in competitions such as the 'Green Product Awards' in Germany is exemplary, where innovative projects are validated and supported by an international community”*, she asserts.

Building networks and establishing strategic partnerships with renowned entities through networking events are also crucial, highlights another startup founder. The founder of Startup 5

explained how such interactions led to collaborations with international organizations. *“These partnerships not only validate the innovation but also open pathways for commercial development and the application of sustainable solutions in various contexts”*. According to most interviewed startups, government support is also a key catalyst for integrating circular economy practices into nascent companies. The founder of Startup 8 highlighted the impact of this support: *“Being coached by the Ministry of Environment integrated circular economy aspects into our process”*. These ten entrepreneurs also claim to have benefited from tax advantages that alleviate financial burdens, thus supporting the growth and sustainability of these initiatives. As the founder of Startup 8 shared, *“Being recognized by a label is perceived as a mark of seriousness that facilitates access to significant resources and enriching experiences”*.

Regarding the challenges the interviewed startups face, they need more support, particularly in financing, regulation, and a sparsely spread ecological culture. *“We had to convince the authorities to obtain the innovation label, which was not easy”*, explains the founder of Startup 8. The lack of appropriate funding for the nature of the innovation also represents a significant challenge, as most startups state that state funding still needs to be increased and only sometimes matches the amount required to realize the innovation. Furthermore, investors are only sometimes willing to commit to financing innovations whose return on investment is only evident in the medium or long term.

The main challenge for recycling startups is integrating informal collectors into the official waste management circuit, as regulations need an insertion mechanism to integrate them officially into the recycling process.

Startups involved in eco-construction report overcoming challenges related to recognizing ecological materials and a lack of financial support. *“We had to overcome many challenges to get our ecological materials recognized”*, says the founder of Startup 5. This same startup in southern Algeria raised issues related to limited infrastructure, resource inaccessibility, and geographical isolation, which hindered its ability to develop and operate effectively. In addition, the region's conservative nature constituted a form of social resistance at the beginning of the project.

The absence of specific regulations for ecological startups also constrains these types of businesses, which have a distinct professional aspect from ordinary startups.

Discussion

The backgrounds and motivations of the founders of ecological startups reveal a richness of skills and experiences that directly contribute to their ability to innovate. The diversity of training fields and local and international experiences create fertile ground for innovation. Their socially responsible behaviour, stemming from their participation in cleanup campaigns or observation of sustainable development practices abroad, transforms personal ecological challenges into entrepreneurial initiatives. This alchemy between diversified skills and deep motivations fosters a holistic and engaged approach, essential for overcoming traditional barriers to innovation in sectors sometimes resistant to change, enabling the piloting of projects that innovate not only technologically but also socially and managerially by aligning their companies with the United Nations' sustainable development goals. Their ability to win international awards and attract funding highlights the effectiveness of their interdisciplinary and international approach.

The innovations developed by these startups do not stop at introducing new technologies; they redefine interactions between the community, environment, and economy. For example, adopting reward systems granted to households practising selective sorting transforms waste management practices and strengthens community engagement in sustainable development. Using agricultural waste materials for construction perfectly illustrates how these companies turn environmental problems into economic opportunities while reducing ecological impact. These practices successfully integrate ecological innovation into daily business operations, proving that sustainability efforts can coexist with business longevity. We also observe a direct impact of these innovations on societal well-being, such as opening up rural areas and improving living conditions for specific social categories, particularly rural inhabitants and farmers, through the use of renewable energies (innovations proposed by startups 8 and 9) and invaluable social inclusion

effects, such as integrating some informal collectors into the production process by granting them salaries and social coverage.

Startup 5, located in a Saharan area, has had a considerable impact on women in this region. It has encouraged local female entrepreneurship and noticed a change in the community's mindset.

The innovations introduced by the interviewed startups have had significant direct and indirect impacts on society. The founders adopted a positive attitude and were intrinsically predisposed to socially responsible behaviour. This disposition stems from the influence of other international business models, their academic training, or their character traits despite varying perceptions of CSR. Furthermore, the conditions imposed by international funding bodies stipulate that startups must align with sustainable development goals (SDGs) to qualify for funding and international coaching. Our analysis reveals a notable concordance between the ecological goals of startups and their social impact.

In recent years, startups in Algeria have benefited from increased attention from public authorities, marking a significant evolution in the country's entrepreneurial ecosystem by implementing support programs within incubators and accelerators. Interviews conducted with various sector actors confirm this trend, highlighting the importance of initiatives implemented to support innovation and entrepreneurship at the national level, offering young project leaders, whether students or not, a favourable framework to achieve their goals.

These initiatives aim to strengthen the entrepreneurial skills of project leaders and increase their chances of long-term success.

Conclusion

This study explored the impact of ecological innovations on the emergence of CSR practices within Algerian environmental startups. The results demonstrate that these innovations play a decisive role in companies' social and environmental transformation, making them more sustainable and socially engaged. With their diverse academic and professional backgrounds and local and international experiences, the founders of the studied startups adopt socially responsible behaviours and integrate CSR practices into their business models.

However, challenges remain numerous. Regulatory obstacles, limited access to financial resources, and infrastructure constraints, particularly in rural areas, pose significant barriers to startup growth. Additionally, social and cultural barriers, especially for women entrepreneurs, require innovative and inclusive approaches to be overcome.

Strengthening institutional support is essential to encouraging and supporting ecological startups in Algeria. Public authorities should intensify their assistance by simplifying administrative procedures and increasing tax incentives for startups engaged in ecological innovation. Additionally, developing financing mechanisms tailored to the specific needs of ecological startups, such as dedicated investment funds and grants for environmental impact projects, is crucial. Improving basic infrastructure, particularly in rural areas, is also necessary to facilitate the expansion and competitiveness of these startups.

Furthermore, implementing training and mentoring programs focused on sustainable management and ecological innovation to enhance entrepreneurs' skills is recommended. Promoting equal opportunities is also fundamental; specific initiatives to support women entrepreneurs, such as dedicated mentorship programs and support networks, should be developed. Finally, increasing awareness campaigns and educational programs on the benefits of ecological innovation and CSR practices is crucial to fostering a responsible entrepreneurial culture.

Several research perspectives can be considered to deepen the understanding of the dynamics between ecological innovation and CSR. It would be beneficial to conduct longitudinal studies to observe the evolution of CSR practices and the environmental performance of startups over several years.

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**TEACHERS' ATTITUDES TOWARD HUMAN RESOURCE
MANAGEMENT PRACTICES IN COLLEGES OF BANGLADESH:
A COMPARATIVE STUDY***Received 15 September 2024; accepted 27 September 2024; published 21 October 2024*

Abstract. *Human Resource Management (HRM) is a crucial function for any organization, with its success largely dependent on the effective management of human resources. This is particularly important for educational institutions, especially at the tertiary level, where future leaders are cultivated. If teachers in academic institutions are not managed effectively, they may not fully commit their efforts to developing future leaders. This study aims to compare teachers' attitudes toward current HRM practices at tertiary colleges, focusing on both government and non-government institutions in the Narsingdi district of Bangladesh. The study employed both primary and secondary data sources. Primary data were collected using a close-ended questionnaire, while secondary data were obtained from published sources. The reliability and validity of the data were assessed, with Cronbach's Alpha value of 0.75 and Pearson's correlation coefficient of 0.312 being considered acceptable for the factors analysed. Out of 17 factors, 15 were used for data collection. The study's population included 723 tutors, from which primary data were gathered from 114 tutors using the Yamane (1973) formula. Respondents were selected purposively for primary data collection. Descriptive statistical tools, such as mean and standard deviation, were employed to analyse the responses using SPSS Version 23. The comparison of responses from government and non-government college tutors revealed only minor differences in HRM practices, with significant variations observed in salary, job security, and social status — key components influencing job satisfaction.*

Keywords: *tertiary education, teachers' attitudes, HRM practices, job satisfaction.*

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Introduction

Human resources (HR) are the most valuable asset for any organization. With the evolving landscape of the workplace — particularly in terms of technology, organization, and competition — colleges face ongoing challenges in recruiting and retaining qualified tutors. According to Collings et al. (2018), educational human resource management (EHRM) is becoming increasingly crucial in the 21st-century knowledge-based economy, where people are considered essential for gaining a competitive edge.

Over the past two decades, Bangladesh has implemented several education development plans aimed at addressing local challenges and driving long-term improvements in the education sector. For instance, the Government's sixth development plan introduced several changes to the

curriculum structure to ensure growth and expansion in various sectors. This growth strategy has enabled the country to make significant strides in developing a globally competitive, resource-based education system (Madsen, 2004).

Tertiary education in Bangladesh has seen significant growth over the decades, both in terms of enrolment and the expansion of universities. However, investment in the sector has not kept pace, with current funding amounting to less than 0.2% of GDP (Chowdhury et al., 2020). Consequently, Bangladeshi universities have not achieved notable rankings in the Times Higher Education rankings. The existing practices in tertiary education are failing to produce skilled professionals, resulting in lower economic returns (Ehsan, 2021). Despite quantitative advancements in higher education, questions remain about its quality. It is crucial to invest in developing high-quality teachers by ensuring fair selection processes, providing effective training and development opportunities, and offering adequate motivation. This investment is essential for fostering a skilled future workforce and enhancing the nation's human resources.

Research Question

This study investigates the following questions:

- i. Are there any gaps between the training and development opportunities available to government and non-government college teachers?
- ii. Are there differences in the responses of college teachers regarding their motivation?
- iii. Are there differences in the responses of college teachers concerning their job satisfaction?

Objectives of the Study

The primary objective of this study is to compare HRM practices at the tertiary education level in colleges within the Narsingdi district of Bangladesh. Additionally, the study aims to address several specific objectives:

- To compare current practices related to training and development opportunities between government and non-government colleges at the tertiary level.
- To compare teachers' responses regarding motivational practices at the tertiary education level between government and non-government colleges.
- To analyse differences in job satisfaction among teachers at the tertiary education level.

Hypothesis of the Study

The study is based on the following hypotheses:

H0: There is no difference between the responses of government and non-government college teachers regarding training and development opportunities.

H1: There is no difference between the responses of government and non-government college teachers regarding motivation.

H2: There is no difference between the responses of government and non-government college teachers regarding job satisfaction.

Literature Review

Human Resource Management (HRM)

Human Resources (HR) are among the most strategic assets of any organization, crucial for the effective utilization of other resources such as technology, information, finance, and infrastructure. HR should be managed strategically, taking into account individual differences, personality, gender, experience, and education (Javed et al., 2019). In modern organizations, the Human Resource Management (HRM) department is primarily responsible for the optimal use of HR. According to DeCenzo and Robbins (2016), the functions of HRM encompass staffing, development, motivation, and maintenance of HR to achieve organizational goals. Effective execution of these functions, as outlined by DeCenzo and Robbins, allows individuals to fully commit to achieving organizational objectives. Organizations must be mindful of and proficient in executing HRM functions to gain a competitive advantage. Research on HRM practices in the education sector in Bangladesh has not received as much attention compared to other sectors

(Hossain & Rahman, 2019). Mia and Akter (2020) found that HRM practices at National University were inadequate, with academic staff expressing greater satisfaction than faculty regarding HRM execution. Given that teachers play a vital role in national development, academic institutions should place a strong emphasis on staffing, training, compensation, performance management, and job satisfaction.

Human Resources Development (HRD)

The HRD process begins with recruitment and selection. Recruitment involves identifying potential employees and attracting them to apply for open positions, while selection focuses on choosing the best candidate from a pool of applicants for a specific role (Dessler, 2021). Once candidates are selected, they need to be developed through appropriate training. Training is a planned effort by an organization to enhance employees' organizational competencies, knowledge, skills, and attitudes (KSA) through structured programs. In contrast, development encompasses formal education, experiences, relationships, skills, personality traits, and abilities that prepare employees for future challenges (Noe, 2023). It is crucial to equip educators with the necessary skills and competencies to address societal changes and effectively prepare learners to be skilled and productive. Learners need a diverse set of skills, including information and communication technology (ICT), entrepreneurship, problem-solving, communication, teamwork, adaptability, creativity, analytical skills, soft skills, and emotional intelligence, to meet the demands of the 21st-century workplace (Tushar & Sooraksa, 2023). Unfortunately, due to outdated education systems, Bangladeshi graduates often lack the employability skills needed to meet global workplace challenges (Milon et al., 2021).

Tutors, as developers of human resources, require comprehensive training and development programs to effectively prepare learners with the skills needed for the workforce. Training is particularly important for enhancing the knowledge, skills, and attitudes (KSA) of teachers, enabling them to focus on the competencies required in the 21st-century workplace. Well-designed training programs can foster highly motivated, productive, creative, and up-to-date educators. In line with this goal, the National University is providing technology-based training for tutors at its affiliated colleges to enhance their skills (Mia, 2017a). Additionally, in 2016, the Government of the People's Republic of Bangladesh launched the College Education Development Project (CEDP) to train tutors at the tertiary level, including those under the National University and Open University. This project includes training on subject-specific issues, pedagogy, ICT, mental health, and more (CEDP, 2017). Furthermore, the National Academy for Educational Management, established in 1959, continuously organizes training programs to develop tutors as human resources for tertiary colleges (NAEM, 1959).

Motivation

Motivation plays a crucial role in driving employees to exhibit the desired behaviour. According to Griffin (2016), motivation encompasses the set of forces — both financial and non-financial — that influence how individuals act. To steer employees toward achieving organizational goals, leaders should implement diverse motivational strategies. Effective performance appraisals can be a key motivational tool. Aguinis (2009) describes performance appraisal as an ongoing process designed to identify, measure, and enhance individual performance in alignment with the organization's strategic objectives. This process includes formative aspects, which focus on professional development, career growth, and feedback, and summative aspects, which evaluate performance for decisions related to promotions, demotions, terminations, and transfers. Similarly, Absar et al. (2010) emphasize that performance appraisals are vital for identifying employee strengths and weaknesses, which in turn informs key motivational decisions such as promotions, bonuses, transfers, training needs, and rewards. Additionally, effective reward systems are instrumental in motivating employees toward organizational success. Wayne and Casper (2012) highlights that adequate rewards — such as pay, promotions, fringe benefits, and status — are crucial for achieving educational goals. Rokeman et al. (2023) support this view, finding that rewards and recognition significantly boost tutors' job satisfaction by providing motivation.

Workplace Relation

Workplace relationships significantly impact both physical and mental health, which in turn influences overall job satisfaction. Despite this, many organizational administrators often overlook this critical factor. Research by Raziq and Maulabakhsh (2015) found a positive relationship between the working environment and employee job satisfaction. This finding is supported by Taheri et al. (2020), who emphasized that working relationships are fundamental to employee satisfaction and organizational effectiveness. In contrast, Harmer and Findlay (1997) reported that the impact of relationships with co-workers and immediate supervisors on individual well-being was not significant. Similarly, Rahman and Taniya (2017) found that Human Resources Practices, Shared Goals/Values, and Leadership Styles had a more substantial effect on employee performance than Communication and Trust with co-workers. Nevertheless, maintaining sound workplace relationships remains crucial for job satisfaction. Furthermore, organizational factors also play a role in shaping workplace relationships. Kumari (2011) identified key factors contributing to job satisfaction through factor analysis, including Teamwork, Commitment, Culture, Communication, and Training. Additionally, factors such as Delegation, Job Design, Opportunities, Rewards, and Leadership were found to be critical in fostering effective workplace relationships. These findings suggest that cultivating positive workplace relationships is essential for job satisfaction and organizational success, influenced by various factors that can enhance overall performance.

Job Satisfaction

The retention of a talented workforce heavily relies on job satisfaction, which can also contribute to gaining a competitive advantage. According to Robbins and Judge (2019), job satisfaction is the positive feeling derived from evaluating one's job characteristics. When employees' expectations are met through this evaluation, they tend to be satisfied with their jobs. However, this satisfaction can vary across organizations, individuals, and even between genders. Mia (2017b) demonstrated that employees are generally satisfied with aspects such as job security, working conditions, logistical support, financial benefits, fair promotion policies, and recognition of exceptional performance. Additionally, Baluyos et al. (2019) identified job satisfaction as a prerequisite for excellent teaching performance. Their study highlighted that effective supervision and job security are critical factors influencing teachers' performance.

Teachers working at the tertiary education level in various colleges often experience job dissatisfaction due to a range of factors. Pronay (2011) found that college tutors are dissatisfied with their jobs primarily because of the lack of a smooth and fair promotion system. This dissatisfaction contributes to higher job turnover among teachers. Rahman and Chowdhury (2012) identified several factors leading to tutor turnover in the private university sector, including inadequate job security, limited promotional opportunities, insufficient professional development, lack of autonomy, subpar working conditions, and unsatisfactory compensation packages. To ensure workforce stability, organizations must address these issues to improve tutor job satisfaction. Additionally, Ali and Akhter (2009) noted that a shortage of logistical support and excessive course loads negatively impact teachers' job satisfaction. These factors affect both male and female tutors equally, as they face similar challenges in these areas. Conversely, teachers in government education institutes tend to report higher job satisfaction compared to their counterparts in private institutions. Hossen (2018) observed that private education institute tutors face poorer job security than those in government institutes. Furthermore, non-government college tutors experience higher levels of job stress compared to government college tutors (Dey et al., 2013).

Literature Gap

The literature review highlights several research gaps. Javed et al. (2019) argued for an assessment of HRM practices across various attributes, with their study focusing specifically on comparing government and non-government college teachers. In contrast, Hossain and Rahman (2019) and Mia and Akter (2020) noted that HRM practices in educational institutions have received limited attention. Additionally, Milon et al. (2021) emphasized that improving graduates' employability necessitates skilled teachers, which can be achieved through effective training and

development programs. Wayne et al. (2012) found that job-seeking intentions are influenced by perceptions of an organization's status, expected support, and anticipated performance in a given role. The reputation of a company positively affects college students' desire to work there, particularly in terms of remuneration, work-life balance, and diversity initiatives. Furthermore, Baluyos et al. (2019) asserted that job satisfaction is crucial for effective teaching performance, while Pronay (2011), Rahman and Chowdhury (2012), and Ali and Akhter (2009) identified various factors leading to teacher dissatisfaction. This study addresses these issues comprehensively.

Methods

The quantitative research approach was used to compare HRM practices at the college level within tertiary education in the Narsingdi district. This study specifically examined various government and non-government colleges affiliated with NU in the district. The research considered a total of 723 teachers working across these colleges as the study population including 423 lecturers, 252 assistant professors, 37 associate professors and 11 professors. On the other hand, there are 23 colleges in the district, comprising 7 government and 16 non-government institutions, which constitute the institutional population for this study. The sample size was determined using the formula provided by Yamane (1973). The calculations for the sample size are detailed below.

$$n = \frac{z^2 * p * q * N}{e^2 (N - 1) + z^2 * p * q} = \frac{1.96^2 * 0.5 * 0.5 * 723}{0.1^2 (723 - 1) + 1.96^2 * 0.5 * 0.5} = \frac{694.36}{6.91} = 100 \quad (1)$$

Where,

N= Population=723

z= z table value =1.96

p= Probability of success= 50% or 0.5

q= Probability of failure= 50% or 0.5

e= degree of error= 10% or 0.10

n=sample?

Both primary and secondary data were utilized for this study. Primary data were collected from the target population using a close-ended questionnaire designed with a 5-point Likert scale. Respondents were given five options to express their views: Strongly Agree (SA), Agree (A), Neutral (N), Disagree (D), and Strongly Disagree (SD). Additionally, secondary data were sourced from various books, articles, newspapers, and online resources. Data processing was conducted using Statistical Package for the Social Sciences (SPSS) version 23. Statistical tools such as mean and standard deviation were employed to analyse the primary data. A 90% confidence level was applied, with a 10% margin of error. A one-sample t-test was used to compare the responses, with a test level set at 3.00.

Limitations of the Study

Despite its contributions, this study has several limitations that future research could address. Firstly, the study focuses exclusively on NU-affiliated colleges in the Narsingdi district, which limits its scope since NU-affiliated colleges are spread across the entire country. Consequently, the findings may not fully represent the national scenario. Additionally, the sample size for primary data collection was insufficient, with an error margin of 10%, which may affect the reliability of the comparisons. Ideally, reducing the error margin to 5% would provide more accurate results. Furthermore, the study did not consider gender differences, which can influence expectations and responses. A separate analysis of male and female participants could provide more nuanced insights. Despite these limitations, the research findings are expected to offer valuable contributions towards improving HRM practices at the tertiary education level.

Analysis of the Data

A reliability test was conducted on the responses from 40 samples. Typically, a Cronbach's Alpha value closer to 1 is regarded as excellent. The Table 1 shows that the Cronbach's Alpha value is 0.75, which is considered good and indicates reliable overall data. However, Cronbach's Alpha is above 0.70 for all constructs except for construct 4.

Table 1. Reliability Test

Sl. No.	Construct	Cronbach's Alpha	Items
1	Teachers' opinion about training and development	0.83	5
2	Teachers' opinion about motivation	0.75	6
3	Teachers' opinion about workplace relationship	0.31	5
4	Teachers' job satisfaction	0.74	5
Overall		0.75	21

The Pearson correlation coefficient was utilized to assess the validity of the questions. The Table 2 indicates that the significance level for all factors is below 0.05, demonstrating strong validity for the questions. According to the Pearson correlation coefficient table, the critical value is 0.312 with 38 degrees of freedom (n-2). The Table 2 also shows that the observed values exceed the critical value for all items except factors 14, 15, and 21. Consequently, these factors have been removed from the dataset.

Table 2. Validity Test

Factors	Test	Output	n	
1	Pearson Correlation	.446**	40	Significant
	Sig. (2-tailed)	0		
2	Pearson Correlation	.696**		Highly
	Sig. (2-tailed)	0		Significant
3	Pearson Correlation	.718**		Highly
	Sig. (2-tailed)	0		Significant
4	Pearson Correlation	.810**		Highly
	Sig. (2-tailed)	0		Significant
5	Pearson Correlation	.753**		Highly
	Sig. (2-tailed)	0		Significant
6	Pearson Correlation	.482**		Significant
	Sig. (2-tailed)	0		
7	Pearson Correlation	.608**		Highly
	Sig. (2-tailed)	0		Significant
8	Pearson Correlation	.585**		Significant
	Sig. (2-tailed)	0		
9	Pearson Correlation	.725**		Highly
	Sig. (2-tailed)	0		Significant
10	Pearson Correlation	.795**		Highly
	Sig. (2-tailed)	0		Significant
11	Pearson Correlation	.491**		Significant
	Sig. (2-tailed)	0		
12	Pearson Correlation	.507**		Significant
	Sig. (2-tailed)	0		
13	Pearson Correlation	.357*		Significant
	Sig. (2-tailed)	0.02		
14	Pearson Correlation	0.28		Insignificant
	Sig. (2-tailed)	0.08		
15	Pearson Correlation	0		Highly
	Sig. (2-tailed)	0.98		Insignificant

16	Pearson Correlation	.734**	Highly
	Sig. (2-tailed)	0	Significant
17	Pearson Correlation	.729**	Highly
	Sig. (2-tailed)	0	Significant
18	Pearson Correlation	.689**	Highly
	Sig. (2-tailed)	0	Significant
19	Pearson Correlation	.736**	Highly
	Sig. (2-tailed)	0	Significant
20	Pearson Correlation	.768**	Highly Significant
	Sig. (2-tailed)	0	
21	Pearson Correlation	0.23	Insignificant
	Sig. (2-tailed)	0.16	
Total	Pearson Correlation	1	
	Sig. (2-tailed)		

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Results

Data Analysis

Below is a brief overview of the primary data analysis:

Table 3. Descriptive Statistics on the responses of training and development opportunity

Sl. No.	Factors	Mean	SD	t	p-value
1.	Training facility	2.35	0.7	-9.84	0
2.	Higher education facility	2.3	0.61	-12.31	0
3.	Linking training and education with promotion	2.32	0.66	-10.95	0
4.	Investment on skill development	3.11	0.74	1.65	0.1
5.	Learning environment	2.27	0.73	-10.61	0
	Overall	2.47	0.5	-11.3	0

The Table 3 presents teachers' responses regarding training and development opportunities at the tertiary education level. It reveals that the mean value for all factors, except for factor four, is below the test value of 3.00, with an overall mean of 2.47. The p-value is 0.00, indicating strong evidence to support accepting the hypothesis.

Table 4. Comparison of Teachers' response about teachers about Training and development opportunity

Sl. No.	Factors	Government College		Non-Government College	
		Mean	SD	Mean	SD
1.	Training Facility	2.4	0.55	2.32	0.77
2.	Higher Education Facility	2	0.23	2.45	0.68
3.	Linking Training with promotion	2	0.23	2.5	0.74
4.	Investment on skill development	3	0.39	3.17	0.86
5.	Learning Environment	1.97	0.35	2.43	0.82

The Table 4 compares the responses of government and non-government college teachers regarding training and development opportunities. It shows that the mean value for each response is below 3, except for factor 4. Notably, the responses from both groups of teachers are nearly identical.

Table 5. Independent Samples Test

Factors		Levene's Test		t-test	
		<i>F</i>	<i>p-value</i>	<i>t</i>	<i>p-value</i>
Training Facility	*	3.73	0.05	0.54	0.58
	**			0.6	0.54
Higher Education Facility	*	100.11	0	-4.1	0
	**			-5.25	0
Linking Training with promotion	*	92.51	0	-4.13	0
	**			-5.33	0
Investment on skill development	*	29.2	0	-1.21	0.22
	**			-1.48	0.14
Learning Environment	*	45.85	0	-3.32	0
	**			-4.09	0

*Equal variances assumed, **Equal variances not assumed

The Table 5 presents the results of Levene's test for equal variances between the groups. Levene's test indicates a p-value of less than 0.05 for each case, suggesting that the variances are equal. Additionally, the t-test reveals a p-value of less than 0.05 for factors 2, 3, and 5, which implies that there is no significant difference between the responses of teachers from both groups for these factors.

Table 6. Descriptive Statistics on the responses of teachers about motivation

Sl. No.	Factors	Mean	SD	t	p-value
1.	Timely Promotion	2.61	0.73	-5.6	0
2.	Motivational opportunity	2.57	0.81	-5.48	0
3.	Job security	1.81	0.82	-15.3	0
4.	Financial support	2.57	0.87	-5.26	0
5.	Recognition of unique efforts	2.24	0.67	-11.97	0
6.	Sound relation with management	2.07	0.56	-17.72	0
	Overall	2.31	0.51	-14.26	0

The Table 6 reflects teachers' responses regarding the construct of motivation at the tertiary education level. It shows that the mean value for every case is below the test value of 3.00, with an overall mean of 2.31. The p-value is 0.00, indicating strong evidence to support accepting the hypothesis.

Table 7. Comparison of teachers' response about teachers regarding motivation

Sl. No.	Factors	Government College		Non-Government College	
		<i>Mean</i>	<i>SD</i>	<i>Mean</i>	<i>SD</i>
1.	Timely Promotion	2.7	0.46	2.56	0.84
2.	Motivational opportunity	2.15	0.42	2.81	0.88
3.	Job Security	1.27	0.45	2.1	0.83
4.	Financial Support	2.17	0.38	2.78	0.98
5.	Recognition of unique efforts	2	0.22	2.37	0.78
6.	Sound relation with management	1.92	0.26	2.14	0.65
	Overall	2.03	0.19	2.46	0.56

The Table 7 compares the responses of government and non-government college teachers regarding motivation. It shows that the mean value for each response is below 3 for both groups. Notably, the responses from both groups are nearly identical. However, the responses indicate worse outcomes in terms of recognition and job security for non-government college teachers compared to their government counterparts.

Table 8. Independent Samples Test

Factors		Levene's Test		t-test	
		F	p-value	t	p-value
Timely promotion	*	14.66	0	0.91	0.36
	**			1.08	0.28
Motivational opportunity	*	11.06	0	-4.43	0
	**			-5.36	0
Job security	*	2.21	0.13	-5.84	0
	**			-6.9	0
Financial Support	*	38.91	0	-3.75	0
	**			-4.7	0
Recognition of unique efforts	*	71.52	0	-2.96	0
	**			-3.84	0
Recognition of unique efforts	*	18.41	0	-4.63	0
	**			-5.9	0

**Equal variances assumed, **Equal variances not assumed*

The Table 8 displays the results of Levene's Test for equal variances between the groups. The p-value is less than 0.05 for every factor except for factor 3, indicating that equal variances are present for all factors except this one. The t-test results show a p-value of less than 0.05 for all factors except factor 1. Therefore, it can be concluded that there is no significant difference between the responses of teachers from both groups for these factors, with the exception of factor 1.

Table 9. Descriptive Statistics on the responses of teachers about job satisfaction

Sl. No.	Factors	Mean	SD	t	p-value
1.	Happiness with profession	1.85	0.73	-16.47	0
2.	Dignity in society from job	2.44	0.71	-8.22	0
3.	Balance between work and life	2.57	0.9	-4.98	0
4.	Feelings about work organization	1.66	0.67	-21.12	0
	Overall	2.13	0.57	-15.86	0

The Table 9 reflects teachers' responses regarding job satisfaction at the tertiary education level. It shows that the mean value for every case is below the test value of 3.00, with an overall mean of 2.13. The p-value is 0.00, indicating strong evidence to support accepting the hypothesis.

Table 10. Comparison of Teachers' response about teachers regarding job satisfaction

Sl. No.	Factors	Government College		Non-Government College	
		Mean	SD	Mean	SD
1.	Happiness with profession	1.4	0.54	2.1	0.71
2.	Dignity in society from job	2.05	0.38	2.66	0.76
3.	Balance between work and life	2.17	0.44	2.79	1
4.	Feelings about work organization	1.32	0.47	1.85	0.69
	Overall	1.73	0.32	2.35	0.57

The Table 10 compares the responses of government and non-government college teachers regarding job satisfaction. It shows that the mean value for every response is below 3 for both groups. Interestingly, the responses from both groups are almost identical.

Table 11. Independent Samples Test

Factors		Levene's Test		t-test	
		F	p-value	t	p-value
Happiness with profession	*	0.02	0.88	-5.47	0
	**			-5.91	0
Dignity in society from job	*	26.33	0	-4.74	0
	**			-5.66	0
Balance between work and life	*	20.2	0	-3.71	0
	**			-4.55	0
Feelings about work organization	*	1.52	0.22	-4.27	0
	**			-4.77	0
Overall	*	11.27	0	-6.27	0
	**			-7.33	0

**Equal variances assumed, **Equal variances not assumed*

The Table 11 presents the results of Levene's test for equal variances between the groups. Levene's test indicates that the p-value is less than 0.05 for factors 2 and 3, suggesting equal variances for these factors but not for the remaining factors. The t-test results show a p-value of less than 0.05 for all cases. Therefore, it can be concluded that there is no significant difference between the responses of teachers from both groups for these factors, with the exception of factor 1.

Conclusion

This study was conducted to evaluate HRM practices in tertiary education at the college level, specifically within institutions affiliated with NU. It primarily compares the responses of government and non-government college teachers in the Narsingdi district. The study reveals that responses from college teachers are quite similar, highlighting several challenges related to HRM practices. During data collection, it was observed that most colleges lack dedicated HR departments. Regular training is essential to enhance teachers' capabilities, yet such opportunities are limited at the college level, particularly for non-government college teachers. Many teachers encounter issues related to inadequate salaries and financial benefits, which affect their engagement with the institution. Additionally, the incentive and reward systems are not effectively implemented to motivate private college teachers compared to their government counterparts. Furthermore, most colleges have yet to adopt strategic human resource planning and evaluation systems. These challenges suggest that both government and non-government colleges are struggling with effective HR management. Nevertheless, the study's findings could offer valuable insights for improving HR practices at the college level. It is crucial for the relevant authorities to take these findings into account. Although it was assumed that HR practices in government colleges would be superior to those in non-government colleges, the study indicates a similar pattern of responses across both types of institutions. This similarity is a significant factor contributing to the overall poor quality of the education system.

Recommendations

Based on the study's findings, the following recommendations are proposed to enhance HRM practices at colleges in the tertiary level of education of Bangladesh:

1. **Training and Advanced Education:** College authorities should arrange regular training and advanced education opportunities for teachers. The outcomes of these initiatives should be considered when making decisions about promotions and other benefits. NU should emphasize these professional development activities by offering various incentives and integrating them with career advancement opportunities to motivate teachers. Additionally, the Ministry of Education should facilitate foundational training programs, such as those provided by NAEM or similar organizations, to support teachers' professional growth.

2. **Compensation and Facilities:** It is crucial to improve teachers' salaries and provide essential amenities such as dormitories. Promotions and rewards should be based on transparent

criteria applicable to all staff to ensure fairness. Efforts should be made to bridge the gap between the facilities available at government and non-government colleges.

3. Job Satisfaction and Community Engagement: Addressing job dissatisfaction among college teachers is vital, as it often stems from issues of malpractice. Enhancing their standard of living is essential for ensuring their full engagement in shaping the future generation. College authorities should foster strong relationships with both the community and the teaching staff to better understand and address their challenges. Additionally, involving teachers in decision-making processes can bolster their morale and commitment.

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ANALYSIS OF THE IMPACT OF MACROECONOMIC VARIABLES ON THE VOLUME OF EXPORTS IN ALGERIA DURING THE PERIOD (1995-2023) USING QUANTILE REGRESSION ESTIMATOR

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Abstract. *This study aimed to address the knowledge gaps in the economic literature regarding the impact of macroeconomic variables such as GDP, exchange rate, interest rate, and inflation on export volumes, which play a pivotal role in shaping economic policy in Algeria from 1995 to 2023. This was achieved by interpreting the results of quantile regression analysis applied to data using a quantile regression estimator. The study found that GDP is the main driver of exports, while the exchange rate has a varied and unclear impact on exports. Inflation and interest rates, on the other hand, have a limited and weak effect on exports.*

Keywords: *macroeconomic, exports, GDP, exchange rate, interest rate, inflation, quantile regression estimator.*

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Introduction

In a complex and interconnected economic world where countries increasingly influence each other, international trade plays a crucial role in driving economic growth and development, creating job opportunities, and generating wealth. Exports are a vital component of this equation and are a fundamental pillar in assessing the economic performance of any country. Understanding the macroeconomic factors affecting export volumes is essential for formulating effective economic policies toward advanced economies. This highlights the important role of exports in enhancing GDP, as they are a primary source of financing for investment programs (Haid & ELbachir, 2018). Exports positively impact the growth and development of GDP in the long term by bringing foreign currency into the country's economic cycle, which leads to increased capital accumulation and, consequently, a rise in GDP (Kaki, Elakab, & Rabehi, 2021). Additionally, changes in interest rates also affect capital flows. An increase in domestic interest rates, for instance, leads to capital inflows into the country for investment purposes, which in turn boosts domestic production and, consequently, increases export volumes. A decrease in interest rates, on the other hand, leads to capital outflows from the country, resulting in a decline in domestic production and, consequently, a reduction in export volumes (Lahcine & Massoudi, 2023). Additionally, fluctuations in the foreign exchange rate impact exports. An increase in the domestic currency's exchange rate leads to higher relative prices for the country's local goods, causing an increase in export prices. Conversely, a rise

in the foreign exchange rate relative to the domestic currency results in lower prices for local exports (Abdullah, 2023). Improvements in the exchange rate also contribute to a decrease in imported inflation and enhance the competitiveness of businesses. This allows businesses to achieve productive returns and produce high-quality goods, which improves their competitiveness and subsequently increases export volumes (Dahmani, 2015). These variables serve as indicators for evaluating the economic performance of any country and determining its future prospects. To provide in-depth insights into how macroeconomic variables affect exports and identify which of these variables has a greater impact on export volumes, we aim to gain a deeper understanding of the relationship between macroeconomic variables and export volumes. Thus, the primary research question can be framed as follows: What is the impact of macroeconomic variables on export volumes in Algeria from 1995 to 2023?

Study Hypotheses:

To address the research problem, our hypotheses are as follows:

First hypothesis: There is a significant positive effect of macroeconomic variables, namely GDP and the exchange rate, on the volume of Algerian exports.

Second hypothesis: There is no significant effect of macroeconomic variables, namely the interest rate and inflation rate, on the volume of Algerian exports.

Objectives of the study: This study aims to bridge the knowledge gaps in the economic literature regarding the relationship between macroeconomic variables and export volumes, which are crucial for shaping economic policy in Algeria. Additionally, it seeks to use econometric analysis tools to identify the macroeconomic variables that have a significant impact on export volumes.

Scope of the study: The geographical scope of the study is limited to Algeria, while the temporal scope covers the period from 1995 to 2023.

Methodology of the study: This study employs a scientific research methodology that combines both descriptive and quantitative approaches. The descriptive approach involves presenting concepts and describing the relationships between the study variables. The quantitative econometric approach is used to test the relationship between macroeconomic variables and exports in Algeria.

Literature Review

There are several previous studies that have addressed the topic of macroeconomic variables and exports. Some of these include: The study by (Limaei, Heybatian, Vaezin, & Torkman, 2011) aimed to determine the relationship between macroeconomic variables such as population, GDP, global oil prices, and the quantity of domestic wood production, as well as the import and export of wood in Iran from 1979 to 2009. This was achieved using multiple regression analysis (MRA), time series analysis, and autoregressive forecasting. The results showed a significant relationship between the quantity of domestic wood production, population, global oil prices, GDP, and wood exports. The study by (Uzomba, Imoisi, & Somiari, 2012) examined the impact of macroeconomic variables such as the exchange rate, interest rate, government capital expenditures, and recurrent government spending on the performance of the Nigerian economy, specifically focusing on non-oil exports, the agricultural sector, the manufacturing subsector, and GDP from 1986 to 2010. Using the cointegration methodology of Engle and Granger (1987), the study found that all variables were positively related to non-oil exports, the agricultural sector, the manufacturing subsector, and GDP, except for the interest rate, which was negatively associated.

The study by (Singh Tomar & Singh Tomar, 2014) aimed to identify the macroeconomic variables affecting the exports of India and China during the period from 2000 to 2012 using Principal Component Analysis. The study found the following results: a negative impact of India's GDP growth rate on Indian exports; a significant relationship between per capita GDP in India and Indian exports; and an important relationship between per capita GDP in China and Indian exports. Additionally, the study by (Rahman, 2017) investigated the dynamic analysis between export performance and macroeconomic variables such as interest rates, inflation rates, broad money (M2), exchange rates, and the industrial production index in Bangladesh from July 2011 to June 2016. The

study applied Johansen cointegration methodology, Granger causality, variance decomposition, and the Error Correction Model (ECM). The results revealed a long-term relationship between the selected variables, but no significant relationship in the short term. The study by (Shimu & Islam, 2018) focused on examining the impact of macroeconomic variables on the growth of ready-made garment exports in Bangladesh from 1990 to 2014.

The study employed multiple linear regression analysis. The empirical results indicate that the variables of official exchange rate growth, inflation rate, real interest rate, and female unemployment rate have a negative impact on the growth rate of ready-made garment exports. The study by (Bagheri, 2019) aimed to test the impact of macroeconomic variables, including the real exchange rate, inflation rate, and the ratio of total exports to real GDP, on agricultural exports in emerging economies within the BRICS group and Iran from 2009 to 2018. Using panel data models for time series estimation, the study found that the fixed effects model was the most appropriate.

The results indicated a positive impact of the real exchange rate and the ratio of net exports to GDP on the real agricultural export rate, while inflation had a negative impact on the volume of real agricultural exports. Additionally, the study by (Islam, Sahajalal, & Alim, 2019) aimed to examine the relationship between export earnings and macroeconomic factors such as exchange rates, inflation rates, and interest rates in Bangladesh from 1971 to 2018. The study employed Johansen cointegration methodology, the Error Correction Model (ECM), and conducted CUSUM and CUSUM square tests. The findings revealed a significant impact of real exchange rates, inflation rates, and interest rates on export earnings. Similarly, the study by (Amaliawati & Nursjanti, 2020) aimed to test the impact of macroeconomic variables export price index, exchange rate, economic growth, inflation, and interest rate on the growth of Indonesian exports in both the short and long terms using the Autoregressive Distributed Lag (ARDL) model. The results indicated that export growth was negatively affected by the export price index and exchange rate, while it was positively influenced by the interest rate in both the short and long terms.

Additionally, the study by (Alimawi, Sieng, & Baharin, 2020) aimed to test the impact of imports, exchange rates, foreign direct investment, inflation, and crude oil prices on exports in Indonesia, the Philippines, Malaysia, and Thailand from 1981 to 2016. Using panel data models, the study found that imports and exchange rates were positively associated with exports in these countries, while foreign direct investment had a significant negative impact. The study by (Kiptarus, Chepng'eno, & Saina, 2022) sought to determine the impact of exchange rate fluctuations and some macroeconomic variables on Kenya's export performance from 1974 to 2018. The study used the Autoregressive Distributed Lag (ARDL) model and found that exchange rate fluctuations, terms of trade, inflation, money supply, and trade openness had a significant impact on exports.

Methods

To test the relationship between macroeconomic variables and export volumes in Algeria, annual time-series data from 1995 to 2023 were used. The study analysed the following variables: EXP (exports of goods and services as the dependent variable), GDP (Gross Domestic Product), EXR (official exchange rate), INF (inflation), and INT (interest rate). The data for these variables were obtained from the official website of the World Bank.

To estimate the relationship between the variables, we will apply the quantile regression method introduced by Basset and Koenker in 1978. This technique goes beyond estimating just the mean of the dependent variable (as with OLS), which focuses on the centre of the distribution and the mean (normal distribution). Since this approach may not adequately represent the centre of the data, models have been developed to consider all parts of the distribution (quantiles) rather than focusing solely on the centre. Quantile regression estimates other values such as quartiles and deciles, thereby providing a more detailed understanding of the relationship between variables.

This method has also seen several improvements by various researchers between 1987 and 2006. Quantile regression is particularly useful for estimating cases involving multimodal or skewed data, as well as data with outliers.

This method uses the three quadrants, $\theta=(0.25,0.5,0.75)$ to indicate the correlation between the functions. Less common is the presentation of quantiles as particular centres of the distribution. Minimizing the weighted absolute sum of deviations.

In such a view the θ the quantile is thus:

$$q_{\theta} = \underset{c}{\operatorname{argmin}} E[\rho_{\theta}(Y - c)] \quad (1)$$

Where $\rho_{\theta}(\cdot)$ Denotes the following loss function:

$$\rho_{\theta}(Y - c) = [\theta - I(y < 0)]y = [(1 - \theta)I(y \leq 0) + \theta I(y > 0)]y \quad (2)$$

Such loss function is then an asymmetric absolute loss function: that is a weighted sum of absolute deviations, where $(1 - \theta)$ is assigned to the negative deviations and a θ weight is used for positive deviations (Davino, Furno, & Vistocco, 2013).

The standard model for the study is formulated as follows:

$$\text{EXP} = f(\text{GDP}, \text{EXR}, \text{INF}, \text{INT}) \quad (3)$$

$$\text{EXP}_t = C + \alpha \text{GDP}_t + \beta \text{EXR}_t + \gamma \text{INF}_t + \delta \text{INT}_t + \mu_t \quad (4)$$

where: $\alpha, \beta, \gamma, \delta$ are the model coefficients, t is the time factor, and μ_t is the random error term.

Results

1. Statistical Analysis of Variables

1.1. Descriptive Analysis of Variables

The data is described here using values such as the mean, median, standard deviation, and other statistical measures representing these data.

Table 1. Descriptive Analysis of Variables

EXP		GDP		EXR		INF		INT	
Min.	-12.2	Min.	-5	Min.	47.66	Min.	0.34	Min.	-12.11
1st Qu.	-3.4	1st Qu.	2.5	1st Qu.	72.06	1st Qu.	2.92	1st Qu.	-4.05
Median	0.2	Median	3.2	Median	77.22	Median	4.27	Median	0.84
Mean	0.74	Mean	3.1	Mean	86.24	Mean	5.82	Mean	1.62
3rd Qu.	6.01	3rd Qu.	4.1	3rd Qu.	109.44	3rd Qu.	5.74	3rd Qu.	7.08
Max	11.5	Max	6.5	Max	141.99	Max	29.78	Max	16.6

Source: Prepared by the authors, R software outputs based on World Bank data

From Table 1, focusing on some of the study variables, we find:

The variable EXP has a mean value of 0.7436% with a range between -12.2% and 11.5% as its minimum and maximum values. The GDP variable has a mean value of 3.1% with a range between -5.0% and 6.5% for its minimum and maximum values. The EXR variable has a mean value of 86.24% with a range between 47.66% and 141.99% for its minimum and maximum values.

The third quartile values are close to the mean values for the INF variable, reflecting minimal dispersion of data around its mean, indicating homogeneity. In contrast, other variables exhibit significant dispersion around their means. This is particularly evident for the exports variable (EXP), where the mean is 0.7436% and the third quartile is 6.0051%.

1.2 Correlation Between Variables:

In the presence of outliers within the model's variables, the regular correlation coefficient becomes ineffective in describing the strength of the correlation between the models. Therefore, we apply a coefficient that takes this condition into account.

From Table 2: Correlation Matrix Between Variables, we observe:

- Strong to weak correlations, where we find the highest positive correlation between the Gross Domestic Product (GDP) variable and the Export Volume (EXP) variable, estimated at 59%. This indicates that a significant portion of the available goods and services is being exported to other countries. However, other factors also influence the volume of exports.

Table 2. Correlation Matrix Between Variables

	EXP	GDP	EXR	INF	INT
EXP	1	0.59	-0.26	0.26	-0.13
GDP	0.59	1	-0.28	0.05	-0.28
EXR	-0.26	-0.28	1	0.08	0.25
INF	0.26	0.05	0.08	1	-0.1
INT	-0.13	-0.28	0.25	-0.1	1

Source: Prepared by the researchers, R software outputs based on World Bank data

- A weak positive correlation (26%) between the Export Volume (EXP) variable and the Inflation (INF) variable. This weak correlation can be explained by an indirect relationship; an increase in inflation may lead to higher production costs, prompting companies to seek new markets for exporting their products, thereby increasing the export volume.

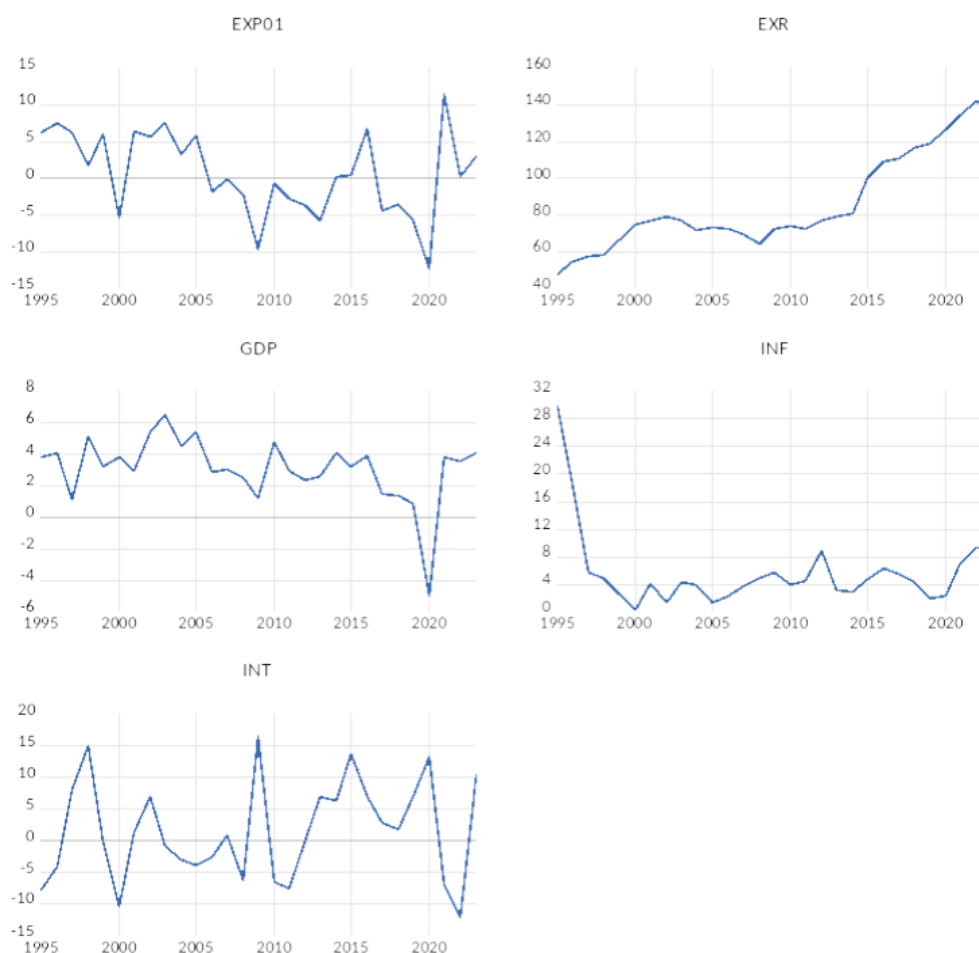
- The correlation strength between the Export Volume (EXP) variable and the Interest Rate (INT%) and the Official Exchange Rate (EXR%) variables is weak and negative, at 25% and 13% respectively. Typically, a rise in interest rates tends to reduce investment, which decreases production and, consequently, the quantity of goods available for export. The weak inverse relationship between export volume and the exchange rate may be due to the low competitiveness of local products in global markets, leading to a decrease in export volume.

- The weak correlation among the independent variables helps avoid the issue of multicollinearity.

2. Pre-study tests:

Before the econometric study of the model, several pre-tests must be conducted, the most important of which are:

2.1. Graphical Tests: These involve plotting the variables and detecting outliers

**Figure 1. Development of Study Variables Over the Period 1995-2023**

Source: Prepared by the researchers, R software outputs based on World Bank data

Looking at the development of the study variables over the period 2005-2022 and through the above graphical representation, we observe that the exchange rate (EXR) shows an upward trend and continuous growth, especially during the period 2020-2023.

As for the other study variables, they exhibit significant and closely related fluctuations. This indicates their interconnection, where an increase in interest rates reduces demand for loans and curbs inflation, while a decrease in interest rates encourages investment and spending, stimulating growth.

It is observed that the growth rate of exports (EXP) shows a low and fluctuating trend from the period 1995-2020, with a notable upward trend during the period 2020-2023. This growth is accompanied by years of contraction due to global economic crises such as the 2008 crisis and the COVID-19 pandemic. The recovery in exports is attributed to the gradual rebound of the global economy from the impacts of the COVID-19 pandemic, the rise in oil and gas prices (which are crucial to the country's total exports), and government efforts to diversify exports by supporting non-oil sectors such as manufacturing and agriculture, entering into new trade agreements with other countries, and opening new markets for its products, especially in light of the changes in global supply chains post-pandemic. This has led to a return to the previous fluctuating trend, as seen in the Gross Domestic Product (GDP) variable.

Looking at the official exchange rate (EXR), it shows a generally upward trend, with some temporary declines.

2.2 . Detection of Outliers: *The presence of outliers in the data creates issues in estimation results*

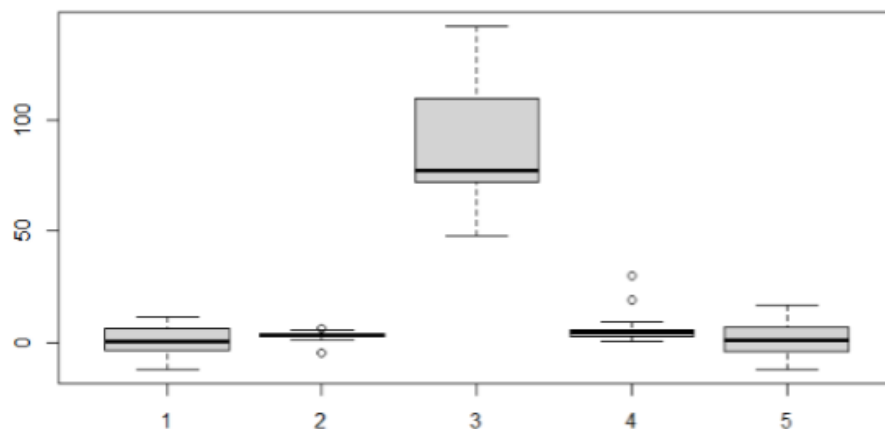


Figure 2. Detection of Outliers

Source: Prepared by the researchers, R software outputs based on World Bank data

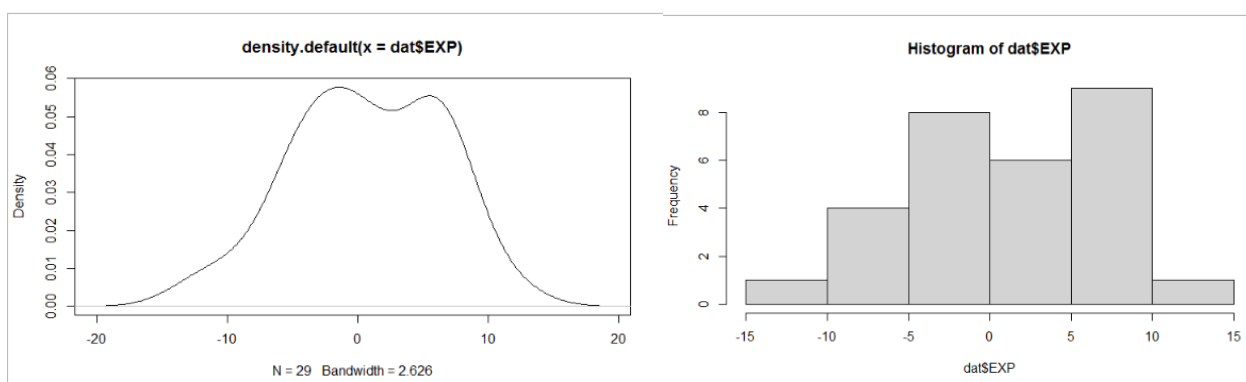


Figure 3. Probability Density Plot of the (EXR) Variable Distribution

Source: Prepared by the researchers, R software outputs based on World Bank data

From the results of the outlier detection test, we find that the data for export of goods and services (EXP), official exchange rate (EXR), and inflation (INF) are free from outliers, except for the years 1995, 1996, and 2020. Specifically, outliers are observed in the inflation (INF) variable for the years 1995 and 1996, and in the Gross Domestic Product (GDP) variable for the year 2020.

The high inflation rates in Algeria during the period 1995-1996 were due to a combination of economic, political, and security factors. The lack of security and stability led to a decline in production across many sectors, resulting in a shortage of goods and services and an increase in their prices. The sharp decline in GDP in 2020, as previously mentioned, was due to the COVID-19 pandemic and its impact on the country's overall revenues.

Based on the previous data examination, a quantile regression model can be applied due to the presence of outliers in the model's variables and skewed data, particularly in the dependent variable.

3. Standard Analysis of the Impact of Macroeconomic Variables on Export Volume During the Period (1995-2023)

The estimation process using the quantile regression estimator involves several stages, which are as follows:

3.1. *Estimation Using Ordinary Least Squares (OLS)*: The parameter estimation is based on the mean, with the following estimation results:

Table 3. OLS Estimation Results

Dependent Variable: EXP					
	(Intercept)	GDP	EXR	INF	INT
Coefficients	-8.18	1.84	0.02	0.26	0.01303

Source: Prepared by the researchers, based on R software outputs

The goal of this estimation is to compare the results with those of the quantile regression.

3.2. Quantile Regression Estimation

Quantile regression addresses the bias resulting from OLS estimation, which arises from the presence of outliers, multimodal data, or skewed data. The following graph illustrates the estimation results.

The parameter is based on the median:

Table 4. Quantile Regression Estimation Results

Dependent Variable: EXP					
	(Intercept)	GDP	EXR	INF	INT
Coefficients	-7.93	2.19	0.01	0.22	0.0640366
Degrees of freedom: 29 total; 24 residual					

Source: Prepared by the researchers, based on R software outputs

The estimation of the effect here is based on the median (50%) and overall. According to these results, we observe:

- Gross Domestic Product (GDP) has a significant positive impact on export volume.
- The Exchange Rate (EXR) has a weak negative effect on export volume.
- Inflation (INF) has a weak positive effect on export volume.
- The Interest Rate (INT) has a weak positive effect on export volume.

To understand the precise and true relationship between the study variables at a detailed level, specifically at the deciles (0.10, 0.90), we chose certain quantiles of the distribution. The results of this estimation are as follows:

$$\text{Call : rq}(\text{exp} \sim \text{gdp} + \text{exr} + \text{inf} + \text{int}, \text{tau} = \text{seq}(0.1, 0.9, \text{by} = 0.1), \text{data} = \text{dat}) \quad (5)$$

Table 5. Quantile Regression Estimation Results by Deciles

tau: [1] 0.1

	coefficients	lower bd	upper bd
(Intercept)	-1.889877e+01	-1.980752e+01	2.155470e+00
GDP	2.988070e+00	4.342800e-01	4.022400e+00
EXR	3.713000e-02	-8.385800e-01	7.061000e-02
INF	4.243500e-0	-1.797693e+308	4.248400e-01
INT	7.123000e-02	-2.002000e-01	7.652000e-02

tau: [1] 0.2

	coefficients	lower bd	upper bd
(Intercept)	-15.27372	-27.14901	-4.79289
GDP	2.36008	0.95551	3.47329
EXR	0.03103	-0.14957	0.11804
INF	0.39408	-1.56786	0.39818
INT	0.07707	-0.15311	0.12018

tau: [1] 0.3

	coefficients	lower bd	upper bd
(Intercept)	-9.85760	-27.78917	-4.92322
GDP	1.89217	1.38748	3.38452
EXR	0.01030	-0.03327	0.14538
INF	0.3081	-0.68023	0.37804
INT	0.0884	-0.19885	0.16964

tau: [1] 0.4

	coefficients	lower bd	upper bd
(Intercept)	-8.11109	-27.51669	-6.07269
GDP	2.13633	1.38651	3.75806
EXR	-0.00451	-0.02393	0.11083
INF	0.23955	-0.49019	0.56859
INT	0.07920	-0.15869	0.12472

tau: [1] 0.5

	coefficients	lower bd	upper bd
(Intercept)	-7.93366	-24.04623	-3.96531
GDP	2.19355	1.48811	3.58174
EXR	-0.00527	-0.01234	0.14738
INF	0.22348	-0.37052	0.50984
INT	0.06404	-0.14788	0.28396

tau: [1] 0.6

	coefficients	lower bd	upper bd
(Intercept)	-7.02416	-21.66364	1.69696
GDP	2.12892	1.54490	3.10661
EXR	-0.00089	-0.03831	0.13807
INF	0.17637	0.04836	1.10922
INT	-0.00310	-0.14662	0.35922

tau: [1] 0.7

	coefficients	lower bd	upper bd
(Intercept)	-0.45439	-18.31370	1.74140
GDP	1.60009	0.94039	2.94188
EXR	-0.04285	-0.04565	0.13554
INF	0.21903	0.09730	2.51035
INT	0.08679	-0.38215	0.37944

tau: [1] 0.8

	coefficients	lower bd	upper bd
(Intercept)	-12.78887	-17.53654	8.41397
GDP	2.11444	-0.50940	2.32180
EXR	0.08893	-0.12326	0.10787
INF	0.34599	-0.13246	2.72199
INT	-0.07113	-0.45889	0.83558

tau: [1] 0.9

	coefficients	lower bd	upper bd
(Intercept)	1.555650e+00	-1.076178e+01	1.046237e+01
GDP	1.948700e-01	-4.038400e-01	4.105510e+00
EXR	5.449000e-02	-8.302000e-02	6.615800e-01
INF	7.447000e-02	-1.841700e-01	1.797693e+308
INT	-1.905000e-01	-5.048300e-01	1.119740e+00

Source: Prepared by the researchers, R software outputs based on World Bank data

Discussion

Considering the effect of the independent variables on the 5% quantile of the EXP distribution, the results show: From the results above, all the model coefficients fall within the confidence intervals, representing the potential range for the true value of the coefficients. The findings indicate a significant positive effect of Gross Domestic Product (GDP) on export volume, a weak positive effect of both Inflation (INF) and Interest Rate (INT) on export volume, and a weak negative effect of the Exchange Rate (EXR) on export volume. For example, the confidence interval for the GDP coefficient is [1.48811, 3.58174], meaning we are 95% confident that the true effect of a one-unit increase in GDP on export volume falls within this range.

- Gross Domestic Product (GDP): This has a strong positive effect across all percentiles, meaning that an increase in GDP leads to an increase in exports, regardless of the export level. In other words, when the economy grows overall, exporting companies have greater capacity to increase their production due to higher income, expand their foreign markets, and export more goods and services.

- Exchange Rate (EXR): The effect varies by percentile, but generally, there is a weak negative effect or no effect at all. A depreciation of the local currency (Algerian dinar) relative to foreign currencies makes Algerian exports cheaper in international markets, enhancing their competitiveness and increasing demand. However, the weak effect might be due to other factors such as product quality or trade barriers.

- Inflation (INF): The effect varies by percentile but is generally a weak positive one. This suggests that an increase in inflation might lead to a slight increase in exports. Higher domestic prices could incentivize companies to boost their export production to achieve higher profits amid rising prices. However, it's important to note that high inflation can lead to economic instability, which might deter investors from investing in Algeria, potentially negatively impacting economic growth and exports in the long term.

- Interest Rate (INT): The effect is a weak positive one, varying by percentile. This implies that an increase in interest rates might lead to a slight increase in exports. Higher interest rates can attract foreign investments, supporting economic growth and exports. However, the increase in interest rates can also raise borrowing costs for companies, potentially reducing their investments and expansion efforts.

To monitor the developments of estimation coefficients across different deciles, the following chart illustrates this:

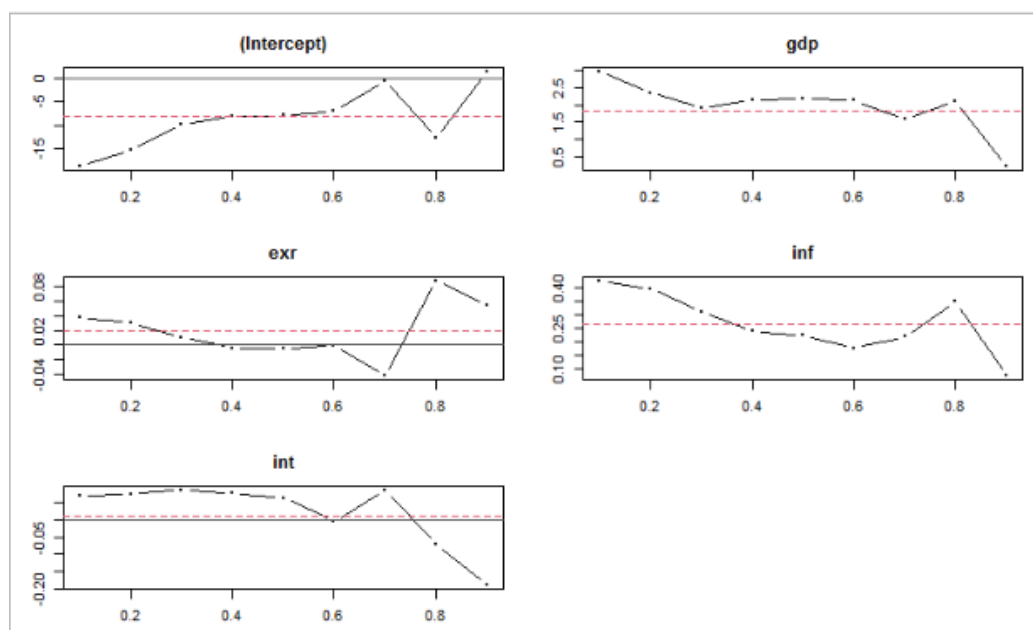


Figure 4. Developments of Estimation Coefficients Across Different Deciles

Source: Prepared by the researchers, based on R software outputs

The provided graph shows the developments of estimation coefficients for each independent variable across different deciles. Analysing these developments aims to understand how the effects of the independent variables (GDP, EXR, INF, INT) on the dependent variable (export volume) change over time. This type of analysis allows us to identify any structural changes in the relationship between the variables and to uncover turning points that may be important for understanding the developments in Algeria's foreign trade.

- Analysis of Each Variable

- Intercept: It is observed that the intercept coefficient generally increases with the rising percentile, then slightly decreases at the 90th percentile. This indicates that the expected value of export volume generally increases as we move from lower to higher percentiles, with the exception of the last percentile.

- Intercept: The intercept coefficient generally increases with the rising percentile, then slightly decreases at the 90th percentile. This indicates that the expected value of export volume generally increases as we move from lower to higher percentiles, with the exception of the last percentile.

- GDP: The coefficient for GDP fluctuates around zero, indicating that its effect on the dependent variable is not constant across all percentiles and can be either positive or negative depending on the percentile.

- EXR: The behavior of the EXR coefficient is similar to that of GDP, as it also fluctuates around zero. This suggests that there is no consistent effect of EXR on export volume.

- INF: The coefficient for INF also fluctuates around zero, but with a slight tendency towards negative values. This implies that an increase in INF may generally lead to a decrease in export volume, though this effect is not strong or consistent across all percentiles.

- INT: The coefficient for INT fluctuates around zero with a slight inclination towards negative values. This suggests that an increase in INT may generally lead to a slight decrease in export volume.

Conclusion

The conducted econometric study analysed the impact of macroeconomic variables on export volume. It began with an examination of theoretical elements that form the framework for this study, which intersect with various economic fields and contribute to understanding the complex relationship between macroeconomic variables and export volume. The study focused on the Algerian economy by constructing an econometric model that assessed the impact of certain macroeconomic variables on export volume during the period from 1995 to 2023, using the Quantile Regression Estimator. Based on both the theoretical and econometric aspects of the study, the hypotheses proposed at the beginning can be assessed as follows:

- Partial confirmation of the first hypothesis: "There is a significant positive impact of macroeconomic variables, specifically GDP and exchange rate, on the volume of Algerian exports". The results show a strong positive impact across all percentiles, indicating that an increase in GDP leads to an increase in exports. However, the exchange rate (EXR) has a weak negative impact.

- Rejection of the second hypothesis: "There is no significant impact of macroeconomic variables, specifically interest rates and inflation rates, on the volume of Algerian exports". The results reveal a weak positive impact for both inflation (INF) and interest rates (INT), with the latter having a negligible effect on export volume.

Overall, the results indicate diverse and varying impacts of these variables on export volume. However, GDP emerges as the most influential economic indicator on export volume in Algeria. In contrast, other variables such as exchange rates, inflation, and interest rates exhibit weak and variable effects. Additionally, there are other factors not included in this analysis that may affect export volume, such as government policies, global events, and technological changes. The relationship between economic variables and export volume is complex and influenced by multiple factors, and results may vary depending on the time period and economic sectors analysed.

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RISK HEDGING IN ISLAMIC BANKS BETWEEN BASEL III CAPITAL ADEQUACY STANDARD AND THE ISLAMIC FINANCIAL SERVICES BOARD STANDARD - AN APPLIED ANALYTICAL STUDY ON QATAR ISLAMIC BANK 2015-2023*Received 21 September 2024; accepted 18 October 2024; published 30 October 2024*

Abstract. *The capital adequacy standard according to Basel III is considered one of the most prominent tools for hedging risks, and it is imposed by all central banks. However, Islamic banks find some difficulties to apply this standard, as it is intended for conventional banks. An Islamic standard issued by the Islamic Financial Services Board amending the Basel III standard has been issued with the aim of applying it by Islamic banks. However, Basel III remains the most accepted standard in the international banking arena. This study aims to identify the most important differences between the two capital adequacy standards issued by the Basel III Accord and the Islamic Financial Services Board, in addition to identifying the extent to which they can be applied at the level of Islamic banks. The study concluded that there are some similarities between the two standards, in addition to some differences, and that their application to Islamic banks is possible, but the Islamic Financial Services Board standard is considered the most appropriate for these banks.*

Keywords: *capital adequacy standard, Basel III Committee, Islamic Financial Services Board, risks, risk hedging.*

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Introduction

The capital adequacy standard issued by the Basel III resolutions is the latest modern trend of the Basel Committee, which was established after the repercussions of the global financial crisis of 2008, after weaknesses appeared in the previous standard, which was characterized by the presence of adequacy ratios that were unable to cover the major effects left by the crisis at that time, which led to the necessary research to develop this standard and improve its financial ratios and make them more capable of hedging risks, which was evident in the Basel III standard issued in 2010 and which came into effect in 2013, as it contains financial ratios that must be maintained higher than its predecessors with an improvement in the capital structure and risk weighting, in addition to creating new ratios such as financial leverage ratios and liquidity ratios. Therefore, the Basel III capital adequacy standard has become more integrated and efficient, which made it essential for application to various global banks, and it has also become the most prominent directives and instructions of central banks in the field of risk management.

It is known that conventional banks were affected by the financial crisis of 2008, due to the difference between conventional banking and Islamic banking, as the latter issues financial products that are significantly different from what exists in the conventional system, in addition to the aspects of financing and investment. Therefore, the impact of Islamic banks was slight compared to conventional banks, which coincided with the formation of the capital adequacy standard according to Basel III according to the features of conventional banks as they are the most affected, which created a major problem for Islamic banks in applying this standard and adapting to it, especially after it was imposed by central banks on all banks without exception, in addition to the increasing volume of risks surrounding and related to Islamic banking.

In this context, an Islamic standard compatible with the Basel III capital adequacy standard was issued in 2013 by the Islamic Financial Services Board, which includes the characteristics of Islamic banks in its composition, as one of the directions for these banks to apply the capital adequacy standard, which is considered necessary, as it is based on an equation similar to the Basel III equation with a focus on Islamic aspects, especially investment deposits, which are the most important source of financing for Islamic banks. However, this standard has not received global recognition, as it is only applied in a few countries, although it is suitable and dedicated to Islamic banks and compatible with the Basel III standard. The latter remains the most mandatory for application to all banks according to the instructions of the central banks.

Qatar Islamic Bank has witnessed a wide development in its financial and banking activities, especially investment activities that are characterized by great diversity, which obliged this bank to apply the Basel III standard for capital adequacy to confront various potential risks and avoid losses surrounding banking work.

1.1 The Problematic

Through the above The following problem can be raised:

“How different are the Basel III and the Islamic Financial Services Board capital adequacy standards? And how difficult is it to apply in Qatar Islamic Bank?”

1.2 The hypothesis

To answer the problematic of the study, the following hypotheses were created:

- The capital adequacy standards issued by Basel III and the Islamic Financial Services Board have similar characteristics, but the only difference is that the Islamic Financial Services Board has entered the characteristics of Islamic banks into the structure of its standard.
- The capital adequacy standard issued by the Islamic Financial Services Board is better for Islamic banks as it is designed for them and not others.

1.3 Objectives of the study

Through this study, we seek to achieve a number of goals, which we mention as follows:

- Knowing the extent of the possibility of applying the Basel III standard for capital adequacy in the Islamic Banks.
- Learn how to calculate the capital adequacy standard according to the Basel III standard and the Islamic Financial Services Board standard.
- Knowing the most important differences between the Basel III standard and the Islamic Financial Services Board standard for capital adequacy.
- Knowledge of Qatar Islamic Bank position on applying the capital adequacy standard according to Basel III as one of the most important risk management procedures.

1.4 Study Approach

This study was conducted based on the descriptive approach, the comparative analytical approach, and the case study approach. The study was divided into two parts, the first theoretical and treated according to the descriptive method, and the second applied, which was treated according to the comparative analytical approach and the case study approach.

1.5 The tools used

This study relied on a group of different references, most notably the reports of the Basel Committee and the reports of the Islamic Financial Services Council. It also relied on the annual reports of Qatar Islamic Bank in order to obtain the data necessary to carry out the applied study.

Literature Review

There are many studies that have focused on capital adequacy in Islamic banks, whether in the form of doctoral theses, articles, etc. Among these studies we mention the following:

Saidi Khadidja's study (Saidi Khadidja, 2017)

"The Problem of Applying the Capital Adequacy Standard in Banks According to the Requirements of the Basel Committee a case Study of Islamic Banks". A PhD Thesis in Commercial Sciences, Specializing in Financial and Banking Sciences, University of Tlemcen, Algeria, 2017. The researcher addressed "the extent to which the capital adequacy standard applied by Islamic banks adapts to what was issued by the Basel Committee", as the most prominent objectives of this study were to make a comparison between the capital adequacy standard issued by the Basel Committee and the capital adequacy standard issued by the Banking Financial Services Board. The researcher used the descriptive analytical approach by dividing the research into two parts, the first theoretical based on the descriptive approach, and the second applied based on the analytical approach. One of the most important results reached in this study is that the capital adequacy standard issued by the Basel III agreement is compatible with the nature of the work of conventional banks only. Also, the standard issued by the Islamic Financial Services Board, despite its suitability for Islamic banks, the latter remain striving to apply the Basel III standard despite the inefficiency of its results at the level of these banks. The researcher has put forward a set of recommendations, the most prominent of which is the necessity of applying the Islamic capital adequacy standard issued by the Islamic Financial Services Board in banks. Islamic as it is more representative and relevant to the standards issued by the Basel Committee.

Toumi Ibrahim's study (Toumi Ibrahim, 2017)

"Adapting Safety Standards in Islamic Banks in Light of the Basel Committee's International Decisions a case Study of Al Baraka Islamic Bank Group". PhD Thesis in Economics, University of Biskra, Algeria, 2017. The researcher addressed the following problem: "How can safety standards be adapted in Islamic banks in light of the Basel Committee's International Decisions and to what extent does Al Baraka Banking Group adhere to these standards?" The most prominent objectives of this study were to shed light on the Basel Committee's International Decisions through its various standards and adapt them to the reality of Islamic banks. The descriptive analytical approach was used in the theoretical aspect and the case study approach in the practical aspect, which was limited to Al Baraka Banking Group. Among the most important results reached by the researcher in this study is that the Basel Committee developed the rules of banking work in its third and final agreement in the field of risk management through the capital adequacy standard, and Al Baraka Banking Group achieved significant results higher than those specified by the Basel Committee. The researcher also presented a set of recommendations, most notably the need to find the necessary Sharia alternatives for risk management in Islamic banks, including capital adequacy according to the Basel III Agreement, so that it can be applied at the level of these banks.

Zaidi Meriem's study (Zaidi Meriem, 2017)

"Basel III Accord for Measuring Banking Capital Adequacy and its Relationship to Islamic Financing Formulas Risk Management a case Study of Abu Dhabi Islamic Bank". PhD Thesis in Economics, Specialization in Economics of Money, Banking and Financial Markets, University of Biskra, Algeria, 2017. The researcher addressed the following problem: "What is the relationship between the banking capital adequacy standard according to the Basel III Accord and the risks of Islamic financing formulas in Abu Dhabi Islamic Bank?" Among the most prominent objectives of this study is to identify both the Basel III Accord and the capital adequacy standard issued by the Islamic Financial Services Board. The researcher relied in her study on the descriptive approach in

the theoretical aspect, and the analytical approach in the applied aspect. One of the most important results reached in this study is that the application of the standard issued by the Islamic Financial Services Board amending the Basel III standard is necessary to enhance the competitiveness of these banks and impose their presence on the global banking arena. The researcher also presented a set of recommendations, most notably the dissemination of various standards related to the Islamic financial industry via the Internet to facilitate access to them, which represents a step towards the spread of knowledge about Islamic finance in various fields.

Bitar and Madies's study (Bitar Mohammed & Madies Philippe, 2014)

"The specificities of Islamic banks and the regulation of Basel III". Financial Economics Review No. 111. This study aimed to clarify the relationship between the characteristics of Islamic banks and the capital adequacy standard according to Basel III decisions and adapting to it. The study was a theoretical research in which reference was made to Islamic banks in general, as the reports of the Basel Committee and the reports of the Islamic Financial Services Board were relied upon in conducting this study, relying on the descriptive and analytical approaches. Among the most prominent results of this study is that Islamic banks can apply the Basel III capital adequacy standard and adapt to it, with modifications to the equation being made to match the characteristics of these banks, although the standard came according to the characteristics of traditional banks, which were greatly affected by the global financial crisis of 2008 compared to Islamic banks.

Canan Ozkan and Zamir Iqbal's Study (Canan Ozkan & Zamir Iqbal, 2015)

"Implications of Basel III for Islamic Banking-Opportunities and Challenges". Policy Research Working Paper Nr: XYZ, The World Bank Group, Global Islamic Finance Development Group. This study aims to examine the elements of the Basel III Accords regarding the capital adequacy standard and the implications of its application in Islamic banks. This study was conducted on a group of Islamic banks operating in six major Arab markets: Qatar, Indonesia, Saudi Arabia, Malaysia, the United Arab Emirates and Turkey. In preparing this research, the International Monetary Fund reports and the Basel Committee reports, especially those related to the Basel III Accord, in addition to the Islamic Financial Services Board reports related to the Islamic capital adequacy standard, were relied upon. The Excel program was also used to represent the graphs. The descriptive and analytical approach is the one adopted in processing this study, which concluded a set of results, the most prominent of which is that Islamic banks face a major challenge in applying the capital adequacy standard issued by the Basel III Committee decisions, as it does not include the characteristics of these banks. It is also considered necessary for Islamic banks to apply the Basel III standard better than the Islamic standard issued by the Islamic Financial Services Board despite the surrounding challenges. With reference to the previous countries to which it was applied, even if the application was at the overall level, the Islamic banks in various countries are working to apply the Basel III standard for capital adequacy.

Rahmani Moussa and Zaidi Meriem's study (Rahmani Moussa & Zaidi Meriem, 2016)

"Basel III Accord as a Scientific Approach to Developing a Model for Calculating Capital Adequacy in Islamic Banks". The researchers addressed the following problem: "To what extent is a new standard for calculating capital adequacy in Islamic banks according to Basel III?" This study aimed to see the dimensions of the problem of applying the capital adequacy standard according to Basel III Accord in Islamic banks with the aim of developing or finding a model for calculating the capital adequacy ratio in these banks in a manner consistent with their functional characteristics. The application was applied to a group of global financial institutions such as the Industrial and Commercial Bank of China, the French BNP Paribas Bank, the Mitsubishi Financial Group and the American JPMorgan Chase Bank, although the application was only on the ratios of risk-weighted assets without looking at the capital adequacy ratios. The data of the Basel III Committee were relied upon in addition to the Excel program in drawing the curves in addition to the reports of the Islamic Financial Services Board. This study was also processed according to the descriptive and analytical approach, the most prominent results of which were that the Basel III capital adequacy standard is dedicated to conventional banks only, which came after the latter were affected by the repercussions of the global financial crisis of 2008, but Islamic banks are forced to apply this

standard in order to impose their presence on the global banking scene and enter into international investments and markets. The Islamic standard is also the most appropriate for these banks, but the Basel III standard remains the most acceptable and recognized.

Through previous studies, it can be said that they share the goal that we seek to achieve in this study of ours by clarifying the most important differences and similarities between the capital adequacy standard issued by the Basel III Agreement, and the amended standard issued by the Islamic Financial Services Board, in addition to determining the most appropriate standard for application at the level of Islamic banks.

Methods

3. Definition of Risks Hedging in the Islamic Banks

The term hedging has many meanings and concepts depending on the type of thing to be hedged against. In the financial aspect, hedging means avoiding financial losses resulting from a specific activity. Among the definitions of hedging, we mention the following:

3.1 First definition: Hedging in Islamic banks can be defined as the various measures and procedures undertaken by the bank that aim to transfer risks to other parties specialized in this field, with the aim of reducing risks, in addition to not affecting profits (Zahan & Kenett, 2012).

3.2 Second definition: Hedging in Islamic banks is defined as various measures and procedures aimed at avoiding risks, eliminating risks, reducing risks and avoiding losses (Azlin & Mustafa, 2014).

3.3 Third definition: It is a set of procedures, measures and methods adopted by banks with the aim of reducing risks and limiting them to the lowest levels, by choosing appropriate formulas and contracts while maintaining the possibility of achieving appropriate and good returns on investment activities (Oubdi & Raghibi, 2017).

The risk hedging mechanism is of great importance at the level of the Islamic banks, as it enables better planning in the field of risk management, as it helps in transferring and transforming risks and developing strategies to avoid falling into losses, in addition to contributing to providing and increasing liquidity for the Islamic banks. It also leads to protecting property and financial resources and controlling and preventing risks. The risk hedging mechanism makes the Islamic banks enjoy a good future outlook in the financial and banking field, by gaining experience in the field of risk management, which enables them to control or avoid various possible future risks, and this would affect the financial return of the Islamic banks.

Results

4. Comparison between Basel III arrangements and the amendments made by the Islamic Financial Services Board

Islamic banks are financial institutions obligated to apply the arrangements set by the Basel III Accord in order to effectively control banking risks. However, this remains a matter of contradiction and poses a problem for these banks in terms of following the Basel III Accord, or relying on what was issued by the Islamic Financial Services Board regarding its arrangements that are in line with those issued by the Basel III Accord, as the latter is designed for conventional banks only, and as is known, there are several differences in the way conventional banks and Islamic banks operate and their characteristics.

4.1 Basel III capital adequacy standard: Basel III decisions are considered an enhancement and support for the points contained in Basel II, as the 2008 global financial crisis played a major role in issuing the Basel III capital adequacy standard, which was established on January 2010, and is to be implemented from January 2013 until 2019, The Basel III agreement came with a set of amendments and the addition of new decisions, which can be summarized as follows:

✓ **Developing capital adequacy ratios:** The most important amendments and additions to the Basel III agreement regarding capital adequacy are as follows (Alexander Reimers, 2012):

- Cancellation the Tier 3 capital in calculating the capital adequacy standard.

- Raising the minimum ratio of common capital from 2% to 4.5% of total risk-weighted assets.
- Raising the minimum capital for the first Tier from 4% to 6%.
- The Basel Committee added 2.5% of capital conservation buffer to Common Equity to become 7%. And from there, the total core Tier 1 capital becomes 8.5%. Therefore, banks must maintain 10.5% of their total capital expressed in risk-weighted assets.
- The Basel Committee has established an additional margin as a reserve at a rate of between 0 and 2.5% of risk-weighted assets.

And it can be clarified the most prominent amendments as shown in Table 1.

Table 1. Capital adequacy ratios according to the Basel III Accord

Statements	Owner's equity ratio	Tier 1 Ratio	Total Capital Ratio
Minimum Capital	4.5%	6%	8%
Conservation Buffer	2.5%	-	-
Minimum Capital+ Conservation Buffer	7%	8.5%	10.5%
Countercyclical buffer range	0%-2.5%		

Source: (Basel Committee on Banking Supervision, 2010)

From the above, the capital adequacy equation according to Basel III can be deduced as follows:

$$CAR = [Tier\ 1\ Capital\ (Core\ Capital + Supporting\ Capital) + Tier\ 2] / [Total\ Risks-Weighted\ Assets\ (Credit\ Risk + Market\ Risk + Operational\ Risk)] \geq 10.5\% \quad (1)$$

The Basel Committee has developed a plan for banks to implement capital standards gradually, which we will explain in the following Table 2.

Table 2. Timeline application of the proposed capital ratios issued by the Basel III agreement

Statements	2013	2014	2015	2016	2017	2018	2019
Minimum common equity capital ratio (1)	3.5%	4%	4.5%	4.5%	4.5%	4.5%	4.5%
Capital Conservation buffer (2)				0.625%	1.25%	1.875%	2.5%
(1)+(2)	3.5%	4%	4.5%	5.125%	5.75%	6.375%	7%
Tier 1	4.5%	5.5%	6%	6%	6%	6%	6%
Minimum total capital (3)	8%	8%	8%	8%	8%	8%	8%
(3)+(2)	8%	8%	8%	8.625%	9.25%	9.875%	10.5%

Source: (Basel Committee on Banking Supervision, 2010)

✓ **Liquidity standard:** In its third agreement, the Basel Committee set standards for liquidity coverage, which are as follows:

- **Liquidity Coverage Ratio (LCR):** Its aim is to enable banks to confront the short-term liquidity crisis, and the Liquidity Coverage Ratio can be calculated as follows (Basel Committee on Banking Supervision, 2010):

$$LCR = [High\ Quality\ Liquid\ Assets] / [Total\ Net\ Flows\ over\ 30\ days] \geq 100\% \quad (2)$$

- **Net Stable Financing Ratio (NSFR):** Its goal is to make banks practice their financing activities using their sources with continuous stability. The Net Stable Financing Ratio can be calculated as follows (Basel Committee on Banking Supervision, 2010):

$$NSFR = [Stable\ Financing\ Available] / [Stable\ Financing\ Required] \geq 100\% \quad (3)$$

- **Financial Leverage Ratio (LR):** Financial leverage is defined as the ratio of assets on and off the balance sheet without introducing risks, so that the ratio must be greater or equal to 3%, and its goal is to reduce lending unless there is sufficient capital, and it can be calculated as follows (Basel Committee on Banking Supervision, 2014):

$$LR = [Tier\ 1\ Capital] / [Total\ Assets] \geq 3\% \quad (4)$$

4.2 The capital adequacy standard according to the Islamic Financial Services Board

The Islamic Banking Services Council issued a modified standard that is identical and parallel to the Basel III standard, which is an Islamic standard that takes into account the characteristics of Islamic banks and its actual application began in January 2015 (Islamic Financial Services Board, 2013).

The amendments to the capital adequacy standard issued by the Islamic Financial Services Board do not differ from those specified in the Basel III agreement with regard to the proportions constituting capital, as capital requirements must not be less than 8% of the total assets weighted by their risk weights, and Islamic banks must have a percentage of 4.5% or more of the equity that makes up the basic capital, and the basic capital must represent 6%, in addition to the necessity of maintaining an additional margin of 2.5% to the equity, which Islamic banks must increase in periods of stability. Therefore, the minimum total capital after increasing the additional margin for the basic capital is estimated at 10.5%, which is equal to that percentage specified in the Basel III agreement (Islamic Financial Services Board, 2013).

The Islamic Financial Services Board has also developed a plan for Islamic Banks to implement capital standards gradually as did the Basel III Committee, which we will explain in the following Table 3.

Table 3. Timeline application of the proposed capital ratios issued by the Islamic Financial Services Board

Statements	2014	2015	2016	2017	2018	2019
Risk-weighted net equity		4.5%	4.5%	4.5%	4.5%	4.5%
Total risk-weighted core capital		6%	6%	6%	6%	6%
Risk-weighted regulatory capital	8%	8%	8%	8%	8%	8%
Additional margin on capital			0.625%	1.25%	1.875%	2.5%
Total capital + hedging capital	8%	8%	8.625%	9.25%	9.875%	10.5%

Source: (Islamic Financial Services Board, 2013)

The Islamic Financial Services Board has also developed two formulas for calculating the capital adequacy ratio, which differ according to the status of each bank, which we will explain below:

- *Standard Equation:* Through this Equation 5, the total assets weighted by market risks and credit risks are excluded, and only operational risks are calculated. This is in the case that the Islamic bank does not provide any addition to profit payments to investment account holders, it can be calculated as follows (Islamic Financial Services Board, 2013):

$$CAR = [Eligible Capital] / [Total Risk-weighted Assets (Credit Risk+ Market Risk) + [Operational Risk] - Assets Weighted according to their Risk Weights funded by Investment accounts (Credit Risk+ Market Risk)] \quad (5)$$

- *Supervisory Authority Estimation Equation:* This Equation 6 is used by banks that provide Helps to investment account holders, especially those with unrestricted investment accounts, which leads to an increase in commercial risks, and therefore additional capital must be maintained to cover these risks, it can be calculated as follows:

$$CAR = \frac{[Eligible\ Capital]}{[Total\ Risk\text{-}weighted\ Assets\ (Credit\ Risk + Market\ Risk) + Operational\ Risk]} - \frac{Assets\ Weighted\ according\ to\ their\ Weights\ Financed\ through\ restricted\ Investment\ accounts\ (Credit\ Risk + Market\ Risk)}{(1 - \alpha) Assets\ Weighted\ according\ to\ their\ risk\ weights\ financed\ through\ restricted\ Investment\ accounts\ (Credit\ Risk + Market\ Risk)} - \alpha \frac{Assets\ Weighted\ according\ to\ their\ risk\ weights\ financed\ from\ the\ profit\ rate\ reserve\ and\ the\ investment\ risk\ reserve\ belonging\ to\ the\ unrestricted\ Investment\ accounts\ (Credit\ Risk + Market\ Risk)}{[Assets\ Weighted\ according\ to\ their\ risk\ weights\ financed\ from\ the\ profit\ rate\ reserve\ and\ the\ investment\ risk\ reserve\ belonging\ to\ the\ unrestricted\ Investment\ accounts\ (Credit\ Risk + Market\ Risk)]} \quad (6)$$

The Islamic Financial Services Board has established also a leverage ratio that is calculated as follows (Islamic Financial Services Board, 2013):

$$LR = \frac{[Core\ Capital]}{[Total\ Risk\ Exposure]} \geq 3\% \quad (7)$$

From the previous two Formulas of the Islamic Financial Services Board and the Basel III equation, we note that the difference lies in the method of calculating total risk-weighted assets (the denominator of the equation), as the Islamic Financial Services Council took into account investment accounts in calculating the capital adequacy ratio because they are the most important source of financing in Islamic banks. Investment accounts also bear losses if they occur, given that their owners have a partnership relationship with the Islamic bank and are not just depositors. Therefore, Islamic banks obtain an additional defensive source to face risks, which represents the basic difference with traditional banks which was mentioned in the capital adequacy standard issued by the Islamic Financial Services Board and it was not mentioned in the Basel III agreement.

The numerator of the equation also differs between the two standards, According to the Islamic Financial Services Council, the eligible capital is divided into two parts: the first is for covering market risks with credit risks, while the second is for covering operational risks, and the eligible capital is a Basel III account for covering all risks without division, this is what was observed in the previous equations.

Discussion

5. Capital Adequacy of Qatar Islamic Bank according to Basel III and Islamic Financial Services Board

5.1 Introducing Qatar Islamic Bank

Qatar Islamic Bank is the first Islamic bank in Qatar and the largest Islamic banking institution in the country, accounting for 43% of the Islamic banking sector nationwide and about 11% of the total Qatari banking market. It started its operations in 1982 and is considered one of the pioneers of Islamic banking. It also has a group of branches distributed throughout Qatar, in addition to external branches in Lebanon and Sudan. It has shares in a number of financial services companies that are compatible with Islamic Sharia in Qatar, such as QInvest Bank, Beema, and Al Jazeera Finance (QIB, 2024).

5.2 Determining the capital adequacy ratios of Qatar Islamic Bank according to Basel III (2015-2023)

Before calculating the capital adequacy ratios of the bank, it is important to address the instructions of the supervising central bank regarding the amendments made to the capital adequacy according to Basel III. The Central Bank of Qatar, which supervises the supervision of Qatar Islamic Bank, requires the calculation of capital adequacy according to Basel III regulations for all banks operating starting from 2015, where it stipulates that the minimum required capital should be greater than or equal to 12.5%, more than what is specified in the Basel III Agreement, in addition to Tier 1 capital being greater than 10.5% (QIB, 2016). The following Table 4 represent the capital adequacy ratios of Qatar Islamic Bank according to the Basel III Agreement during the period 2015-2023.

From the previous Table 4, and after calculating the capital adequacy ratios of Qatar Islamic according to the Basel III standard, we note that the bank can apply the adequacy ratio according to the Basel III agreement, and from the achieved results, we note that Qatar Islamic Bank has

respected the ratios specified by the supervising central bank and what is specified in the Basel III agreement by achieving higher than what is required.

Table 4. Capital adequacy ratios of Qatar Islamic Bank according to Basel III 2015-2023
(Unit: One Million Qatari riyals)

Statement	2015	2016	2017	2018	2019	2020	2021	2022	2023
Property rights	12551.06	13890.15	14551.01	14841.5	16179.02	18090.59	19716.44	21877.02	23717.02
Tier 1 capital	14380.55	17060.99	18613.4	18898.06	20220.05	22140.52	23765.52	25930.52	27773.89
Tier 2 capital	377.81	514.35	440.83	1064.1	1302.21	1442.06	1579.44	1621.78	1698.5
Total capital	14758.36	17575.34	19054.23	19962.16	21522.26	23582.58	25344.95	27552.3	29472.4
Credit risk	98384.67	97915.19	102210.13	97856.41	100895.15	111370.51	122428.77	126262.58	131368.94
Market risk	586.14	748.44	447.68	364.71	372.17	313.28	776.79	531.3	668.18
Operational risk	5886.36	6448.87	7348.83	8177.55	9136.71	9897.93	10839.63	11776.32	12425.58
Total risk weighted	104856.17	105112.5	110006.65	106398.66	110404.03	121581.71	134045.2	138570.2	144462.7
Property rights ratio	0.12	0.13	0.13	0.14	0.15	0.15	0.15	0.16	0.16
Tier 1 capital ratio	0.14	0.16	0.17	0.18	0.18	0.18	0.18	0.19	0.19
Capital adequacy ratio	0.14	0.17	0.17	0.19	0.19	0.19	0.19	0.2	0.2

Source: Prepared by the authors themselves based on the annual reports of Qatar Islamic Bank (QIB, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023)

Thus it can be said that the bank enjoy good financial solvency that enables it to confront potential risks, although these results do not reflect the true financial solvency of this bank and are considered misleading because the capital adequacy standard issued by the Basel III agreement is designed specifically for conventional banks only without taking into account the characteristics of Islamic banks, which contain investment accounts, which are considered one of the most important sources of financing in these banks, as they cover possible losses caused by risks, which was overlooked in the capital adequacy equation according to the Basel III agreement. The capital adequacy ratios of Qatar Islamic Bank according to Basel III decision in the following Figure 1.

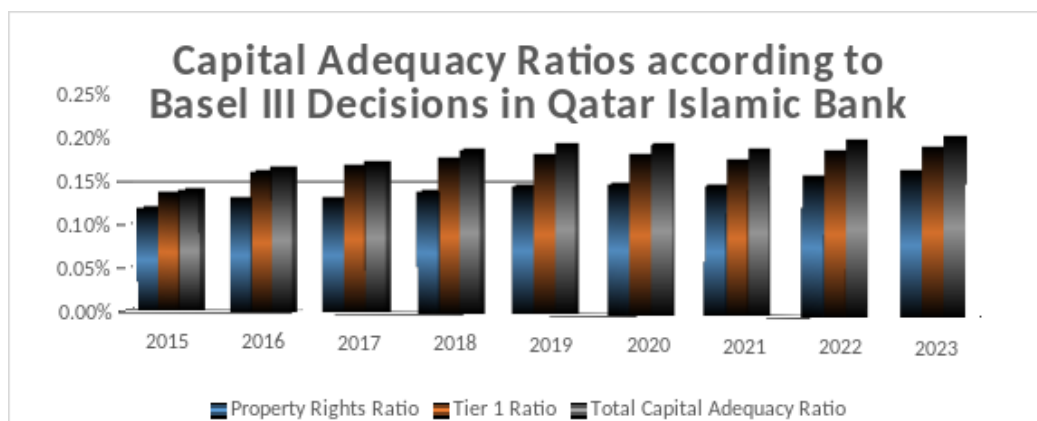


Figure 1. Capital adequacy ratios maintained in Qatar Islamic Bank according to Basel III decision 2015-2023

Source: Prepared by the authors themselves based on the data of the previous Table 4

5.3 Determining the capital adequacy ratios of Qatar Islamic Bank according to the Islamic standard issued by Islamic Financial Services Board

The difference between the Basel III capital adequacy standard and the Islamic standard issued by the Islamic Financial Services Board lies in how the elements of the denominator are calculated, due to the difference in the characteristics of conventional banks and the characteristics of Islamic banks. Through the following Table 5, we will calculate the capital adequacy ratios of

Qatar Islamic bank according to the Islamic standard amended to the Basel III standard issued by the Islamic Financial Services Board during the period 2015-2023.

Table 5. Capital adequacy ratios of Qatar Islamic Bank according to the Islamic Financial Services Board 2015-2023 (Unit: One Million Qatari riyals)

Statement	2015	2016	2017	2018	2019	2020	2021	2022	2023
Property rights	12551.06	13890.15	14551.01	14841.5	16179.02	18090.59	19716.44	21877.02	23717.02
Tier 1 capital	14380.55	17060.99	18613.4	18898.06	20220.05	22140.52	23765.52	25930.52	27773.89
Tier 2 capital	377.81	514.35	440.83	1064.1	1302.21	1442.06	1579.44	1621.78	1698.5
Total capital	14758.36	17575.34	19054.23	19962.16	21522.26	23582.58	25344.95	27552.3	29472.4
Total risk weighted	104856.17	105112.5	110006.65	106398.66	110404.03	121581.71	134045.2	138570.2	144462.7
Total Risk weighted assets funded by investment accounts	60107.47	57932.94	58174.41	54598.25	59850.34	61930.41	62951.39	61554.74	62993.45
Net Risk	44748.7	47179.56	51832.24	51800.41	50553.69	59651.03	71093.81	77015.46	81469.25
Property rights ratio	0.28	0.29	0.28	0.29	0.32	0.3	0.28	0.28	0.29
Tier 1 capital ratio	0.32	0.36	0.36	0.36	0.4	0.37	0.33	0.34	0.34
Capital adequacy ratio	0.33	0.37	0.37	0.39	0.43	0.4	0.36	0.36	0.36

Source: Prepared by the authors themselves based on the annual reports of Qatar Islamic Bank (QIB, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023)

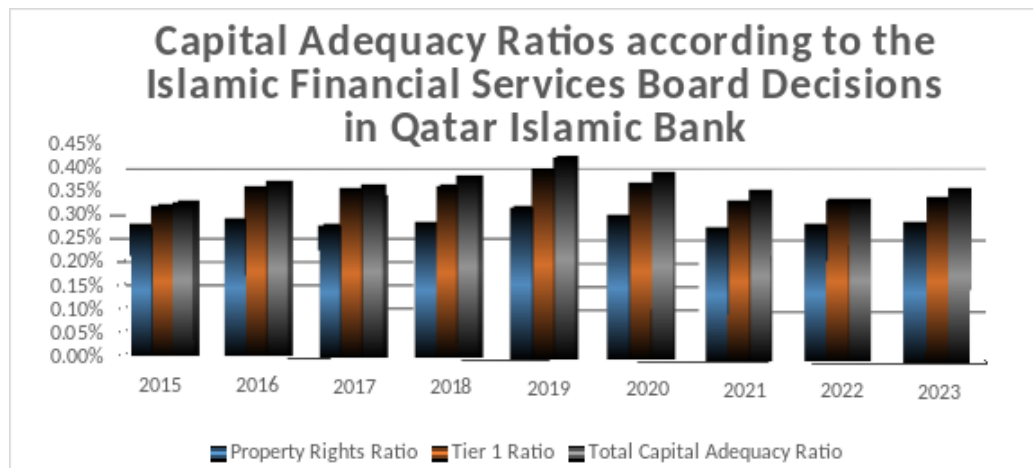


Figure 2. Capital adequacy ratios maintained in Qatar Islamic Bank according to the Islamic Financial Services Board 2015-2023

Source: Prepared by the authors themselves based on the data of the previous Table 5

After calculating the capital adequacy ratios Qatar Islamic Bank according to the Islamic standard issued by the Islamic Financial Services Board during the period 2015-2023, we note that the achieved capital adequacy ratios are much higher than those determined by the Islamic Financial Services Board throughout the study period, whether it is related to property rights (6%), the first tranche (8.5%) or the total minimum (10.5%), which confirms the bank's financial strength in the field of risk hedging, and we also note that the recorded ratios are significantly higher than the capital adequacy ratios according to the Basel III standard achieved in the bank, which is a natural matter, since the capital adequacy equation according to the Islamic standard take into account the assets financed from the investment accounts, and that is in the denominator of the equation, the

opposite of what is found in the equation established in the Basel III agreement, and the capital adequacy ratios can be represented in Qatar Islamic Bank according to the Islamic standard During the period 2015-2023 in the following Figure 2.

After discussing the capital adequacy ratios achieved by Qatar Islamic Bank according to the Islamic standard issued by the Islamic Financial Services Council and the Basel III standard, it can be said that the bank has adapted to the application of both standards by achieving very high ratios, whether it comes to equity ratios (greater than 6%), the first Tier (greater than 8.5%) or the total solvency ratio (greater than 10.5%), and we note the discrepancy in the ratios achieved between the Basel III standard and the Islamic standard. This is explained by the fact that the Islamic standard took investment accounts into account, which was reflected in the high ratios achieved in the Islamic standard.

Conclusion

The capital adequacy standard according to the Basel III agreement is applicable to Islamic banks, as we have seen with Qatar Islamic Bank, which are bound to follow what was issued in the Basel III decisions due to its imposition by the supervising central banks. However, its results do not reflect the true solvency of these two banks, as these decisions are specific to conventional banks only. It also enables the two banks to adapt to the Islamic standard issued by the Islamic Financial Services Board and amended to the Basel III agreement standard for capital adequacy by applying it and conforming to its specified ratios, which is considered the most appropriate for Islamic banks to take into account their constituent characteristics. Therefore, these banks continue to face the problem of applying the capital adequacy standard between the internationally recognized Basel III agreement required by the monetary authorities and the Islamic standard, which is considered the most appropriate for them.

Through our study, we reached a number of results:

- The capital adequacy standard according to Basel III Committee is considered specific only to the conventional banks, after relying on their characteristics in its formation without considering the other characteristics of Islamic banks.
- The distinctive characteristics of Islamic banks are a source of problem and difference in the capital adequacy standards according to Basel III and the Islamic Financial Services Board.
- Most central banks require that the capital adequacy standard issued by the Basel Committee must be applied to either conventional banks or Islamic banks, which may affect the Islamic banking.
- The latest capital adequacy standard issued by the Islamic Financial Services Board is an updated standard of Basel III, which has been modified to suit the operation of Islamic banks.
- The capital adequacy standard issued by the Islamic Banking Services Council is considered less acceptable at the global level compared to the standard issued by Basel III, as some countries apply the latter even to Islamic banks, because these decisions have a global character, and that what was seen with regard to the Central Bank of Qatar, which imposes the application of the Basel III standard on all banks.
- The capital adequacy standard of Basel III shares the same method of calculating the numerator (total capital ratios) as the Islamic standard, but they differ in the denominator (total risks).
- The leverage ratio is the only one issued by the Islamic Financial Services Board as an addition to the capital adequacy ratio in order to keep pace with the Basel III agreement, which issued liquidity ratios and net stable funding ratios as an addition to the capital adequacy ratio.
- Although the Islamic standard amended to the Basel III standard is not accepted at the global level. Its application in Islamic banks remains an inevitable necessity until the Basel Committee issues a standard that takes into account the characteristics of these banks.
- Qatar Islamic Bank was able to apply the capital adequacy standard according to Basel III and the amended Islamic standard, although the results of the first are not considered very credible as it is intended for application to traditional banks only.

- Qatar Islamic Bank has achieved very high solvency ratios, more than those specified in the Basel III Agreement and the Islamic Financial Services Board, The achieved ratios are also higher than those specified by the Central Bank of Qatar, which indicates there great financial competence and the effectiveness of there risk management system.

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