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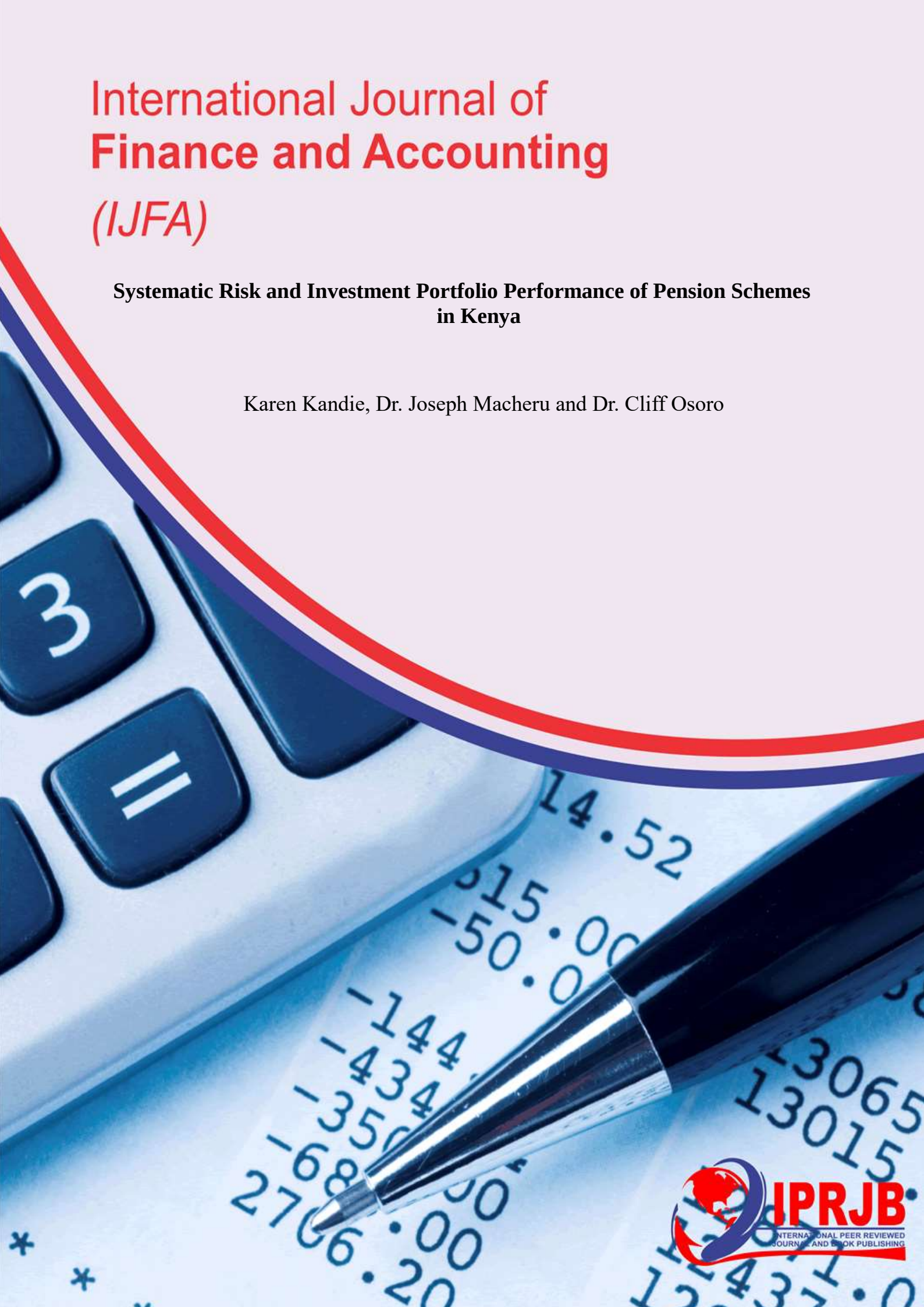

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Systematic Risk and Investment Portfolio Performance of Pension Schemes in Kenya

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Abstract

Purpose: Life expectancy in Kenya has increased from 61 to 67 years, while the fertility rate has declined from 4.4 to 3.4 children from 2010 to 2020, implying an increasing number of pensioners at risk of old age poverty if they do not have sufficient pension. The study's general objective was to investigate the effect of systematic risk on the investment portfolio performance of pension schemes in Kenya. The specific objectives were to evaluate the relationship between interest rates, stock market index, inflation rate and economic growth as independent variables and the investment portfolio performance as the dependent variable. The study examined the moderating effect of asset allocation to various asset classes on the relationship between systematic risk and investment portfolio performance of pension schemes.

Methodology: The study applied Panel data Regression and Maclleland two-step model. It used a census of secondary data on 1,172 pension schemes registered with Retirement Benefits Authority from 2015 to 2021.

Findings: The R-Squared was 0.5451, meaning systematic risk variables simultaneously explained the investment portfolio performance by 54.51%. All the coefficients for the independent variables were significant at 5% level of significance. The Chi-Square test statistic showed that the moderating effect of asset allocation to Treasury Bills and Bonds quoted equities and immovable properties were not significant at 5% level of significance. Finally, the moderating effect of allocation to guaranteed funds was significant at 10% level of significance. The systematic risk variables are strong predictors of the performance of pension Schemes. Asset allocation to guaranteed funds is a strong moderator. Asset allocation to Treasury Bills and Bonds quoted equities, and immovable property are insignificant moderators.

Unique Contribution to Theory, Practice and Policy: The study integrated Capital Assets Portfolio Theory, Arbitrage Theory, and Efficient Market Theory with Modern Portfolio Theory to add to existing literature, particularly in emerging markets. Policymakers should consider the effect on pension performance when setting policy rates, inflation targets and asset allocation limits. Pension practitioners should consider allocation to different assets portfolio construction to diversify risk.

Keywords: *Pension, Performance, Asset Allocation, Systematic Risk*

INTRODUCTION

Due to the global ageing problem and longevity risk, much attention has been focused on the systematic risk and portfolio investment performance problem of pension schemes (Jingyun Sun, 2018; Tang, et al., 2018; Li, et al., 2018). Although the population of Kenya is relatively young, policymakers also have a growing awareness that it will face the interlocking challenges of demographics and urbanisation. Pension schemes' performance is essential to alleviate poverty and smooth consumption over an individual's lifecycle (World Bank Group, 2019). To achieve these functions on a long-term basis, the performance of the schemes face the effects of systematic risk such as interest rates, inflation, economic growth and stock exchange volatility (Verma & Bansal, 2021; Qureshi, et al., 2017; Wiß, 2019). The effects systematic risk on the performance of pension schemes are also moderated by diversification through asset allocation to various asset classes (Addoum, et al., 2010; Novy-Marx & Rauh, 2011).

The pension industry has proliferated in Kenya and Africa since late 2000, making it an essential source of local finance for infrastructure and other long-term socioeconomic development needs (Irving, 2021; World Bank Group, 2019; Estrada & Koutronas, 2019). The industry is regulated by the Retirement Benefits Authority (RBA) with a mission to proactively promote savings for retirement in Kenya through safeguarding, supervising, and facilitating the development of retirement benefits (Retirement Benefits Authority, 2021). As of December 2021, the pension industry in Kenya had mobilised Kshs. 1,547.43 billion in managed pension assets from Kshs. 44.7 billion in 2000, a significant annual average growth rate of 21%.

The investment portfolio decisions by pension schemes in Kenya are driven by systematic risk, which influences the optimal allocation of assets across the various asset classes, such as bonds and equities (Roncalli & Weisang, 2012; Hasanudin & Pangestutia, 2020). The mix of asset classes less than perfectly correlated in portfolio construction is the primary key to balancing risks and rewards (returns) in managing pension schemes. The reason is that the uncorrelated risk can be diversified, increasing the level of returns, as Markowitz (1952) advocated in Modern Portfolio Theory.

Although one state-run scheme, the National Social Security Fund (NSSF), continues to dominate the pension industry in Kenya, privately managed, employer-based pension schemes have emerged and are multiplying. The growth is driven to a large extent by policy reforms that allow a more significant role for privately managed pension schemes that have targeted the middle class as well to ensure the sustainability of pension payments in the future (Irving, 2021; World Bank Group, 2019; Papík & Papíková, 2021). In public DB schemes, employees are guaranteed benefits even if the government has not put funds aside to pay them, making them Pay-As-You-Go. Future liabilities are placed on the taxpayer and future generations, creating intergenerational inequity.

The volatility of financial markets, measured by systematic risks such as policy interest rates, bank interest rates, stock market volatility, inflation, and growth in Gross Domestic Product(GDP), has a substantial impact on the investment portfolio performance of pension schemes and the financial sector in general (Wiß, 2019; Tang, et al., 2018). The effect of systematic risk on portfolio investment decisions and the performance of pension schemes is a growing area of research, especially in Kenya and other developing economies.

This research examines the moderating effects of asset allocation on systematic risk and investment portfolio performance. It is widely acknowledged that pension schemes react strongly to regulatory requirements and asset allocation decisions (Addoum, et al., 2010). The reaction implies that regulatory requirements for pension schemes can override the fund manager's asset allocation strategy, consequently limiting their performance. With no restrictions and limits, it can give rise to a solid incentive to invest in riskier assets, which attract higher expected rates of return (Novy-Marx & Rauh, 2011). However, investing in riskier assets could lead to a loss in the long term. Tight constraints can be an opportunity cost, as fund managers invest a lower than the optimal proportion of assets in assets with high rates of return.

The lessons learnt on the systematic risk brought about by economic crises such as COVID-19 and the 2007/2008 financial market turmoil pose severe challenges for those charged with managing retirement systems and policymakers in deciding how to measure and evaluate the performance of pension schemes (Mitchell, 2010; Irving, 2021). Although portfolio performance measurements have adopted the same metrics as mutual funds and other investments, pension funds are fundamentally different. Measuring the performance of a pension system is much more complex and goes beyond maximising returns. The performance of pension schemes and their funding status are strongly influenced by investment returns, asset allocation decisions, and regulatory restrictions (Andonov, 2014).

Traditionally, in Africa, pensions have been extended family support to retired persons in the community in the absence of formal pension mechanisms. The high fertility rates meant families could hedge their bets for retirement because the mortality rates also increased. With a large family, even if some of the children died before they retired, they still had some remaining children to care for in retirement (World Bank Group, 2019). In Africa, pension assets are comparatively small but growing, with most African countries' pension assets remaining well below the 60% global average. Only South Africa, at 66% and Namibia, at 109%, have exceeded the global average of countries' pension assets to GDP (RisCura, 2022).

In Kenya, pension assets under management as a percentage of GDP is 14.6%, below the global average of 60% but above most African countries (Irving, 2021; World Bank Group, 2019). Regarding workforce coverage, Kenya is still a leading country with a coverage ratio (that is, workers covered/total labour force) of 20 per cent. In contrast, the average coverage in sub-Saharan Africa is estimated at less than 10% (Stewart & Yermo, 2009). Like in most African countries, the legal framework for pension schemes in Kenya is Eurocentric; that is, it favours the formal sector rather than the informal sector (World Bank Group, 2019).

Pension schemes have gained greater importance in Kenya and globally due to the prevalence trend of declining fertility rates and increasing lifespans. The fertility rate in Kenya declined from 4.4 to 3.4 children between 2010 and 2020, while life expectancy increased from 61 to 67 years in the same period. This demographic change has necessitated reforms that allow a more prominent role for privately managed DC pension schemes targeting the growing middle classes to reduce reliance on government-funded schemes and old age grants (World Bank Group, 2019; Lutwama, 2019).

Problem Definition

Pension schemes have experienced systematic risks that have resulted in increased funding risks in the form of the growth of liabilities outpacing assets, resulting in an inability to satisfy all pension obligations on a timely basis.

Systematic risk has put pressure on funding levels for DB schemes and has served a severe blow to members of DC schemes close to retirement, denting confidence in many DC systems. The risk was made worse by the COVID-19 economic crisis, which caused pension schemes to underscore systematic risk and the need to give greater priority to increasing the level of pension schemes as long-term savings. Pension schemes risk making retirement promises that cannot be fulfilled due to uncertain returns brought about by systematic risk, and the consequences can be disastrous, as shown in Malanga (2016). (Tang, et al., 2018; World Bank Group, 2019).

The shift from the traditional defined benefit (DB) scheme to the defined contribution scheme (DC) since the early 2000s globally and in Kenya implies that the pension system is becoming increasingly asset-backed, leading to their value and performance being impacted by systematic risk. For example, in Kenya, 16.45% of all pension assets under management were invested in quoted equities as of December 2021, making the asset class the third largest allocation after government securities and guaranteed funds (Retirement Benefits Authority, 2021). As such, pension scheme investors are at significant risk in the event of a repeat of the stock market collapse similar to the 2007/2008 global financial crisis. Pension assets under management in Kenya grew from Kshs. 778.15 billion in 2010 to Kshs. 1547.43 billion in December 2021, 1.96 times or an average annual increase of 21% (Retirement Benefits Authority, 2021), and comprise 14.6% of the economy, making them key players.

Objectives

The study's general objective was to investigate the effects of systematic risk on the investment portfolio performance of pension schemes in Kenya, while the specific objectives were;

(i) To investigate the effects of interest rates on the investment portfolio performance of pension schemes in Kenya.

(ii) To examine the effects of the stock market index on the investment portfolio performance of pension schemes in Kenya.

(iii) To determine the effects of the inflation rate on the investment portfolio performance of pension schemes in Kenya.

(iv) To study the effects of economic growth on the investment portfolio performance of pension schemes in Kenya.

(v) To explore the moderating effect of Retirement Benefits Authority statutory limits on the relationship between systematic risk and investment portfolio performance of pension schemes in Kenya.

The study limited itself to the retirement benefits schemes, both private and public, that are registered and regulated by the Retirement Benefits Authority. The research covered the total population of 1,172 pension schemes from the RBA database from 2015 to 2021 from the

annual audited financial statements and extracted data on net assets and asset allocation to various asset classes. Other secondary data on systematic risks was from the Central Bank of Kenya(CBK), the Nairobi Securities Exchange(NSE), and the Kenya National Bureau of Statistics(KNBS).

The choice of the study period was limited by the unavailability of pension data before 2015. A large number of possible systematic risks are available for use. The study focused on proxies of systematic risk, including interest rates, stock market index, inflation rate and economic growth. Investment portfolio performance was proxied by the growth in assets of pension schemes.

Theoretical Literature

The study was guided by four theories that anchored the study variables. The Capital Assets Pricing Theory anchored the interest rate variable, the Efficient Market Theory anchored the stock market index, and the Arbitrage Pricing Theory anchored the rate of inflation and GDP growth. The Modern Portfolio Theory anchored the moderating variables.

Research Gaps

Globally, there is rich literature on the effects of systematic risk on portfolio investment performance (Alda, 2017; Andonov, 2014; Boudin & Olsson, 2021; Chovancova, et al., 2019), while the local empirical literature is limited. Ochieng and Oriwo (2012) and Olweny and Omondi (2011) investigated and established that macroeconomic variables influenced stock returns and the growth of capital markets in Kenya. Mutegi (2014) and Njuguna (2011) focused on the impact of corporate governance on the performance of pension schemes in Kenya. Akwimbi (2020) assessed the effect of corporate governance, investment strategy, interest rate, inflation rate, exchange rate and GDP growth rate on the performance of pension schemes in Kenya.

Considering local empirical literature is limited and international empirical evidence is highly contextual, results and conclusions cannot be generalised into the local context. Unlike other studies, this study investigated the effects of a unique combination of systematic risks, using interest rates, the NSE 20-Share index, inflation and growth in GDP on the investment portfolio performance of pension schemes in Kenya. The study methodology was panel data regression, which is more dynamic, unlike similar studies that have used regression analysis, which is less dynamic. It examined the moderating effects of asset allocation on the relationship between systematic risk and investment portfolio performance of pension schemes in Kenya, which was not considered in the other studies.

Ethical Considerations

Ethical clearance was obtained from the National Commission for Science, Technology & Innovation Ref No: 364735. Data confidentiality was maintained by using the registration number of pension schemes instead of their names.

METHODOLOGY

The study used quantitative data on systematic risks covering interest rate, NSE 20-Share Index, inflation rate and growth in GDP as independent variables and portfolio investment performance as dependent variables. The study employed an explanatory research design since

it sought to explain the cause-and-effect relationship between variables. Data regarding RBA limits on asset allocation were used as moderating variables.

The research population comprised 1,172 public and private pension funds registered with the RBA from December 2015 to December 2021, organised as individual or umbrella pension schemes. The unit of analysis was each individual or umbrella pension scheme. This research carried out a census investigating the entire population. The data was collected for each unit of the universe, all the pension schemes registered with RBA.

Secondary data on the performance and asset allocation of pension schemes was collected from the computer database of RBA comprising a summary of audited financial statements of pension schemes. Data on systematic risk was collected from CBK, NSE, and KNBS. Other data was collected from technical publications such as manuals, handbooks, data sheets, standards, books and journals, and official publications of regulatory and government bodies such as the RBA, CBK, NSE, and KNBS.

Panel data regression, frequently used in economic studies, was considered suitable for use given its amenity to dynamic adjustments (Jawad, et al., 2020). According to Purba and Bimantara (2019), the panel data regression approach has numerous advantages, including the fact that it can calculate individual heterogeneity by allowing individual-specific variables.

This study adopted a panel data regression using the Ordinary Least Squares (OLS) method. The data included time series and cross-sectional data pooled into a panel data set and estimated using panel data regression. A similar model is used by Mazreku, Morina and Curraj (2020), Zou et al. (2016), and Akwimbi (2020). The investment portfolio performance of pension schemes was taken as a dependent variable. Independent variables were interest rates, the NSE 20-Share Index, inflation rate and GDP growth. The panel regression analysis was run using E-views 7 data analysis software.

General Equation

The general econometric model used in this research is shown below:

$$IPP_{it} = \alpha_0 + \beta_1 IR_{it} + \beta_2 NSE_{it} + \beta_3 INF_{it} + \beta_4 GDP_{it} + \mu_{it}$$

Where;

IPP_{it} is the investment portfolio performance

IR_{it} is the market interest rate

NSE_{it} is the NSE 20 Share Index

INF_{it} is the average annual rate of inflation

GDP_{it} is the Gross Domestic Product

α_0 is the intercept

β_1, β_2 , β_3 , β_4 are the coefficients of the model

μ_{it} is the stochastic variable, the error term, or the residual

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Moderating Effect Model

The moderating variable is the allocation to the eleven distinct domestic asset classes and offshore/foreign assets approved by RBA from which pension schemes can choose to build an investment portfolio (Retirement Benefits Authority, 2021). Four asset classes constitute over 90% of the pension scheme investments. These are Treasury Bills and Bonds, immovable properties, quoted equities and guaranteed funds. The other seven asset classes constitute less than 10%. The study assessed the moderation effect of allocations to the four largest asset classes on the relationship between systematic risk and the portfolio investment performance of pension schemes by adopting the Whisman and McClelland (2005) two-step moderating tests. In step one, the asset class allocation is introduced as an independent variable. In step two, asset class allocation is introduced as a moderating variable.

Allocation to Treasury Bills and Bonds

$$IPP_{it} = \alpha_0 + \beta_1 IR_{it} + \beta_2 NSE_{it} + \beta_3 INF_{it} + \beta_4 GDP_{it} + \beta_6 TB_{it} + \beta_7 [TB_{it} IR_{it} + TB_{it} NSE_{it} + TB_{it} INF_{it} + TB_{it} GDP_{it}] + \mu_{it}$$

Where;

TB_{it} is the percentage allocation of pension assets to Treasury Bills and Bonds

β_7 is the coefficient of the moderating model

Allocation to Quoted Equities at the Nairobi Securities Exchange

$$IPP_{it} = \alpha_0 + \beta_1 IR_{it} + \beta_2 NSE_{it} + \beta_3 INF_{it} + \beta_4 GDP_{it} + \beta_6 QE_{it} + \beta_7 [QE_{it} IR_{it} + QE_{it} NSE_{it} + QE_{it} INF_{it} + QE_{it} GDP_{it}] + \mu_{it}$$

Where;

QE_{it} is the percentage allocation of pension assets to Quoted Equities at the Nairobi Securities Exchange

Allocation to Immovable Property

$$IPP_{it} = \alpha_0 + \beta_1 IR_{it} + \beta_2 NSE_{it} + \beta_3 INF_{it} + \beta_4 GDP_{it} + \beta_6 IM_{it} + \beta_7 [IM_{it} IR_{it} + IM_{it} NSE_{it} + IM_{it} INF_{it} + IM_{it} GDP_{it}] + \mu_{it}$$

Where;

IM_{it} is the percentage allocation of pension assets to immovable properties.

Allocation to Guaranteed Funds

$$IPP_{it} = \alpha_0 + \beta_1 IR_{it} + \beta_2 NSE_{it} + \beta_3 INF_{it} + \beta_4 GDP_{it} + \beta_6 GF_{it} + \beta_7 [GF_{it} IR_{it} + GF_{it} NSE_{it} + GF_{it} INF_{it} + GF_{it} GDP_{it}] + \mu_{it}$$

Where;

GF_{it} is the percentage allocation of pension assets to guaranteed funds.

RESULTS, DISCUSSION AND RECOMMENDATIONS

The panel data analysis was conducted using the statistical software Eviews version 7. The data were converted to their natural logs to control heteroscedasticity and outliers and establish elasticity relationships.

A correlation analysis was conducted on the data to ensure there were no highly correlated variables between the dependent and independent variables to avoid the problem of serial correlation in the model. The research did not test the correlation between independent variables because panel datasets are usually unaffected by multi-collinearity (Purba & Bimantara, 2019; Shao, et al., 2019). Table 1 shows the results of the correlation analysis of the general model.

Correlation Analysis (General model)

Table 1: Covariance Analysis: Ordinary

Included observations: 4030 after adjustments

Balanced sample (listwise missing value deletion)

Correlation	LN_IPP	LN_IR	LN_NSE	LN_INF	LN_GDP
LN_IPP	1.000000				
LN_IR	-0.008522	1.000000			
LN_NSE	-0.016009	0.991461	1.000000		
LN_INF	0.051375	0.601071	0.593643	1.000000	
LN_GDP	-0.100108	-0.212610	-0.156924	-0.821460	1.000000

Table 1 shows the correlation coefficient of IR, NSE, INF, and GDP was -0.008522, -0.016009, 0.051375, and -0.100108, respectively. The results indicated a weak negative correlation between IR, NSE, and GDP with IPP, independent variable, and a weak positive correlation between INF and IPP. The inflation rate had a weak positive correlation with the Investment Portfolio Performance. In contrast, the other three variables, Interest rate, NSE 20-Share Index and Gross Domestic Product, had a weak negative correlation with Investment Portfolio Performance.

Correlation Analysis of the Moderating Variables

The results in Table 2 show the correlation analysis of pension asset allocations to Treasury Bills and Bonds, quoted equities, immovable properties, and guaranteed funds, which form the main four asset classes to investment portfolio performance. The four variables are the moderator variables.

Table 2: Correlation Analysis (Moderator Variables)

Covariance Analysis: Ordinary
Included observations: 34 after adjustments
Balanced sample (listwise missing value deletion)

Correlation	LN_IPP	LN_TB	LN_QE	LN_IM	LN_GF
LN_IPP	1.000000				
LN_TB	0.224524	1.000000			
LN_QE	-0.105618	0.315498	1.000000		
LN_IM	-0.305169	-0.404859	0.180490	1.000000	
LN_GF	0.222704	-0.428857	-0.712619	0.008763	1.000000

Table 2 shows the allocation to Treasury Bills and Bonds, QE, IM, and GF had a correlation coefficient of 0.224524, -0.105618, -0.305169 and 0.222704, respectively. TB and GF had a weak positive correlation with IPP and QE, and IM had a weak negative correlation with IPP.

Panel Regression Analysis

Panel regression was carried out on the general model. Two major panel data estimation models are the most prevalent and frequently used: the fixed effects model and the random effects model. The Hausman test was done to determine the appropriate model for the available data. (Sheytanova, et al., 2014). The null hypothesis would imply no significant differences between the estimates of the fixed effect model and the random effect model.

Table 3: Hausman Test for General Model

Correlated Random Effects - Hausman Test
Equation: EQUATION1
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	132.744058	4	0.0000

The Hausman test in Table 3 showed the Chi-Square test statistic was 132.74 with a significant probability value of 0.0000, which was significant at 5% level of significance. This, therefore, means that the null hypothesis was rejected in favour of the Fixed Effects model. Consequently, the researcher accepted the Fixed Effects model as suitable for this study's general model.

Table 4: Fixed Effects Model

Dependent Variable: LN_IPP
Method: Panel Least Squares
Cross-sections included: 1082
Total panel (unbalanced) observations: 4030

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_IR	-3.721652	1.353508	-2.749634	0.0060
LN_NSE	3.802764	1.314464	2.893014	0.0038
LN_INF	-1.635495	0.506141	-3.231303	0.0012
LN_GDP	-2.730452	0.480703	-5.680124	0.0000
C	-17.77287	6.451003	-2.755056	0.0059

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.545100	Mean dependent var	-1.891638
Adjusted R-squared	0.377449	S.D. dependent var	1.108380
S.E. of regression	0.874533	Akaike info criterion	2.794707
Sum squared resid	2251.593	Schwarz criterion	4.492834
Log likelihood	-4545.334	Hannan-Quinn criter.	3.396420
F-statistic	3.251389	Durbin-Watson stat	2.076019
Prob(F-statistic)	0.000000		

The results of the panel regression Fixed Effects estimation model are shown in Table 4. The probability (F-statistic) was 0.000000, which means the model is stable. The R-Squared for the general model was 0.5451, meaning that the proxies of systematic risk, interest rates, NSE-Share Index, rate of inflation and GDP simultaneously affect the investment portfolio performance of pension schemes significantly by 54.51 %. The adjusted R-Squared was 37.74 %, which is less than 20 % different from the R-Squared, meaning that the model is stable.

The Durbin-Watson statistic was 2.076, meaning the model no serial correlation. The probability (F-statistic) was 0.000000, which means the model is stable. The general model is specified as follows:

$$IPP_{it} = -17.7729 + -3.7217IR_{it} + 3.8028NSE_{it} + -1.6355\,INF_{it} + -2.7305GDP_{it} + \mu_{it}$$

The first specific objective of the study was to investigate the effects of interest rates on the investment portfolio performance of pension schemes in Kenya. The panel regression results above show that interest rates had a coefficient of -3.7217 and a probability value of 0.0060, which is significant at 5% level of significance. This means interest rates are a predictor of portfolio investment performance, and when interest rates are reduced by -3.72 %, investment portfolio performance increases by 1 %.

The result above contradicts the findings of Pablo, Schich and Yermo (2011), who researched the economic impact of protracted periods of low interest rates on pension funds among insurance companies in select OECD countries. Further, Lu, Pritsker, Zlate, Anadu, and Bohn (2019) found evidence consistent with the reach-for-yield and interest rate (risk-premia) channels of risk-taking behaviour, as pension schemes take more risk in response to underfunding and low-interest rates on safe assets.

The findings of this study were consistent with Akwimbi (2020), which established the effect of selected macroeconomic variables on the performance of the pension fund industry in Kenya. Further, Akwimbi (2020) found that the average interest rate was individually valuable in predicting the performance of seven pension funds out of the 13 pension funds in his study. He also found that interest rates were positively correlated with the performance of pension funds.

The second specific objective was to examine the effects of the stock market index on the investment portfolio performance of pension schemes in Kenya. The coefficient of the NSE 20-Share Index was 3.80276 and a probability value of 0.0038, which is significant at 5% level of significance. The data shows that the stock market index does not have a significant relationship with the investment portfolio performance of pension schemes in Kenya. The results imply that when the NSE 20-Share Index grew by 3.80%, the investment portfolio performance improved by 1%.

The findings were consistent with Alda (2017), who examined the relationship between pension funds and the stock market in 13 European countries and whether the ageing population of Europe affect it. The results were also consistent with Chovancova, Hudcovsky and Kotaskova (2019) investigation of the impact of stocks and bonds on pension scheme performance in OECD countries. Thomas, Spataro, and Mathew (2014) investigated the empirical relationship between the investment of pension funds in stocks and stock market volatility in the OECD market.

The third objective was to determine the effects of the inflation rate on the investment portfolio performance of pension schemes in Kenya. The null hypothesis was that the inflation rate does not have a significant relationship with the investment portfolio performance of pension schemes in Kenya. The panel data regression results showed that the rate of inflation had a coefficient of -1.64 and a probability value of 0.0012, which is significant at 5% level of significance. This implies that the inflation rate hada significant relationship with the investment portfolio performance of pension schemes in Kenya. The results show that when inflation is reduced by 1.64%, investment portfolio performance increased by 1%.

The negative correlation between inflation rate and investment portfolio performance is consistent with Calisto, Kufakunesua, Zyla and Beyers (2021). It is also consistent with Wanga, Lib and Sun (2021), who investigated a robust portfolio choice for a DC pension plan with inflation risk and mean-reverting risk premium under ambiguity.

The fourth objective was to study the effects of economic growth on the investment portfolio performance of pension schemes in Kenya. The study results showed that the Gross Domestic Product coefficient was -2.73 and a probability value of 0.0000, which is significant at 5% level of significance. The researcher, therefore, rejected the null hypothesis that economic growth does not have a significant relationship with the investment portfolio performance of

pension schemes in Kenya. This means that when GDP growth was reduced by 2.73%, the investment portfolio performance grew by 1%.

The negative correlation is contrary to Irving (2021), who assessed the short-to-medium-term impact of COVID-19 on African pension fund sectors' portfolio management. The results are also contrary to Mazreku, Morina and Curraj (2020), who evaluated the financial performance of pension schemes in Kosovo, Albania and North Macedonia. The results showed a statistically significant (P - value = 0.000 <0.10) positive relationship between the gross domestic product as the independent variable and the performance of pension funds.

Panel Regression with Moderating Variables

The moderating variables are pension fund allocation to Treasury Bills and Bonds, quoted equities, immovable properties and guaranteed funds, which comprise over 95% of pension assets.

Table 5: Hausman Test for Allocation to Moderating Variables

	Chi-Sq. Statistic	Prob.
EQUATION2-TB	52.005149	0.0000
EQUATION3-QE	33.300081	0.0000
EQUATION4-IM	4.369887	0.6268
EQUATION5-GF	102.864079	0.0000

The results of the Hausman test in Table 5 show that the Chi-Square test statistic was 52.005149 for allocation to Treasury Bills and Bonds, 33.300081 for allocation to quoted equities, 102.864079 for guaranteed funds, all with a significant probability value of 0.0000 which was significant at 5% level of significance. This, therefore, means that the null hypothesis was rejected in favour of the Fixed Effects model. Consequently, the researcher accepted the Fixed Effects model as suitable for this study's equations 2, 3 and 5.

The results of the Hausman test above show that the Chi-Square test statistic for the immovable property was 4.3699 with a significant probability value of 0.6268 which was insignificant at 5% level of significance. Therefore, the researcher accepted the Random Effects model as suitable for this study.

Table 6: Model for Allocation to Moderating Variables

Dependent Variable: LN_IPP
Method: Panel Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MOD1_TB	-0.298932	0.195862	-1.526238	0.1273
MOD2_QE	-0.022423	0.098438	-0.227789	0.8199
MOD3_IM	0.112607	0.155413	0.724565	0.4693
MOD4_GF	0.160175	0.090028	1.779168	0.0754

Table 6 shows the coefficients of asset allocation to various asset classes (Fixed Effects and Random Effects complete analysis are shown in Appendix I, II, III and IV. The results show

that the moderator variable of allocation to Treasury Bills and Bonds (MOD1_TB) had a coefficient of -0.298932 and an insignificant probability value of 0.1273. This means that allocation to Treasury Bills and Bonds did not moderate the relationship between systematic risk variables and investment portfolio performance.

The moderator variable of allocation to Quoted Equities (MOD2_QE) had a coefficient of --0.022423 and an insignificant probability value of 0.8199. This means that allocation to Treasury Bills and Bonds did not moderate the relationship between systematic risk and investment portfolio performance.

The moderator variable of allocation to immovable properties (MOD3_IM) had a coefficient of 0.112607 and an insignificant probability value of 0.4693. This means that allocation to Treasury Bills and Bonds did not moderate the relationship between systematic risk variables and investment portfolio performance.

The moderator variable of allocation to Guaranteed Funds (MOD4_GF) had a coefficient of 0.160175 and a significant probability value of 0.0754 at 10% level of significance. This means that allocation to Guaranteed Funds moderated the relationship between systematic risk variables and investment portfolio performance. The coefficient was not significant at 5% level of significance.

CONCLUSIONS, RECOMMENDATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

The study established varying degrees of influence between the independent systematic risk variables selected for the study and the investment portfolio performance of pension schemes as the dependent variable. From the variable with the highest influence to the one with the least, their correlation can be ranked as NSE 20 Share index, interest rate, GDP growth rate and Inflation.

The study also established that asset allocation to Treasury Bills and Bonds, quoted equity, and immovable properties did not significantly moderate the effect of systematic risk on the investment portfolio performance of pension schemes. The allocation to guaranteed funds had a moderating effect on the effect of systematic risk on the investment portfolio performance.

The study established that all the selected proxies for systematic risk had an effect on the investment portfolio performance of pension schemes in Kenya. All the variables had a significant correlation with the investment portfolio performance of pension schemes in Kenya. It also established that the allocation of pension assets to three of the four major asset classes, namely Treasury Bills and Bonds, quoted equity, and immovable assets, did not have a significant moderating effect on the investment portfolio performance of pension schemes. Allocation of pension assets to guaranteed funds had a significant moderating effect on the effect of systematic risk on the investment portfolio performance of pension schemes in Kenya.

Preparation of the investment policy should take into account interest rate, NSE Share Index and growth in GDP in particular as having the most significant influence on the direction taken by investment portfolio performance of pension schemes. The effect of inflation was significant, although it had a lower influence. The investment policy should also consider the allocation of guaranteed funds because it had a significant moderating impact on the effect of systematic risk on the investment portfolio performance.

The asset allocation to guaranteed funds, one of the four major asset classes, was the only one that had a significant moderating on the effect of systematic risk on investment portfolio performance. Hence, interest rates, NSE 20 share index, inflation and, GDP and allocation to guarantee funds variables should be carefully considered by the Retirement Benefits Authority and the National Treasury as industry regulators in the pension industry when setting up limits on asset classes for pension scheme investments. All other stakeholders, such as pensioners, pension fund trustees and administrators, should also consider these factors when making decisions about pension schemes and the pension industry.

Although RBA has approved 14 asset classes in which pension schemes can invest their assets, four major asset classes account for over 95% of the pension industry assets. The diverse asset classes aim to mitigate risk, an objective that may not be achieved when the risk concentration is on four classes of assets. Further research could investigate the concentration risk to only four asset classes. A large portion of asset allocation is on Treasury Bills and Bonds, which are risk-free, indicating risk-averse behaviour and possible financial repression. Further research could be done to investigate risk aversion and possible financial repression and the effect on investment portfolio performance.

Since the pension industry in Kenya is nascent, further comparative research needs to be carried out between Kenya and more developed markets to determine the policies adopted by these markets and how they differ from the Kenyan market. This might result in adopting better market practices and optimising the investment portfolio performance of pension schemes in Kenya

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APPENDICES I

Table 7: Fixed Effects Model for Allocation to Treasury Bills and Bonds

Dependent Variable: LN_IPP
Method: Panel Least Squares
Cross-sections included: 412
Total panel (unbalanced) observations: 1382

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_IR	1.888289	2.604434	0.725029	0.4686
LN_NSE	-3.282659	2.439970	-1.345369	0.1788
LN_INF	1.463064	0.946939	1.545045	0.1227
LN_GDP	-0.506399	0.932419	-0.543103	0.5872
LN_TB	3.934199	2.656860	1.480770	0.1390
MOD1_TB	-0.298932	0.195862	-1.526238	0.1273
C	18.78261	11.75029	1.598481	0.1103

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.611033	Mean dependent var	-1.969519
Adjusted R-squared	0.442777	S.D. dependent var	1.187433
S.E. of regression	0.886388	Akaike info criterion	2.841400
Sum squared resid	757.3985	Schwarz criterion	4.423656
Log likelihood	-1545.407	Hannan-Quinn criter.	3.433264
F-statistic	3.631558	Durbin-Watson stat	2.281660
Prob(F-statistic)	0.000000		

APPENDICES II

Table 8: Fixed Effects Model for Allocation to Quoted Equity as Moderator Variable

Dependent Variable: LN_IPP
Method: Panel Least Squares
Cross-sections included: 402
Total panel (unbalanced) observations: 1368

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_IR	3.688445	2.491674	1.480308	0.1391
LN_NSE	-4.608219	2.428433	-1.897610	0.0580
LN_INF	2.014905	0.938656	2.146586	0.0321
LN_GDP	0.058982	0.909724	0.064835	0.9483
LN_QE	0.347103	1.347554	0.257580	0.7968
MOD2_QE	-0.022423	0.098438	-0.227789	0.8199
C	24.03395	12.07413	1.990532	0.0468

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.593555	Mean dependent var	-1.986494
Adjusted R-squared	0.421240	S.D. dependent var	1.175289
S.E. of regression	0.894116	Akaike info criterion	2.856358
Sum squared resid	767.4665	Schwarz criterion	4.413530
Log likelihood	-1545.749	Hannan-Quinn criter.	3.439135
F-statistic	3.444585	Durbin-Watson stat	2.189194
Prob(F-statistic)	0.000000		

APPENDICES III

Table 9: Random Effects Model for Allocation to Immovable Properties as a Moderating Variable

Dependent Variable: LN_IPP
Method: Panel EGLS (Cross-section random effects)
Cross-sections included: 98
Total panel (unbalanced) observations: 302
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_IR	-1.916552	6.297251	-0.304347	0.7611
LN_NSE	1.487613	6.112911	0.243356	0.8079
LN_INF	-0.430889	2.425944	-0.177617	0.8591
LN_GDP	-2.017379	2.351254	-0.858001	0.3916
LN_IM	-1.888575	2.131736	-0.885933	0.3764
MOD3_IM	0.112607	0.155413	0.724565	0.4693
C	-7.058960	29.72630	-0.237465	0.8125

Effects Specification	S.D.	Rho
Cross-section random	0.594605	0.2402
Idiosyncratic random	1.057399	0.7598

Weighted Statistics			
R-squared	0.111918	Mean dependent var	-1.545380
Adjusted R-squared	0.093856	S.D. dependent var	1.131655
S.E. of regression	1.066148	Sum squared resid	335.3179
F-statistic	6.196109	Durbin-Watson stat	1.385072
Prob(F-statistic)	0.000004		

Unweighted Statistics			
R-squared	0.130527	Mean dependent var	-2.238966
Sum squared resid	433.1812	Durbin-Watson stat	1.080647

APPENDICES IV

Table 10: Fixed Effects Model for Allocation to Guaranteed Funds as a Moderator

Dependent Variable: LN_IPP
Method: Panel Least Squares
Cross-sections included: 742
Total panel (unbalanced) observations: 2627

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LN_IR	-9.340162	1.674618	-5.577489	0.0000
LN_NSE	9.965244	1.636806	6.088224	0.0000
LN_INF	-4.281705	0.638691	-6.703880	0.0000
LN_GDP	-5.106398	0.613580	-8.322300	0.0000
LN_GF	-2.057399	1.179322	-1.744560	0.0812
MOD4_GF	0.160175	0.090028	1.779168	0.0754
C	-47.75899	8.013290	-5.959973	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.550183	Mean dependent var	-1.843104
Adjusted R-squared	0.371357	S.D. dependent var	1.075423
S.E. of regression	0.852671	Akaike info criterion	2.753482
Sum squared resid	1366.122	Schwarz criterion	4.425903
Log likelihood	-2868.698	Hannan-Quinn criteria.	3.359123
F-statistic	3.076643	Durbin-Watson stat	2.090596
Prob(F-statistic)	0.000000		