INTERNATIONAL JOURNAL OF ECONOMICS AND FINANCE STUDIES
Vol: 14 **No:** 1 **Year:** 2022 **ISSN**: 1309-8055 (Online) (**pp.** 202-217) **Doi:** 10.34109/ijefs. 202220008
Received: 25.11.2021 | **Accepted:** 15.01.2022 | **Published Online:** 19.03.2022

-RESEARCH ARTICLE-

PENSION FUNDS AND STOCK MARKET PERFORMANCE IN SOUTH AFRICAN ECONOMY: ASYMMETRIC COINTEGRATION ANALYSIS

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─Abstract─

Pension funds' stock market investments have been steadily expanding, possibly due to the expansion of pension funds' assets. Using asymmetric cointegration analysis, this study examines the effects of pension fund assets invested in the stock market on the development of the Johannesburg Stock Exchange. The study analyses quarterly statistics on pension funds invested in the stock market and the value and volume of equities traded on the Johannesburg Stock Exchange from 1990 to 2020. The findings indicate that pension funds' investments in the stock market and the stock market variables used display long-run asymmetric correlations that are meaningful in the long run. The study suggests that pension funds can bolster the stock market's depth and strength if the pension funds' security and safety are ensured.

Keywords: Pension funds, value of stocks, volume of stocks, asymmetric cointegration

1. INTRODUCTION

The previous decades have seen significant modifications and development in various countries' public pension systems and pension industries. Numerous governments emphasised the importance of retirement savings. As a result of the changes

Citation (APA): Sanusi, K. A., Eita, J. H. (2022). Pension Funds and Stock Market Performance in South African Economy: Asymmetric Cointegration Analysis. *International Journal of Economics and Finance Studies, 14* (1), 202-217. doi: 10.34109/ijefs. 202220008

implemented in various nations, pension funds have grown enormous and highly considerable. The primary justification for pension changes across the globe is that pension funds will play a dynamic role in expanding and developing the capital market.

Additionally, it was expected that a reformed pension system would encourage private sector savings and eventually cut enterprises' cost of capital (Raddatz et al., 2008). Unlike other institutional or retail funds, pension funds are thought to be capable of providing long-term domestic funding to firms and governments, owing to pensioners' long-term savings. Pension funds provide a reliable source of financing for capital markets since retirees are legally compelled to contribute a consistent supply of funds to pension funds for a specified number of years (Briard et al., 2020). Due to the long-term nature of pension fund assets, these funds are mandated by statute to invest primarily in domestic capital markets. They are expected to contribute to capital markets' growth significantly.

Several empirical arguments have taken place over pension funds' role in capital market development. An understanding of the role of pension funds in capital market development would inform policymakers on how to utilise the accumulated and growing stock of pension funds. It is to be observed on the African continent in general and in the South African economy in particular to stimulate capital market growth for the economy's overall development and the benefit of the populace.

According to some studies, pension funds contribute to the development of domestic equity and debt markets by increasing demand for investment instruments (E. P Davis, 1995)(Davis, 1995; Vittas, 1995, 1999; Catalán, 2004; Catalán et al., 2000; Lefort and Walker, 2000, 2000a, 2002b; Corbo and Schmidt-Hebbel, 2003; and Andrade et al., 2007). Several other research concluded that pension funds make a negligible contribution to capital market development (Arrau et al., 1998; Berstein, 2006; F, 1999; Olivares, 2005; Yermo, 2005) (Arrau and Chumacero, 1998; Zurita, 1999; IMF and World Bank, 2004; Yermo, 2005; Olivares, 2005; Berstein and Chumacero, 2006). However, these analyses have a significant flaw: they assume that all pension funds are invested in the local stock market (Alda García et al., 2017) . As a result, these studies could not segregate pension funds that were not involved in the stock market when assessing the influence of pension funds in stock market development. Alda García et al. (2017) were the first to overcome this limitation. Their findings indicate that pension funds benefit the stock market's size in eight European countries (Duke et al., 2020).

In contrast to Alda García et al. (2017), this study examines the impact of pension funds invested in equities on the stock market's evolution, but within a non-linear framework. Although the real world is not linear, Alda García et al. (2017) assumed linearity for the variables they used, yet empirical time series are almost always non-linear until otherwise demonstrated. Our preliminary analysis verified this conclusion by showing that the linearity hypothesis is rejected (Gudalov et al., 2020). Thus, this study attempts to contribute to the literature by examining pension funds' role in developing the stock market in the South African economy using a non-linear framework. Cuestas et al. (2011), Cuestas et al. (2014), and J. Hu et al. (2016) non-linear unit root tests were then used to determine the variables' time-series properties. None of the variables are I(2), they were simulated using the Nonlinear Autoregressive Distributed Lag model and the Enders et al. (2001) non-linear cointegration test. The remainder of the essay is structured as follows. Section 2 includes an empirical examination of the relationship between pension funds and stock market performance (Habanabakize, 2020). The empirical approach is discussed in Section 3. Section 4 discusses empirical findings, whereas Section 5 discusses concluding remarks.

2. EMPIRICAL REVIEW

Numerous studies in industrialised nations have been conducted to determine the effect of pension fund equity investments on the performance and development of stock exchanges. Meng et al. (2010) used a biased-corrected Least Square Dummy Variables (LSDVC) estimator to examine the effect of pension funds' equity and bond investments on stock market development. They discovered that pension fund investments have a beneficial impact on stock market depth and liquidity, but only in nations with a high level of financial development. Thomas et al. (2014) examined the link between pension fund assets invested in stocks and stock market volatility in 34 OECD nations from 2000 to 2010. The study finds an inverse link between stock market volatility and institutional investors using a random-effects panel model and a Prais–Winsten regression with panel-corrected standard and autoregressive errors. Moleko and Ikhide (2017) conducted an empirical study in South Africa. They demonstrated a positive association between pension savings and stock market development, but no long-run relationship between pension savings and bond market development (Kikulwe et al., 2020).

Alda García et al. (2017) investigated eight European stock markets. They discovered that pension funds have a favourable effect on market size, return, and stability in the short and long run (with higher influence on the short-term than in the long-term). Alda (2017) reached the same conclusion, concluding that pension fund equity investments have a favourable effect on stock market development, after conducting an efficiency analysis in 13 European nations from 1999 to 2014. Holzmann (1997), Catalan et al. (2000), Impavido et al. (2003), Y. Hu (2006), and Davis & Hu (2008) all established a similar viewpoint regarding pension funds' favourable impact on stock market development. Similarly, Babalos et al. (2020) examined the influence of pension fund equity investments on the stock market development. The study discovered a significant bidirectional relationship between stock market development and pension fund investments in stocks using a panel VAR of 29 nations. It argued that stock market volatility is the primary driver of future variations in pension fund assets invested in equities (Matthews et al., 2020). On the other hand, it has been demonstrated that other market indices such as dividend yield, turnover ratio, and market volatility all have a favourable effect on the growth of pension assets. On the other hand, some research, such as Bijlsma et al. (2018), E Philip Davis et al. (2004), and E Philip Davis (2004) , examined the effect of pension fund growth on other market indices, rather than the effect of market indices on pension fund growth. The findings from the few available research are mostly inconsistent and inconclusive. (Berstein, 2006); Walker et al. (2002), Faugère et al. (2003), and Bohl et al. (2009) indicated that pension fund growth mitigated the adverse consequences of market volatility. At the same time, E Philip Davis (2004) and E Philip Davis (2004) acknowledged that pension fund growth exacerbates market volatility in their empirical findings. Hu also confirms this position (2006). Pension rise, the report argued, enhances and exacerbates market volatility in 16 OECD nations and eight emerging markets (Yoon et al., 2020).

3. EMPIRICAL APPROACH

The study examined the impact of pension funds on stock market development using non-linear adjustment methods. It has been argued and demonstrated that macroeconomic and financial variables adjust unequally over the business cycle (Beaudry et al., 1993; Bradley et al., 1997; DeLong et al., 1988; Potter, 1995). The Engle et al. (1987) and Johansen (1995) tests, which almost all previous research on pension funds and stock market performance has implicitly embraced, imply a linear adjustment process. The current investigations distinguish themselves from previous research because they take a non-linear adjustment approach to the topic matter (Valencia, 2020). The study used a cointegration technique to determine the probability of asymmetric error repair. This is critical because Enders and Granger (1998) demonstrate that unit-roots tests and cointegration have low power in the presence of asymmetric adjustment (Wallenius et al., 2020). The study analyses quarterly statistics on pension funds invested in the stock market and the value and volume of equities traded on the Johannesburg Stock Exchange from 1990 to 2020.

3.1 Non-linearity Test

Both BDS and Mcleod-Li tests are adopted to establish the non-linearity of the variables. Conventionally, -the BDS test confirms a null hypothesis that a series consists of independent and identically distributed random variables The Mcleod-Li test determines the non-linearity given the assumption that the variables under consideration are fourth-order stationery. The specification is as follows: Given a time series that could any variable under consideration; pension funds invested in stocks, the value of share, and volume of share. Let the variable be denoted by y_t $\{y_t|t = 1, \dots . T\}$, T represents sample size. m is assumed to be a positive integer. m history of the series as $y_t^m = (y_t, y_t, \dots \dots y_{t-m+1})$ for $t = m, \dots \dots . T$.

We define the correlation integral embedding the dimension m as:

$$C(m, \epsilon) = \lim_{T\to\infty} \frac{2}{T_m(T_m-1)} \sum\sum_{m\le s<t\le T} I(y_t^m, y_t^m \backslash \epsilon) \quad (1)$$

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BDS test likens the $C(m,\epsilon)$ with $C(1,\epsilon)$ under the null hypothesis.

Our BDS test can specified as follow:

$$D(m,\epsilon) = \frac{\sqrt{T}\,[\hat{C}\ (m,\epsilon) - \{\hat{C}\ (1,\epsilon)\}^{m}]}{s(m,\epsilon)} \tag{2}$$

and $\hat{C}(k,\epsilon)$ is specified as follows;

$$\hat{C}(k,\epsilon) = \frac{2}{T_2(T_2-1)} \sum\sum_{K\le s<t\le T} I(y_t^K, y_T^K \backslash \epsilon),\ k = 1, m,.$$

The standard error of $\widehat{C}\ (m,\epsilon) - \{\hat{C}\ (1,\epsilon)\}^{m}$ is $s(m,\epsilon)$, and we estimate this from the data under the assumed null hypothesis.

The Mcleod-Li test, which is the lag ℓ autocorrelation of the squared residuals, can be specified as:

$$\hat{\rho}_{aa}(\ell) = \frac{\sum_{t=\ell+1}^{T}(\hat{a}_t^2 - \hat{\sigma}^2)(\hat{a}_{t-\ell}^2 - \hat{\sigma}^2)}{\sum_{t=1}^{T}(\hat{a}_t^2 - \hat{\sigma}^2)} \tag{3}$$

$\hat{\sigma}^2 = {\hat{a}_t^2}/{T}$ and the sample size is T. Mcleod-Li test shows that for a given positive integer m, the joint distribution of $\sqrt{T}\ [\hat{\rho}_{aa}(2), \dots \dots . \hat{\rho}_{aa}(m)]^{\iota}$ is asymptotically multivariate normal with mean zero and identity covariance matrix if the fitted linear model is adequate for the series.

3.2 Non-linear ARDL

The asymmetric long-run relation of the variables under investigation can be specified as follow (Ibrahim, 2015; Shin et al., 2014):

$$LSTV_t = \alpha_0 + \alpha_1 LPFS_i^{+} + \alpha_2 LPFS_t^{-} + e_t \ \dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where $LSTV_t$ is vector of stock market variables used to measure stock market performance in logarithmic form. In this case, value of stock and volume of stocks traded in the Johannesburg Stock Exchange market were adopted. Value share denotes the value of stock traded while Volume share denotes volume of stock traded in the estimation process. While $\alpha(\alpha_{0i}, \alpha_{1i}, \alpha_{2i},)$ is the vector form of long-run parameters. Pen_share is denoted by share of pension funds invested in stock market. $LPFS_t^{+}$ and $LPFS_t^{-}$ capture both upward and downward changes in pension funds invested in stock market.

Accordingly, we have:

$$LPFS_{it}^{+} = \sum_{i=1}^{t} \Delta LPFS_i^{+} = \sum_{i=1}^{t} \max\,(\Delta LPFS_I, 0) \dots\dots\dots\dots\dots\dots\dots\dots (5)$$

$LPFS_{it}^{-}=\sum_{i=1}^{t}\Delta LPFS_{i}^{-} = \sum_{i=1}^{t}\min(\Delta LPFS_{I},0)$ ....(6)
The long-run linkages between stock market performance variables and increase in pension funds invested in stock market are α_{1i}, and α_{2i}, and they capture the long-run relations between stock market performance variables and decrease in pension funds invested in stock market

Equation (4) can be restated in a panel ARDL framework.as:

$$\Delta LSTV_t = \beta_i + \alpha_\alpha LSTV_{t-1} + \alpha_1 LPFS_{t-1}^{+} + \alpha_2 LPFS_{t-1}^{-} + \sum_{i=1}^{p}\rho_i \Delta LSTV_{t-j} + \sum_{i=0}^{q}\left(\emptyset_t^{+}\Delta LST_{t-j}^{+} + \emptyset_t^{-}\Delta LSTV_{t-j}^{-}\right) + \mu_\mu \quad \text{...(7)}$$

p, q are lag orders, and α_1 and α_2 are the long-run effect of the individual increase in pension funds invested in stock and reduction in pension funds invested in the stock.

$\sum_{i=0}^{q}\emptyset_t^{+}$ captures the impacts of an increase in pension funds invested in stock in the short-run, while $\sum_{i=0}^{q}\emptyset_t^{-}$ captures the impacts of reduction in pension funds invested in stock in the short run. Consequently, we also capture the asymmetric effects of pension funds invested in stock in the short-run.

3.3 Enders and Siklos Nonlinear Cointegration Test Function

The conventional model for cointegration between two variables which inherently assume linear and symmetric relationship is given as:

$$Y_t = \alpha_0 + \alpha_1 X_t + v_t \quad \text{..(8)}$$

$$\Delta v_t = \rho v_{t-1} + \sum_{I=1}^{P}\delta_I v_{t-i} + \omega_t \quad \text{...(9)}$$

Both Y_t and X_t are vector of $(n \times 1)$ vectors of integrated variables of order 1 while first differencing is denoted Δ and α_1 $(n \times n)$ matrix. v_t is a vector of error terms that is normally and independently distributed with zero mean and constant variance and denoted by σ^2. The deviation from the equilibrium between Y_t, X_t and ω_t is captured error term. It would be recalled that Engle et al. (1987) investigated the presence of cointegration between Y_t and X_t inequation (8). It was established that Y_t and X_t are cointegrated as long as $\rho \neq 0$. In the face of non-linear adjustment, which characterized time series. Enders et al. (2001) adjusted the linear cointegration to account for non-linear adjustment in equation (8).

$$\Delta v_t = \rho_1 I_t v_{t-1} + \rho_2(1 - I_t)v_{t-1} + \sum_{k=1}^{P}\varphi_k \Delta v_{t-k} + \omega_t \quad \text{...........................(10)}$$

Where P is the lag order based on Akaike Information Criterion (AIC), and ρ_1, ρ_2 and φ_k are coefficient terms. I_t is known as Heaviside indicator function, and is usually denoted in term of lagged values of v_t as $I_t = 1$, if $v_{t-1} \geq \tau, 0$ otherwise (Threshold model; TAR), or $I_t = 1$, if $\Delta v_{t-1} \geq \tau, 0$ otherwise (Momentum, model; MTAR).

The TAR model entails the deep movements in the long-run equilibrium deviations. On the other hand, MTAR model entails steep movements in the series (Tsagkanos et al., 2015). The speed of adjustment when there is long-run equilibrium deviation are denoted in the model as ρ_1, ρ_2. $\rho_1 < 0$ and $\rho_2 < 0$ as long as there is the existence of cointegration. Note that as long as $(|\rho_1| \leq |\rho_2|)$, increases will be persistent, and decreases will move quicker and faster to equilibrium.

4. EMPIRICAL RESULTS

4.1 Summary Statistics of the Variables

Table 1 summarises the value of shares, volume of shares, and pension fund investments on the Johannesburg Stock Exchange. For all factors, the mean return was positive. Additionally, the mean and median values for all variables are near. Further, the results indicate that all series display negative skewness, with the kurtosis test statistic above its normal value. According to the Jarque-Bera test, none of the series are regularly distributed. The absence of the normalcy requirement also implies the possibility of asymmetric relationships between the variables. The trend of the variables over the research period is depicted in Figure 1. The findings indicate that pension funds' investment in the stock market has constantly expanded over the study period as measured by share value and volume.

4.2 Non-linearity Test Results

BDS and Mcleod-Li tests are used to evaluate the non-linearity or otherwise of the variables. Both BDS test and Mcleod-Li test confirm the non-linearities in the variables. The respective p-value was significant, so the null hypothesis of linearity was rejected. The results of the BDS test and Mcleod-Li test are contained in Tables 2 and 3, respectively.

Table 1: Summary Statistics of Variables

Statistics	Valu_share	Volm_shar	Pen_share
Mean	12.15259	3.507	4.584
Median	12.54588	3.453	4.594
Maximum	14.28031	3.843	4.628
Minimum	8.159089	3.0982	4.504
Std. Dev.	1.855742	0.225	0.032
Skewness	-0.689050	0.141	-0.763
Kurtosis	2.138096	1.843	2.962
Jarque-Bera	13.21019	2.125	3.499
Probability	0.001353	0.345	0.173
Observations	124	124	1 24

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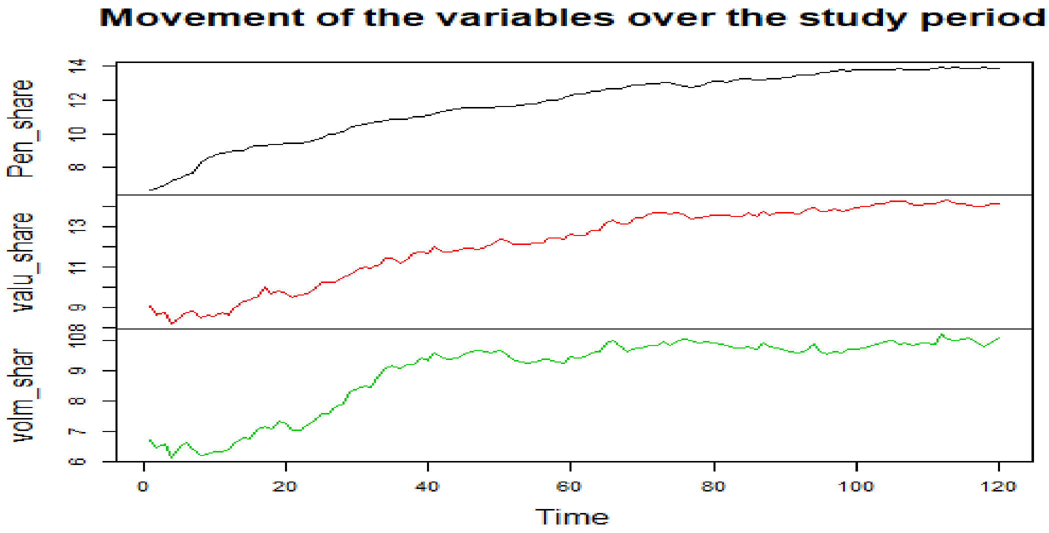

Figure 1: The trend of the variables

Table 2: **BDS Nonlinearity Test**

Statistics	Valu_share	Volm_shar	Pen_share
1(2)	7.76(0.00000)*	4.63(0.000)*	9.00(0.0000)*
1(3)	15.02(0.0000)*	20.2(0.00)*	10.4(0.001)*
2(2)	22.42(0.001)*	11.89(0.05)*	12.2(0.00)*
2(3)	2.13(0.000)*	9.6(0.000)*	7.31(0.000)*
3(2)	6.56(0.01)*	5.25(0.000)*	13.81(0.000)*
3(3)	10.14(0.000)*	20.4(0.00)*	6.32(0.000)*
4(2)	11.81(0.04)*	18.02(0.000)*	23.10(0.04)*
4(3)	17.01(0.00)*	8.11(0.000)*	14.61(0.000)*

* indicates parameter is significant at 5%

Table 3: Mcleod-Li test Non-linearity Test

	Mcleod-Li Statistic	p-value
Valu_share	628.52	0.00000*
Volm_shar	731.16	0.00000*
Pen_share	462.45	0.00000*

* indicates parameter is significant at 5%

4.3 Nonlinearity Unit Root Test Results

The section presents the results of the non-linear unit root test. Cuestas et al. (2011), Cuestas et al. (2014) and J. Hu et al. (2016) non-linear unit root tests are used to determine the time-series properties of the variables as contained in Table 4. The results simply show that all the series are stationary after first differencing, and hence none of the variables is I(2).

4.4 Nonlinear ARDL Results

Table 5 contains bounds F-statistic and critical value bounds for the F-statistic. The results indicate that the values of the computed F-statistics (5.67) in Panel A and (4.87) in Panel B are respectively more than the upper bound critical values (4.35) in Panel A and (4.17) in Panel B of the bounds testing. Hence, we reject the null hypothesis of no cointegration and submit that both the value of stocks and volume stocks traded in Johannesburg Stock Exchange Market are cointegrated with pension funds invested in the stock market.

Having established a long-run relationship between the stock market performance variables and the pension funds invested in the stock market, the next task is to establish the existence or otherwise of the long asymmetric relationship among the variables. The results are presented in Table 6. The results show a long-run asymmetric relationship between each of the value and the volume of stocks traded in Johannesburg Stock Exchange and pension funds invested in the stock market.

The non-linear ARDL long- and short-run estimations are shown in Table 7 due to the estimation of equations (6 & 7). As shown in Table 7, pension funds invested in the stock market have an asymmetric effect on stock market development. This is done with increased pension funds invested in the stock market being significantly associated with stock market development at the 5% level of significance. In comparison, a decrease in pension funds invested in the stock market is also significantly associated with stock market development at the 5% significance level. However, short-run estimation revealed that pension funds invested in the stock market are not significantly related to the stock market's growth. The diagnostic test for models demonstrated that the estimated models pass the normality, serial correlation, and heteroscedasticity tests.

4.5 Enders and Siklos Nonlinear Cointegration Test Results

Enders et al. (2001) asymmetric cointegration results are contained in Table 8.

The cointegration results with TAR and M-TAR models are reported in Table 8. As can be observed from Table 8, Panels A and B, the Φ statistics rejects the null hypothesis: H0:$\rho_1 = \rho_2 = 0$ of no cointegration between the stock market performance and pension funds invested in stock market under both TAR and M-TAR models. Also, the F-statistic which confirms the existence or otherwise of asymmetric relationship with the null hypothesis of H0: $\rho_1 = \rho_2$ also, establish the existence of asymmetric relationships under both models. The Enders et al. (2001) asymmetric cointegration results confirm NARDL asymmetric and bound test results.

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Table 4: Non-linearity Unit Root Test Result

Test	Valu_share		Volm_shar		Pen_share	
	Level	1st.diff	Level	1st.diff.	Level	1st.diff.
Cuestas & Garratt (2011)	-2.34	-7.74*	-3.89	-9.56*	-1.27	-18.25*
Cuestas & Ordonez (2014)	-1.76	-3.77*	-1.89	-5.32*	-1.36	-3.30*
Hu & Chen (2016)	-0.092	-3.218*	-1.36	-2.92*	-0.073	-3.514*

* indicates parameter is significant at 5%

Table 5: **Bounds Test for Non-Linear Cointegration**

	Panel A: Value of Stocks as dependent variable	Panel B: Volume of Stocks as dependent variable
Statistic	Coefficient	Coefficient
95% lower bound	3.23	3.12
95% upper bound	4.35	4.15
F -statistic	5.67	4.87

* Indicates parameter is significant at 5%

Table 6: **Test for Asymmetry**

	Panel A: Value of Stocks as dependent variable	Panel B: Volume of Stocks as dependent variable
Statistic	Coefficient	Coefficient
F-statistic	5.656	4.395
p-value	0.01	0.03
decision	Asymmetry	Asymmetry

* indicates parameter is significant at 5%

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Table 7: Short-Run and Long-Run NARDL Estimates

Panel A: Value of Stocks as dependent variable		Panel B: Volume of Stocks as dependent Variable	
Variable	Coefficient	Variable	Coefficient
Pen_share^{+}	0.999^{*}	Pen_share^{+}	0.73*
Pen_share^{-}	-1.35^{*}	Pen_share^{-}	-0.62*
ΔPen_share^{+}	0.27	ΔPen_share^{+}	0.08
ΔPen_share^{-}	-0.46	ΔPen_share^{-}	-0.28
$\Delta(Pen\_share^{+}(-1))$	0.16	$\Delta(Pen\_share^{+}(-1))$	0.001
$\Delta(Pen\_share^{+}(-2))$	0.22	$\Delta(Pen\_share^{+}(-2))$	0.13
$\Delta(Pen\_share^{+}(-3))$	0.02	$\Delta(Pen\_share^{+}(-3))$	0.11
$\Delta(Pen\_share^{+}(-4))$	0.04	$\Delta(Pen\_share^{+}(-4))$	0.24
Δ(Pen_share-(-1))	-0.08	Δ(Pen_share-(-1))	-0.27
Δ(Pen_share-(-2))	-0.13	Δ(Pen_share-(-2))	-0.16
Δ(Pen_share-(-3))	-0.27	Δ(Pen_share-(-3))	0.35
Δ(Pen_share-(-4))	-0.16	Δ(Pen_share-(-4))	0.42
C	2.90	C	6.4
model diagnostic tests		model diagnostic tests	
JB(p-value)	0.72	JB(p-value)	0.22
LM test (p-value)	0.27	LM test (p-value)	0.41
ARCH test (p-value)	0.07	ARCH test (p-value)	0.47

* indicates parameter is significant at 5%

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Table 8: Enders et al. (2001): **Threshold (TAR) and Momentum (M-TAR) results**

Panel A: Value of Stocks as dependent variable			Panel B: Volume of Stocks as dependent Variable	
Variable	Coefficient	t-values	Coefficient	t-values
Threshold cointegration with TAR Model				
ρ_1	- 0.1592*	-4.67	-0.0321*	-3.23
ρ_2	-0.9887*	-2.01	-0.6712*	-5.35
Threshold τ				
AIC	652		634	
Lag selection by AIC	1		2	
	critical values (5%)		critical values (5%)	
F-joint(∅)	-5.0363	-1.623	-8.91	-2.15
$H_0: \rho_1 = \rho_2 = 0$				
F-statistic: $H_0: \rho_1 = \rho_2 = 0$	7.123	2.580	12.67	3.67
Threshold cointegration with MTAR Model				
ρ_1	-0.0952*	-3.71	-0.0212*	-7.89
ρ_2	-0.0142*	-1.98	-0.5321*	2.81
Threshold τ				
AIC	652		634	
Lag selection by AIC	1		1	
	critical values (5%)		critical values (5%)	
F-joint(∅)	-6.165	-1.78	-9.025	-1.12
$H_0: \rho_1 = \rho_2 = 0$				
F-statistic: $H_0: \rho_1 = \rho_2 = 0$	4.43	2.76	5.13	3.01

* indicates parameter is significant at 5%

5. CONCLUSION

Using asymmetric cointegration analysis, this study examines the effects of pension fund assets invested in the stock market on the development of the Johannesburg Stock Exchange. The study analysed quarterly statistics on pension funds invested in the stock market and the value and volume of stocks traded on the Johannesburg Stock Exchange from 1990 to 2020. The empirical evidence for the variables' non-linearity confirms the variables' non-linearity. As a result, asymmetric approaches were used. Cuestas et al. (2011), Cuestas et al. (2014), and J. Hu et al. (2016) non-linear unit root tests demonstrate that all series are stationary upon first differentiation, implying that none of the variables is I (2). NARDL empirical evidence suggests the existence of long-run yet unequal linkages. The Enders and Siklos asymmetric cointegration tests confirmed this. The association was determined to be important in the long run but not in the short run. The study suggests that pension funds can bolster the stock market's depth and strength if the pension funds' security and safety are ensured.

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