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Trend of NPS in India

Abstract

Census 2011 predicts that Indian population above the age group of sixty is expected to go up from 8 per cent to 21 per cent, while population above the age of eighty years may go up from 8 per cent to 15 per cent between 2011 and 2050. To cope with the challenge of financial insecurity faced by the aging population,the Government of India (GOI) introduced in January 2004 a comprehensive social security system viz. the "New Pension Scheme" (NPS) which was subsequently renamed as "National Pension Scheme" (NPS). The new system marked a conscious shift from the traditional defined benefit scheme, which was proving to be an unsustainable burden, to a globally recognized practice of defined contribution schemes. The present research is about the role played by the PFMs and the schemes introduced by them in providing post retirement financial security to the subscribers. Published NAV values from Pension Fund Regulatory and Development Authority (PFRDA) have been used to develop the ARIMA models. Augmented Dickey Fuller (ADF) test is used for testing the stationarity of the series. Also to know the volatility in returns from pension plan the Generalised Autoregressive Conditional Heterscedasticity (GARCH) model has been used.

Keywords: Pension Plan, National Pension Scheme (NPS), ARIMA, Trend, GARCH, Volatility.

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Introduction

India is expected to become the most populous country of the world in 2050 leaving behind China (Census, 2011), which also means an increase in the number of its elderly population. It has been predicted that the population above the age of sixty will go up from 8 per cent to 21 per cent, while population above the age of eighty years will go up from 8 per cent to 15 per cent during this period. Population growth and increase in number of the elderly have serious social and economic consequences and need to be addressed immediately. To cope with the forthcoming challenge, aninadequate and unsustainable system of social security and pension system needed requisite overhaul. The Government of India (GoI) therefore, introduced in January 2004 the "New Pension Scheme" (NPS) which was subsequently renamed as National Pension Scheme (NPS).The new system marked a conscious shift from the traditional defined benefit scheme, which was proving to be unsustainable burden, to a globally recognized practice of defined contribution scheme.It was initially introduced for the Central Government employees but has been extended since May 2009 to all employees including state government employees, most of the central and states autonomous bodies, private and unorganized sector although on a voluntary basis. As per Annual report 2017-18 the number of subscribers registered under NPS are 115.72 lakhs and total asset under management is 2,30,761 crores. The growth in the above numbers may be attributed to the Pension Regulatory and Development Authority of India established through an act of parliament on 19th September 2013.There are eight specialized entities working under National Pension System (NPS) with specific functions assigned to them. Theyare Points of Presence (POP), Central Recordkeeping Agency (CRA), Trustee Bank, Pension Fund Managers (PFMs), NPS Trust, Custodian, Annuity Service Providers & Retirement Advisers.The functions of PFMs include:

1. Investing the contributions as per the instructions provided by Central Record Keeping Agency.
2. Constructing the scheme portfolio.
3. Maintenance of books and records, reporting to authorities and making disclosures.

The schemesare primarily aimed at striking a balance between the return and risk apart from ensuring optimum return to the investor while guarding them against the market volatility.

Review of Literature

In order to gain an in-depth understanding the researcher delved deep into the available literature. It was found that not much research work has been conducted in this area in India. Some of the literature surveyed is given below.

Researchers suggest that preparing for retirement typically increases with the age and older age groups show greater interest in financial preparation for retirement (Evans, David and Raymond, 1985; Kilty and John, 1986). It has been found out that planning must start early approximately fifteen years prior to actual retirement, but such process is not very familiar in the United States and also among professionals (Kilty and John, 1986).Richardson and Keith (1989) found out that the age and income are one of the most important predictors of financial planning. People reaching the time of retirement get more involved in investments or savings.

Globally, pension funds are critical drivers of the development of the stock or local securities market (Chan-Lau, 2004). It has been tested that stock market development has a positive and significant correlation with growth in pension funds (Caporale, Howells &Soliman, 2005). The authors verified that investment levels, productivity and growth of the funds are significantly correlated with the stock markets. They arguedthat the countries with better developed banks and financial systems grow faster than those with weak financial systems. The ability to allocate capital, monitor and provide finance for investments, risk management, mobilization and pooling of savings are some of the benefits of well-developed financial systems (Levine, 1997; Levine, 2004). As pension funds contribute to financial systems through capital markets by impacting savings rates, productivity growth and capital accumulation, many scholars have argued that pension funds also contribute to capital market development (Bijlsma, van EwijkHaaijen, 2014; Raisa, 2012; Hu, 2012; Niggermann&Rocholl, 2010; Walker &Lefort, 2002).

In modern finance theory, Markowitz (1952) used volatility of return as a measure of risk. According to Markowitz (1952) existing literature has supported that most time series data of financial assets exhibit linear dependence in volatility, which is referred to as volatility clustering in econometrics and empirical finance.A number of stylized facts of financial assets such as time-volatility and volatility clustering are captured by Engle (1982) who first proposed the ARCH (Autoregressive conditional heteroskedasticity) model, which assumes normal errors for asset returns. The traditional econometric time series model generally assumes a normal distribution of stock returns. However, the financial literature has long beenaware that financial returns are non-normal and tend to have leptokurtic and fat - tailed distribution (Fama, 1965). Bali, (2007) modeled the nonlinear dynamics of short-term interest rate volatility with SGED distributions, and conclude that the level - GARCH model that accommodates the tail - thickness of interest rate distribution generates satisfactory volatility forecasts of short - term interest rate.

Xu (1999) in his research paper predictedthat volatility of stock markets in China. Xu (1999) modeled volatility for daily spot returns of Shanghai composite stock index from the period May 21, 1992 to July 14, 1995. The researchers found that the GARCH model is superior to that of either EGARCH or GJR -GARCH models, and indicating that there is almost no leverage effect in the Shanghai stock market since volatility is mainly caused by government policy on stock market under the present financial system. The study suggested that good forecasting models required specifications which are able to capture leverage effects.

Messow P. (2013) studied GARCH and Stochastic Volatility models for describing unobserved volatility in asset returns. The author argued that these competing models looked quite similar in continuous time, but very much different in discrete time. He used nested hypothesis tests to decide whether a GARCH- or a SVmodel was appropriate. The results indicated that after applying the test to exchange rate and stock index returns, the SV-model is preferred to the GARCH-model. But for some time series both models were rejected, indicating that these simple models may not be adequate for describing the turbulent last year's reasonably well.

Allal and Benmoumen (2014) proposed a new estimate algorithm for the parameters of aARCH(1) model without any assumptions about initial values which are important in QMLE method. This algorithm turned out to be very reliable in estimating the true parameter values of a given model. The authors have combined maximum likelihood method, Kalman filter algorithm and the SPSA method. Simulation results demonstrate that the algorithm is viable and promising.

Objectives of the Study

Investment in equities is risky as it is a volatile asset class and there is no guarantee of returns. But in the long run, equity has been able to deliver higher than inflation-adjusted returns compared to all other asset classes.

This paper seeks to-

1. Analysethe trends of selected schemesthrough stochastic modeling
2. Evaluate volatility in return of the selected schemes using GARCH

Methodology

As mentioned earlier the researcher has made an attempt to evaluate the selected schemes introduced by the PFMs. The professional PFMs who have been assigned the task of judicious and prudent investment of the pension corpus invested by the subscribers are as follows:

1. HDFC Pension Management Co. Ltd.
2. ICICI Prudential Pension Fund Management Co. Ltd.
3. Kotak Mahindra Pension Fund Ltd.
4. LIC Pension Fund Ltd.

5. Reliance Capital Pension Fund Ltd.
6. SBI Pension Funds Pvt. Ltd
7. UTI Retirement Solutions Pvt. Ltd
8. Aditya Birla Sun Life Pension Management Limited

The schemes which are currently being managed by the aforementioned PFMs are

1. Scheme applicable to Central Government Employees and employees of Central AutonomousBodies
2. Scheme applicable to State Govt. employees and employees of State Autonomous bodies
3. Schemes applicable to individuals and corporates
   (a) NPS Lite Scheme
   (b) APY Scheme
   (c) Corporate CG Scheme
   (d) E-C-G-A pattern for Tier I & Tier II – The assets are invested in Equity, Corporate Bonds, Government Securities and Alternative Investment Funds. SEBI Regulated 'Alternative Investment Funds' AIF (Category I and Category II only) as defined under the SEBI (Alternative Investment Fund) regulations 2012.

The schemes chosen for the present study are

1. Scheme E, Tier I managed by UTI Retirement Solutions Pvt. Ltd
2. Scheme E, Tier I managed by Reliance Capital Pension Fund Ltd.

Asset class E, Tier I (equity market instruments)

The subscriber can contribute his savings for retirement/ pension into this partiallywithdrawable account where premature withdrawals are allowed subject to certain conditions.As per the investment guideline of PFRDA this asset class is invested in index funds that replicate the portfolio of either the BSE Sensitive index or the NSE Nifty 50 index. The subscribers are given two choices viz. auto choice and active choice.A subscriber with a Tier I account has been given the flexibility to choose any one out of available Pension Fund Managers (PFMs) and also decide the percentage in which the selected PFM will invest the funds.If a subscriber chooses Active Choice, he can specify the percentage in which his / her money is to be invested in these asset classes. However, allocation in Equity cannot be more than 50%. For a subscriber opting for Auto Choice, system will automatically calculate the asset allocation percentages based on the subscriber's age.

Tools used for the study

The tool used for implementation isStrata software version 5. Historical data of daily NAVobtained from the website of Pension Fund Regulatory Development Authority (PFRDA) has been used in this researchwork.Subsequently GARCH model has been used to assess the scheme's volatility in return.

Proper model selection is extremely important as it reflects the underlying structure of the series and this fitted model in turn is used for future forecasting. A time series model is said to be linear or non-linear depending on whether the current value of the series is a linear or non-linear function of past observations. In order to determine a proper model for a given time series data, it is necessary to carry out the ACF and PACF analysis. These analyses reflect how the observations in a time series are related to each other. Next for proper modeling and forecasting purpose it is often useful to plot the ACF and PACF against consecutive time lags. These help in determining the order of AR and MA terms. Required mathematical definitions are given below:

ARIMA stands for Autoregressive Integrated Moving Average. ARIMA is also known as Box-Jenkins approach. Box and Jenkins claimed that non-stationary data can be made stationary by differencing the series, Y_t. The general model for Y_t is written as, $\mathbf{Y_t = \phi_1 Y_{t-1} + \phi_2 Y_{t-2} \ldots \phi_p Y_{t-p} + \epsilon_t + \theta_1 \epsilon_{t-1} + \theta_2 \epsilon_{t-2} + \ldots \theta_q \epsilon_{t-q}}$

Where Y_t is the differenced time series value, ϕ and θ are unknown parameters and ϵ are independent identically distributed error terms with zero mean. Here, Y_t is expressed in terms of its past values and the current and past values of error terms.

Auto Regressive Integrated Moving Average or ARIMA model combines three basic methods:

Auto Regression (AR) – In auto-regression, the values of a given time series data are regressed on their own lagged values, which are indicated by the "p" value in the model.

Differencing (I-for Integrated) – This method involves differencing the time series data to remove the trend and convert a non-stationary time series to a stationary one. This is indicated by the **"d"** value in the model. If d = 1, it looks at the difference between two time series entries, if d = 2 it looks at the differences of the differences obtained at d =1, and so forth.

Moving Average (MA) – This is represented by the "q" value which is the number of lagged values of the error term.

The model is called Autoregressive Integrated Moving Average or ARIMA **(p,d,q)** of $\mathbf{Y_t}$. We will follow the steps enumerated below to build our model.

It is that class of model that captures a suite of different standard temporal structures in time series data. It's a way of modeling time series data for forecasting (i.e., for predicting future points in the series), in such a way that:

1. a pattern of growth/decline in the data is accounted for (hence the "auto-regressive" part)
2. the rate of change of the growth/decline in the data is accounted for (hence the "integrated" part)
3. noise between consecutive time points is accounted for (hence the "moving average" part)

The aim of the researcher is to find an appropriate ARIMA model based on the ACF and PACF. To determine a proper model for a given time series data, it is necessary to carry out the ACF and PACF analysis. These statistical measures reflect how the observations in a time series are related to each other. For modeling and forecasting purpose it is often useful to plot the ACF and PACF against consecutive time lags. These plots help in determining the order of AR and MA terms. For this the rules are as follows:

Rule 1

'If the PACF of the differenced series displays a sharply cutoff and/or the lag-1 autocorrelation is positive--i.e., if the series seems slightly "underdifferenced"--then consider adding an AR term to the model. The lag at that the PACF cuts off is the indicated number of AR terms.'

Rule 2

'If the ACF of the differenced series displays a sharply cutoff and/or the lag-1 autocorrelation is negative--i.e., if the series seems slightly "overdifferenced"--then consider adding an MA term to the model. The lag at that the ACF cuts off is that the indicated range of MA terms.'

Periodic market volatility is in the very nature of financial markets. Volatility may also be described as the rate and magnitude of price changes which is referred to as a risk in finance. Change in the return of stock has been of great concern in the recent years; this is because volatility is being used for measuring financial risks. The crucial component is creating structural advantages that equip one better to handle such volatile periods. While it is true that NPS returns are market-determined and therefore bound to be volatile, Indian savers, who largely shun equities and mutual funds, would not want to be part of something like this, for a very long time. This would be a big blow to the scheme at a time when the government is set to adopt a new and improved PFRDA Bill into an Act.In Financial Time series Volatility clustering and leptokurtosis (fat tails) is commonly observed. The effects of Leverage are also observed in financial returns which occurs when the change in stock prices are negatively correlated with the changes in volatility. This kind of phenomena has led to the financial time series analyst to use varying variance models to estimate and predict volatility of stock prices. Engle (1982) has proposed modeling of time-varying conditional variance with Autoregressive Conditional Heteroskedasticity (ARCH) process using lagged disturbance. The results obtained from this work indicated that in order to capture the dynamic behaviour of conditional variance, a high order ARCH model is required. This problem was solved by Bollesrslev, (1986) by developing a Generalized ARCH model (GARCH) basing on infinite ARCH specifications which reduces the number of estimated parameters from infinity to two. Both ARCH and GARCH model capture volatility clustering and lepkurtosis but they fail to model leverage effects because their distribution is symmetric. A number of non-linear extensions of GARCH like exponential GARCH (EGARCH) model by Nelson (1991) and Asymmetric Power Arch (APARCH) modeled by Ding et al (1993) were introduced.A problem encountered when using GARCH is that they do not always fully embrace the thick tails property of a high frequency financial time series data.

Therefore, the following section shows the volatility in return for scheme E of aforesaid fund under Tier-I of aforesaid pension funds.

The model that describes the returns of an asset at time t can be defined as;

$Y_t = \mu + \sigma_t\varepsilon_t, t \in R$, Where,

----------$\{\sigma_t\}$ is non-negatives to chastic process such that for a fixed t,ε_t and σ_t are independent.

---------- $\{\varepsilon_t\}$ is as equence ofiid and symmetric random variables.

Volatile process is identified by $\{\sigma_t\}$.The time series $\{Y_t\}$ and the volatile process $\{\sigma_t\}$ are assumed to be strictly stationary and the mean μ is assumed to be zero.

The movement of the price changes can be modeled only by the sign of ε_t which is independent of the order of magnitude of this change which can be directed by σ_t.

The GRACH (p, q) model is given by

$Y_t = \mu + \sigma_t\varepsilon_t \ , t \in R$ ..... (1)

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^{q} \alpha_i Y_{t-i}^2 + \sum_{j=1}^{q} \sigma_{t-j}^2 \quad \ldots\ldots (2)$$

Where, p and q are order GARCH and ARCH respectively which are actually the numbers of lags. ε_t is the error term which is assumedto benormally distributed with mean zero and conditional variance σ^2_t. Here returns are represented by Y_t and their mean value μ is positive and small. The model parameters are represented by α_0, α_i, $\alpha_j$and they are relative weights of the lagged terms and usually assumed to be non-negative. Estimation of parameters with the GRACH approach requires the use of Maximum Likelihood Estimation (MLE) method.

In this study, conditional variance (Volatility) can be estimated using the GRACH (1.1) Model which is given,

$Y_t = \mu + \sigma_t\varepsilon_t$

$\sigma^2_t = \alpha_0 + \alpha_1 Y^2_{t-1} + \beta_j \sigma^2_{t-1}$

Where, Y^2_{t-1} and $\sigma^2_{t-1}$are squared residuals and conditional variance of the previous day

The residuals of a return at time t may be given as $Y_t - \mu = \sigma_t\varepsilon_t \Rightarrow R_t = \sigma_t\varepsilon_t$.

To obtain the volatility of the returns, it is derived as follows;

$\sigma^2_t = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} + \beta_j\sigma^2_{t-1}$..... (3)

Here, $\alpha 0 = \gamma V_L$where γ is a weight assigned to the long run average variance rate V_L. Since weights must sum up to 1.

$\gamma + \alpha_1 + \beta_1 = 1 \Rightarrow \gamma = 1 - \alpha_1 - \beta_1$. This impliesthat

$$V_L = \frac{\alpha_0}{1 - \alpha_1 - \beta_1} \quad \ldots\ldots (4)$$

This implies that as the lag increases the variance forecast converges to unconditional variance given by equation (4).

Data Analysis

This section deals with the analysis of trend and volatility of Scheme E under Tier I of the Public Pension Fund, viz. UTI Retirement Solutions Ltdand the Private Pension Fund,viz. Reliance Capital Pension Fund Ltd, since the date of their inception till 31st March 2018.

UTI Retirement Solutions

UTI Retirement Solutions is the India's first equity oriented fund launched in October 1986. Predominantly it invests in companies with large market capitalization available at reasonable valuation

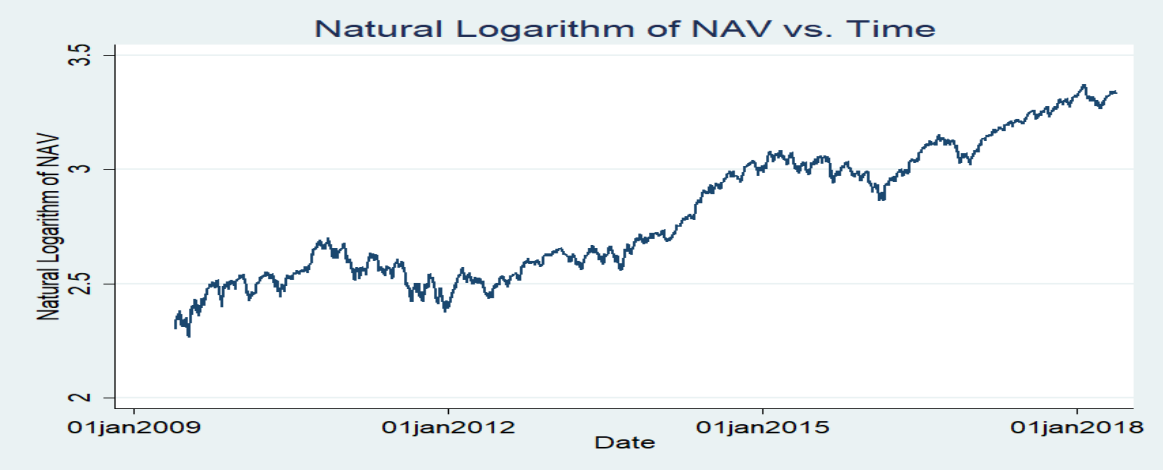
considering the expected earnings growth. This strategy helped the fund in generating steady returns effectively weathering through the volatility in the bear and bull phases of the market. The fund has an impeccable track record of uninterrupted year-on-year dividend declaration since its inception.The scheme E aims at securing for the unit holders capital appreciation by investing the funds of the scheme in equity shares, equity-related instruments and fully convertible bonds/debentures of companies. Besides, investment may also be made in issues of partly convertible debentures/bonds including that issued on rights basis subject to the condition that, as far as possible, the non-convertible portion of the debentures/bonds so acquired or subscribed shall be disinvested within a period of twelve months from the date of acquisition.

UTI Retirement Solutions

Scheme E - TIER I is an NPS scheme that invests predominantly in Equity. This scheme is meant for TIER I investors. The scheme was introduced on 21/05/2009.

The following plots depict the trend of this scheme since its inception.

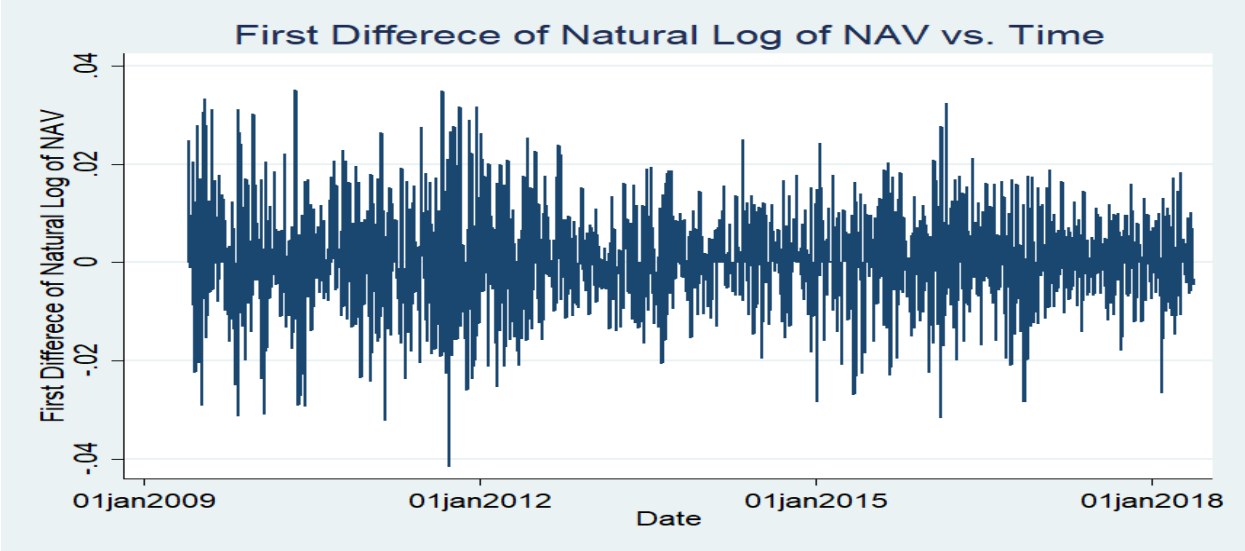
Line Plots



(Source: Author's Calculation)

The above figure clearly shows that an upward trend of the NAV since the date of inception.

The following figure shows stationarity by taking 1st difference of Natural log of NAV plotted against time.



(Source: Author's Calculation)

ADF Test of Time Series

Dickey-Fuller test for unit root Number of obs = 2826

	Interpolated Dickey-Fuller			
	Test Statistic	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-0.808	-3.430	-2.860	-2.570

MacKinnon approximate p-value for Z(t) = 0.8169

The above result rejects the Null Hypothesis and the researcher concludes that the Time Series is stationary.

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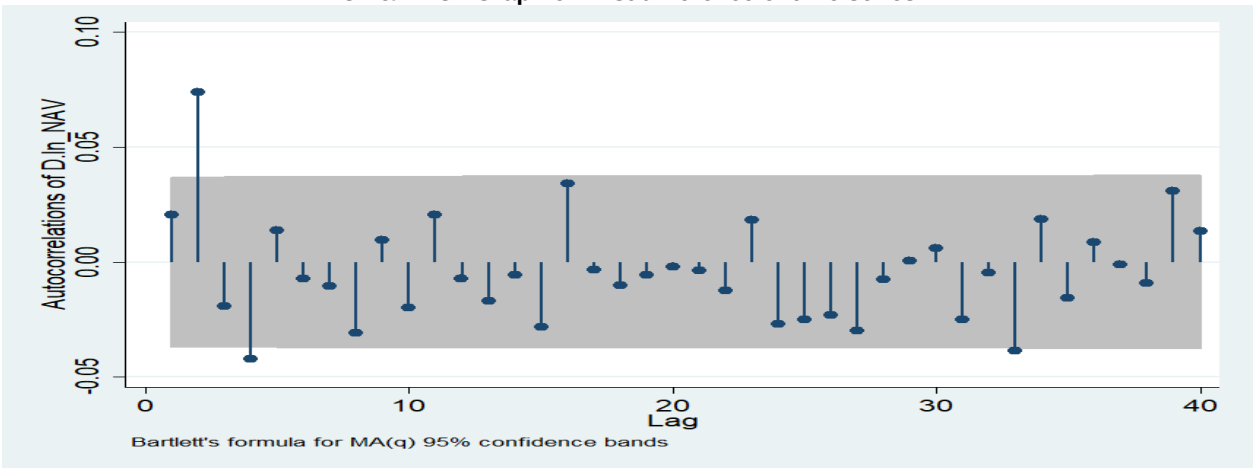
ADF Test on First Difference of Time Series

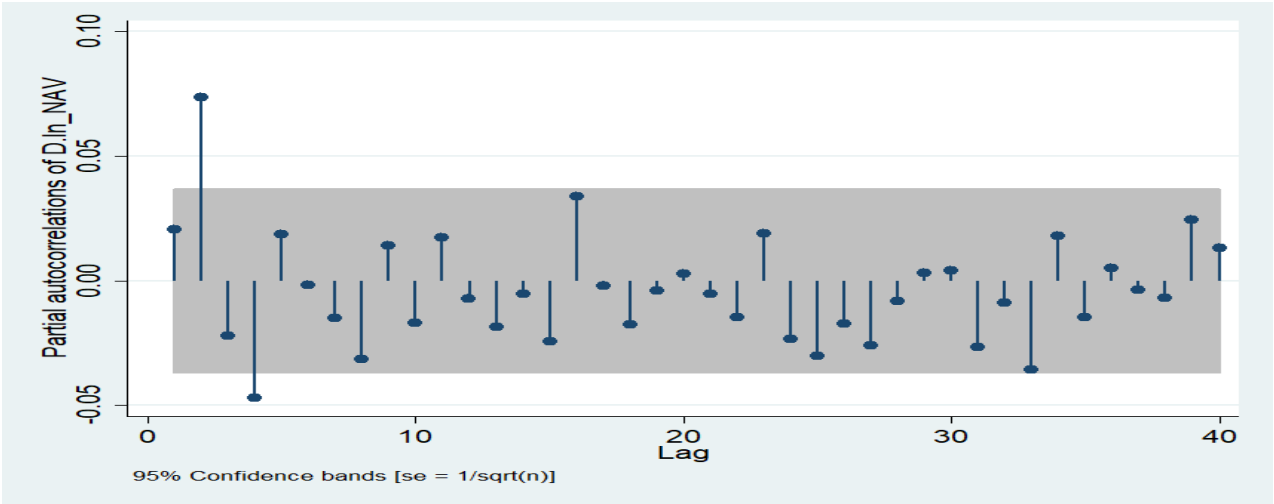
Dickey-Fuller test for unit root Number of obs = 2825

	Interpolated Dickey-Fuller			
	Test Statistic	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-52.052	-3.430	-2.860	-2.570

ACF & PACF Graph on first difference of time series:

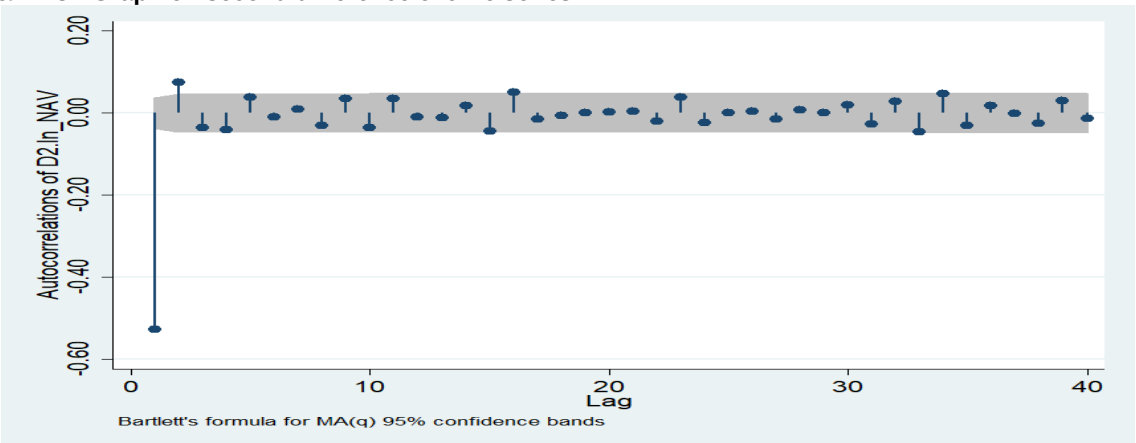


(Source: Author's Calculation)

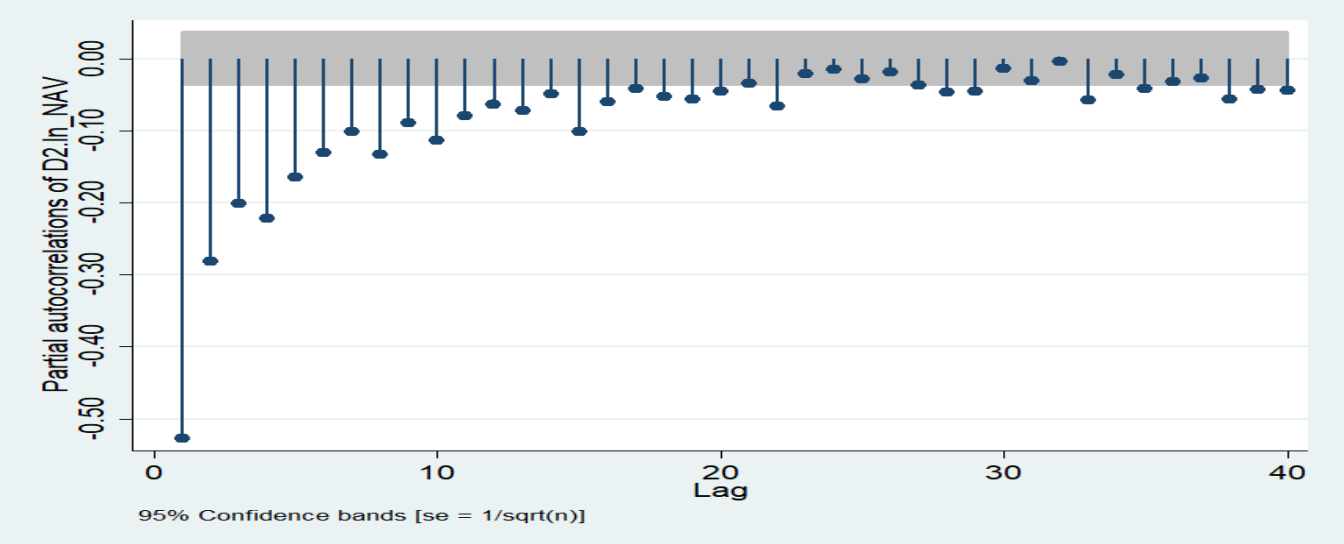


(Source: Author's Calculation)

ACF & PACF Graph on second difference of time series



(Source: Author's Calculation)



(Source: Author's Calculation)

ACF graph at second difference shows sharp cut off after second lag and PACF shows exponential decay at second difference. So, we can conclude that there is MA signature and maximum of two MA terms can be considered and the following output has been derived.

ARIMA Output

ln_NAV	ARIMA(0,1,1)	ARIMA(0,1,2)
Constant	.0003651*	.0003648*
L1.ma	.0178146	.0222287
L2.ma		.082399*
AIC	-18840.26	-18855.73
BIC	-18822.42	-18831.94

(Source: Author's Calculation)

ARIMA (0,1,1) model is not statistically significant (probability>chi^2=0.3126). So we can consider ARIMA (0,1,2) as the preferred model. Hence it can be concluded that this scheme has a trend.

In the following section, the researcher has made and attempt to frame GARCH (1,1) model to know the volatility in return of the Scheme. Using SAS package, the researcherobtained the following result.

UTI RETIREMENT PENSION FUND

OUTPUT OF VAR

The AUTOREG Procedure

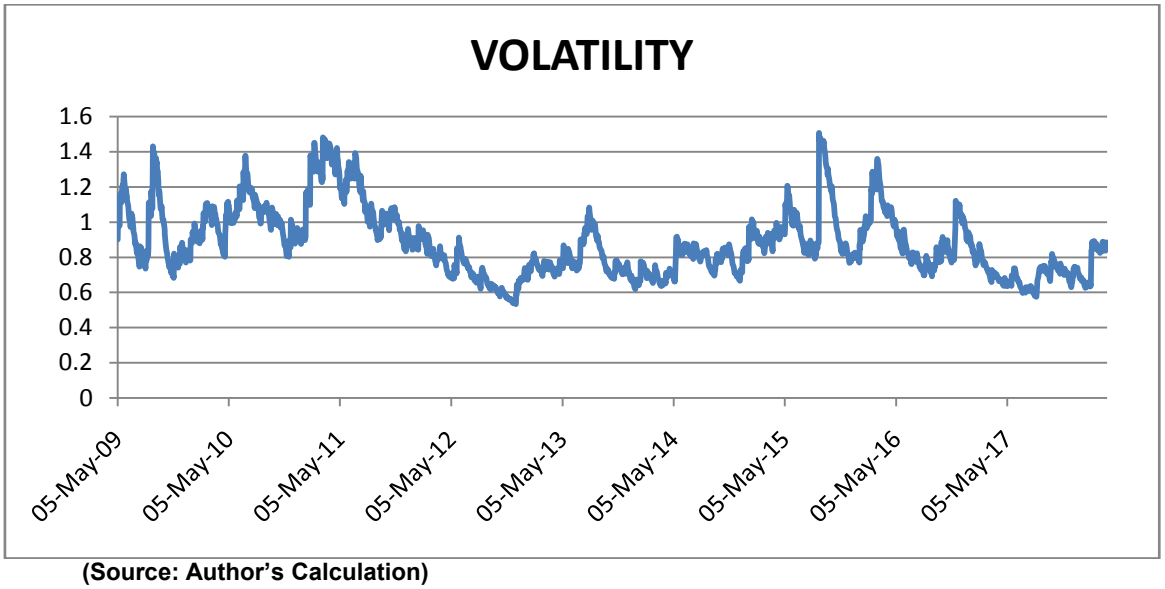
GARCH Estimates			
SSE	1755.90358	**Observations**	2185
MSE	0.80362	**UncondVar**	0.84064575
Log Likelihood	-2773.1681	**Total R-Square**	.
SBC	5584.7831	**AIC**	5556.33624
Normality Test	339.2228	**Pr>ChiSq**	<.0001

Variable	DF	Estimate	Standard Error	t Value	Approx Pr> |t|	Variable Label
Intercept	1	-0.1210	0.3641	-0.33	0.7396	
Date	1	9.137E-6	0.0000185	0.49	0.6211	Date
ARCH0	1	0.009981	0.003069	3.25	0.0011	
ARCH1	1	0.0432	0.006142	7.04	<.0001	
GARCH1	1	0.9449	0.008530	110.77	<.0001	

(Source: Author's Calculation**)**

From the table, it can be observed that most of the information are from the previous days forecast amounting to about 94% and there is a minimal change on the arrival of new information and there is a very small effect on the long run average variance. The long run average variance per day implied by the model is given by equation (4) as mentioned earlier in methodology.

The figure below shows that conditional volatilities derived from the fitted returns of the scheme E prices.



(Source: Author's Calculation)

This also shows that the assumption of independence and identically distribution (iid) is not realistic since financial returns tend to occur in clusters (volatility clustering).

Similarly the analysis of trend and volatility ofReliance Capital Pension Fund Ltdis presented below:

Reliance Capital Pension Fund (RCPFL)

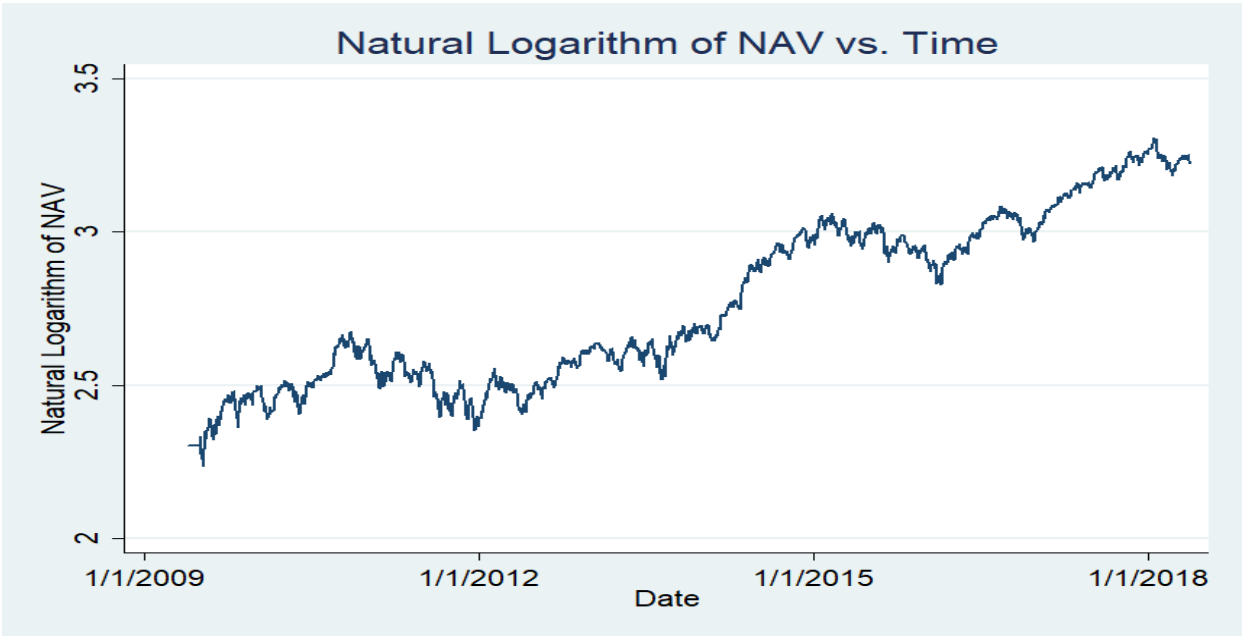
RCPFL was appointed as pension fund manager in accordance with the terms of Investment Management Agreement executed with the NPS Trust. The Pension Fund was incorporated under the Companies Act, 1956 on 31st March, 2009 and was issued the Certificate of Commencement of Business by the Registrar of Companies on April 24, 2009 and by the PFRDA on April 30, 2009. RCPFL has an authorized share capital of Rs. 27 crores and paid up share capital of Rs. 25 crores. Reliance Pension Fund endeavors to figure along with the regulators, PFRDA and Trustees of NPS Trust, to offer the NPS subscribers sustainable retirement solutions and adequate retirement income.

RELIANCE Scheme E –Tier I

Reliance Capital Pension Fund Ltd.- Scheme E - TIER I is an NPS scheme that invests predominantly in Equity. This scheme is meant for TIER I investors. The scheme was incepted on 01/05/2009.

The following plots depict the trend of the scheme since its inception.

Line Plots



(Source: Author's Calculation)

From the above figure, we can depict an uptrend in NAV of RELIANCE Scheme E under Tier I from the date of inception.

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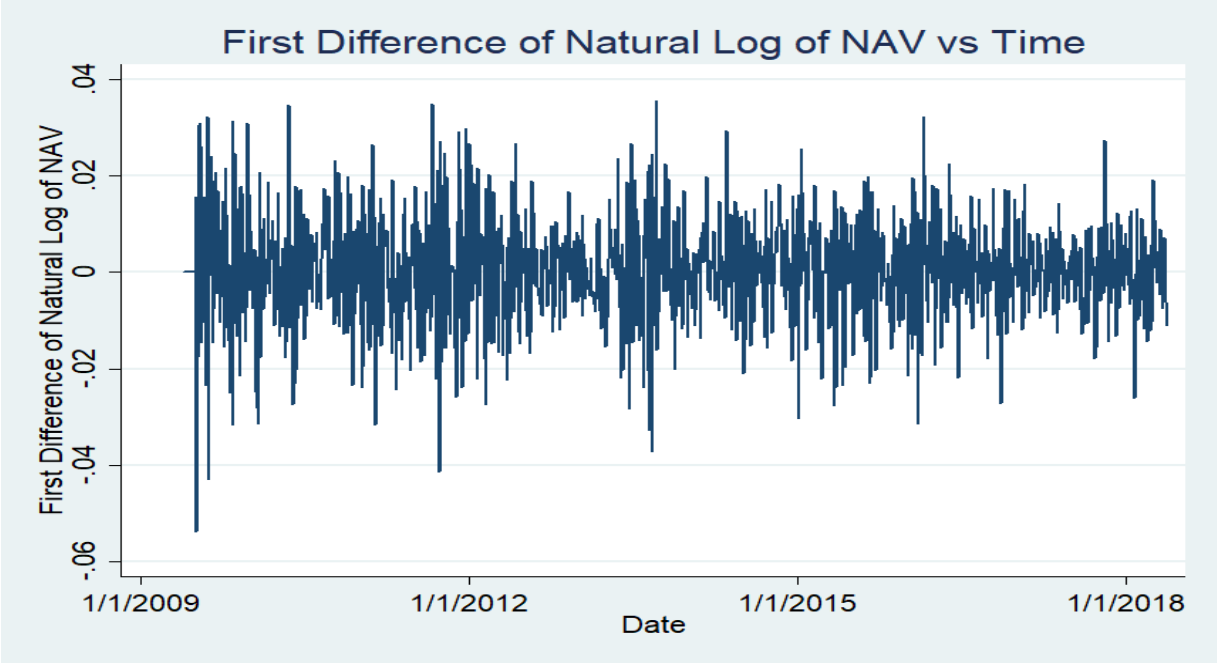


(Source: Author's Calculation)

By taking 1st difference of Natural log of NAV plotted against time shows stationarity.

ADF Test of the time series and first difference of the same:

Dickey-Fuller test for unit root Number of obs = 2201

	Interpolated Dickey-Fuller			
	Test Statistic	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-0.777	-3.430	-2.860	-2.570

MacKinnon approximate p-value for Z(t) = 0.8257

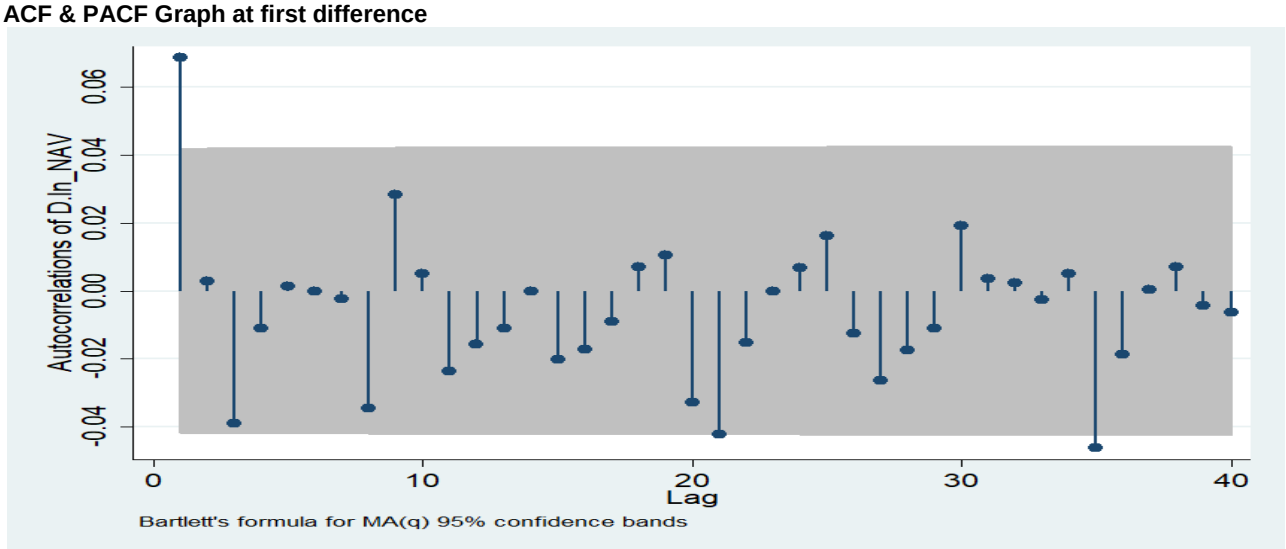
The above result rejects the Null Hypothesis and the researcher concludes that the Time Series is stationery.

Dickey-Fuller test for unit root Number of obs = 2200

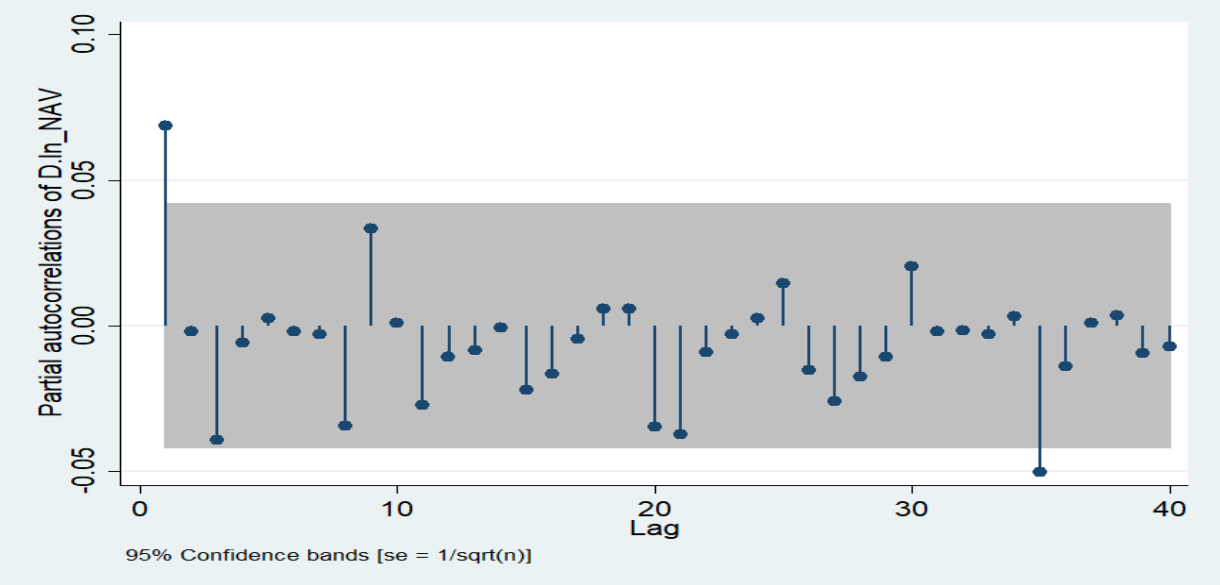
	Interpolated Dickey-Fuller			
	Test Statistic	**1% Critical Value**	**5% Critical Value**	**10% Critical Value**
Z(t)	-0.777	-3.430	-2.860	-2.570

MacKinnon approximate p-value for Z(t) = 0.0000

ACF & PACF Graph at first difference

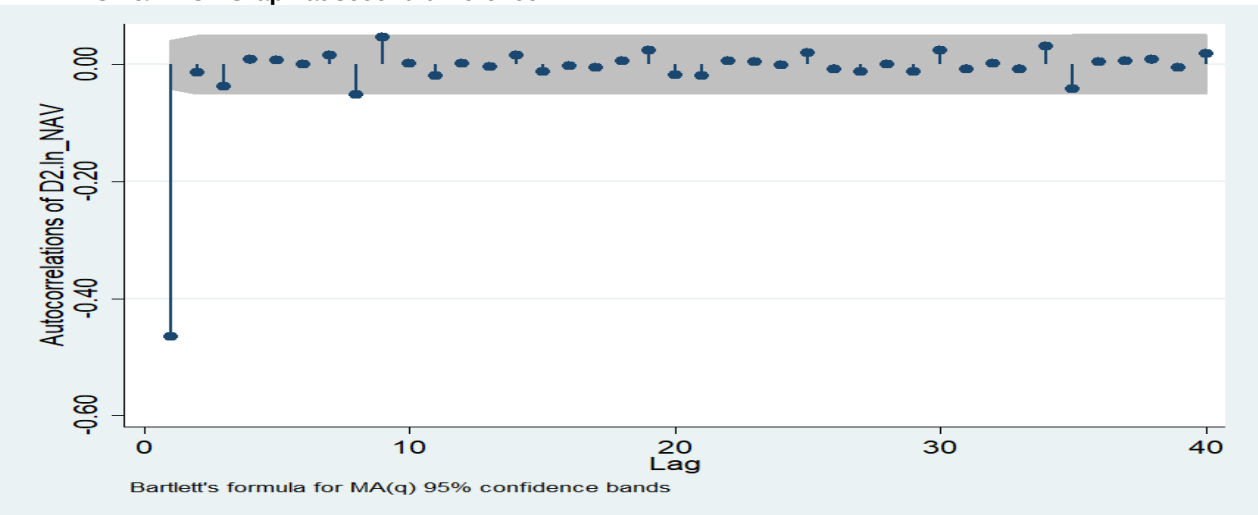


(Source: Author's Calculation)

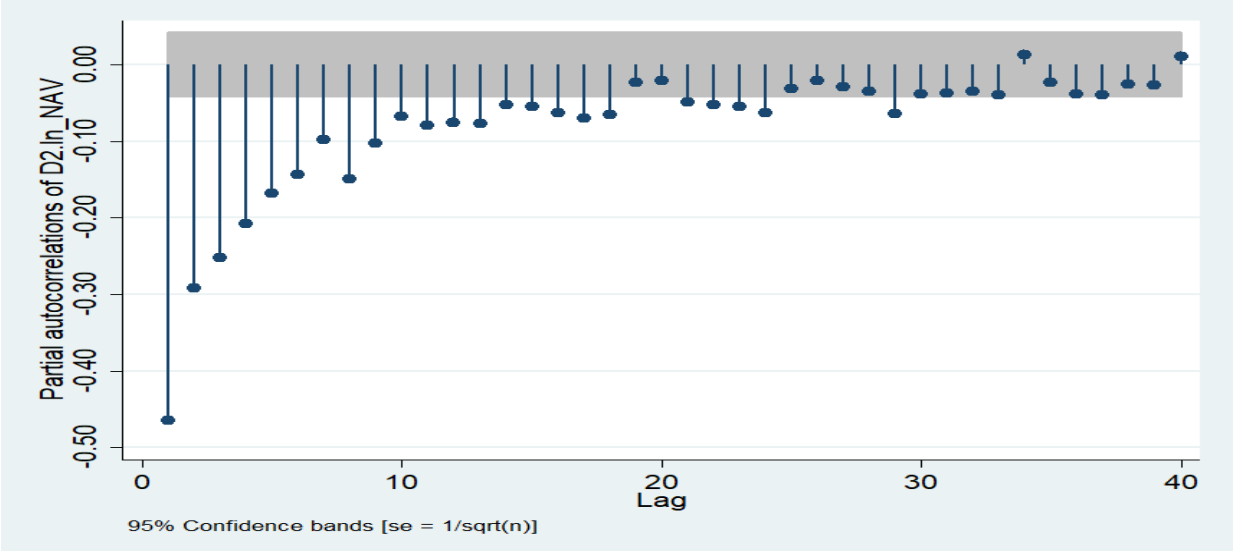


(Source: Author's Calculation)

ACF & PACF Graph at second difference:



(Source: Author's Calculation)



(Source: Author's Calculation)

Considering the rules as mentioned in the methodology it is observed that ACF is in line with rule 2, hence, we are adding one MA component (ACF shows negative autocorrelation and sharp cut-off at lag 1).

We are not adding any auto regressive term as PACF result is violating the rule 1 (mentioned earlier) and the following output has been derived.

ARIMA Output

ln_NAV	ARIMA(0,1,1)	ARIMA(1,1,1)
Constant	.0004184	.0004184
L1.ar		.0555546
L1.ma	.0680057*	.0131161
AIC	-14009.12	-14007.18
BIC	-13992.03	-13984.4

*Significant at 0.05 level

(**Source**: Author's Calculation**)**

Preferred model is ARIMA (0,1,1). The model finds that the scheme is having a trend.

The following part shows the volatility in return of Reliance Capital Pension Fund Ltd.

Reliance Pension Fund

OUTPUT OF VAR

The AUTOREG Procedure

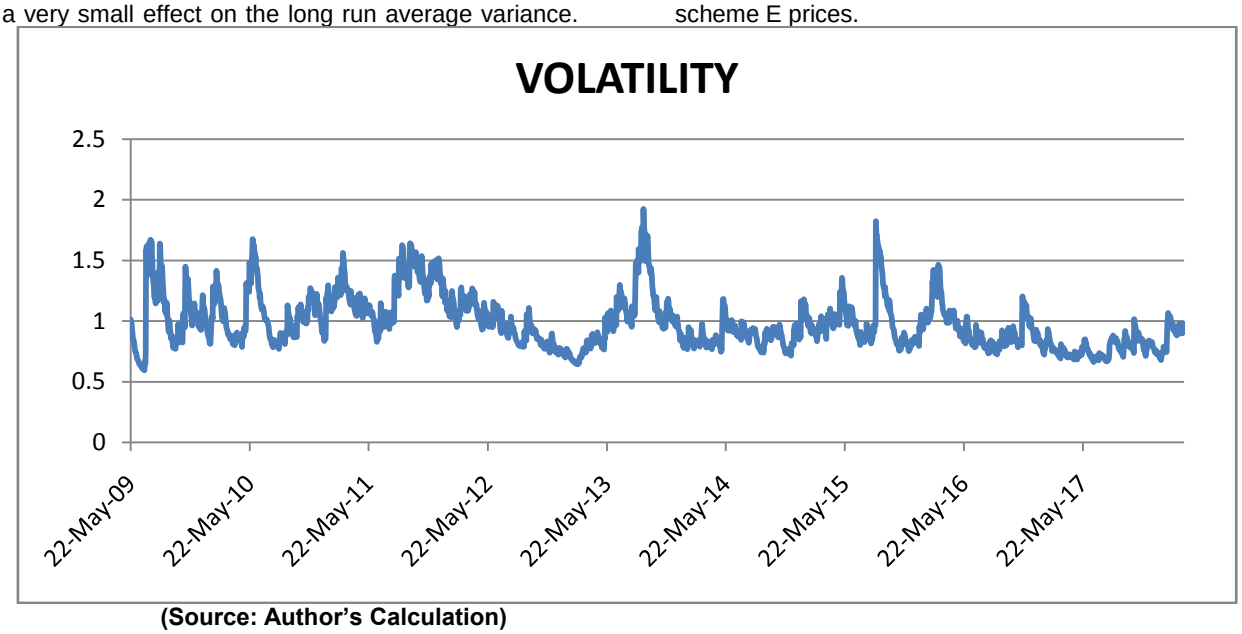
GARCH Estimates			
SSE	2207.34238	**Observations**	2172
MSE	1.01627	**UncondVar**	1.0510612
Log Likelihood	-3008.3209	**Total R-Square**	.
SBC	6055.05883	**AIC**	6026.64181
Normality Test	569.9199	**Pr>ChiSq**	<.0001

Variable	DF	Estimate	Standard Error	t Value	Approx Pr> |t|	Variable Label
Intercept	1	-0.0449	0.3788	-0.12	0.9057	
Date	1	5.4295E-6	0.0000193	0.28	0.7788	Date
ARCH0	1	0.0325	0.004933	6.58	<.0001	
ARCH1	1	0.0698	0.009312	7.49	<0.0001	
GARCH1	1	0.8993	0.0119	75.65	<0.0001	

(Source: Author's Calculation)

From the table, it can be observed that most of the information are from the previous days forecast amounting to about 90% and there is a minimal change on the arrival of new information and there is a very small effect on the long run average variance. The long run average variance per day implied by the model is given by equation (4) as mentioned earlier.

The figure below shows that conditional volatilities derived from the fitted returns of the scheme E prices.



(Source: Author's Calculation)

This also shows that the assumption of independence and identically distribution (iid) is not realistic since financial returns tend to occur in clusters (volatility clustering).

Findings and Conclusion

From the above analysis it can be concluded that

1. Scheme E under Tier I of both Public (UTI Retirement Solution Pension Fund) and Private (Reliance Capital Pension Fund) is having an upward trend since the date of inception.
2. Although NPS is volatile in nature but private scheme is less volatile compared to public scheme.
3. The latest move, allowing up to 75 per cent in equities, will only increase the flow of pension money into equities. The clinching argument in favour of equities is that they provide better returns in the long-term.
4. Although NPS is volatile in short term but it is a long term product which lock in till the age of 60. Short term volatility will not impact it much as short term volatility won't significantly pull down long term returns, therefore subscribers should stick with NPS.

For countries such as India that are looking to create vital infrastructure to further boost economic growth and for investors seeking long-term investments that deliver requisite returns, such periods of volatility provide an opportunity to learn some critical lessons that help implement structural changes that prepare one better for future periods of volatility. While it is true that NPS returns are market-determined and therefore bound to be volatile, Indian savers, who largely shun equities and mutual funds, would not want to be part of something like this, for a very long time. It will facilitate investigation of interest rate risk which can be indicator of the state of the economy. Over the period 2009-11, returns of the schemes for the unorganised sector have varied from 23.51% to -3.15%. This surprising volatility in the returns of NPS, when the investments are supposed to be strait-jacketed, has scared away savers, who simply cannot associate volatility with a pension plan. This factor alone has ensured that NPS for the voluntary sector has remained a non-starter. Although there is underperformance of NPS but this is because of the stock market's current large-cap bias. While the lock-in ensures the subscriber doesn't use the funds throughout his operating life, annuity makes sure the money is paid in installments over a long period. Despite rating well on performance and price, NPS failed on the awareness front.

For long-term goals, it is important to chalk out the judicious mix of investment risk, taxation, return as well as horizon in mind. There are different investments vehicles like large, mid and ELSS category those have registered progressively higher returns than NPS or Mutual fund asset allocation but these returns have come with added volatility as well. Therefore an investor must consider his/her financial goal before deciding the type of investment they would like to make.

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