

Research on the Pension Investment Decision: Case of a Firefighter

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Abstract: As the worldwide phenomenon of ageing continues, retirees' spiritual and material requirements are receiving increasing attention. It is essential to utilize pensions, which serve as the most significant financial resource for retirees, in a reasonable manner to safeguard their later life's well-being. This study focuses on fire protection in Florida, USA, to investigate how different life expectancy groups should effectively invest their pensions. The investigation employs the FAMA three-factor model and incorporates the Sharpe ratio to simulate and appraise the investment outcomes. The investigation demonstrates that opting for an annual pension is the suitable option when a retiree has a lengthy life expectancy or aspires towards a dependable and cautious retirement. However, retirees with a pessimistic health status, those from regions with poor health conditions or those who want to lead a more adventurous lifestyle in their later years could benefit the most from taking a lump sum pension. This paper aims to provide individuals with references and advice on managing their pensions wisely and correctly to safeguard their financial security. Enterprises, government, and the state should consider providing sensible guidance to the vast retirement group. This paper requires some enhancements which include exploring specific occupations as well as the inadequate prediction of future investment portfolio returns by the FAMA three-factor model.

Keywords: Pension, Fama three-factor model, Investment portfolio

1. Introduction

In present-day society, the trend of worldwide ageing is on the rise, and retired individuals' expectations of their post-retirement life are increasingly being voiced. However, pensions alone are insufficient to support these expectations, leading to a growing interest in personal pension planning and investment management. Ensuring financial security in retirement through proper personal pension management is of utmost importance; however, a lack of clear guidance remains. This paper aims to use the Fama three-factor model to calculate the expected portfolio return and assess its worthiness for investment via the Sharpe ratio. Additionally, personalized advice will be provided for groups with varying life expectancies.

This paper presents a case study on a group of firefighters in Florida, USA. Firstly, the data and samples used will be introduced, followed by a description of the case study. The application and calculations of the Fama three-factor model will then be elaborated upon, and the results will be

analyzed before recommendations and guidance are given. This research aims to provide an effective approach to pension planning for individuals.

Population ageing is an unavoidable trend. Robine and Michel suggest that the increased life expectancy of humans is due to the decline in disease and disability rates.[1] Coping with it properly is an economic issue that merits global attention. Davis asserts that managing population ageing without causing significant economic disruptions is a significant challenge that the global economy and financial markets will face in the foreseeable future.[2] Bodie et al. highlighted that the life stages of consumers have a significant impact on their pension planning. It is important to consider this factor when making financial decisions. Additionally, every retiree should give careful thought to managing their pension.[3] Poortvliet and Laine contend that governments are increasingly seen as unable to manage public systems equitably and proficiently whilst ensuring satisfactory levels of welfare provision. Consequently, there is a desire to establish further privatization funds to boost capital markets and productivity.[4] Managing one's pension correctly is crucial for maintaining a sense of well-being in retirement. However, making the correct investment choices is a complex task. Friedman postulated that individuals' consumption patterns are primarily dependent on their permanent income.[5] In contrast, portfolio theory, introduced by Markowitz, contends that high-yield investments come with significant risks.[6] Nonetheless, one can still take measures to maximize pension benefits. Fama and French identified three stock market factors in their research: market-wide factors, factors linked to company size, and book-to-market ratio. These three factors appeared to account for the average returns on stocks and bonds. The renowned Fama three-factor model was subsequently introduced. [7] Sattar and Gaunt both noted that the Fama three-factor model outperforms the CAPM model in predicting and explaining stock returns and changes.[8] Faff's employment of a GMM testing procedure provides strong support for the Fama three-factor model.[9] Additionally, Sharpe introduced the Sharpe ratio to combine return and risk.[10]

The article is structured as follows: The section 2 will outline the research methodology. It will commence with an overview of the case study, followed by an introduction to the FAMA three factors model. And also discuss data collection and analysis methods, and present the analysis results. The section 3 will critically analyze the study outcomes. This paper presents the case, followed by an examination of retirees from a range of diverse occupations and regions. The final section of the article will provide a summary.

2. Research Method

2.1. Case Introduction

This paper presents the case of X, a firefighter from Florida, USA, who will retire at the age of 55 after serving for 25 years. X is unmarried, in good health, and resides in a stable accommodation. Throughout X's working life, their savings amounted to \$600,000. The government has provided two pension plans. The first is to grant X \$100,000 per annum after retirement, along with an annual increase of 3% in cost-of-living until death. The other option available in the state is a lump-sum of \$1,450,000. Official data shows that individuals retiring at the age of 55 in California have a life expectancy of 80 years, resulting in 25 years of life expectancy after retirement. As a result of this variation in life expectancy, the amount of pension received under the first option will differ. This paper employs the equation to determine the monthly pension return for life expectancies of 70, 75, and 80 years. In this equation, K represents the annual pension amount, R is the yearly discount rate, g stands for the annual growth rate, and N refers to the number of payment years.

2.2. Data Collection and Analysis

The fama three factors are the market factor, the market capitalisation factor and the book-to-market ratio factor, which objectively reflect the impact of the market on the returns of stocks and funds. This study employs the fama three-factor model for computing the returns of stocks and funds. The application of the fama three-factor model enhances the precise prediction of future returns of the chosen stocks and funds in this paper. The data analysed for this study were sourced from the Kenneth R.French Data Library.

The article draws on Yahoo Finance (Hong Kong) for the stock and fund data. The stocks and funds investigated in this case study are GM, NYCB, LYG, EXTR, UAL, DAR, AVALX, and RMQAX. GM is a large capitalization stock while NYCB and LYG are growth stocks, undervalued with more than 25% earnings growth and relatively low P/E ratios and P/E growth ratios. EXTR is a technology-oriented growth stock with above 25% revenue and earnings growth. UAL and DAR are large-cap stocks that may be undervalued. In this paper, we have selected AVALX, a large-cap growth fund, and RMQAX, a small-cap value fund, with the objective of diversifying investment funds and reducing portfolio risk. Monthly returns have been calculated using the adjusted close price for each month over the previous five-year period. This time frame offers relevant information for contemporary investors, and the use of monthly data provides enhanced visibility of stock and fund return trends. Furthermore, the Florida government bond has been employed as a proxy due to potential state government pension defaults.

The study employs regression analysis to compute the profits from both stocks and funds when simulated via the FAMA three-factor model. The Sharpe ratio is employed to evaluate the investment worth of the portfolio. The study evaluates the covariance of each stock and fund. The Sharpe ratio of the portfolio is computed using the expected returns from the FAMA three-factor model. The paper calculates the Sharpe ratio for a portfolio invested in the same stocks and funds across diverse scenarios and lifespan ranges. The non-linear regression is applied to adjust the weight of each stock and fund.

3. Result

3.1. Data Result

When the lump-sum option is selected and the entire sum is withdrawn and invested, the calculations reveal that the portfolio possesses a Sharpe ratio of 0.1289, as listed in table 1.

Table1: The result of lump-sum

	without pension
Weight HAL	0.1192
Weight NYCB	0.1037
Weight LYG	0.1841
Weight EXTR	0.0204
Weight UAL	0.0743
Weight DAR	0.1073
Weight AVALX	0.1945
Weight RMQAX	0.1965
Weight FL GO BOND	0.0000
Sum	1.0000
Expected return	0.0143

Table 1: (continued).

Variance	0.0077
Standard Deviation	0.0876
Sharpe ratio	0.1289

In contrast, if the firefighter opts for the annually-paid selection, their savings amounting to \$600,000, which constitute 29% of the total amount (i.e., savings and the pension received over 25 years), would result in a constant weight of 0.71 for the Florida Government Bond (table 2). As the retiree has a lower risk tolerance, the allocation of technology stocks and funds is reduced and the allocation of large cap stocks is increased.

Table2: The result of annually-paid pension

Portfolio Optimizer	with pension (25)	with pension (20)	with pension (15)
Weight HAL	0.0523	0.0506	0.0329
Weight NYCB	0.0866	0.0664	0.0000
Weight LYG	0.0205	0.0290	0.0666
Weight EXTR	0.0000	0.0000	0.0362
Weight UAL	0.0204	0.0303	0.0487
Weight DAR	0.0601	0.0561	0.0459
Weight AVALX	0.0471	0.0485	0.0398
Weight RMQAX	0.0030	0.0092	0.0199
Weight FL GO BOND	0.7100	0.7100	0.7100
Sum	1.0000	1.0000	1.0000
Exepected return	0.0082	0.0074	0.0063
Variance	0.0007	0.0007	0.0010
Standard Deviation	0.0265	0.0272	0.0314
Sharpe ratio	0.1974	0.1621	0.1038

The Government Bond always has a weight of 0.71, however, due to the retirees' lower risk tolerance levels, the portfolio's allocation is adjusted to hold a lower weight for tech stocks and funds, and a higher weight for large cap stocks. This is because tech stocks and funds have a greater variance, which may lead to higher losses for the investor. Large-cap stocks have lower variance, reducing risk and providing investors with a stable measure of wealth growth. Calculations demonstrate that the longer an individual's life expectancy, the greater the Sharpe ratio of their investment portfolio when opting for the first pension receiving scheme. If one's remaining life expectancy is less than 15 years, it is more economical to withdraw the entire pension at once.

Retirees can accumulate wealth proportional to their life expectancy if they opt to receive a annually pension. Alternatively, choosing to take a lump sum provides retirees with more flexibility in managing their wealth. For instance, in cases where a significant amount of funds are urgently required, such as during a major illness, the latter pension option offers retirees greater comfort and ease in handling emergencies. When the global economy enters a downturn or the stock market experiences a bearish trend, a state pension provides a dependable and secure source of income, surpassing an investment portfolio in reliability.

3.2. Discussion

Firefighter X is hopeful about their health and needs to ensure timely payment of their rent. Therefore, selecting an annually pension plan would optimize their benefits. By choosing an annually pension scheme, the need for intentionally maintaining rent payments is eradicated. Furthermore, the individual would benefit from a stable cash flow and greater returns than a lump-sum payment. Similarly, retirees who anticipate a prolonged life-span of at least 15 years post-retirement could maximize their benefits by selecting a annually pension plan. For retirees in poor health, a shorter life expectancy and potential high hospital bills may make taking out their pension in a lump sum a more attractive option. When deciding what to do with their pension, individuals should consider their occupation, living situation, and personal preferences. Those who are white-collar workers or reside in regions with better health conditions are likely to have a longer life expectancy. Individuals in high-risk professions or engaged in manual labour, or those residing in disease-prone regions, have a reduced likelihood of living for a prolonged period. For those in the former category, an annually government pension can provide greater financial security, whereas for the latter, a lump sum pension offers a higher probability of a better monetary outcome than an annually pension. Should an elderly citizen aspire to a conservative and tranquil lifestyle during their post-retirement years, then clearly an annually pension is more appropriate. However, if he intends to pursue an exciting lifestyle post-retirement, which undoubtedly demands significant financial backing, receiving a lump sum payment is the most suitable option.

4. Conclusion

Taking X, a retired firefighter from Florida, United States, as a case study, this study examines reasonable means of managing personal pensions for the purpose of securing financial security in retirement. The study applies the Fama three-factor model to calculate portfolio returns and employs the Sharpe ratio to evaluate the portfolio. The results demonstrate that proper pension management should account for retirees' life expectancy and personal desires. Individuals with a longer life expectancy or those seeking stability in retirement should opt for an annually pension as it can optimize their wealth and offer a secure and stable cash flow. However, those with a shorter life expectancy or desiring an adventurous retirement may benefit more from a lump sum payment to maximize their personal gain. Well-managed pensions offer retirees financial security and the chance to tailor their future lives to their preferences, maximizing satisfaction and happiness in old age. It's important to carefully consider a pension management plan and select an appropriate investment portfolio to guarantee a contented life in the coming decades.

However, there are still some shortcomings and scope for improvement in this paper. The addition of bonds and futures to the portfolio selection can be considered, and more factors can be incorporated while computing portfolio returns. When providing investment advice, investors' preferences should also be taken into account. Furthermore, the paper should specify the life expectancy of different professions. In future investigations, more advanced and refined models may be employed to simulate the income of investment portfolios in the decades to come. Detailed surveys can be conducted by researchers to provide personalized advice to retirees in varying occupations and regions.

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