

## 摘要

本文主要是針對保險業及退休基金的資產負債管理議題為研究重心，延續 Huang (2004) 的研究，其研究是以理論求解的方式求出多期最適資產配置的唯一解，而其研究也衍生出兩個議題：首先是文中允許資產買賣空；再者其模型僅解決單期挹注資金的問題，而不考慮多期挹注資金。但這對於實際市場操作上會有一些的問題。因此本文延續了其研究，希望解決這兩個議題，讓模型更能解出一般化的資產負債管理問題。

本文所選擇的投資的標的是以一般退休基金與保險業所採用，分別是短債 (short-term bonds)、永續債卷 (consols)、指數連結型債券 (index-linked gilts (ILG))、股票 (equity) 為四種投資標的，以蒙地卡羅模型模擬出 4000 組 Wilkie 投資模型 (1995) 下的四種標的年報酬率以及負債年成長率，利用這些預期的模擬值找出最適的投資比例以及應該挹注的金額。而本文主要將問題化為決策變數的二次函數，並以一般化最小平方法 (generalized least square, GLS) 來求出決策變數，而用此方法最大的優點在於一般化最小平方法具有唯一解，且在利用軟體求解的速度相當快，因此是非常有效率的。本文探討的問題可以分成兩個部分。我們首先討論「單期挹注資金」的問題，只考慮在期初挹注資金。接著我們考慮「多期挹注資金」的問題，是在計畫期間內能將資金分成多期投入。兩者都能將目標函數化為最小平方的形式，因此本文除了找出合理的資產配置以及解決多期挹注資金的問題之外，也將重點著重於找一個能快速且精準的方法來解決資產配置的問題。

關鍵詞：資產負債管理、一般化最小平方法、多期最適投資

# **A Generalized Least Square Formulation for Multi-period Optimization of Asset Allocation**

## **Abstract**

This paper deals with the insurance and pension asset liability management issue. Huang (2004) derives a theoretical close solution of multi-period asset allocation. However, there are two further problems in his paper. First, short selling is allowable. Second, multi-period investing is not acceptable. These two restrictions sometimes are big problems in practice. This paper extends his paper and releases these two restrictions. In other words, we intend to find a solution of multi-period asset allocation so that we can invest money and change proportion of investment in each period without problems of short selling.

In this paper, we use the standard asset classes used by pension or insurance funds such as short-term bonds, consols, index-linked gilts and equities. We generate thousand times of Monte Carlo simulations of Wilkie investment model (1995) to predict future asset returns. Furthermore, in order to improve time-efficiency and accuracy, we derive a quadratic objective function and obtain a unique solution using sequential quadratic programming.

**Key words:** Asset liability matching, generalized least square (GLS), multi-period approach