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The enigma of volatility: Exploring asymmetric threshold effects in U.S. bond futures prices during yield curve inversions

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ABSTRACT

In contrast to the majority of literature that focuses on financial product volatility during financial crises, this paper stands as the first study delving into the asymmetric threshold effects on the volatility of intermediate-term and long-term U.S. Treasury bond futures prices during the inverted yield curve period.

We present compelling evidence confirming the presence of both TAR (Threshold AutoRegressive) and MTAR (Momentum Threshold AutoRegressive) effects within the sample period. Using a synchronous grid search algorithm, we simultaneously searched for the optimal threshold values for TAR and MTAR models. Our empirical findings indicate a reduction in the volatility of U.S. bond futures prices during the period of yield curve inversion. Moreover, negative shocks trigger the TAR and MTAR threshold effects, leading to an increase in the volatility of bond futures prices. Furthermore, our research has revealed that the total effects of TAR and MTAR models display contrasting correlations in response to market shocks. Consequently, if the magnitude of market shocks changes exceeds the threshold level, the influence of the TAR threshold effect could be offset by the MTAR effect. As a result, the determination of threshold values plays a significant role and simultaneously reflects the volatility sensitivity of bond futures. Based on the findings of this study regarding asymmetric volatility and sensitivity comparisons, the optimal U.S. Treasury futures options trading strategies during periods of yield curve inversion are to purchase 30-year Treasury bond futures put options or to buy 10-year Treasury bond futures call options.

This study investigates the varied responses of bond futures volatility to market shocks and assesses the sensitivity of volatility to these shocks by analyzing how impacts are transmitted through threshold values and their economic implications.

Keywords:

Yield curve inversion, Asymmetric volatility of bond futures, Volatility sensitivity of bond futures, SMTAR-GARCH model.

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波動率之謎:探索美國政府公債期貨價格於殖利率倒掛期間之不對稱波動門檻效果

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摘要

有別於多數文獻探討金融商品於金融危機期間的波動率特性，本文為首次針對殖利率倒掛期間，檢驗美國中長期公債期貨是否具有不對稱波動門檻效果。本研究透過創新的實證模型及網格演算法找出最適隨機門檻估計值，並取得顯著的證據顯示美國中長期公債期貨於殖利率倒掛期間具有 TAR (Threshold AutoRegressive) and MTAR (Momentum Threshold AutoRegressive)門檻效果。其中 TAR 為衡量市場衝擊之水準程度;而 MTAR 衡量市場衝擊變動程度之門檻效應。

本文實證結果顯示，美國公債期貨於殖利率倒掛期間價格波動率將下降。此外，不對稱波動門檻效果顯示，當市場出現負面衝擊且程度超過門檻水準時，TAR、MTAR 效果與倒掛殖利率的交互作用將使債券期貨價格波動率上升。再者，當考量債券期貨價格完整的 Total TAR 效果時，若市場出現不利衝擊且程度超過門檻水準，債券期貨價格波動率仍會有顯著增加現象。然而當考量 Total MTAR 效果時，實證結果發現其與市場衝擊的相關性出現反轉，亦即當市場出現正面消息且衝擊變動程度大於門檻水準時，則債券期貨價格波動率出現大幅上升現象。因此對於產生不對稱波動效果的門檻水準將具有顯著的經濟意義，而各公債期貨透過實證模型所估計之最適門檻值將代表其對市場衝擊的敏感性。經由本文的敏感性比較分析，得有效應用於債券期貨選擇權的交易策略。其中對市場衝擊的波動不對稱特性得應用於債券選擇權 Call 或 Put 的選擇，而各期貨對市場衝擊的敏感性分析有助於選擇權 Underlying Asset 的決策。因此根據本文實證結果，於殖利率倒掛期間，最適選擇權交易策略為買進 30 年期美國公債期貨賣權(Put)或買進 10 年期美國公債期貨買權(Call)。

關鍵字:

倒掛殖利率曲線、債券期貨不對稱波動、債券期貨波動敏感性、SMTAR-GARCH 模型