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Using CVaR and Markov Switching GARCH, an Airline Organization Manages the Menace Associated with Propellant Hedging

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Abstract

In order to lower the cost of their core business, airline companies must use a hedging strategy to stabilise the price of fuel. In this study, we build models for controlling the risk associated with the hedging strategy. First, we quantify the risk associated with a company's hedging strategy using conditional value at risk (CVaR). CVaR satisfies subadditivity, positive homogeneity, monotonicity, and transfer invariance when compared to the value at risk (VaR). CVaR is a reliable way to quantify risk as a result. Second, to create a Markov Switching-GARCH, time-varying state transition probability is added to our model (MS-GARCH). The dynamic changes in market state are taken into account by MS-GARCH, a feature that has clear advantages over the conventional constant state model. Furthermore, we apply a Markov chain Monte Carlo an approach based on Gibbs sampling to estimate the MS-parameters. GARCH's To apply and assess our approach, we use fuel oil futures data from the Shanghai Futures Stock Exchange. In this study, we empirically evaluate the risk associated with the hedging approach used by airlines and come to the conclusion that our model is clearly successful in terms of hedging risk management, a use that has some guiding relevance for reality.

Keywords: Hedge strategy • MS-GARCH • Aviation fuel

Introduction

Enterprise risk management (ERM) is a crucial component of how businesses are run and managed. The primary business revenue and the main business costs are the main components of the profit of a firm, which may be expressed as income minus costs. An organisation can increase the efficiency of its production and operations and grow the size of the business if it is successful in controlling the costs associated with its core business. However, for an airline company, changes in the global environment—such as sharp variations in the price of fuel oil commodities in domestic and international markets—have a greater impact on operating costs. As a result, the cost of fuel purchased by an airline company cannot be kept within a reasonable range of late For many years, China's large airlines have engaged in hedging activities in the derivatives market; some have even set up futures Ltd. to handle futures trading and clearing. However, the initial hedging strategy has changed into speculation during the process of using financial derivatives for hedging due to some enterprises' imprecise knowledge of risk management and the objective of derivatives use, which nearly caused the bankruptcy of some aviation companies. For an airline firm to cut the cost of their core operation, hedging is crucial. Therefore, it is crucial for these businesses to handle the risks associated with their hedging strategy responsibly [1].

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Subjective Heading

Related works

The futures market, a significant component of the financial market, primarily implements the function of risk transfer through hedging methods. Finding the ideal hedging ratio is the central challenge of hedging theory. The hedging ratio for a conventional comprehensive hedging plan must be 1:1, meaning that the number of futures contracts must equal the number of held places. The base risk, however, makes this ratio less than ideal. Under the mean and variance framework, suggested a minimum variance hedging method based on OLS. The ideal hedging ratio should fluctuate with the spot price, however OLS overlooks the volatility agglomeration and this strategy relies on statistical estimation while the market is dynamic. Chang et alreferenced's CCC-GARCH and BEKK-GARCH to examine how energy futures markets were hedged during bull and bear markets, and they came to the conclusion that CCC-GARCH performed better than BEKK-GARCH [2].

In their investigation of the hedging of index futures, used a DCC-GARCH with a dynamic correlation coefficient and came to the conclusion that it is superior to a CCC-GARCH. GO-GARCH is the best model for assessing hedging between stocks and gold, who studied hedging using DCC, ADCC, and GO-GARCH. In light of this, several researchers explore the relationship between volatility and state, incorporating Markov state transitions into the GARCH model. They develop a Markov-based GARCH model (MRS-GARCH), investigate its function in hedging ratio accuracy, and hedging performance is examined from both a theoretical and an empirical perspective. Hamilton originally suggested a Markov switching (MS) model, also known as a mechanism switching model, and then included it into the autoregressive model in order to fit the variable structure of volatility [3].

The first-order Markov process is used to transfer variables in the MS model, which incorporates hidden discrete-state variables that are based on real-world experience. Then, in order to explain the variation of the exchange rate of a second-order moment in an ARCH model, Hamilton and Sumsel devised Markov transformation. An ARCH model typically requires more lag orders in practise. It goes without saying that numerous academics have converted an MS-ARCH model to an MS-GARCH model. State variables cause MS-GARCH to become path dependent, therefore parameter estimate is required. will get intricate. To estimate an MS-ARCH model, Bauwens et al. used MCMC and Gibbs sampling techniques. Based on various model assumptions, Das et al. employed MCMC to estimate an MS-GARCH model. In this study, the fluctuating state of asset prices is described using MS-GARCH, and parameter estimation is done using MCMC [4].

Model construction

Hamilton originally used an MS model based on an autoregressive model to incorporate the Markov state switching model in 1989. Hamilton's MS model states that the sample's condition can be described by varying the constant terms and regression coefficients. An MS-GARCH model is taken into account in this paper. To implement the mechanism transformation within the parameters of a GARCH model, we introduce a Markov state process in accordance with Hamilton's theories. The conditional variance of each mechanism has a different volatility persistence in sequence when the state variables are set, and a Markov chain is used to transition the state structure. Currently, maximum likelihood estimation, the EM algorithm, and Monte Carlo simulation are the three primary parameter estimation techniques utilised in a Markov state transition model (MCMC).

Because this method combines the prior distribution of parameters and the information of the data, it samples parameters iteratively while an MCMC algorithm requires substantial calculation and takes a long time. The convergence parameter can serve as the foundation for parameter estimation after the gathered samples exhibit the stability of a Markov chain. In this study, the MCMC approach is utilised to estimate the parameters of the model by using the hidden-state variables as the parameters of the model [5].

Discussion

For an autoregressive GARCH model, stationarity is a prerequisite. As a result, for time series, we must first check the stability of the n-order difference series using autoregression. The sample time series illustrates the past and present circumstances of random variables, so the so-called "fundamental qualities" of random variables are unaffected; hence, the primary features of the sample data time series can persist into the future. The key properties of the sample time series are described using their mean, variance, and CO (self) variance. As a result, we refer a sample time series as "stable" if the values of these statistics remain constant over time. It's clear that a stable time series refers to the representative time series that can be found in the upcoming. We can draw the conclusion that its median value, variance, and covariance must match the sample time series currently available.

Conclusion

The majority of airlines' primary operating expenses are related to fuel expenditures. Domestic and international airlines both employ hedging tactics when fuel oil prices are rising since they know how they will impact their bottom lines. In this study, we creatively employ CVaR for hedging strategy risk measurement and MS-GARCH for hedging strategy risk control. The findings indicate that hedging strategies could have a positive impact on fuel cost management in China's aviation sector and are a useful tool for stabilising fuel price volatility. As a result, the research presented in this paper is crucial for China, which needs to improve its less than ideal financial and derivative market. border the entire world simultaneously. Reasonable risk control can be important in the overall operation process when fuel prices are volatile, which has a direct impact on the effectiveness and effects of hedging.

Acknowledgement

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Conflict of Interest

None.

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