WEP Warwick Evans Publishing

International Journal of Global Economics and Management
ISSN: 3005-9690 (Print), ISSN: 3005-8090 (Online) | Volume 3, Number 2, Year 2024
DOI: https://doi.org/10.62051/ijgem.v3n2.55
Journal homepage: https://wepub.org/index.php/IJGEM/index

Research on the effectiveness of hedging on SSE 50 stock index futures

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ABSTRACT

Stock index futures is an important investment product, which gives financial market participants a new way to manage risks, especially in the case of investors holding more spot positions, the risk avoidance function of stock index futures is more prominent. Therefore, this paper to the optimal hedging ratio of stock index futures as the research focus, the above card 50 stock index futures main contract (code: IHL 8) as the research object, on this basis, using OLS and VAR model, for the SSE 50 index (code: 000016), and use the effectiveness of hedging index He to evaluate the effectiveness of the hedge, so as to get the most effective hedging model. Through the empirical research in this paper, it is found that the hedge effect obtained by using the VAR model is better than that of the traditional OLS model. By using the stock index futures, the market participants can effectively avoid the risk of the spot market.

KEYWORDS

SSE 50 stock index futures; Hedging; OLS; VAR

1. INTRODUCTION

The SSE 50 index for the underlying assets of the futures contract, on April 16,2015, the China stock exchange announced its trading code for IH, the simulation of the contract trading time since March 21,2014, the buyers and sellers will in a period of time, on the basis of the price of the stock index, through the way of cash settlement difference for delivery.

2. LITERATURE REVIEW

Many scholars believe that simple hedging models will be better effective when hedging risks in the spot market. Because the operation process of the static model is relatively simple, there are fewer constraints. Therefore, one is also more inclined to use static hedging models to measure the size of the risk.

Ma Shujuan (2014) used the static and dynamic hedging models in the hedging function study of CSI 300 stock index futures and Harvest 300ETF respectively. The study found that the hedging effect estimated by OLS model was the best, but this was limited to the sample with short hedging time [1]. Shang Xiufen(2015) Taking the CSI 300 index futures as an example, the hedge effect is analyzed, and the results show that the OLS model is better than the GARCH model in terms of the hedge effect [2]. Li Xing and Chen Ying (2016) used OLS and VAR in the study of CSI 300 stock index futures in the spot market, and analyzed their effects. The study found that the hedging estimated by OLS model was the best [3]. Fan Jingyun (2017) used OLS, B-VAR, ECM-GARCH and other methods to study the degree of risk avoidance in the spot market in the SSE 50 stock index futures, and found that the best risk aversion could be achieved by using the classic OLS method [4]. Chen Xin (2018), based on the empirical research of SSE 50 and CSI 500 stock index futures, found that OLS performed the best compared with other dynamic models in terms of hedging effect and risk reduction [5]. Dai Jun and Zhu Xinling (2019) use OLS,VECM-GARCH-X and other six models conducted empirical analysis on CSI 300 index futures, and the results show that OLS model still has high advantages in practical application [6]. Sun Shanshan (2019) made a comparative study on the advantages of various hedge models such as OLS, CCC-GARCH, DCC-GARCH and Copula-GARCH, and found that the classic OLS model had the best effect [7]. Yang Youzhi (2020) made an empirical analysis of the hedging ratio of SSE 50 stock index futures, and the results show that the OLS model has a better hedging effect [8]. In the empirical analysis of the CSI 300 index and the CSI 300 index futures by Zhang Wei (2020), it was found that the OLS model is highly effective [9]

3. EMPIRICAL ANALYSIS OF SHANGHAI COMPOSITE 50 STOCK INDEX FUTURES HEDGING

In the empirical study, we took risk minimization as the prerequisite to discuss the optimal hedging ratio of stock index futures, that is, the optimal hedging ratio obtained by the variance minimization method, and we used the hedge efficiency index He in the return variance method to evaluate the implementation effect of hedging.

3.1. Sample Data Selection and data Processing

3.1.1. Selection of sample data and descriptive statistics

In this paper, the CSI 50 Index (code: 000016) and the corresponding main stock index futures main contract (code: IHL 8) are selected as the sample objects of the research, and the trading data of the weekly continuous closing price from January 4,2019 to November 4,2022 is selected. In this paper, the main contract is chosen to maintain the continuity of hedging; at the same time, the daily trading data changes the daily hedging ratio, while the weekly trading data is relatively stable.stem or root of plants.

All the data were obtained from the official website of CITIC Securities and China International Financial Exchange. The data were analyzed by using Eviews and Excel tools.

Among them, the Shanghai Composite 50 stock index futures main contract with FtSaid that the Shanghai Composite 50 index uses Strepresentation. To reduce heteroscedasticity, we first treated St, FtLog smoothing was used to process the data, denoted as lnSt, lnFt, Putting these processed data into the Eviews produces a price trend chart, as shown in Figure 1.

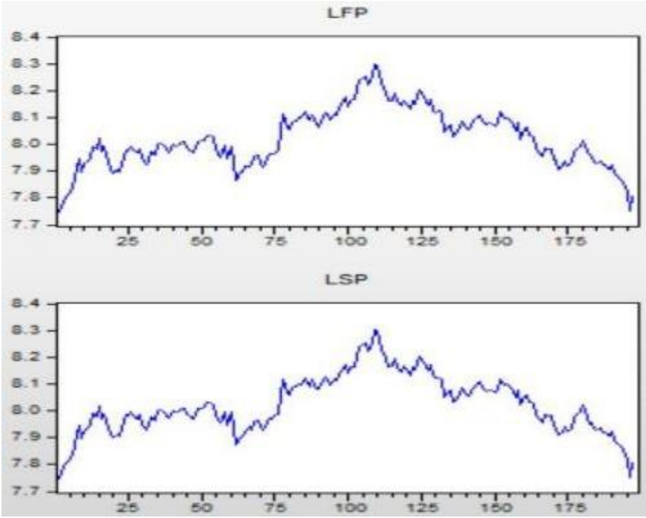

Figure 1. Shanghai Composite 50 period spot price trend

As can be seen from Figure 1 above, the overall trend shows that the trend of SSE 50 futures price and spot price are generally consistent. Although it can be preliminarily judged that there is a connection between the two, the specific situation needs more quantitative analysis.

In the process of empirical analysis, there are many ways to measure price volatility, and the logarithmic differential yield method is one of the more commonly used methods, i.e., using the variance (or standard deviation) of weekly yields to measure the magnitude of the market risk, and expressing the first-order differential yields of the logarithm of the futures and spot prices as $\Delta \ln S_t = \ln S_t - \ln S_{t-1}$, $\Delta \ln F_t = \ln F_t - \ln F_{t-1}$, and obtaining the weekly yield volatility plots of the SSE 50 Index and SSE 50 Stock Index futures,as shown in Figure 2.

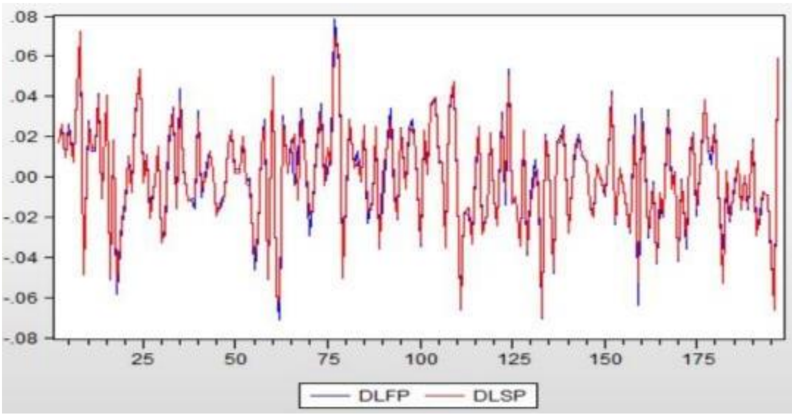

Figure 2. Weekly yield volatility

As can be seen from Figure 2 above, there is a certain degree of positive correlation between the volatility of the weekly return and the previous cycle, that is, the higher the volatility of the previous cycle, the correspondingly higher the volatility of the week in the next week. In other words, the weekly return rate of the SSE 50 index period spot market shows a significant aggregation phenomenon, which is consistent with the characteristics of volatility in the economic cycle.

Table 1. Descriptive statistics for DLSP and DLFP

	DLFP	DLSP
Mean	0.000332	0.000328
Median	0.002063	0.001723
Maximum	0.078738	0.072204
Minimum	-0.71036	-0.069248
Std.Dev	0.027610	0.026915
Skewness	-0. 151426	-0. 168800
Kurtosis	3.010110	3.044567
Jarque-Bera	0.749874	0.947004
Probability	0.687333	0.622817
Sum	0.065100	0.064263
Sum.Sq.Dev.	0. 148655	0. 141261
Observations	196	196

Table 2 based on the results of Table 1:

Table 2. Descriptive Statistics of SSE 50 Futures Spot Weekly Returns

Mean		Crest value	Least value	Standard error	Skewness	Kurtosis	Observe d value
Spot goods	0.000328	0.072204	-0.069248	0.026915	-0. 168800	3.044567	196
Futures	0.000332	0.078738	-0.071036	0.027610	-0. 151426	3.010110	196

Through the above Table 2, this paper makes a detailed analysis of the characteristics of the Shanghai Composite 50 index period spot market.auxiliary word for ordinal numbers

First, from the perspective of standard deviation, the weekly return rate of futures is higher than that of spot, that is to say, the investment of futures has risks to a certain extent. In other words, the changes in futures prices and spot prices do not exactly match, which creates a risk of a basis. Second, in terms of deviation degree, both futures and spot values are negative; both peaks exceed 3. This indicates that the skewness of the weekly yield is slightly lower than the standard normal distribution level (S =0), and the kurtosis is slightly higher than the standard normal distribution level (K =3), indicating that the financial data is left-sided and the other is peak thick tail. Accordingly, can judge, no matter be spot or futures, do not accord with formal standard distribution.

Generally speaking, when we use time series data to build a model, it is necessary to test the data first. If the time series data is non-stationary, there will be false regression, which will have a great impact on the results of the subsequent empirical analysis below. Therefore, we first do a stationarity test on these time-series data.

3.2. Empirical Studies

3.2.1. Optimal hedging ratio estimation —— OLS model

We brought the SSE 50 index and SSE 50 stock index futures into the model and conducted regression analysis on the model using OLS method. The results are shown in Figure 3 below:

Dependent Variable: DLSP
Method: Least Squares
Date: 11/14/22 Time: 15:41
Sample (adjusted): 2 197
Included observations: 196 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.99E-06	0.000298	0.026814	0.9786
DLFP	0.963101	0.010816	89.04401	0.0000

R-squared	0.976117	Mean dependent var	0.000328
Adjusted R-squared	0.975994	S.D. dependent var	0.026915
S.E. of regression	0.004170	Akaike info criterion	-8.111552
Sum squared resid	0.003374	Schwarz criterion	-8.078102
Log likelihood	796.9321	Hannan-Quinn criter.	-8.098010
F-statistic	7928.837	Durbin-Watson stat	2.791136
Prob(F-statistic)	0.000000		

Figure 3. The OLS estimation results

As available from Figure 3 above, the OLS model is: ΔlnSt=0.00000799+0.963101ΔlnFt. In the formula, the coefficient of ΔlnSt is the hedging ratio. Therefore, after the above regression of the relevant data of the Shanghai Composite 50 Index and its futures, the optimal hedging ratio is obtained, that is, the optimal hedge factor is 0.963101. However, when there is a temporal autocorrelation between the remaining terms in the OLS model, it will cause errors in our obtained data.

Then, in order to detect the sequence autocorrelation of the residual term, the LM method (also called the BG method) will be used here to detect the sequence autocorrelation problem, and the results are shown in Table 3 below:

Table 3. LM test results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	26.34967	Pro.F(2, 192)	0.0000
Obs*R-squared	42.21128	Prob. Chi-Square(2)	0.0000

From the above Table 2-4, it can be seen that the F-statistic of p=0.0000, meaning that we can reject the null hypothesis of "no autocorrelation" at the significance level of 5%, then considers the problem of autocorrelation between the residual sequences of the model. Then we solve this problem, we can introduce the delay relationship between the futures price and the current price into this relation, thus in the VAR model.

3.2.2. Optimal hedging ratio estimation —— VAR model

Compared with the OLS method, the biggest difference of the VAR method is that it adds a historic variable in the model. That is, the value of the variable at time t-i is influenced by two factors; it is influenced by the variable and its related variables.

For the autocorrelation of the residual sequence, the VAR model fails by choosing the optimal lag order (p, q). Before making the model estimation, we first need to determine the optimal lag order of the variable count.

The output results of the Eviews software are shown in Table 4 below:

Table 4. Results for the lag order

Lag	ogL	LR	FPE	AIC	SC	HQ
0	1173.524	N A	1.33e -08	- 12.46302	- 12.42859	- 12.44907
1	1190.404	33.22079	1. 16e-08	- 12.60004	- 12.49675	- 12.55819
2	1198.833	16.40899	1. 10e-08	- 12.64715	- 12.47500	- 12.57741
3	1212.776	26.84886	9.92e -09*	- 12.75294*	- 12.51193*	- 12.65529*

From the results in Table 4, we can determine the optimal lag order as p =q =3. Then,we constructed the VAR model. The model results are shown in Table 5 below:

Table 5. Regression results of the VAR model

	DLFP	DLSP
DLFP (-1)	-0.508074 (0.52160) [-0.97406]	0.074713 (0.51137) [0. 14610]
DLFP (-2)	-1.317612 (0.56421) [-2.33531]	-0.874018 (0.55314) [- 1.58010]
DLFP (-3)	-1.333341 (0.52097) [-2.55936]	-0.978556 (0.51075) [- 1.91594]
DLSP (-1)	0.446201 (0.53575) [0.83286]	-0. 151827 (0.52524) [-0.28906]
DLSP (-2)	1.329042 (0.58267) [2.28097]	0.858523 (0.57123) [1.50293]
DLSP (-3)	1.433899 (0.53812) [2.66465]	1.067697 (0.52756) [2.02383]
C	-1.56E-05 (0.00198) [-0.00792]	-1.50E-05 (0.000194) [-0.00777]

The covariance matrix of the regression residuals is shown in Table 6 below:

Table 6. residual covariance matrix results

DLS P		D LFP
D LSP	0.000716	0.000721
D LFP	0.000721	0.000730

The results of the residual covariance matrix are brought into Equation $h^* = \frac{cov(\varepsilon_{st}, \varepsilon_{ft})}{Var(\varepsilon_{ft})} = \rho \frac{\sigma_s}{\sigma_f}$, to obtain the optimal hedging ratio:h * $= \frac{0.000721}{0.000730}$ = 0.987671

3.3. Comparison of the Hedging Effect

Table 7. Comparison of the effectiveness of the hedging method

Before hedging VaT (U_t)		Hedging ratio h^*	After hedging VaT (H_t)	Validity of the hedging, He
OLS	.207197E -04	0.963101	.906273E -05	0.945800
VAR	.207197E -04	0.987671	1.72131E -05	0.976117

Source: Results of the empirical analysis.

According to Table 7 above, the two models are regression, and the best hedge ratio is not the same, and there is no rule to follow. However, by using the income variance method, it can be found from the table, although the difference between the two is not large, which should be greatly related to the model using weekly continuous closing price trading data. However, from Table 7 above, we can clearly see that, compared with the OLS model, the optimal hedging ratio measured by the VAR model is relatively high, and its hedging effectiveness is also relatively high.

In addition, we also found that although hedging can not completely avoid the systemic risks in the market, it can be seen from the data in Table 7 that the variance of returns after hedging is less than that of returns after hedging, indicating that the risks borne by investors can be reduced after hedging. Empirical analysis shows that the stock index futures can be used as an effective hedge means.

4. STUDY CONCLUSIONS AND SUGGESTIONS

4.1. Conclusions

First, after a comprehensive analysis of the above series of data, this paper draws the conclusion that the price trend of the SSE 50 stock index futures contract and its spot commodities is relatively consistent. The distribution pattern of the log-first order difference yield sequence is left side and peak thick tail, which goes against the standard normal distribution. Based on this work, we further investigated the stability of the time series data and found that LSP and LFP are unstable and DLSP and DLFP are stable time series. So we from the point of view, the spot prices are relatively stable. Therefore, we can believe that the SSE 50 index and its futures contracts show a good long-term and stable relationship.

Second, the utility of the best hedge ratio obtained will also differ under different empirical models. After using the yield variance method in this paper, we believe that the optimal hedging ratio estimated by VAR model is higher than that of OLS model, and the hedging realization effect is better and the hedging realization effect is greater.

4.2. Stock Index Futures Hedging Investment Advice

4.2.1. Select the period spot with high linear correlation to avoid risk

In practice, the price fluctuation of financial derivatives is often affected by other market factors, and is linked with other market factors, thus having an impact on the spot market. For example, in the stock index futures market, there is a high correlation between the stock index futures price and the spot price. However, because the change degree of correlation between different markets and different types of futures contracts is different, in order to achieve effective hedging, it is necessary to choose the appropriate hedging strategy according to the correlation between futures contracts.

In this paper, the SSE 50 stock index futures and the spot SSE 50 index have a very high correlation, so the hedging effect is relatively significant. Therefore, when hedging, we should try to choose futures or spot products with high linear correlation, which can effectively avoid the risks borne by market participants and reduce their losses. The principles of hedging have been explained in detail above, not here. Then hedging, after a period of time, the spot losses caused by price changes can be compensated or offset by the losses in futures, thus forming a hedging mechanism between spot and futures, so that market participants can effectively reduce the price risks they face. Therefore, we can use the futures to hedge the risk, and the main reason is the convergence of the futures and the spot. In short, we should choose futures and spot with high linear correlation as hedge tools.

4.2.2. Select the appropriate hedging model

Based on the hedging effect of SSE 50 index futures, the SSE 50 index is studied, and an in-depth empirical analysis is made by using two models: OLS and VAR. It is found that the optimal hedging ratio estimated by the VAR model is higher and the hedging effect is better. Then, when choosing an appropriate hedging model, we can first conduct empirical analysis to explore which model has higher hedging efficiency through the previous data, so as to provide a reference for the subsequent hedging model selection. In fact, hedging will be affected by many subjective and objective factors. Therefore, how to select the appropriate hedging model should be determined according to the length of the trading time. When the trading time is very short, the static hedging model can be selected; otherwise, for a long time.The transaction of the period risk adopts the dynamic hedging model. Due to the long hedging time selected in this paper, which was nearly four years from January 4,2019 to November 4,2022, the final empirical results show that the hedging effect of VAR model is better than the OLS model. The above is only based on the empirical research of this paper, which provides some reference opinions for the investment strategy of China's securities market.

4.2.3. Strengthen the supervision and management of the financial market

Compared with other financial products, stock index futures have more speculative nature, and its investment risk is also greater. Any kind of securities market manipulation will bring great impact to the capital market, which will not only bring risks to the financial market, but also have a certain impact on the spot market. In recent years, under the background of the rapid development of the financial market and the lower investment threshold, the chaos of financial crimes has occurred frequently. Therefore, it is very necessary to establish a set of legal system that can prevent the risks of stock index futures, and at the same time to provide appropriate guidance and constraints on the overheated industry index, so as to ensure the efficient operation of the futures market and promote the long-term and stable development of China's financial market.

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