Hedging Effectiveness of Hong Kong Stock Index Futures Contracts

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Abstract

This paper investigates the hedging performance of both the HSIF and HHIF contracts using daily data for the period January 2004-June 2005. The hedged portfolios consist of market indices and unit funds. The dynamic OLS-modeled strategies and EWMA-modeled hedging strategies for both 63-day and 126-day estimation windows are compared. The results show that (1) compared to the HSIF contract, the HHIF contract is an important additional hedging instrument; (2) the EWMA model is slightly superior to the dynamic OLS model generally; (3) the cross-hedging effectiveness for actual spot portfolios to be hedged appears to be much lower than that for market indices.

Keywords: Stock index futures, Dynamic hedging, Actual spot portfolios

1. Introduction

As derivative instruments, stock index futures contracts provide people in the stock market with additional risk management opportunities. To reduce the inherent risk in holding stocks, investors can protect the value of his portfolio by selling stock index futures in the market. If the price movements of the spot and futures positions offset roughly each other, a successful hedging will be achieved. However, due to the existence of basic risk, futures could not completely eliminate the risk associated with the spot position (see Figlewski, 1984; Holmes, 1996). Therefore, it is important for market participants to have an understanding of how effective the stock index futures are in hedging. For this reason, the hedging effectiveness of stock index futures has been widely examined over the past twenty-five years.

Hedging effectiveness of stock index futures have been mainly investigated by a variety of hedging strategies in US and UK. However, there are very few studies done in the Pacific Basin region markets, especially in the Hong Kong market. Hong Kong futures market represents one of the largest markets in the Pacific Basin region. According to Choudhry (2004), the average percentage of trading volumes in numbers of shares in the Hong Kong futures market relative to the US futures market between 1990 and 2000 is 45.8% while those in Australian and Japanese futures markets are only 6.6% and 21.6%, respectively. As a result, it is worthwhile to investigate the hedging effectiveness of stock index futures in the Hong Kong market.

Since the traditional one-to-one and beta hedges could not minimize the risk associated with the spot portfolios, numerous studies use Johnson's(1960) minimum variance hedge ratio(MVHR) which measures hedging effectiveness as the reduction in variance of the hedged positions to investigate hedging performance. The MVHR, h^*, is calculated by Johnson as follows:

$$h^* = -\frac{Cov(R_s, R_f)}{Var(R_f)} \tag{1.1}$$

where R_s is the return on the spot portfolios and R_f is the return on the futures contract. These studies report the existence of considerable risk reduction of the hedged positions (see Feglewski (1984), Junkus and Lee (1985), Graham and Jennings (1987), Lindahl (1992)). However, most previous studies have been seriously challenged. Firstly, there are plenty of disagreements regarding the genuineness of such risk reduction and the procedures used for estimating the hedge ratios. Some researchers argue that previous studies concentrate on *ex post* hedging effectiveness that may exaggerate hedging effectiveness (Holmes, 1995; Butterworth & Holmes, 2000). Holmes (1995) also interprets that ex post hedging assumes that hedgers have perfect foresight for spot and futures prices and can thus estimate the optimal hedge ratio for the subsequent period. But, it is unrealistic because in real world, hedgers do not have perfect foresight and optimal hedge ratios are time-varying (Malliaris and Urrutia, 1991). Alternatively, Malliaris and Urrutia (1991), Holmes (1995) and Butterworth & Holmes (2000) investigate ex-ante hedging effectives in US and UK market respectively. Secondly, Butterworth and Holmes (2000) claim that majority of previous studies have failed to obtain true hedging effectiveness by examining performance for actual stock portfolios that investors may hold in real world. Most using market index as portfolios to be hedged, this may make the empirical results of hedging effectiveness questionable more or less.

The main purpose of this paper is to examine and compare the hedging effectiveness of two contracts-Hang Seng Index Futures (HSIF) and Hang Seng H-shares Index Futures (HHIF) contracts for a range of spot portfolios in the Hong Kong stock market with static and dynamic strategies. The organization of this paper is as follows. Section 2 presents the data. Section 3 presents methodology. Empirical results and evaluation of hedging effectiveness of different hedging techniques are presented in Section 4. Section 5 concludes.

2. Data

Hedging performance is examined for Hang Seng index futures(HSIF) and Hang Seng H-shares index futures contracts(HHIF) traded on HKSE. The data used in the analysis covered the period of one and a half year, from 5th January 2004 to 29th June 2005 (Note 1). For purpose of comparisons, we hedge four cash market indices and two investment funds. The 4 market indices are Hang Seng Index(HSI), Hang Seng China Enterprises Index(HKHCHIE), Hang Seng 50(HKHF50I) and Hang Seng Composite Index(HKHCOMP). The two unit funds include Track Fund of Hong Kong(TFHK) and IShares MSCI China Tracker(MSCI). Unit funds are used in this study because they represent diversified portfolios which are well managed by professional investment companies. Moreover, they have similar composition to those held by individual investors and have growing trading volumes in recent years. Only two unit funds are chosen because of a lack of available funds with sufficiently long trading history. Therefore, it is of more interest to examine hedging effectiveness for these two actual spot portfolios.

Daily closing prices are used and collected for all futures contracts and spot portfolios from Datastream. This results in a time series consisting of 388 price observations for both spot and futures positions.

Table 2.1 shows descriptive statistics of the returns of all futures and spot portfolios. According to Jarque-Bera (JB) test, all 9 series show excess kurtosis, signifying fatter tails than a normal distribution. The unit roots of the series is tested by using Augmented Dickey-Fuller test (ADF). Appropriate DF critical value (Harris & Sollis, 2003) is used. Results show null hypothesis of unit roots are all significantly rejected at 1% level of significance, which means all series are stationary.

Table 2.1 Descriptive statistics (Jan 2004-Jun 2005)

	Mean	SD	Skewness	Kurtosis	JB	ADF
HSI	0.00024111	0.008986	-0.14229	1.7477	36.524**	-18.73**
HKHCHIE	-0.000256	0.017076	-0.33807	2.7194	64.976**	-14.94**
HKHF50I	0.00019983	0.0097598	-0.25094	2.5652	62.907**	-18.63**
HKHCOMP	0.00023075	0.0093885	-0.25881	2.5761	63.028**	-18.41**
TFHK	0.00026237	0.0098068	-0.15126	1.379	25.032**	-20.64**
MSCI	-3.828E-05	0.017121	-0.79241	3.6318	64.102**	-15.22**
HSIF	0.00031112	0.01015	-0.30131	1.9355	39.300**	-20.17**
HHIF	6.51E-05	0.022042	1.1429	21.574	788.07**	-16.46**

***significant at the 1% level*

3. Methodology

The paper employs a log-return formulation to calculate continuously compounded returns from each cash portfolio and each futures contract as follows:

$$r_t = \ln(P_t / P_{t-1}) \quad (2.1)$$

where: r_t denotes the weekly return on either the cash or futures position at time t;

P_t denotes the price at time t;

Ln denotes the natural logarithm.

Both *ex post* and *ex ante* hedging effectiveness of Hong Kong stock index futures contracts are examined. *Ex post* hedging strategies are implemented for the purpose of providing comparable benchmarks. We investigate the direct-and cross-hedging performance of HSIF and HHIF contracts by using the Johnson(1960) minimum variance hedge ratio method.

A variety of approaches could be adopted to estimate the MVHR by different hedgers. Here we first employ OLS method to calculate MVHR by regressing the following equation:

$$RS_t = \alpha + \beta RF_t + \varepsilon_t \tag{2.2}$$

where : *RS* is the return on the cash portfolios;

RF is the return of the futures contracts;

ε is a residual term;

α, β are regression parameters, where β is the minimum variance hedge ratio, h^*.

To make the analysis more reasonable, we assume that the hedgers use historical information in one period to calculate the hedge ratio, and use it to estimate hedge ratio in the subsequent period. This ex ante approach of hedging effectiveness is first introduced by Holmes (1995) in UK market. Like Butterworth and Holmes (2000), we also apply a dynamic strategy to ex ante hedging approach, where hedge ratios are estimated using rolling regression procedures. Two window sizes, 63-day (3 months) rolling window and 126-day (6 month) rolling window, are used respectively. For comparison purposes, hedging effectiveness is investigated from 127-387 observations in post-sample period. Therefore, 261 *ex ante* hedge ratios for each hedged spot portfolio will be generated in line with 63-day and 126-day rolling windows. Laws and Thompson (2005) point out an argument that latest observations may have stronger effects and another counter argument that using fewer observations may introduce instability into estimates. By using different rolling windows, we could examine whether the window sizes influence the stability of hedged ratio and hedging performance also.

Moreover, like Laws and Thompson (2005), we use the exponential weighted moving average model (EWMA) for estimating dynamic hedge ratios, in which the conditional variance-covariance matrix of futures and spot portfolio returns are estimated. The EWMA covariance and variance equations (Note 2) are given by:

$$\sigma(x, y) = (1-\lambda)\sum_{i=1}^{T} \lambda^i x_{t-i} y_{t-i} \tag{2.3}$$

$$\sigma^2(y) = (1-\lambda)\sum_{i=1}^{T} \lambda^i y^2_{t-i} \tag{2.4}$$

where *T* is the lag horizon and λ ($0<\lambda<1$) is the decay factors and also called "smoothing" parameter. The larger the value of λ is, the more weight is placed on early data and the more influence of early data on future data. Therefore, the series becomes smoother (Alexander, 1997). Since JP Morgan RiskMetrics uses an infinite EWMA with λ=0.94 for all markets and suggests that it is the most optimal weighting for daily data, we take λ as 0.94. Both 63-day and 126-day estimation window sizes are also used here.

Once the hedge ratio is estimated, each return of hedged spot portfolio could be estimated as the following equation:

$$R_h = R_s - hR_f \tag{2.5}$$

where: R_h is the return of each hedged spot portfolio;

R_s is the return of each unhedged spot portfolio;

R_f is the return of futures contracts;

h is the hedge ratio.

Meanwhile, mean and standard deviation of returns of the unhedged and hedged portfolios will be calculated. Finally, the hedging effectiveness of minimum-variance hedge can be determined by examining the percentage of risk reduction by the hedge which is suggested by Butterworth and Holmes (2000) as following equation:

$$Risk\ reduction = \frac{\sigma_u - \sigma_h}{\sigma_u} \times 100\% \tag{7}$$

where: σ_u refers to standard deviation of returns of the unhedged positions; σ_h refers to standard deviation of returns of the hedged positions.

4. Empirical results

4.1 The OLS results

Out-of-sample summary details of the empirical results with respect to the *ex post* and *ex ante* hedging performance of both HSIF and HHIF contracts are recorded in Table 4.1 and 4.2. Each table composes four panels of results. For each panel, there are seven spot portfolios: the first four are market indices, the middle two are unit funds and the last one is the randomly created portfolio (see Appendix for abbreviations and details).

A. Stock market indices

To begin, we examine hedging performance where the underlying spot portfolios are broadly diversified market indices. Table 4.1 reports the results of the HSIF contracts. Overall, hedging for stock market indices show a better performance than hedging for investment funds or created portfolio in terms of risk reduction. We can see that HSIF contracts produce considerable risk reduction in both ex post and ex ante hedging. Specially, it results in 0.6693 of risk reduction on HSI which is the direct underlying market index in ex post hedging; for other cross hedged positions- HKHCHIE, HKHF50I and HKHCOMP, the level of risk reduction is reduced by 0.3017, 0.6312 and 0.6575 respectively, which are relatively lower than the level of risk reduction on HSI. We notice that the level of risk reduction of HKHCHIE is particularly low (0.3017). It shows the relatively weak covariance relationships that links HSIF contract and HKHCHIE due to the special nature of the HKHCHIE which consists of only Chinese enterprises traded on Hong Kong stock market. Unfortunately, we find that the average mean returns of all hedged market indexes are extremely low, some even negative. The results confirm findings reported by Butterworth and Holmes(2000) who indicate that in order to achieve risk reduction, the mean returns have to be sacrificed.

Panel (C) and (D) in Table 4.1 show the results when the rolling *ex ante* hedging strategies are used. Note that slightly lower levels of risk reduction could be obtained by using such *ex ante* hedging strategy compared to *ex post* hedging strategy. Moreover, with the expansion of rolling window from 63 days to 126 days, the degrees of risk reduction are, apart from one exception, close to the ex-post benchmarks. The result is expected and consistent with Holmes (1995), Butterworth and Holmes (2000). As Butterworth and Holmes(2000) point out that, ex ante hedging performance would be improved by enlarging the rolling window size used for estimating hedge ratios.

In addition, the last column in Table 4.1 shows that, with the enlarging window size from 63 days to 126 days, the standard deviations of ex ante hedge ratios tend to decrease, except HKHCHIE. These findings agree with Butterworth & Holmes (2000) who find the problem of the degree of ex ante hedge ratio instability could be alleviated when larger window sizes are employed. However, it should be noticed that the standard deviation of ex ante hedge ratio for HKHCHIE reaches 0.1811 for 126-day rolling window size, significantly higher than 0.0205, 0.0311 and 0.0275 for other three market indices-HSI, HKHF50I and HKHCOMP, respectively. The possible reason is that HSIF contract and the cross-hedged spot portfolio- HKHCHIE has weak economic relationship.

Table 4.2 reports the ex post and ex ante hedging effectiveness of the HHIF contract. To begin, we can see clearly that, for ex post hedging strategy, the HHIF contract could reduce 0.5199 of the risk associated with its underlying market index-HKHCHIE, not great as the level(0.6693) of risk reduction of HSIF contract direct hedge, but still acceptable. For the cross hedges with HSI, HKHCHIE and HKHCOMP, the level of risk reduction is reduced only by 0.3159, 0.3927 and 0.3773 respectively. More importantly, the results also show that the overall degree of both direct- and cross-hedged risk reduction of HHIF contract is weaker that that of HSIF. It is not surprising. This may be attributable to the large return variability of the HHIF contract, since it is just introduced at the end of 2003 and has relatively shorter trading history, lower trading volume and lower liquidity compared to HSIF contract. It should be also mentioned here that the mean returns on direct and cross-hedges are substantially greater than those associated with the HSIF contract. For example, the results show that by *ex post* cross hedging strategy, the level of sacrificed mean returns of HHIF for hedging HKHF50I and HKHCOMP is 0.6319 and 0.5804, lower to figures for the HSIF of 0.9167 and 0.8753 respectively. It indicates that, the hedgers, by hedging their spot positions with HHIF contracts, do not have to sacrifice substantial mean returns to pursue relatively higher risk reduction. Once again, these findings confirm Butterworth & Holmes (2000). From this point of view, the HHIF contract appears to be an important hedging instrument.

Panel(C) and (D) in Table 4.2 also report the ex ante hedging effectiveness of HHIF contract. In all cases, the mean returns on *ex ante* hedges for the HHIF contract is examined to be relatively higher than those on *ex post* hedges. Furthermore, with the enlarged rolling window from 63 days to 126 days, mean returns of hedged spot portfolios on *ex ante* hedges tend to slightly increase. Additionally, it is worthwhile noting that, the levels of risk reduction for hedged the four market indices drop from 0.2827, 0.4634, 0.3442 and 0.3372, to 0.2491, 0.4140, 0.3229 and 0.3015 respectively, when the estimation window size is enlarged from 63 days to 126 days. These figures are the opposite of conclusions reached by Holmes (1995) and Butterworth & Holmes (2000) which suggest that effectiveness of the hedge improves with the length of estimation window. Two possible reasons are: (1) the relatively lower stability of daily data may have some negative impact on the accuracy of hedging effectiveness (Laws & Thompson, 2005); (2) Great return variability of the HHIF contract may lead to these seemingly contradictory findings since HHIF is a new contract. It may take some time for the investors to be familiar with the new contract and also for the trading volume to reach a stable and sufficient level.

Table 4.1 OLS-modeled hedging effectiveness of the HSIF contract:*(Annually)

	Average hedge ratio	mean return	S.D. of returns	Decrease in S.D.	S.D.of hedge ratios
(a) Unhedged					
*HSI**		0.158459	0.114772		
HKHCHIE		0.136947	0.175754		
HKHF50I		0.165677	0.117036		
HKHCOMP		0.169182	0.113423		
TFHK		0.158875	0.127318		
MSCI		0.164574	0.201959		
(b) Ex post hedging					
*HSI**	0.843221	0.007912	0.037950	0.669346	
HKHCHIE	0.979344	-0.037903	0.122733	0.301680	
HKHF50I	0.850932	0.013754	0.041827	0.631235	
HKHCOMP	0.829571	0.021072	0.038847	0.657500	
TFHK	0.859129	0.005489	0.063487	0.501350	
MSCI	0.813243	0.019380	0.172842	0.144173	
(c)Ex-ante hedging-63 day window					
*HSI**	0.845724	0.005506	0.038186	0.667286	0.037808
HKHCHIE	1.082466	-0.072033	0.131563	0.251439	0.174074
HKHF50I	0.870738	0.006294	0.043380	0.617534	0.047745
HKHCOMP	0.846223	0.014523	0.040225	0.645353	0.044322
TFHK	0.874555	-0.002943	0.064294	0.495012	0.061076
MSCI	0.905401	-0.005864	0.182002	0.098817	0.212414
(d)Ex-ante hedging-126 day window					
*HSI**	0.845731	0.009471	0.038242	0.666804	0.020530
HKHCHIE	1.149676	-0.085502	0.129120	0.265340	0.181147
HKHF50I	0.884155	0.006264	0.042423	0.637523	0.031102
HKHCOMP	0.858198	0.015060	0.039328	0.653266	0.027536
TFHK	0.881027	0.002062	0.063805	0.498858	0.030718
MSCI	0.956329	-0.012832	0.176801	0.124568	0.125973

**represents the spot portfolio directly underlying the HSIF contract*

The results in the last column in Table 4.2 show the great instability in hedge ratios of the HHIF contract. Interestingly, observe that the standard deviations of ex ante hedge ratio adversely increase with the enlarging rolling window expect for its underlying index-HKHCHIE. More importantly, the stability of *ex ante* hedge ratio of HHIF contract is much weaker than that of HSIF contract for all market indices, reflecting HHIF's inherent liquidity nature and less hedging effectiveness for Hong Kong market-based indices.

Table 4.2 OLS-modeled hedging effectiveness of the HHIF contract:*(Annually)

	Average hedge ratio	mean return	S.D. of returns	Decrease in S.D.	S.D. of hedge ratios
(a) Unhedged					
HSI		0.158459	0.114772		
*HKHCHIE**		0.136947	0.175754		
HKHF50I		0.165677	0.117036		
HKHCOMP		0.169182	0.113423		
TFHK		0.158875	0.127318		
MSCI		0.164574	0.201959		
(b) Ex post hedging					
HSI	0.438371	0.065806	0.078517	0.315891	
*HKHCHIE**	0.807357	-0.033693	0.084377	0.519913	
HKHF50I	0.495477	0.060955	0.068884	0.392682	
HKHCOMP	0.464733	0.070958	0.070632	0.377273	
TFHK	0.459887	0.061676	0.092181	0.275978	
MSCI	0.607978	0.036075	0.165251	0.181759	
(c)Ex-ante hedging-63 day window					
HSI	0.393723	0.099769	0.082326	0.282699	0.131340
*HKHCHIE**	0.711978	0.031857	0.094313	0.463379	0.225180
HKHF50I	0.442506	0.100359	0.074387	0.344167	0.144119
HKHCOMP	0.417947	0.106103	0.075177	0.337201	0.133345
TFHK	0.409804	0.096036	0.096055	0.245550	0.142115
MSCI	0.544861	0.078204	0.167027	0.172965	0.153100
(d)Ex-ante hedging-126 day window					
HSI	0.343217	0.119763	0.086183	0.249091	0.140297
*HKHCHIE**	0.624410	0.060597	0.102997	0.413970	0.222668
HKHF50I	0.386104	0.121278	0.079240	0.322943	0.152879
HKHCOMP	0.366925	0.125792	0.079227	0.301495	0.141237
TFHK	0.355816	0.120732	0.100378	0.211601	0.153078
MSCI	0.497521	0.089049	0.169368	0.161372	0.147633

**represents the spot portfolio directly underlying the HHIF contract*

B. Unit trust funds

Compared to evaluation of *ex ante* hedging effectiveness of market indices, it is more realistic to study the *ex post* and *ex ante* hedging performance on actual portfolios. Table 4.1 and 4.2 report the relevant results for the HSIF and HHIF contract for the two hedged unit funds. It can be easily found that HSIF contract is superior to HHIF contract in terms of risk reduction for hedging TFHK based on both *ex post* and *ex ante* hedging strategies. For example, HSIF contract gets 0.4950 of risk reduction for *ex ante* hedged TFHK based on the 63-day rolling window, whereas HHIF contract only gets the figure of 0.2456. It is not hard to offer an explanation that TFHK is designed to track Hang Seng Index and therefore, has a similar portfolio composition to the market index. Dismally, both HHIF and HSIF contract only achieve extremely poor level of risk reduction on hedged MSCI, for example, 0.1730 and 0.0988 respectively for 63-day estimation window. The results show that weak economic relationship between the MSCI and the two futures contracts. Nevertheless, the HHIF contract is slightly superior to the HSIF contract in terms of risk reduction since the MSCI holds a part of H-shares which are the spot portfolios directly underlying the HHIF. However, MSCI seems to be little related to the HSIF due to the nature of the unit fund. As a result, we can see that HHIF are slightly more effective for hedging the unit fund—MSCI compared to the HSIF. Thus, the HHIF contract could be regarded as an important hedging instrument.

As anticipated, with the enlarging window size, the level of risk reduction continues to improve with respect to the two hedged unit funds. However, compared to the hedging effectiveness on hedged market indices, the degrees of risk reduction for unit funds are significantly lower. It demonstrates that the levels of cross-hedging effectiveness appear to be overstated using the market indices. The actual hedging effectiveness could be only achieved for hedging true spot portfolios.

Table 4.1 and 4.2 also display the standard deviations of ex ante hedge ratio with the two investment funds. The results show that the larger the rolling window size, the more stable the ex ante hedge ratios are. The opposite is observed for the hedged TFHK with the HHIF. The standard deviation of ex ante hedge ratio increases from 0.1421 to 0.1531 with the length of the estimation window. This finding suggests the instability of hedge ratios of the HHIF. It also may be attributable to the inherently instability of the daily data. Nevertheless, notice that the standard deviation of the HSIF for MSCI for 63-day estimation window is 0.2124, higher than the figure for the HHIF of 0.1531, indicating again that the HHIF is more effective for hedging MSCI than the HSIF.

Considering the stability of *ex ante* hedge ratio, the results show that HSIF contract has great hedge ratio instability than HHIF contract. For instance, the standard deviation of *ex ante* hedge ratio based on 26-week rolling window procedure for HSIF contract reaches 0.1205 while that for HHIF is only 0.0919. Additionally, we find that the mean returns of the hedged portfolio associated with HHIF contract is higher than that associated with the HSIF contract. Overall, the results demonstrate that the hedging performance of HSIF contract is effective than the HHIF contract in risk reduction, but only slightly. Given the higher mean return and more stable hedge ratios generated from the HHIF compared to the HSIF, one can conclude that HHIF contract has a relatively higher hedging ability for "actual" portfolios in financial industry compared to HSIF contract.

4.2 The EWMA results

The out-of-sample EWMA empirical results with respect to the hedging performance of both HSIF and HHIF contracts are recorded in Table 4.3 and 4.4. The two tables have the same organization as Table 4.1 and 4.2 but only compose three panels. Because the main results are unchanged, we only briefly discuss the main results and highlight particular findings as follows.

As can be seen from Table 4.3 and 4.4, similar to the results from OLS method, overall hedging effectiveness in risk reduction for stock market indices based on EWMA model is better than hedging for "actual" spot portfolios for both HSIF and HHIF(for HSIF, HKHCHIE is the exception). Note that direct hedge of the HSIF with the 63-day estimation window results in 0.6652 of risk reduction which is greatly higher than the figure of 0.4819 for the HHIF. It indicates again that the new HHIF is not as effective as the HSIF for hedging its underlying index. Besides, cross hedging effectiveness of 126-day estimation window of HSIF for other market indices- HKHF50I and HKHCOMP is 0.6361 and 0.6517 respectively, greater than 0.3811 and 0.3445 of the HHIF. These figures suggest two features: First, the HSIF is a better hedge instrument for market indices than the HHIF; Second, cross hedge is unlikely to be as effectiveness as a direct hedge. Additionally, we notice that, like the OLS estimation, level of risk reduction of the HSIF for hedging HKHCHIE is particularly low (0.2740 with 63-day estimation window). It shows the relatively weak covariance relationships that link the HSIF contract and HKHCHIE since HKHCHIE only consists of the Chinese enterprises traded on Hong Kong stock market. When considering the risk reduction for the hedged investment funds, the results reveal that the with 63-day estimation window, HSIF could obtain 0.4966 and 0.1326 of risk reduction level for hedged TFHK and MSCI respectively while the HHIF could obtain 0.2565 and 0.1803 for same spot portfolios. According to these figures, one can conclude that the HHIF is more effective for hedging the unit fund-MSCI than the HSIF since MSCI contains some H-shares, and in turn, is more related to the HHIF. Apart from one or two exceptions, the levels of risk reduction for both HSIF and HHIF contract rise as the estimation window size is enlarged from 63 days to 126 days. Note that these findings for the HHIF are a little different from those obtained using OLS in this paper which show that with the enlarged estimation period, levels of risk reduction for some hedged portfolios with the HHIF even decrease. In general, the above findings suggest that the HSIF are more effective in risk reduction than the HHIF, especially for hedging market indices. However, compared to the HSIF, the HHIF achieves a better performance when the hedged cash portfolios is the underlying market index—HKHCHIE or true unit fund—MSCI. Thus, for portfolios related to H-shares, the HHIF is a significant additional hedging instrument.

Table 4.3 EWMA-modeled hedging effectiveness of the HSIF contract:*(Annually)

	Average hedge ratio	Average mean return	S.D.of returns	Decrease in S.D.	S.D. of hedge ratio
(a) Unhedged					
*HSI**		0.158459	0.114772		
HKHCHIE		0.136947	0.175754		
HKHF50I		0.165677	0.117036		
HKHCOMP		0.169182	0.113423		
TFHK		0.158875	0.127318		
MSCI		0.164574	0.201959		
(b) hedging with 63-day estimation window					
*HSI**	0.847506	-0.000049	0.038427	0.665186	0.052744
HKHCHIE	1.046793	-0.052420	0.127590	0.274041	0.152921
HKHF50I	0.864560	0.004584	0.042644	0.624026	0.056068
HKHCOMP	0.841715	0.011022	0.039553	0.651284	0.054803
TFHK	0.871799	-0.013052	0.064098	0.496551	0.077274
MSCI	0.893527	0.005014	0.175178	0.132608	0.263540
(c)Ex-ante hedging-126 day window					
*HSI**	0.847074	0.000285	0.038407	0.665362	0.050798
HKHCHIE	1.052542	-0.054740	0.127397	0.275144	0.144117
HKHF50I	0.865314	0.004347	0.042579	0.636191	0.053312
HKHCOMP	0.841481	0.011807	0.039501	0.651737	0.052151
TFHK	0.871776	-0.012585	0.064046	0.496964	0.074733
MSCI	0.897485	0.002904	0.174844	0.134257	0.245200

*represents the spot portfolio directly underlying the HSIF contract

Table 4.4 EWMA-modeled hedging effectiveness of the HHIF contract:*(Annually)

	Average hedge ratio	Average mean return	S.D.of returns	Decrease in S.D.	S.D. of hedge ratio
(a) Unhedged					
HIS		0.158459	0.114772		
*HKHCHIE**		0.136947	0.175754		
HKHF50I		0.165677	0.117036		
HKHCOMP		0.169182	0.113423		
TFHK		0.158875	0.127318		
MSCI		0.164574	0.201959		
(b) hedging with 63-day estimation window					

HIS	0.403561	0.080415	0.081937	0.286090	0.122704
*HKHCHIE**	0.731271	0.007489	0.091062	0.481880	0.205565
HKHF50I	0.449329	0.068017	0.072538	0.360465	0.131844
HKHCOMP	0.427644	0.085525	0.074514	0.343049	0.123493
TFHK	0.421438	0.057425	0.094657	0.256535	0.136668
MSCI	0.565283	0.047669	0.165545	0.180301	0.186306
(c) hedging with 126-day estimation window					
HIS	0.395507	0.086621	0.081786	0.287404	0.120657
*HKHCHIE**	0.716124	0.017532	0.091710	0.478194	0.195467
HKHF50I	0.440130	0.075082	0.072432	0.381120	0.128473
HKHCOMP	0.419250	0.091838	0.074345	0.344533	0.120458
TFHK	0.412703	0.073396	0.095579	0.249288	0.134743
MSCI	0.558348	0.047669	0.167070	0.172753	0.180961

**represents the spot portfolio directly underlying the HHIF contract*

Another concern is about the mean returns of the hedged spot portfolios. We find that in most circumstances, the average mean returns of hedged spot portfolios with the HSIF are greatly lower than those with the HHIF. For example, with the 63-day estimation window, the HSIF remains mean return of -0.0131 for hedged TFHK, compared to figures of 0.0574 for the HHIF.

As for the stability of hedge ratios, we notice that, without exception, the hedge ratios for both HSIF and HHIF contracts show more stability with the length of the estimation window. More importantly, the standard deviations of the hedge ratios of the HHIF contract (except MSCI) are greater than those of the HSIF. Such findings are similar to those obtained from ex ante OLS model which indicate that the majority of the hedge ratios of the HSIF is more stable compared to the HHIF and also confirm again great instability in hedge ratios of the HHIF contract.

4.3 Overall comparison of results obtained from OLS and EWMA

A comparison of the hedging performance in terms of risk reduction and stability of the hedge ratios using dynamic OLS and EWMA model is shown in Table 4.5 for both the HSIF and HHIF estimates. Both 63- and 126-day estimation windows are used.

Table 4.5 shows that the overall levels of risk reduction obtained by EWMA model are higher than those obtained by ex ante OLS model. Particularly, for the HHIF estimates, the EWMA model provides better hedging performance than the OLS model in all cases. For example, the HHIF achieves superior risk reduction of 0.2861, 0.4819, 0.3605 and 0.3430 for HSI, HKHCHIE, HKHF50I and HKHCOMP respectively by EWMA model with 63-day estimation window, compared to 0.2827, 0.4634, 0.3442 and 0.3372 by dynamic OLS model. In contrast, for the HHIF contract, we find that the EWMA is superior to OLS model with 63-day estimation window (expect HSI). However, when the estimation window is enlarged to 126 days, the superiority of the EWMA disappears. In other words, the improvement of risk reduction level with the enlarged estimation window using the EWMA model is less significant than that of the dynamic OLS model. Generally, the EWMA model is slightly better than the dynamic OLS model.

As for the results of the stability of hedge ratios, interestingly, the evidence is mixed. For the HHIF contract, apart from one exception, the hedge ratios obtained by EWMA are more stable than those obtained by the OLS model. However, for the HSIF contract, we see that the standard deviations of hedge ratios estimated by the EWMA are lower than the OLS only for HKHCHIE.

Generally speaking, the EWMA model could provide better hedging performance than the dynamic OLS model in terms of risk reduction, particularly for the HHIF contract, but only slightly. This results are consistent with some previous researchers' findings, such as Brooks and Chong(2001) and Laws & Thompson(2005) who suggest that EWMA hedging strategy performs best given the criteria of risk reduction, but also in line with Tong(1996) who indicates that using more complex hedging model seems not improve the performance much.

Table 4.5 Comparison in hedging effectiveness between dynamic OLS and EWMA

	63-day estimation window				*126-day estimation window*			
	Risk reduction		S.D. of hedge ratio		Risk reduction		S.D. of hedge ratio	
	OLS	EWMA	*OLS*	EWMA	*OLS*	EWMA	*OLS*	EWMA
Panel(A) Using the HSIF contract								
*HSI**	0.6673	0.6652	0.0378	0.0527	0.6668	0.6654	0.0205	0.0508
*HKHCHIE**	0.2514	0.2740	0.1741	0.1529	0.2653	0.2751	0.1811	0.1441
HKHF50I	0.6175	0.6240	0.0477	0.0561	0.6375	0.6362	0.0311	0.0533
HKHCOMP	0.6454	0.6513	0.0443	0.0548	0.6533	0.6517	0.0275	0.0522
TFHK	0.4950	0.4966	0.0611	0.0773	0.4989	0.4970	0.0307	0.0747
MSCI	0.0988	0.1326	0.2124	0.2635	0.1246	0.1343	0.1260	0.2452
Panel (B) Using the HHIF contract								
*HSI**	0.2827	0.2861	0.1313	0.1227	0.2491	0.2874	0.1403	0.1207
*HKHCHIE**	0.4634	0.4819	0.2252	0.2056	0.4140	0.4782	0.2227	0.1955
HKHF50I	0.3442	0.3605	0.1441	0.1318	0.3229	0.3811	0.1529	0.1285
HKHCOMP	0.3372	0.3430	0.1333	0.1235	0.3015	0.3445	0.1412	0.1205
TFHK	0.2456	0.2565	0.1421	0.1367	0.2116	0.2493	0.1531	0.1347
MSCI	0.1730	0.1803	0.1531	0.1863	0.1614	0.1728	0.1476	0.1810

**represents two spot portfolios directly underlying HSIF and HHIF contract respectively*

5. Conclusions

In this paper the hedging performance of both HSIF and HHIF contracts is investigated using daily data for the period since the first trading of the HHIF in January 2004. Several hedging models including the static and dynamic OLS model and the EWMA model are used. Among them, ex post hedging performance estimated by static OLS model is used as benchmarks and EWMA-modeled hedging strategies and the dynamic OLS-modeled strategies for both 63-day and 126-day rolling estimation windows are compared to determine which perform better. The results show that generally, the EWMA model is superior to the dynamic OLS model in terms of risk reduction, particularly for the HHIF contract. Interestingly, we find that for the HSIF contract, the superiority of the EWMA disappears as the estimation window is enlarged from 63-day to 126-day. This may suggest that the improvement of risk reduction level with the enlarged estimation window using the EWMA model is less than that of the dynamic OLS model.

More importantly, the HSIF contract is more effective than the HHIF contract in most cases, especially for hedging market indices. However, when hedging its underlying index-HKHCHIE and some actual spot portfolio, like unit fund-MSCI, the HHIF provides a better hedge than the HSIF, indicating that the HHIF is an important additional instrument, and particularly effective for hedging Chinese-enterprise stocks. The results also show that, for the HSIF, the risk reduction level and stability of the hedge ratios will improve with the length of estimation period. However, these are not the cases for the HHIF due to the inherently great instability and variability of the new contract.

Finally, the results show the magnitude of risk reduction with both futures contracts for cross hedging unit funds is significantly lower than that for market indices, suggesting the level of cross-hedging effectiveness appears to be overstated when market indices are to be hedged. It also demonstrates that actual hedging effectiveness could only be achieved by using "true" spot portfolios that does not mimic the broad market indices.

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Notes

Note 1. H-shares index futures contract was traded on 5th Jan. 2004, although it is introduced on 8 Dec. 2003.

Note 2. Note x and y refer to deviations from the means. When dealing with daily returns, a common assumption is the mean return is zero (See Harris and Shen (2002). Here we assume that the mean returns are zero.