

Best Hedge of a position in Fantasia Holdings Group Company

Limited in late 2021

Li Yu

Mathematical Finance Program, Rutgers University

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Abstract: On October 5, 2021, Fantasia Holdings missed a payment on a USD\$206 million bond that had matured the day before, triggering a default. Because of the default, the stock price of Fantasia Holdings Group Company Limited has gone through a large downside movement. The price of one share of Holdings Group Company Limited dropped from 1.510 dollars to 0.330 dollars, which is nearly an 80% decrement of the price within a year. Currently, the stock price movement still does not show a growing tendency. Now assume we were a risk manager, and we were the unfortunate guys that still held a position in the company. Also, we were told that we cannot sell the position. Under this idiosyncratic circumstance, we are anxious to find a way to hedge our position in order to shrink the risk exposure. The aim of this study is to find the best hedge for a position in Fantasia Holdings Group Company Limited and calculate the size of the hedge.

Keywords: Fantasia Holdings Group Company Limited, default, risk management, best hedge, hedge size

Introduction:

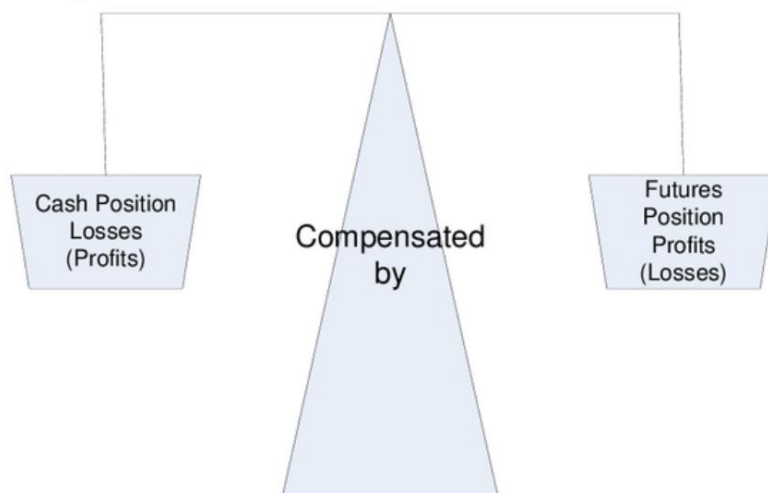
Fantasia Holdings Group Company Limited (SEHK: 1777) is a leading property developer in China. It operates mainly in five segments: property development, property investment, property operation services, property agency services and hotel services. Its other operations include provision of tourism and entertainment services, and interior design services. (Wikipedia) Fantasia Holdings is also considered as a real estate-based company which is the same as Evergrande, the most striking real estate company that has come in front of the eyes of risk managers. For some reason, the macrotrend shows that real estate companies are going through a depression, which I will not explain much in my project.

Risk-return portfolio managers seek to a portfolio with a high risk-return ratio, while risk managers aim to minimize risk. In this study, we seek to find the best strategy, minimizing the risk of our position. Thirty stocks in S&P500 ranked by market capitalization and thirty futures ranking by yahoo finance are selected to be the instruments of our hedging strategy. I will choose stocks or futures with negative correlation to the stock price of Fantasia Holdings, combining each of them with a 10,000 dollars position of Fantasia Holdings to construct a portfolio.

In this research, assume that it is only when Fantasia Holdings triggered a default that we decided to hedge the position. I will firstly find a best hedging instrument by the data before Fantasia Holdings' default. Then, I will use the data after the default to manipulate the real situation, finding if the strategy we choose is practical.

Literature review:

There is a considerable of literature on option hedging and future hedging, the development of option hedging and future hedging are popular topics both in practice and academia. Future or option contracts provide companies with the opportunity of removing the risk of an increment of costs or a decrement of gained profit. In chapter eight of ESSENTIALS OF FINANCIALMANAGEMENT, an introduction to futures trading and hedging using futures, using raw material futures to hedge exposure. For example, a vehicle manufacturer company like Tesla that is exposed to an incremental price in their raw materials such as metals could use metal futures to hedge the risk. Since a rise in the price of raw materials increases the cost, which lower the profit of Tesla. By hedging with metal futures, an increment in the price of metals in turn drives the price of metals futures growing up, which reduces the risk of increasing cost.



However, the Fantasia Holdings Group Company Limited is not such a manufacturing company that has specifically raw materials. It is not easy to find a raw material future or option straightforwardly to hedge such a real estate company.

Martin states that hedging real estate is a difficult problem. Lacking a futures contract, real estate still remains one asset, which is difficult to hedge in a proper fashion. He also implies that the simplest and effective means of hedging real estate position is short of selling it whereas we are not allowed to do so.

As mentioned by Wan-Yi in his research, naïve hedging is defined as a portfolio for which an investor takes an equal but opposite position of spot assets in futures contracts. That is, the hedging ratio of the naïve hedging is defined as $c = -1$. Notice that the size of hedge equals to c multiply the size of our position. (10,000 dollars)

There is another hedging strategy mentioned in Value at Risk, The New Benchmark for Managing Financial Risk, 3rd Edition by Philippe Jorion. This strategy is also call minimum variance hedging strategy, calculated by finding the largest negative incremental value at risk. The size of hedge is calculated as follows:

$$a^* = -W \frac{\sigma_{ip}}{\sigma_i^2} = -W \beta_i \frac{\sigma_p^2}{\sigma_i^2}$$

(Sigma i-p is the covariance between the return of portfolio and return of investment i.

Sigma i square is the variance of the return of investment i)

Methodology and Data description:

The idea of hedging with future contracts demonstrates that an investment with negative correlation to the original investment can shrink the risk of our initial position. Those investments with a negative correlation perform better hedge than the

others. In this project, I select 30 stocks in S&P500 ranked by capitalization and first 30 futures listed on Yahoo Finance. The stocks' tickers are ['AAPL', 'MSFT', 'GOOGL', 'AMZN', 'NVDA', 'TSLA', 'ABT', 'V', 'JPM', 'JNJ', 'WMT', 'UNH', 'PG', 'HD', 'BAC', 'TMO', 'MA', 'DIS', 'ADBE', 'CMCSA', 'KO', 'CRM', 'NFLX', 'NKE', 'ORCL', 'CSCO', 'LLY', 'DHR', 'XOM', 'VZ']. The future tickers are ['ES=F', 'YM=F', 'NQ=F', 'RTY=F', 'ZB=F', 'ZN=F', 'ZF=F', 'ZT=F', 'GC=F', 'MGC=F', 'SI=F', 'SIL=F', 'PL=F', 'HG=F', 'PA=F', 'CL=F', 'HO=F', 'NG=F', 'RB=F', 'BZ=F', 'LE=F', 'ZC=F', 'ZO=F', 'KE=F', 'ZR=F', 'ZM=F', 'ZL=F', 'ZS=F', 'GF=F', 'HE=F.'].]

The last stock price data before the default of Fantasia Holdings is on '2021-09-29'. So, I use a time window of a year and set '2020-09-29' to be the start date and '2021-09-29' to be the end. Since Fantasia Holdings is not in the U.S. region, missing data of the Fantasia Holding stock price are spotted. I delete all data with missing date and keep the same-day data only. (Stock price data are downloaded from Yahoo Finance and stock capitalization information is from Bloomberg) After dealing with the raw data, negative correlated instrument will be carried out to the next stage.

In the next part of my project, I will use the stocks or futures we got and construct portfolios based on naïve hedging strategy and min-variance hedging strategy. The naïve hedging strategy is simply allocating an equal weight to the instrument we choose and our Fantasia position, because naïve hedging ratio is -1.

$$\text{Naïve Portfolio Return} = 0.5 * 1777.HK \text{ Return} + 0.5 * \text{Instrument Return}$$

Based on the method of computing the size of min-variance hedging method,

$$\text{Weight of Fantasia Holding} = \frac{1}{1 - \frac{\sigma_{if}^2}{\sigma_i^2}} \text{ and weight of instrument} = \frac{\frac{\sigma_{if}}{\sigma_i^2}}{1 - \frac{\sigma_{if}^2}{\sigma_i^2}}$$

(Note that $\frac{\sigma_{if}}{\sigma_i^2}$ also refer to the correlation between the Fantasia position and instrument)

$$\text{Min-var Portfolio Return} = \frac{1}{1 - \text{corr}(i,f)} * 1777.HK \text{ Return} + \frac{-\text{corr}(i,f)}{1 - \text{corr}(i,f)} * \text{Instrument Return}$$

The new portfolio variance of dollar return is:

$$\sigma_{p+a}^2 W_{p+a}^2 = \sigma_p^2 W^2 + 2aW\sigma_{ip} + a^2\sigma_i^2$$

Due to the fact that I will only choose instrument with negative correlation, we do not need to concern that we might get a negative weight. If the correlation of 1777.HK return and hedge instrument return is positive in the result, I will delete them and only keep those with negative correlation.

After 2021-09-29, the latest stock price of 1777.HK is updated on 2021-11-10. The data download from Yahoo Finance is not enough for a strategy performance evaluation because there we only twelve stock price observations after default. To this point, I add a list of number which simulate the linear decreasing trend of Fantasia Holding price, which can provide us with a more sensible result. Portfolio VaR and hedge efficiency will be computed to evaluate performance.

$$\text{Hedge Efficiency} = \frac{\text{Gain or Loss on future or stock position}}{|\text{Loss or Gain on spot position}|}$$

Notice that a negative hedge efficiency means our hedge position is losing money.

Assumption: For convenience, we assume that we can trade futures like stocks at any time. In addition, we assume we can buy and sold fraction of shares. That is, we only focus on the total amount of investment. Also, assume that we have a 10,000-dollar position of Fantasia Holdings position on 2021-09-21)

Result:

From the following two tables, stock tickers ['ADBE', 'DHR'] and future tickers ['GF=F', 'ZB=F', 'ZC=F', 'ZF=F', 'ZN=F', 'ZT=F'] are selected to be instrument of our hedging strategy.

AAPL	0.035584 BZ=F	0.080883
ABT	0.044442 CL=F	0.088751
ADBE	-0.052367 ES=F	0.137956
AMZN	0.061831 GC=F	0.049571
BAC	0.130237 GF=F	-0.078922
CMCSA	0.072066 HE=F	0.007486
CRM	0.041408 HG=F	0.063362
CSCO	0.033826 HO=F	0.104684
DHR	-0.005159 KE=F	0.066753
DIS	0.052097 LE=F	0.042325
GOOGL	0.053092 MGC=F	0.051395
HD	0.056592 NG=F	0.018746
JNJ	0.071187 NQ=F	0.084634
JPM	0.148211 PA=F	0.148097
KO	0.037258 PL=F	0.170802
LLY	0.109821 RB=F	0.113105
MA	0.059437 RTY=F	0.126238
MSFT	0.016083 SI=F	0.094192
NFLX	0.085722 SIL=F	0.094307
NKE	0.120095 YM=F	0.174870
NVDA	0.086410 ZB=F	-0.161435
ORCL	0.033724 ZC=F	-0.015119
PG	0.058457 ZF=F	-0.142550
TMO	0.057545 ZL=F	0.093059
TSLA	0.022846 ZM=F	0.080830
UNH	0.062638 ZN=F	-0.143045
V	0.046799 ZO=F	0.077392
VZ	0.034200 ZR=F	0.017695
WMT	0.091082 ZS=F	0.039146
XOM	0.065674 ZT=F	-0.073771
Fantasia_Holdings	1.000000 Fantasia_Holdings	1.000000

Table 1: (Covariance matrix of selected stocks and Fantasia Holding prices)

	ADBE	DHR	Fantasia_holdings
ADBE	1.000000	0.184563	0.049699
DHR	0.184563	1.000000	0.046952
Fantasia_holdings	0.049699	0.046952	1.000000

Table 2: (Covariance matrix of selected futures and Fantasia Holding prices)

	GF=F	ZB=F	ZC=F	ZF=F	ZN=F	ZT=F	Fantasia_holdings
GF=F	1.000000	0.007172	-0.223184	0.104997	0.036684	0.165957	0.467627
ZB=F	0.007172	1.000000	-0.074424	0.679612	0.887857	0.467008	-0.106946
ZC=F	-0.223184	-0.074424	1.000000	-0.138321	-0.077822	-0.157825	-0.101167
ZF=F	0.104997	0.679612	-0.138321	1.000000	0.879863	0.945761	-0.273798
ZN=F	0.036684	0.887857	-0.077822	0.879863	1.000000	0.728265	-0.215768
ZT=F	0.165957	0.467008	-0.157825	0.945761	0.728265	1.000000	-0.287295
Fantasia_holdings	0.467627	-0.106946	-0.101167	-0.273798	-0.215768	-0.287295	1.000000

We can see that after default, the correlation of between Fantasia holdings return and selected stocks are all positive, which cause a negative weight in our min-var portfolio. To this point, only five futures, ‘ZB=F’, ‘ZC=F’, ‘ZF=F’, ‘ZN=F’ and ‘ZT=F’ are left.

Naïve Strategy: (Size = 10,000)

The 95% daily VaR of naive hedge and gain on ZB=F are: (346.09584909320546, 237.67432724415636)
The 95% daily VaR of naive hedge and gain on ZC=F are: (374.0424191103229, 885.8998144712431)
The 95% daily VaR of naive hedge and gain on ZF=F are: (334.3205517309428, -117.27416798732172)
The 95% daily VaR of naive hedge and gain on ZN=F are: (334.9470732781472, -22.581411932493463)
The 95% daily VaR of naive hedge and gain on ZT=F are: (339.22424583793907, -47.48910231420775)

The hedge efficiency of ZB=F naive hedge is: 0.054325559686915416
The hedge efficiency of ZC=F naive hedge is: 0.20249138308592013
The hedge efficiency of ZF=F naive hedge is: -0.02680552370380269
The hedge efficiency of ZN=F naive hedge is: -0.005161465506088476
The hedge efficiency of ZT=F naive hedge is: -0.010854651792485327

Min-Var Strategy:

The 95% daily VaR of minimum variance hedge, gain and size using ZB=F are: (341.51023427182207, 25.418214542161042, 1069.4556217697675)
The 95% daily VaR of minimum variance hedge, gain and size using ZC=F are: (341.0731187269744, 89.62404744716576, 1011.6724936968031)
The 95% daily VaR of minimum variance hedge, gain and size using ZF=F are: (339.872083391974, -32.10942913204319, 2737.9797003134126)
The 95% daily VaR of minimum variance hedge, gain and size using ZN=F are: (340.11640011163297, -4.8723546620342395, 2157.683796124005)
The 95% daily VaR of minimum variance hedge, gain and size using ZT=F are: (341.5021731492527, -13.643392957238305, 2872.9523811521885)

The hedge efficiency of ZB=F naive hedge is: 0.005809877521296074
The hedge efficiency of ZC=F naive hedge is: 0.020485496247864745
The hedge efficiency of ZF=F naive hedge is: -0.007339297975728176
The hedge efficiency of ZN=F naive hedge is: -0.001113681048674009
The hedge efficiency of ZT=F naive hedge is: -0.0031184897713798588

From the above result, the VaR of min-var strategy of futures $ZB=F$, $ZC=F$ is less than naïve strategy, however, for the other three futures, the min-Var VaR is greater than naïve VaR. Min-Var hedging strategy VaR should be strictly less than VaR of any other portfolio constructions, mathematically. Because the min-var hedge position amount is calculated by finding an optimal point. In terms of hedge efficiency, only $ZB=F$ and $ZC=F$ enjoy a positive hedge efficiency and naïve hedging strategy has much higher hedge efficiency than min-var strategy. This is because the size of naïve hedge is far greater than the hedge size of min-var hedge. To evaluate the hedge efficiency in the dollar, I divided the gain of hedge position by hedge size.

$ZB=F$ naïve hedge efficiency in dollars is: 0.023767432724415637
 $ZB=F$ min var hedge efficiency in dollars is: 0.023767432724415637
 $ZC=F$ naïve hedge efficiency in dollars is: 0.08858998144712431
 $ZC=F$ min var hedge efficiency in dollars is: 0.0885899814471243

Summary:

To sum up everything that have been stated above, we can see that the efficiency in dollars for both futures by either naïve hedge or min-var hedge is almost the same. Since the min-var hedging strategy has relatively lower one-day VaR and has the same hedge efficiency in dollars as naïve hedge strategy, we conclude that the best hedge is future ' $ZC=F$ ' and the size of hedge is 1101.67 dollars.

For future studies, a misery question is left in my project. Why are several min-var VaRs greater than naïve hedge Vars? My thoughts on the matters are those three future turns out to have negative gain, hence increasing the total loss of the min-var

portfolio, which finally results in an increment in VaR. Our best hedge result is 'ZC=F', which does not have a relatively large negative correlation in Table2. To some extent, I would say selecting investment just by finding the largest negative return correlation might not be the most precious way of find a best hedge position. There still could be better hedges in practical. Last but not least, I hope future studies or equity market could provide options or futures for real estate companies.

References:

Philippe Jorion, Value at Risk the New Benchmark for Managing Financial Risk

Wang, Yudong, et al. "Hedging with Futures: Does Anything Beat the Naïve Hedging Strategy?" *Management Science*, vol. 61, no. 12, INFORMS, 2015, pp. 2870–89, <http://www.jstor.org/stable/24551564>.

https://www.jstor.org/stable/j.ctvt6rjjs.11?Search=yes&resultItemClick=true&searchText=hedging+using+futures&searchUri=%2Faction%2FdoBasicSearch%3FQuery%3Dhedging%2Busing%2Bfutures%26so%3Drel&ab_segments=0%2Fbasic_search_gsv2%2Fcontrol&refreqid=fastly-default%3A0e3849ed2a3869ef562464b8a5e24e92&seq=8#metadata_info_tab_contents

Wan-Yi Chiu, An optimal combination of risk-return and naïve hedging, *Brazilian Journal of Probability and Statistics*, Vol. 29, No. 3 (2015), pp. 656-676 (21 pages)

https://www.jstor.org/stable/26359004?seq=12#metadata_info_tab_contents

Martin A. Armstrong, How to Hedge Real Estate

<https://www.armstrongeconomics.com/investments/how-to-hedge-real-estate/>