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Applications of Stochastic Processes and Mathematical Statistics to Financial Economics and Social Sciences III

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Conference Materials

Business Sc

SYMBOLIC IMPRINTING AND TRIGGERS IN ORGANIZATION CONTEXT

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Key words

BEHAVIORAL PERSPECTIVE IN MANAGEMENT

Irina Khechoshvili

Keywords

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Keywords

Georgian-American University
Business School
PhD Program

Real options valuation of hedging strategies

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widget *gold*

$$= \frac{\quad}{\quad} = \frac{87.66 \quad 42.03}{1 + 0.02} = 44.74$$

Hedging Strategy Replicating Put Option on Gold Price

$$= \quad (\quad) + \quad ^{(\quad)} (\quad)$$

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		Beginning Week			Wealth		
Week	Z	Gold	Put	Omega	Total Wealth	Stock	Bond
0		40.44	3.37	0.50	43.81	21.80	22.01
1	-0.45	39.71	3.65	0.49	43.37	21.11	22.25
2	-0.22	39.36	3.78	0.48	43.13	20.77	22.36
3	0.73	40.51	3.23	0.50	43.74	21.86	21.89
4	0.25	40.91	3.03	0.51	43.93	22.23	21.71
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49	-3.07	40.40	0.44	0.56	40.84	22.80	18.04
50	0.02	40.43	0.25	0.57	40.68	23.36	17.33
51	-1.24	38.47	0.90	0.45	39.36	17.84	21.52 [illegible]

	w=0	***w=4***	***w=8***	***w=12***	***w=16***
					159.66
				137.43	***111.88***
			118.31	***89.85***	118.31
		101.84	***71.13***	101.84	***70.75***
	87.66	***55.41***	87.66	***54.88***	87.66
H	***42.42***	75.46	***41.75***	75.46	***41.09***
		31.14	64.96	***30.34***	64.96
			21.90	55.92	***20.98***
				14.54	48.13
					8.93

Introduction

The main purpose of the article is to introduce Conditional Value At Risk (CVAR) as a downside risk measure and build a model of portfolio selection process in the mean - CVAR framework for the portfolio returns which are simulated by copula functions. Volatility as a risk measure is ideal in the normal distribution but when dealing with asymmetric distributions, it simply leads to misinterpretation of the risk. It penalizes losses equally to profits of the same magnitude. However, investors are more concerned with a downside risk rather than upside risk which they refer to favorably.

Coherent Risk Measure

According to Artzner et al. a risk measure satisfying the following four axioms is called

CVAR

Like VAR, CVAR is also a downside risk measure and it measures the average loss beyond VAR with a certain level of confidence. To put it specifically, CVAR is the average return given that the return is smaller than VAR with a certain level of confidence β :

$$CVaR_{\beta} = \frac{1}{1-\beta}\int_{f(x,r)\le VaR_{\beta}} f(x,r)\,p(r)\,dr$$

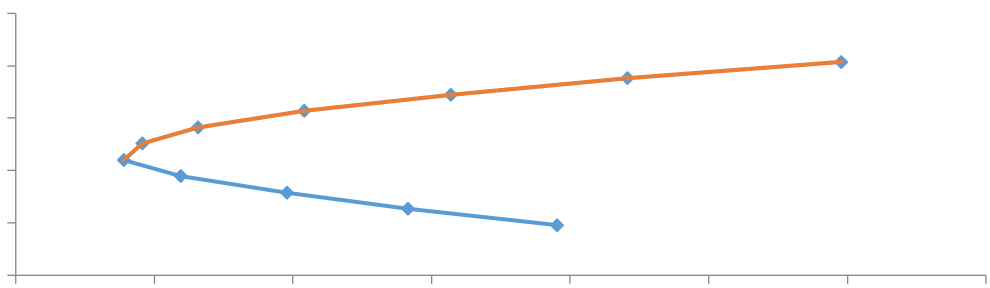
Where $f(x,r)$ is the return function with the distribution of $p(r)$ over a certain time period. VAR is calculated on the same time period. The advantages of using CVAR in portfolio optimization are obvious. It is a coherent risk measure, it is applicable to non-symmetric loss distributions and it is convex and smooth with respect to portfolio positions. In addition, it accounts for risks beyond VAR meaning that it is more conservative than VAR and handles fat tails more effectively.

Optimization

Our goal is to find the weights of the assets in the portfolio which minimizes CVAR on a given portfolio return or maximizes portfolio return on a given CVAR. Let $f(x,r)$ be the loss function with the decision vector $x \in X \subseteq R^{n}$ (portfolio weights) and random vector $r \in R^{m}$ (returns on portfolio assets). When r has a distribution $p(r)$, then the probability of the loss $f(x,r)$ not exceeding a certain threshold level α is given by:

$$\Psi(x,\alpha) = \int_{f(x,r)\le\alpha} p(r)\,dr$$

If ̎0 and ̎0 are strictly increasing marginal distribution functions, then C is unique. There are many patterns of random variables which can be identified by empirical methods and modeled by the copula dependency structure. We use Archimedean copulas to model the dependency and simulate the uniform variables based on the Monte-Carlo method from which we can recover the simulated original variables using the marginal distributions of returns. Once having done so, we obtain the returns vectors as ὼ ̎0 ⁹ᵒ ó ȟ ώ ̎0 ⁹ᵒ ù (for two random variables in our case, it can obviously be extended to many). As long as we have the simulated returns, it is possible to calculate the CVAR of a portfolio and minimize the function mentioned in the previous section for every possible return of a portfolio. This gives us the optimal weights based on which we can build the efficient frontier.



Conclusion

CVAR provides a better alternative to variance as a risk measure, especially when returns do not follow the symmetrical distribution. It is a coherent risk measure satisfying very rational requirements unlike variance and VAR. In addition, CVAR has many other advantages over other measures. Simulating returns by copula functions may be crucial if the dependency of the pairs of random variables are perfectly modeled.

Used Literature

[1]. Roger B. Nelsen: “An introduction to Copulas”, second edition, Lecture Notes in Statistics. Vol. 139, Springer, New York.

[2]. Umberto Cherubini, Elisa Luciano, Walter Vecchiato (2004). “Copula Methods In Finance”

[3]. Umberto Cherubini, Fabio Gobbi, Sabrina Mulinacci, Silvia Romagnoli (2012). “Dynamic Copula Methods in Finance”

[4]. Philippe Artzner, Freddy Delbaen, Jean-Mark Eber, David Heath (1998). “Coherent Measures of Risk”

The Itô formula for non-anticipative functionals according to Chitashvili

Ab rac . For non-anticipative functionals, differentiable in Chitashvili's sense, the Itô formula for cadlag semimartingales is proved. Relations between different notions of differentiability of functionals are established.

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ffi $(f(t,x), t \geq 0, x \quad R)$ $f(t,X)$ X $f(t,X)$ X fi- fi 200 (4)] fi $f \quad D(0,T , R) \to$

f ff f^0 f^1 ($d)$ $f(\cdot,\omega)$ $V_{[0,T]}$ fi ω $V_{[0,T]}$

$$f(t,\omega) \quad f(0,\omega) + \int_0 f^0(s,\omega)ds + \int_0 f^1(s-,\omega)d\omega + \qquad (\ )$$

$$+ \sum_{\leq} f(s,\omega) - f(s-,\omega) - f^1(s-,\omega)\Delta\omega \ ,$$

$(t,\omega) \quad 0,T \times V_{[0,T]}$.

, , ( ) , $\partial_\omega f$, ( )

$f(t,\omega)$ ff ff $D_\omega f(t,\omega)$,

$$D_\omega F(t,\omega) \quad \lim_{\to 0,\ >0} \frac{f(t+h,\omega + \chi_{,}\ ) - f(t+h,\omega\ )}{h}, \qquad (\ )$$

$(t,\omega) \quad 0,T \times V_{[0,T]}$,

$$\chi_{,}\ (s) \quad (s-t)1_{(, +]}(s) + h1_{(+ ,T]}(s).$$

$f(t,\omega)$ ff ( ) , 1,

$$f^0(t,\omega) \quad \partial f(t,\omega t) \quad TsT$$

X fi f f^1,

$$\sum_{s \le \cdot} f(s, X') - f(s-, X') - f^1(s-, X')\Delta X \to \qquad (1)$$

$$\to \sum_{s \le \cdot} f(s, X) - f(s-, X) - f^1(s-, X)\Delta X$$

f, f^0, f^1 (1)

$f(t, X') \to f(t, X)$,adfs

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$a < b$ $f(a)$ $f(b)$.

$$\varepsilon \quad \frac{|f(b) - f(a)|}{2(b - a)} \quad 0.$$

fi c fi x $(a, b$ ff f ε , .

$$c \quad \{\, x \quad (a, b \mid |f(x) - f(a)| \quad \varepsilon(x - a) \,\}.$$

f, $c < b$ $|f(c) - f(a)|$ $\varepsilon(c - a)$. c f , d $(c, b$ $|f(x) - f(c)| \leq \varepsilon(x - c)$ x $(c, d$. ,

$$|f(x) - f(a)| \leq |f(x) - f(c)| + |f(c) - f(a)| \leq \varepsilon(x - a)$$

x $c, d)$, fi c.

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[illegible], 3 (2013), 201 -202 .