Prüfung: Risk Management SS/06

Dozent: P. Embrechts
Dauer: 30 Min.

- Einstieg:
  - Was wissen sie über die Cook-Ratio? -> Formel angegeben und kurz kommentiert.
  - Was für Sorten von Capital gibt es? -> Tier I, II kurz aufgezählt, keine Erläuterungen.
  - Was für Risiko-Klassen kennen sie? -> MR, CR, OR.
- MR:
  - Wie bestimmt man das VaR-Based Risk-capital? -> Formel aufschreiben.
  - Besprechung der Struktur der Formel (max, Mittelwert, Wahl der Parameter (insb. 10-Tage -> abhängig von durchschnittlicher Halteperiode)).
  - Welche Möglichkeiten für die Bestimmung von MR kennen sie?
    - Mean-Variance: Vorgehen, Vor- und Nachteile
    - Historical Simulation: dito
    - Scenario-Based: dito
    - MC-Simulation: dito
- VaR:
  - Welche zentrale Eigenschaft sollte bei einem solchen Risiko-Mass stets gegeben sein? -> Subadditivität.
  - Für welche „Menge“ von Z.V. ist VaR subadditiv? -> elliptic und insb. multivariat NV.
  - Zeigen Sie, dies für zwei NV-ZV. -> Ups, darauf war ich nicht gefasst. Ich begann mit der Darstellung von VaR für NV-Z.V. und von dort gab mir Embrechts auch ein paar Tipps bis zu (Cov(X,Y))^2<=Var(X)*Var(Y). Zum Glück wusste ich noch, dass dies die Cauchy-Schwarz’sche Ungl. ist. (Das stand nämlich nirgends im Skript od. Buch!)
- Copula und Dependence:
  - Bei welcher Dependence-struktur gilt Additivität für VaR? Comonotonicity (perfect dependence)
  - Def. von Comonotonicity? -> Copula und prop. Über Z.V.
  - „Gegenteil“? -> Countermonotonicity
  - Besondere Eigenschaften dieser Abhängigkeiten bei linearer Correlation? -> Stichwort „attainable correlation“ rho_min und rho_max und Fallacy II.
  - Wie sah der Graph für rho_min und rho_max für das in der Vorlesung besprochene Bsp. mit 2 LogNV Z.V. aus? Konnte mich noch dumpf an Fig. 5.8 auf S. 206 erinnern. Dies hat auch genügt.
  - Besondere Eigenschaften von Gauss- und t-Copula? -> Tail dependence
  - Problem mit Copulas: Schätzung (2 Schritte: erstens, Schätzung der Randverteilung, zweitens, ML-Schätzung der Copula)
- OpRisk:
  - Def.?
  - Welches Modell haben wir in der Vorlesung kennen gelernt? -> Matrix mit Business Lines und Risiko-Typen.
  - Weshalb ist VaR für OpRisk wohl ein ungeeignetes Risiko-Mass? -> Generelle Antwort: Subadditivität funktioniert nicht, falls 1) very skewed, 2) very heavy tailed oder 3) spezial dependence.
- Zu EVT kam nix dran!

Prüfungsart Mathematik, Teil B

Prüfungssession Frühling 2005

Fach Riskmanagement

DozentIn Prof. Dr. Embrechts

- History of risk management, Basel accords. What are the main regulations, which risks do they concern? What is new in Basel II? Three pillar concept, internal measurement approach, new risk class: operational risk but mostly new regulations about credit risk!
- VaR, definition, coherent risk measure, expected shortfall
- how to estimate F_L, explain all 3 methods, their advantages and disadvantages

the exam is done on a piece of paper, occasionally he leans over and looks what exactly you wrote - after posing the question you only have a short time to think, as soon as you say something he'll finish for you, meaning: Don't use any ohms and useless words while you think. Just shut up, think quickly, then respond fully. And as he himself has said even in exams, just keep him in a good mood...

Riskmanagement Prüfung Okt. 2007

Kohärente Risikomasse
- Eigenschaften des kohärenten Risikomasses + finanzielle Bedeutung
- Beispiele und Gegenbeispiele von kohärenten Risikomassen
- Def. VaR + ES
- Wann ist VaR subadditiv und warum und wann nicht. Wann additiv.

Säule 1 von Basel II
- Risikomass für Marktrisiken
- Risikomass für operationelle Risiken mit Quantil 99.9%
- Def. Operationelle Risiken

Kopula + Abhängigkeitsmasse
- Def. Kopula
- Kopula bei nicht stetigen Randverteilungen
- Die 3 Fehlschlüsse
- Theorem über die erreichbaren Korrelationen

EVT
- Theorem 7.3 (Fisher-Tippet, Gnedenko)
- Def. Von MDA
- Theorem 7.20 (Pickands-Balkema de Haan)

Prüfungsart Mathematik, Schlussdiplom Teil B, Wahlfach

Prüfungssession Frühling 2007

Fach Quantitative Risk Management II

DozentIn Prof. Paul Embrechts

Erhaltene Note 6

Konvention: **(P)** = Prüfer, **(I)** = Ich

(P) Why do we need risk measures, what are coherent risk measures?
(I) Well, the question is: what are reasonable measures? Reasonable measures are those that we call coherent, and these are defined as risk measures that satisfy 4 axioms.
(P) Yes, what are those axioms?
(I) Translation invariance, subadditivity...
(P) Write them down.
(I) 1)
(P) Well, first, what is a risk measure, and where is it defined?
(I)

$L_0 = \{\text{rvs X s.t. } P[|X| < \infty] = 1\}, M \in L_0$ convex cone, $\rho : M \to \mathbf{R}, L \mapsto \rho(L)$

(P) At the beginning you had $X \in L_0$, now you have L...?
(I) Well, they denote the same. It's just notation.
(P) All right, doesn't matter. What does $\rho(L)$ mean?
(I) It's the amount of capital that has to be added to a position with loss L so that it becomes acceptable to a risk controller.
(P) Yes, now what are the axioms?
(I) 1) Translation invariance

$$L \in M, l \in \mathbf{R} : \rho(L + l) = \rho(L) + l$$

(P) If you had interest rates, where would you put them in there?
(I) ...?
(P) Well, as soon as you'll enter the real world you'll see that interest rates are important.
(I) **nodding** ...??

(P) Over what period do you calculate?
(I) A year?
(P) Yes, and when is L calculated? At the beginning or at the end of the year or when?
(I) ...? At the end of the year?
(P) And when do you set l?
(I) At the beginning?
(P) Yes, so the interest rates would be somewhere in the middle. What's the second axiom?
(I) 2) Subadditivity

$$L_1, L_2 \in M \Rightarrow \rho(L_1 + L_2) \leq \rho(L_1) + \rho(L_2)$$

(P) The third?
(I) 3) Positive homogeneity

$$L \in M, \lambda > 0 \Rightarrow \rho(\lambda L) = \lambda \rho(L)$$

4) Monotonicity

$$L_1, L_2 \in M \text{ s.t. } L_1 \leq L_2 \Rightarrow \rho(L_1) \leq \rho(L_2)$$

(P) We had an existence theorem...
(I)

$$\mathcal{P} \subset \mathcal{P}^1(\Omega, \mathcal{F}) = \{Q \text{ prob. on } (\Omega, \mathcal{F})\}$$
$$M_{\mathcal{P}} = \{L \text{ rvs } / \ E^Q[|L|] < \infty\}.$$

A risk measure induced by this set of generalized scenarios is $\rho_{\mathcal{P}} : M_{\mathcal{P}} \to \mathcal{R}$, $\rho_{\mathcal{P}}(L) = \sup\{E^Q[L], Q \in \mathcal{P}\}$.
(P) Can you give me some examples of risk measures?
(I) VaR and Expected shortfall.
(P) Yes, what are they?
(I) First the definition: $VaR_\alpha(L) = F_L^{\leftarrow}(\alpha)$. The problem with VaR is that it is in general not coherent because the subadditivity axiom is often not satisfied.
(P) Can you give me reasons for why that is the case?
(I) If the distributions show strong skewness, strong heavy-tailedness or strong dependence...
(P) Where do copulas enter?
(I) ... They're used to model dependence between random variables.

(P) And why would you do that?
(I) Because it is often wrongly believed that dependence is fully described by linear correlation.
(P) *(I've forgotten what he asked there, something about linear correlation)*
(I) ...?
(P) If the variables are independent...
(I) then $\rho = 0$.
(P) Is the converse true?
(I) No, only for the multivariate normal. For the multivariate t, it does not hold for instance.
(P) Can you show me one or two examples? Of where one of the two fallacies is violated?
(I) ...?
(P) I'm sure you know that. Take for example the lognormal.
(I) ?
(P) ... I'm sure I talked about that... . What are the three main types of risk?
(I) Market risk, credit risk and operational risk.
(P) And for which risk type do you think that non-subadditivity of VaR is important?
(I) ... Operational risk.
(P) What is operational risk?
(I) The risk of losses due to inadequate or failed internal processes, people and systems, or external events.
(P) Can you give me an example?
(I) September 11th, Enron, ...
(P) What is the period for operational risk?
(I) One year.
(P) What is the period in which market risk is measured?
(I) It's measured daily.
(P) No, it's not quite such a short time.
(I) Weekly?
(P) Two-weekly, 10 days. What is the level α for market risk?
(I) ...?
(P) I'm sure I said that.
(I) I don't know.
(P) What's the level for operational risk?
(I) 99.9% or even higher.
(P) Yes, it's far too high. And it 99% for market risk.
(P) What do operational risk data look like?
(I) The loss amounts show extremes, the loss occurrence times are irregularly

spaced in time and we have non-stationarity.
(P) Yes, and what is the main problem here?
(I) ...
(P) The extremes. You mentioned expected shortfall.
(I)

$$ES_\alpha(L) = \frac{1}{1-\alpha}\int_\alpha^1 VaR_u(L)du$$

(P) Why is it called expected shortfall?
(I) ???
(P) Think about the word „expected“.
(I) Because there's an alternative definition if L is continuous:

$$ES_\alpha = E[L|L \geq VaR_\alpha(L)]$$

The exam was done on the blackboard in HG E41. I was given the choice between English and German at the beginning.