Compliance for Uncertain Inventories: Yet Another Look?

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- Probabilistic approaches
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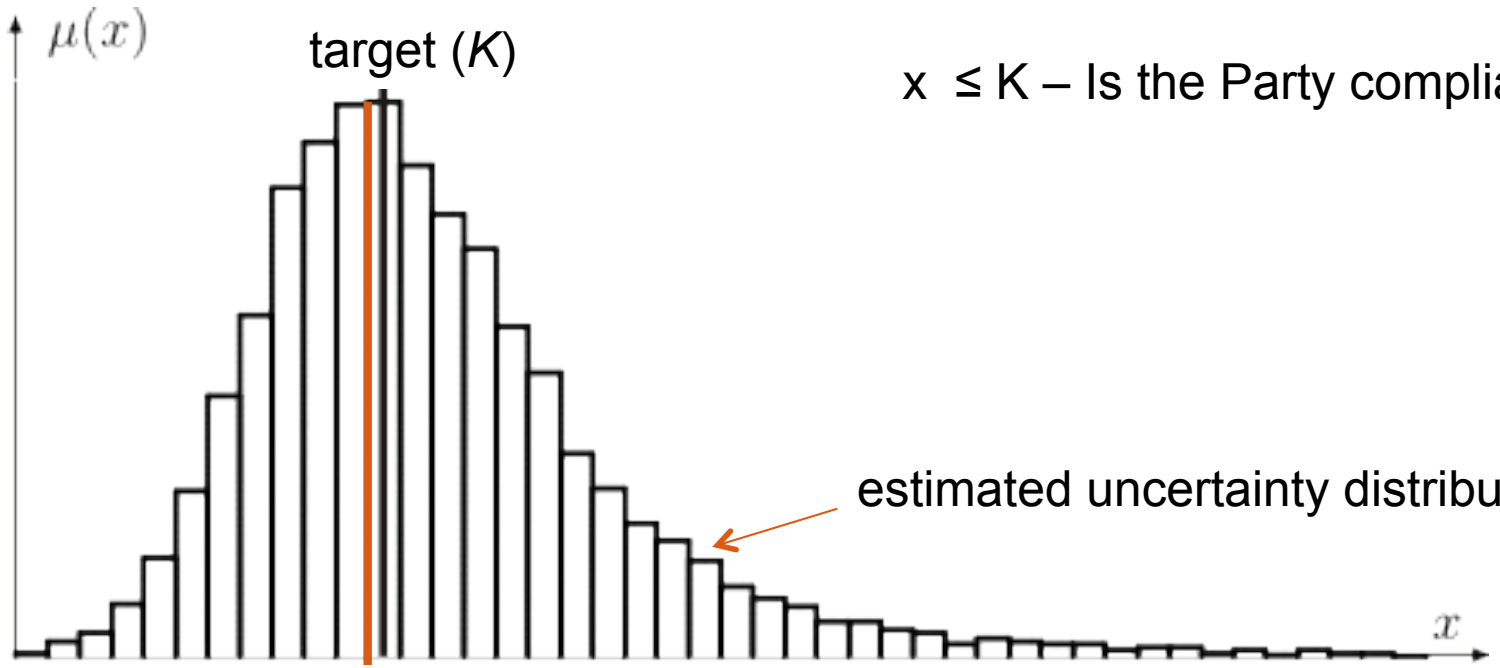
Asymmetric uncertainty distribution: compliant or noncompliant?



x ≤ K – Is the Party compliant?

Methods discussed for GHGs

Jonas M., Gusti M., Jeda W., Nahorski Z., Nilsson S. (2010) Comparison of preparatory signal analysis. *Climatic Change*. DOI: 10.100// s10584-010-9914-6

Comparison of uncertain inventories

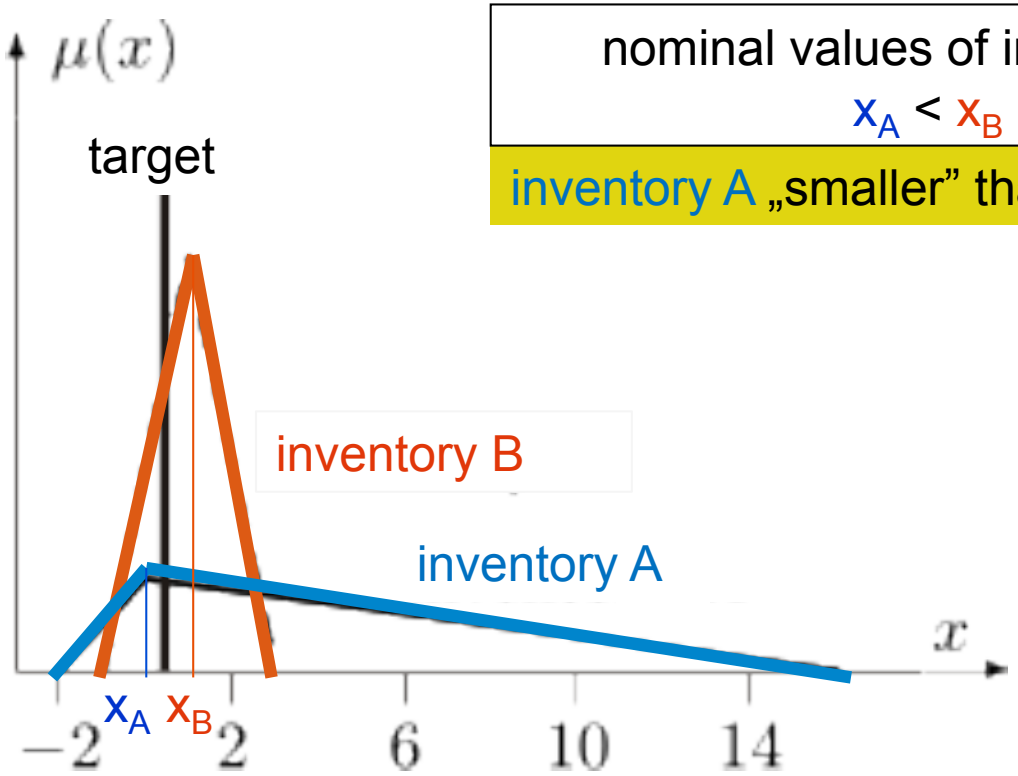
1. Decision on compliance should be fair:
   a compliant inventory should be „smaller” than a noncompliant one – comparison is required.

2. In the Kyoto Protocol comparison of inventories in the compliance year and the basic year is necessary.

Comparison of uncertain values has been considered in various fields where selection from risky projects are necessary, like:

- finance,
- R & D projects,
- IT projects

Which inventory is „smaller”?

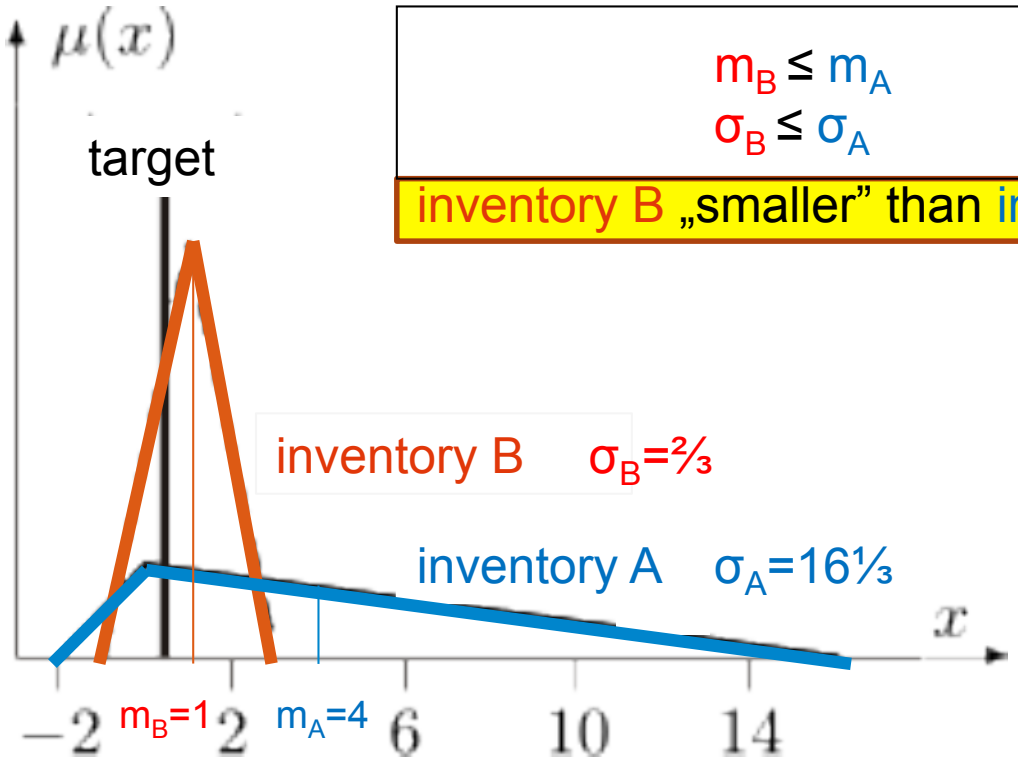


nominal values of inventories:

$x_A < x_B$

inventory A „smaller” than inventory B

Mean Value and Variance

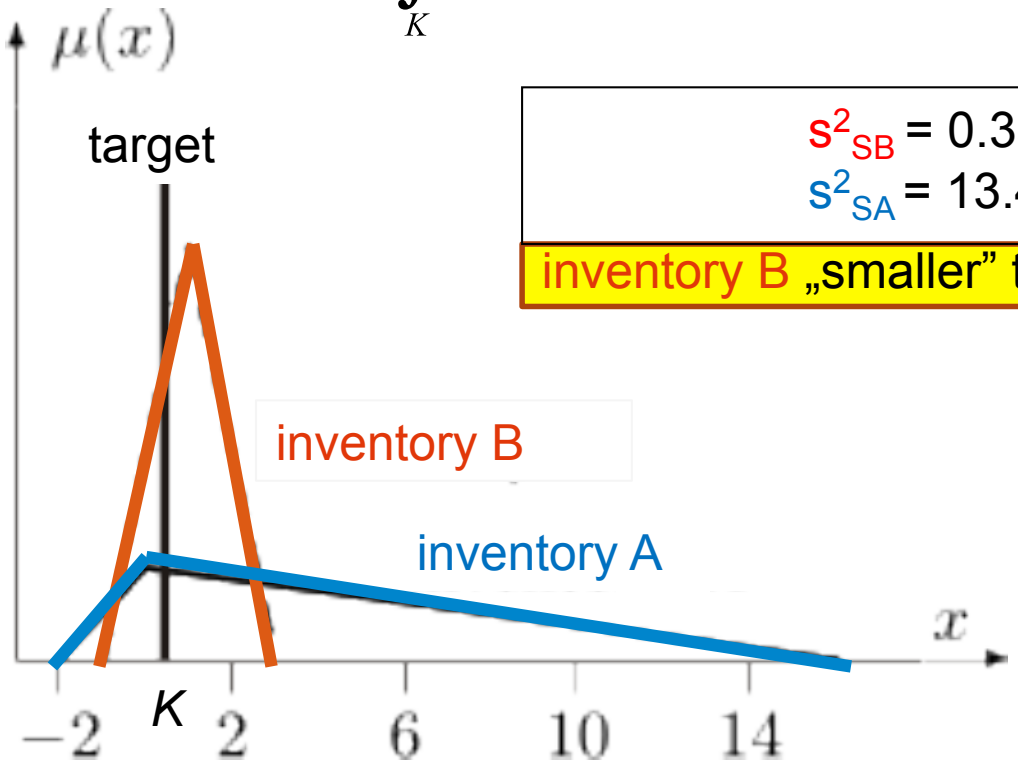


$m_B \leq m_A$
$\sigma_B \leq \sigma_A$

inventory B „smaller" than inventory A

Semivariance

$$s_s^2 = \int_K^{\infty} (x - K)^2 \, \mu(x) dx$$

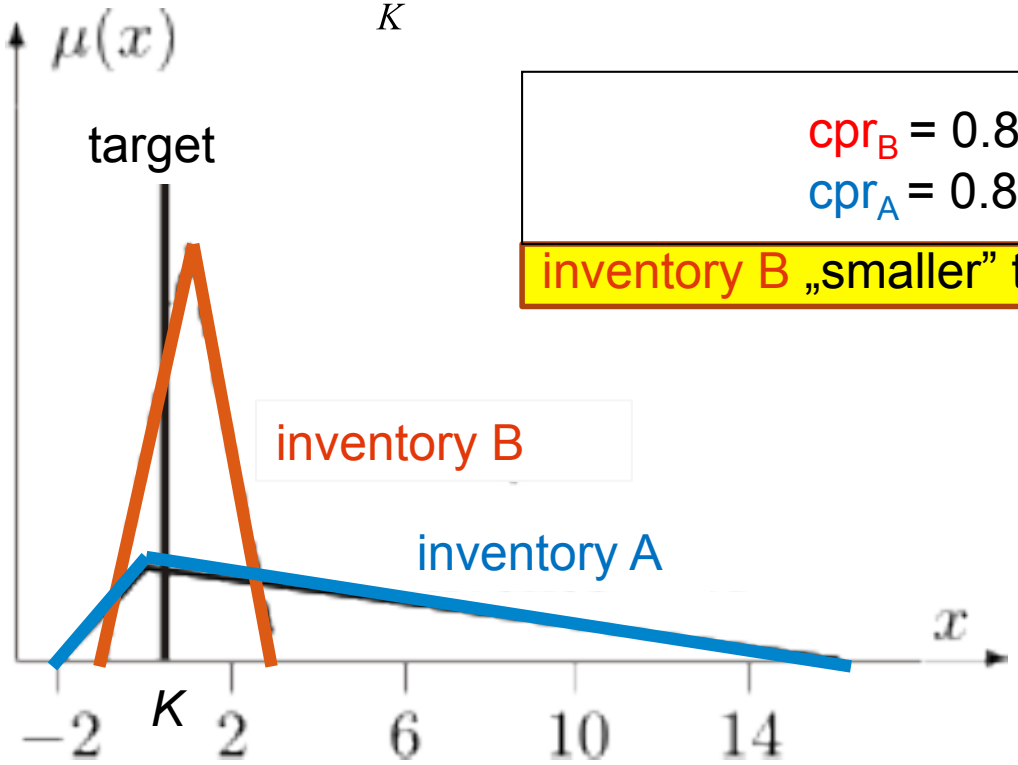


s^2_{SB} = 0.35
s^2_{SA} = 13.45

inventory B „smaller" than inventory A

Critical Probability

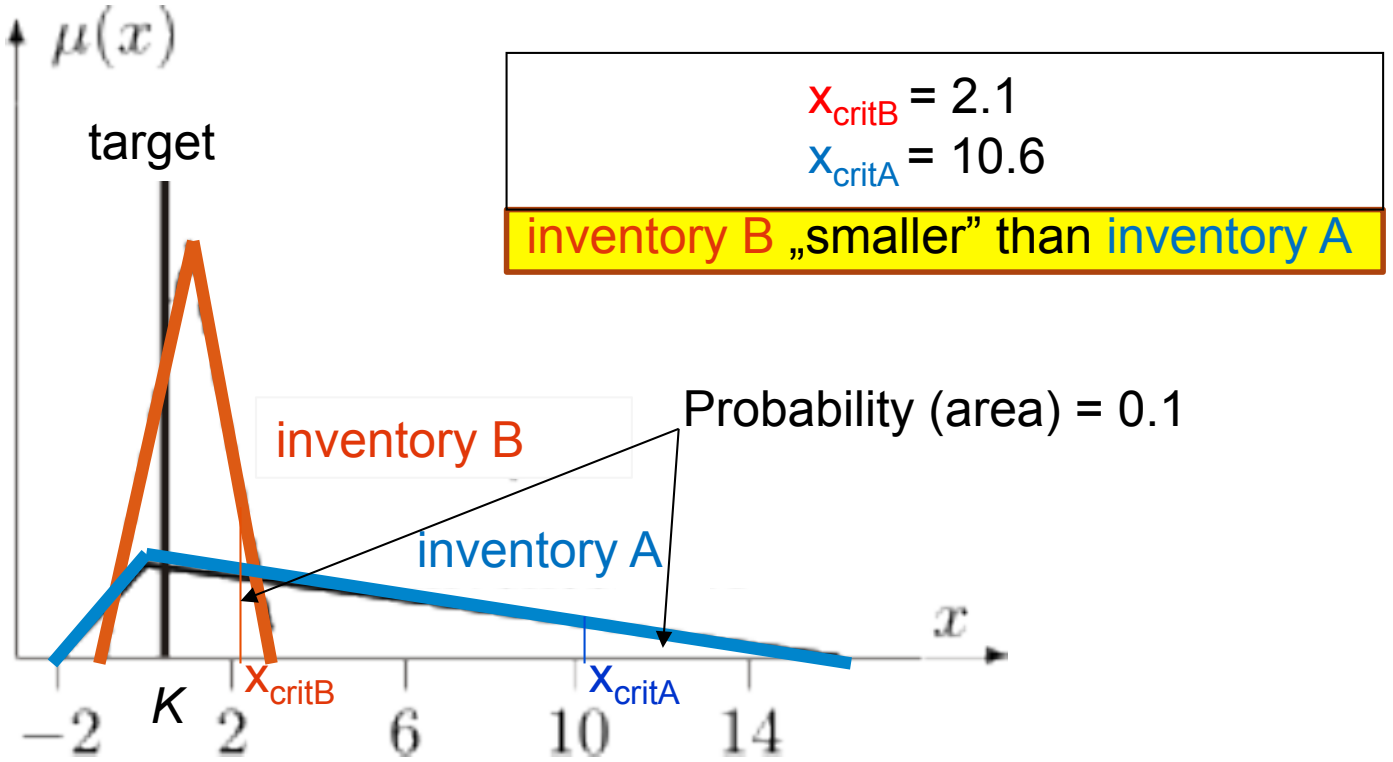
$$cpr = \int_{K}^{\infty} \mu(x)dx$$ - area right to the target *K*



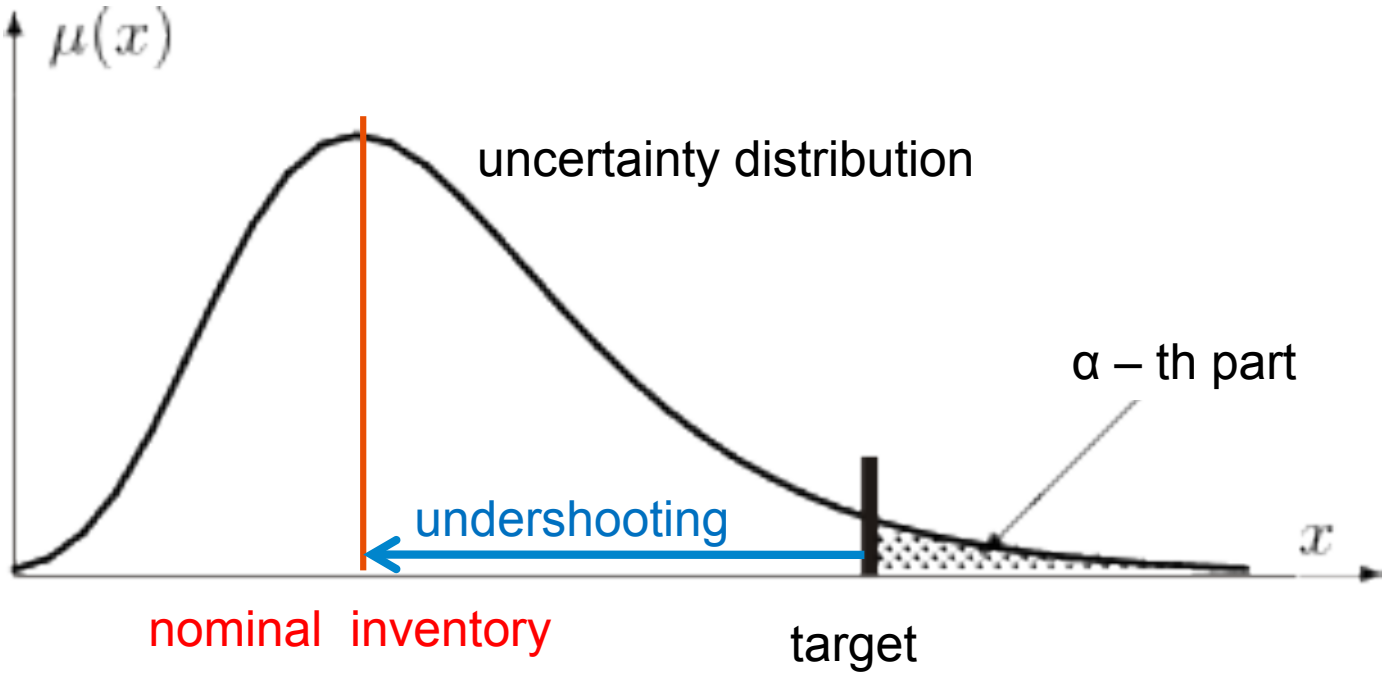
cpr_B = 0.875
cpr_A = 0.888

inventory B „smaller" than inventory A

Baumol's Risk Measure Value at Risk



Undershooting Approach

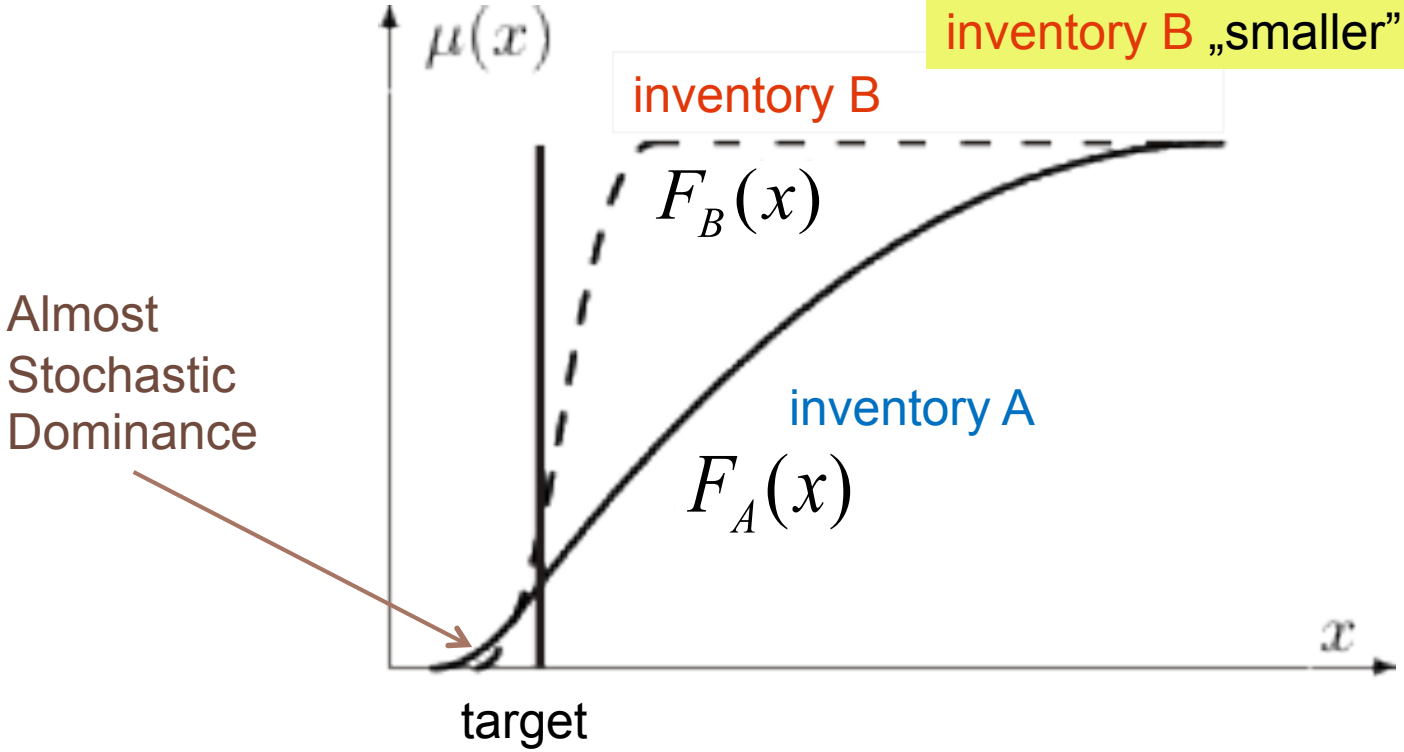


=> market for „effective permits”, which take into account uncertainties

Stochastic Dominance Criterion

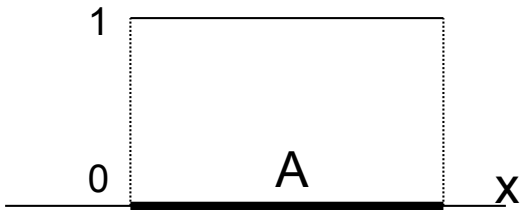
$F_A(x) \leq F_B(x)$

inventory B „smaller" than inventory A

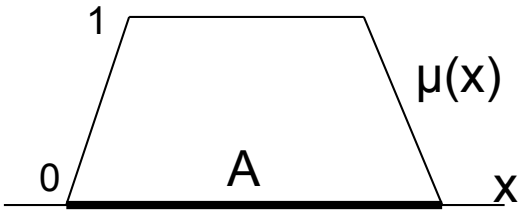


$F(x)$ - cumulative probability function

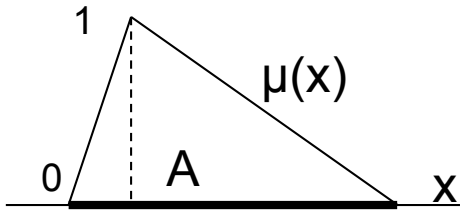
Fuzzy Set, Fuzzy Number



an ordinary set A and its characteristic function



a fuzzy set A and its membership function μ(x)



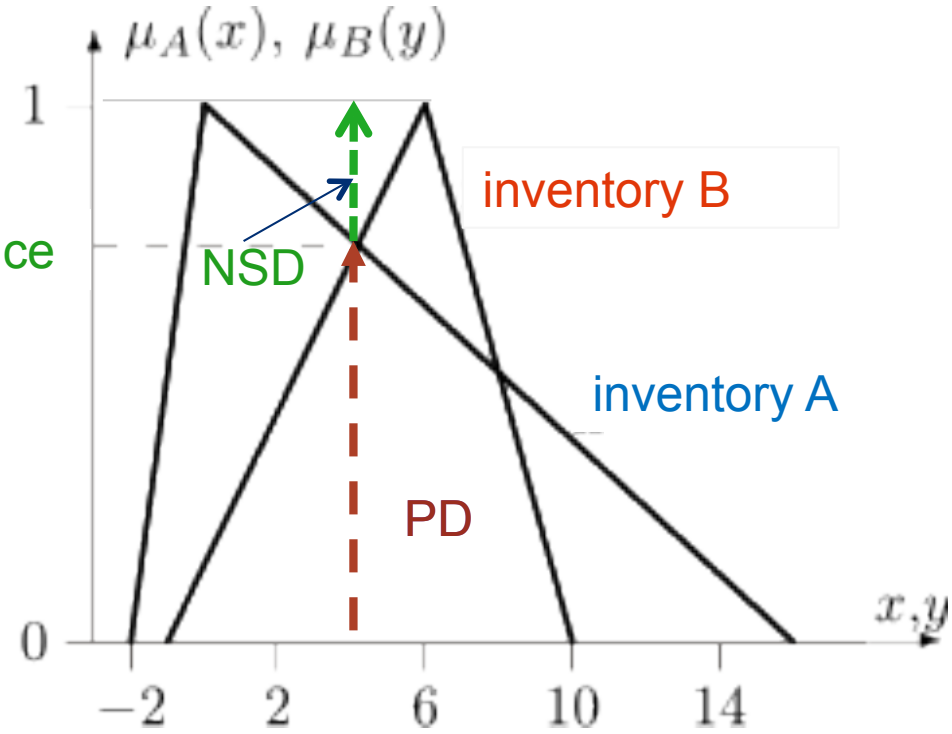
a fuzzy number A and its membership function μ(x)

possibility distribution

Possibility and Necessity Measures (Dubois & Prade)

NSD = 1 - PD

NSD – Necessity of Strict Dominance of B over A



PD – Possibility of Dominance of A over B

weak statements

Different methods

R. Jain (1976, 1977)
S. M. Bass & H. Kwakernaak (1977)
R. R. Yager (1980, 1981)
E. E. Kerr (1982)
D. Dubois & H. Prade (1983)
E. S. Lee & R.-S. Li (1988)
P. Fortemps & M. Roubens (1996)
L. Tran & L. Duckstein (1999, 2002)

Conclusions

- With high and possibly asymmetric uncertainty of emission knowledge, using nominal inventory value to verify fulfilment of a limit is flawed
- There is a hadful of methods that were proposed to compare uncertain values
- A review of usefullness of these methods for veryfying compliance is worth to be done