Rome 20/3/2003

Banking and Financial Stability:
A Workshop on Applied Banking Research

P. de Fontnouvelle et al. “Quantification of operational risk”

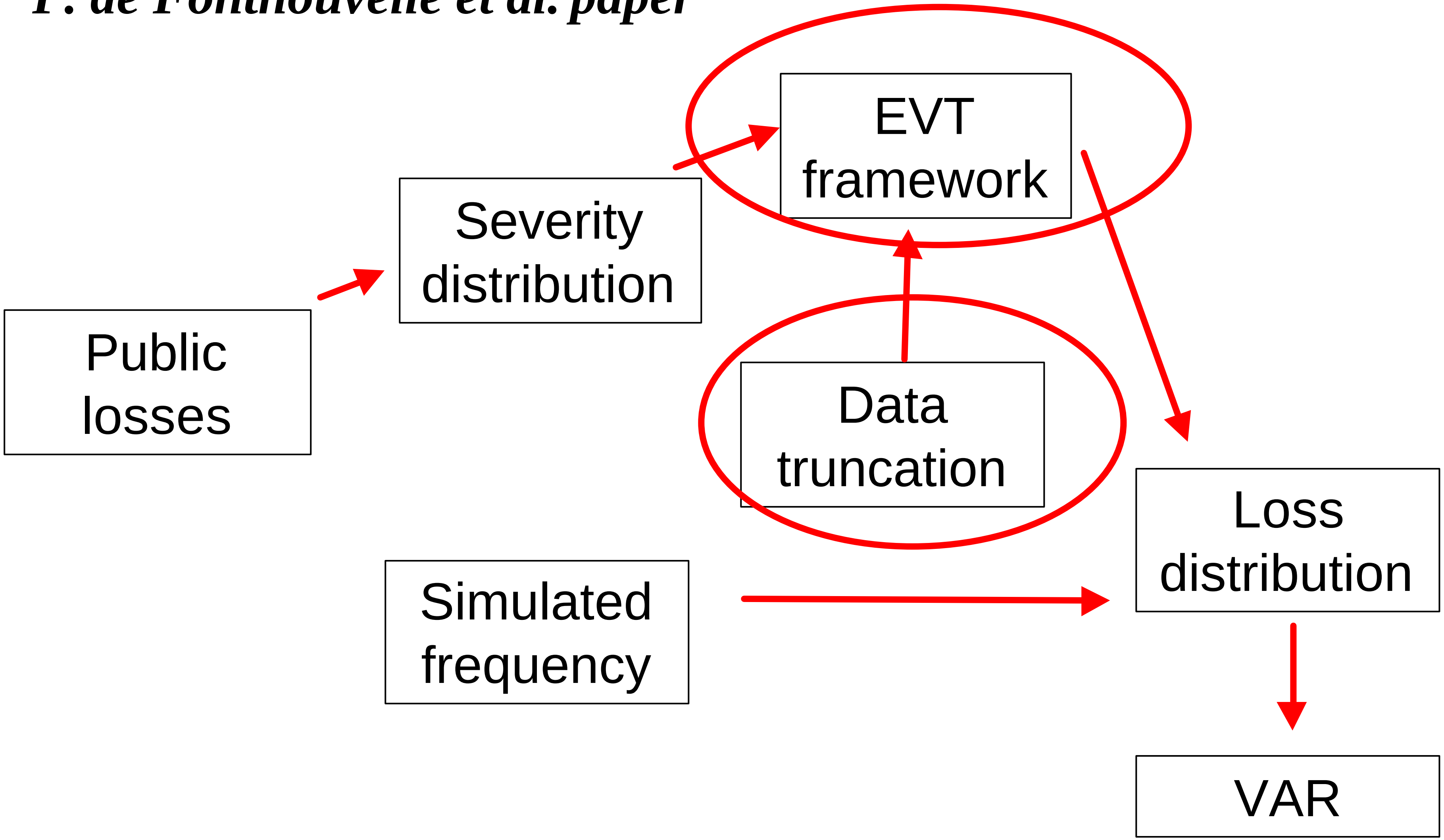
Fabrizio Leandri
Banking Supervision Department.
Bank of Italy

Quantification of operational risk

- What the paper is about:
  - High impact - low frequency operational losses
  - Modelling severity losses over threshold (source: external data base)
- What it is not about:
  - Fitting frequency distribution (only simulated)
  - Use of external data from risk management pourpose
    - scaling issue / control environment /assumption for scenario based analyses
- Why the paper is relevant:
  - It gives a preliminary evidence on how external data could be used to understand large loss distribution

Quantification of operational risk

P. de Fontnouvelle et al. paper



Quantification of operational risk

P. de Fontnouvelle et al. paper : result

1. Logit - Exponential function provides a good estimates of the loss data in external database

2. Op risk severity distribution (of large losses) does not vary across business lines. Differences are driven by frequency or other factors

Quantification of operational risk

EVT framework

Fit severity distributions only to large losses (*EVT*)

$$GPD = F(u, X_?, x, b)$$

Where:

- u = threshold
- X_i = excess over threshold = $x_i - u$
- ξ = shape index
- b = scale parameter

$$GPD = \begin{cases} 1-(1+\xi x/\sigma)^{-1/\xi} & \text{if } \xi \neq 0 \\ 1-e^{-x/\sigma} & \text{if } \xi = 0 \end{cases}$$

Quantification of operational risk

..EVT approach: assumption

"We assume that the distribution of operational losses belongs to the heavy-tailed class of distributions, and that the distribution of log losses belongs to the light-tailed class"

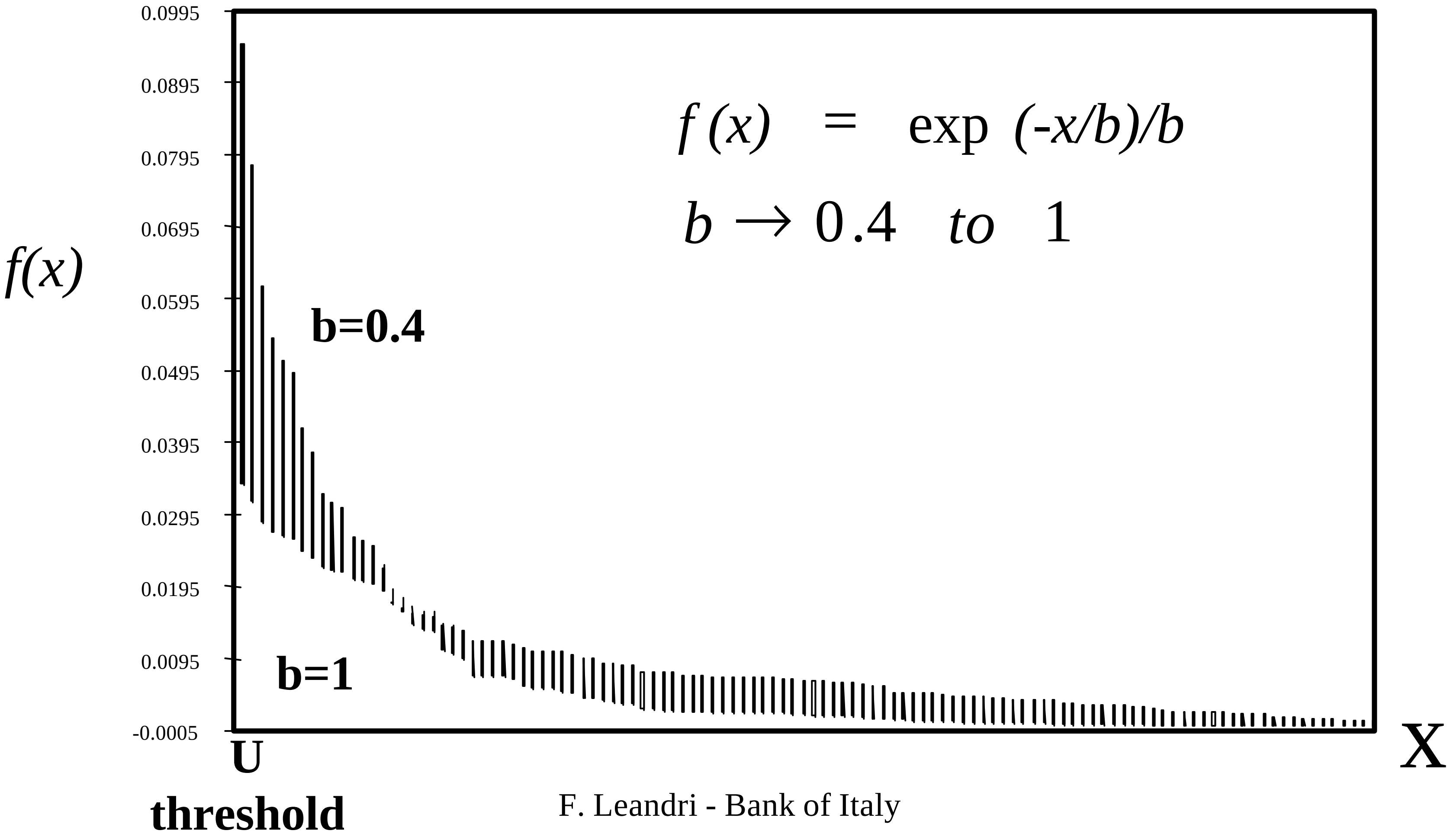
$$f(x) = \begin{cases} \cancel{1-(1+\xi x/\sigma)^{-1/\xi} \quad \text{if } \xi \neq 0} \\ \exp(-x/b)/b \end{cases}$$

This assumption could have an important impact on results

Quantification of operational risk

..EVT approach: comment

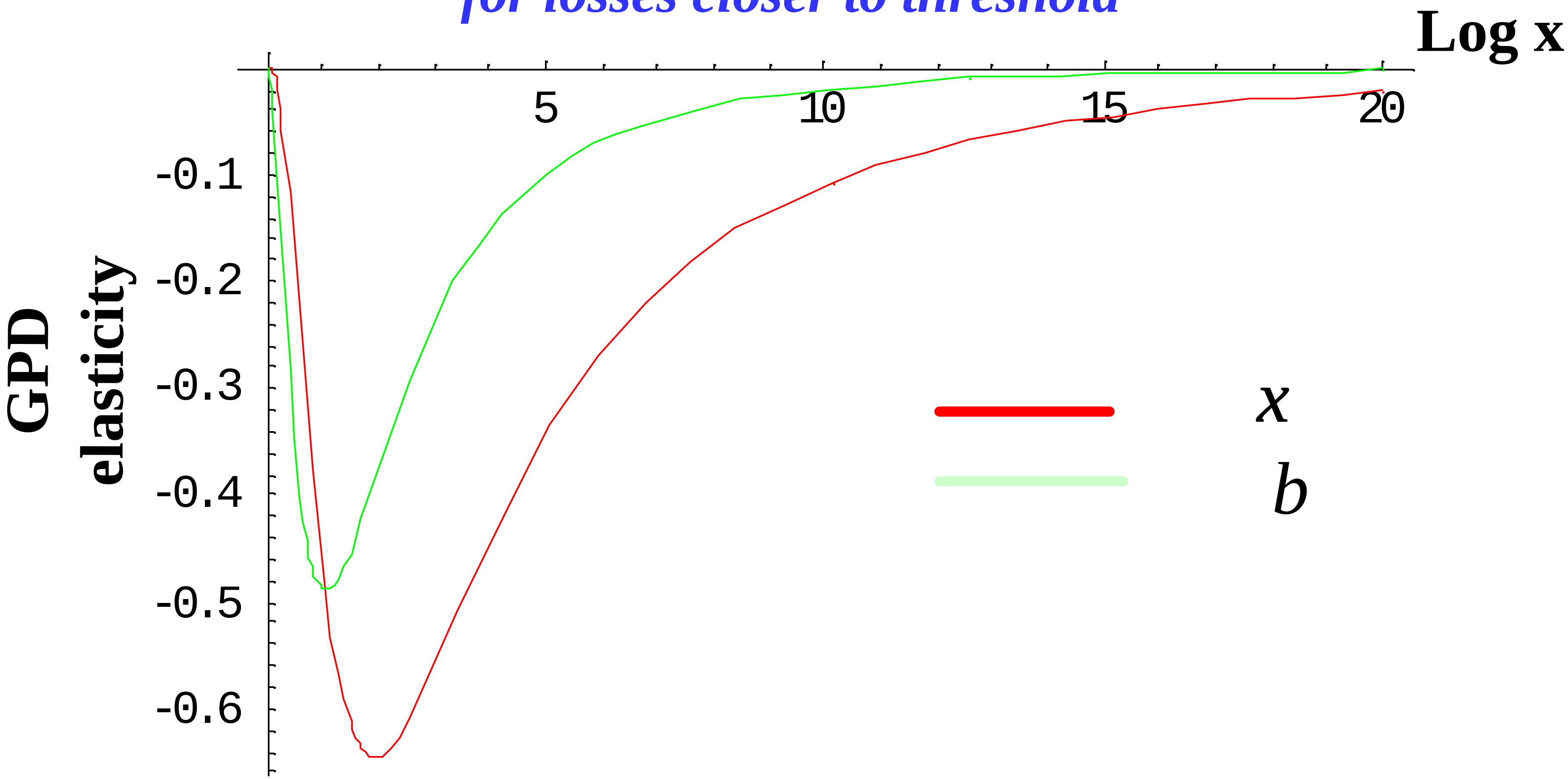
a variation of b parameter affects the f(x) shape mostly around the threshold.



Quantification of operational risk

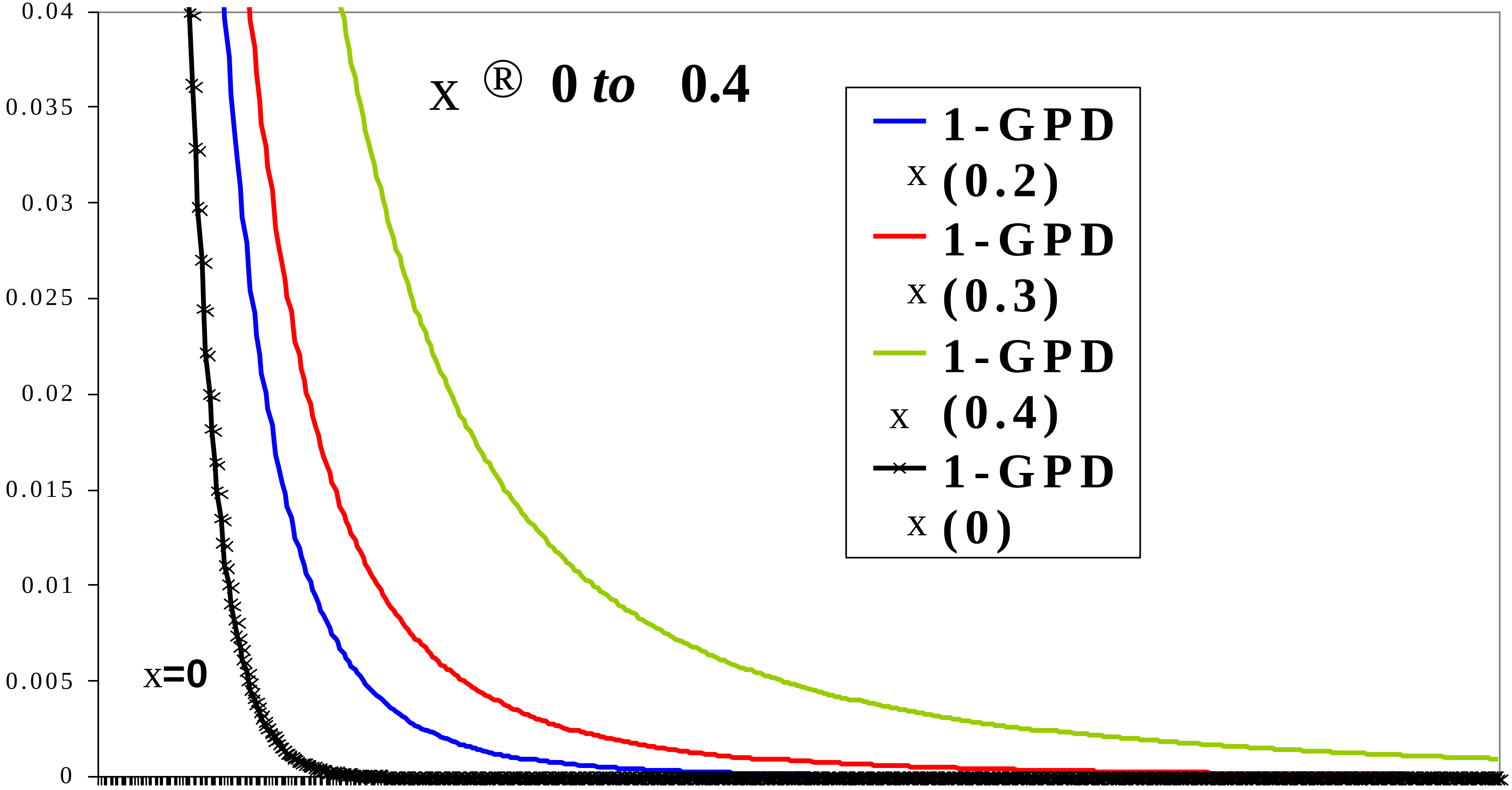
..EVT approach: comment

GPD elasticity to b parameters - opposite to x one - is higher for losses closer to threshold



Quantification of operational risk

..EVT approach: comment



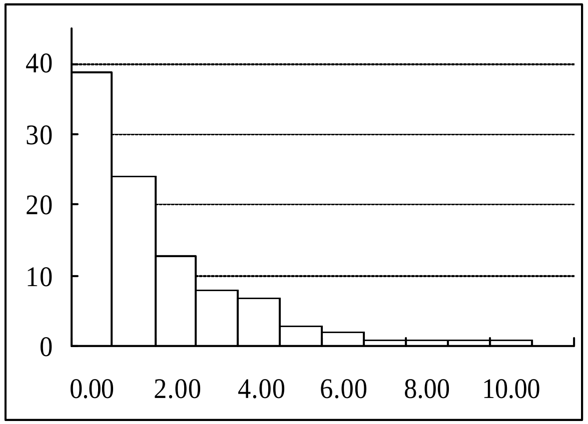
We cannot appreciate differences in BL driven by high impact losses, as they are not well captured by differences in b

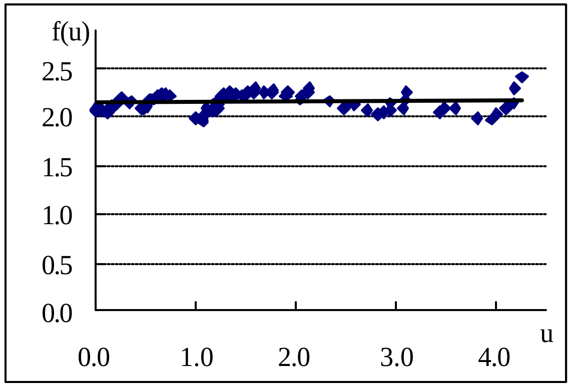
Quantification of operational risk

..EVT approach: Sensitivity of results to threshold (MEF)

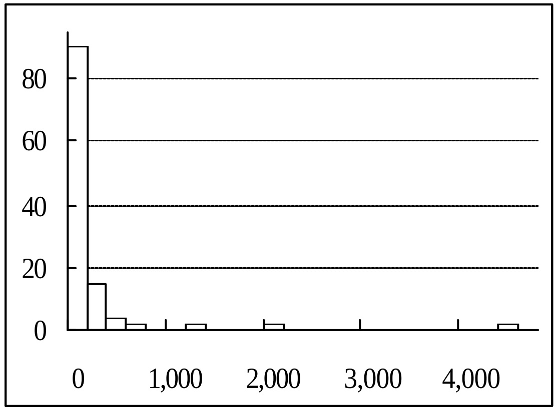
by definition an exponential f. produces a constant mean excess threshold

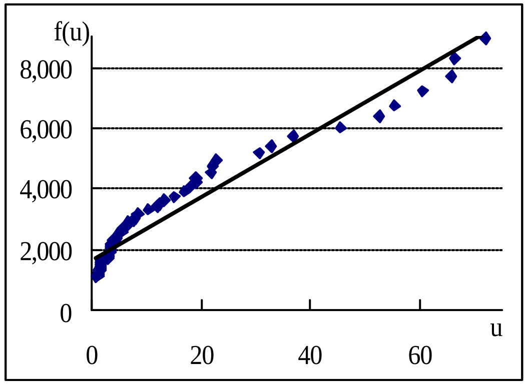
exponential





Pareto





Less fat-tale **More fat-tale**

Quantification of operational risk

..EVT approach: comments

As the impact of $x=0$ on result is relevant

- **the hypothesis must be supported by preliminary EDA analyses (Mef, QQ-plot) and confirmed by goodness of fit tests**
- **only after that, the stochastic threshold correction can be included**

Quantification of operational risk

.. Stochastic threshold: assumption

"We assume that the truncation point has a logistic distribution"

$$G(x) = 1 / [1 + \exp(-ß(x - t))]$$

This assumption (logit) is not grounded on empirical evidence

As such, it is the authors' *apriori*

As the impact of this assumption on the results is relevant, further works must be done to analyze results' sensitivity to different distribution

Quantification of operational risk

.. Stochastic threshold: comment

Result: " there is significant cross business line- variation in the probability that a particular size loss is reported…such result is intuitive as a loss amount that is noteworthy for retail banking may be rather ordinary for Trading & sales"

Is not it in contrast with the previous result that severity distribution does not differ across-BL?

exp (^{t}) \$M	Retail banking	Trading & sales
Op risk	**43**	**198**
Opvantage	**68**	**129**

Source: table 3.

Quantification of operational risk

P. de Fontnouvelle et al. paper : some questions

Logit - Exponential function provides a good estimates of the loss data in external database

There is not clear evidence of fit robustness:

Why tail Q-Q plot fit test deteriorate towards the tail of the loss distribution?

If you find that *b* does not vary depending on the threshold, can we assume that also for higher thresholds QQ plot still deteriorates?

Quantification of operational risk

P. de Fontnouvelle et al. paper : some questions

Op risk severity distribution (of large losses) does not vary across business lines. Differences are driven by frequency or other factors

For this dataset "*b*" does not seems a good estimator of tail thickness across BL:

Why raw data are so different across BL (also for 75th percentile)?

Why the size of loss with the 50% chance of being reported is so different across BL?

End