

# VaR and the Pareto distribution

Dr. Arturo Erdely – Risk Theory I

- `md"# VaR and the Pareto distribution`
- `> Dr. Arturo Erdely -- Risk Theory I"`

- `using Distributions, Plots, PlutoUI`

**Exercise 1.5** Let  $S$  be a Pareto random variable with probability density function:

$$f(s|\beta) = \frac{\beta}{s^{\beta+1}} \mathbb{1}_{\{s>1\}}$$

with parameter  $\beta > 0$ . Then for any given  $0 < \alpha < 1$  there exists a  $\beta > 1$  such that  $\mathbb{E}(S) > \text{VaR}_\alpha(S)$ .

- `md"**Exercise 1.5** Let $$$ be a Pareto random variable with probability density function:`
- `$$$f(s\,,|\,\,,\beta) = \frac{\beta}{s^{\beta + 1}}\mathbb{1}_{-\{\{s\,,>\,,1\}\}}$`
- `with parameter $\beta > 0.$ Then for any given $0<\alpha<1$ there exists a $\beta>1$ such that $\mathbb{E}(S)>\text{VaR}_{-\{\alpha\}}(S).$"`

`S = Distributions.Pareto{Float64}(\alpha=1.15, \theta=1.0)`

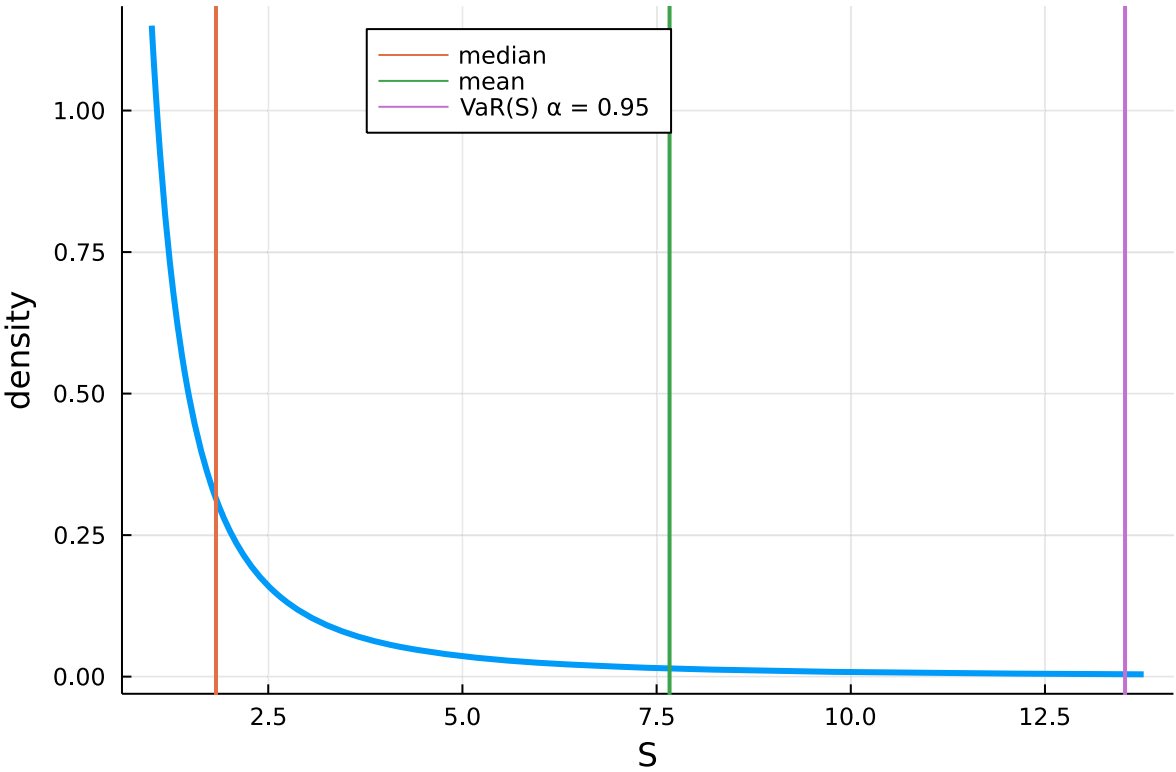
- `S = Pareto(β[1], 1)`

VaR of level α =  0.95

- `@bind α PlutoUI.combine() do Param`
- `md"""`
- `VaR of level α = $(Param(Slider(0.950:0.001:0.999; default = 0.95, show_value = true)))`
- `"""`
- `end`

β =  1.15

- `@bind β PlutoUI.combine() do Param2`
- `md"""`
- `β = $(Param2(Slider(1.0:0.0001:1.15; default = 1.15, show_value = true)))`
- `"""`
- `end`



```
begin
  x = range(1.0, max(quantile(S, α[1]+0.001), mean(S)), length = 1_000)
  plot(x, pdf.(S, x), lw = 3, label = "", legend = :top)
  axis!("S"); axis!("density")
  vline!([median(S)], lw = 2, label = "median")
  vline!([mean(S)], lw = 2, label = "mean")
  vline!([quantile(S, α[1])], lw = 2, label = "VaR(S) α = $(α[1])")
end
```