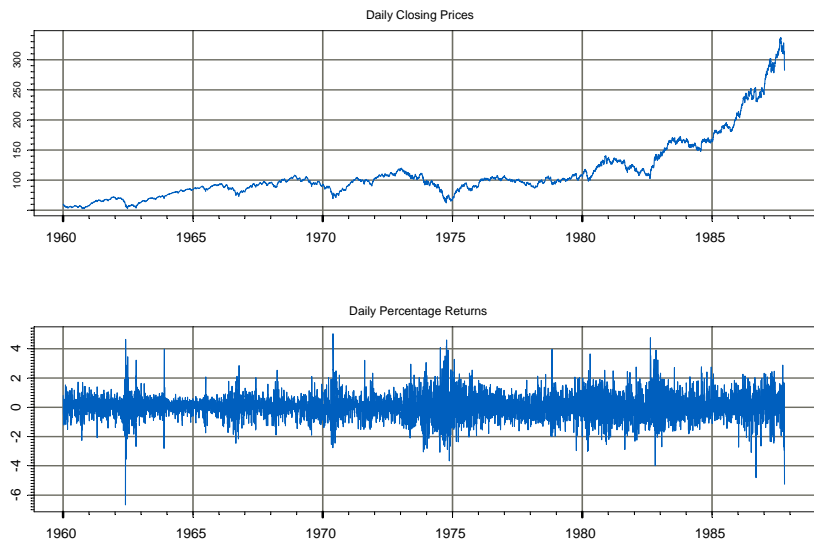


# Financial Econometrics and Volatility Models

Eric Zivot  
Updated: May 3, 2010

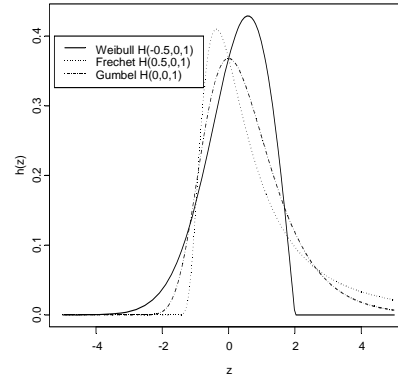
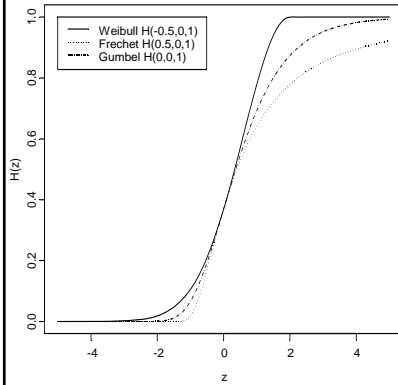
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## Example Data: S&P 500 returns



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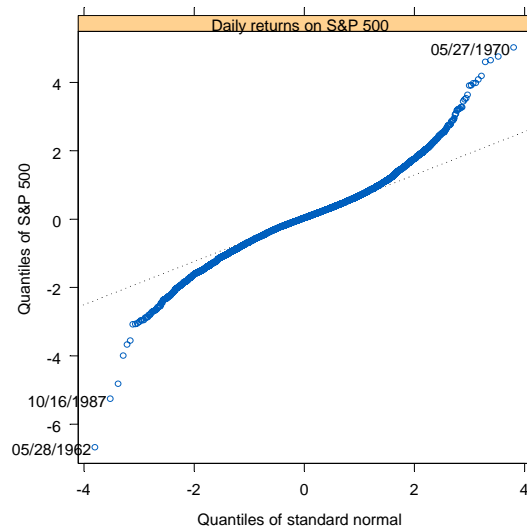
## GEV df and pdf



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## Returns are not normally distributed

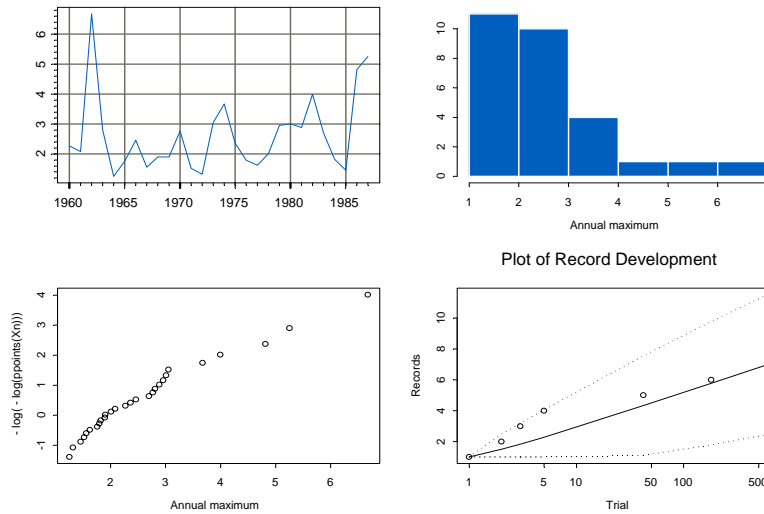


Tail behavior of returns is likely to be described by GEV with positive shape parameter

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## Empirical Distribution of Block Maxima



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## GEV fit to annual blocks

```
> gev.fit.year = gev(-spto87,block="year")
> gev.fit.year
Generalized Extreme Value Distribution Fit --
```

```
28 blocks of maxima data
ML estimation converged.
Log-likelihood value: -38.34
```

Parameter Estimates, Standard Errors and t-ratios:

	Value	Std.Error	t value
xi	0.3344	0.2081	1.6068
sigma	0.6716	0.1308	5.1337
mu	1.9750	0.1513	13.0549

$\xi$  is not estimated very precisely with annual blocks

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## GEV fit to quarterly blocks

```
> gev.fit.quarter= gev(-spto87,block="quarter")
> gev.fit.quarter
Generalized Extreme Value Distribution Fit --
```

```
112 blocks of maxima data
ML estimation converged.
Log-likelihood value: -111.9
```

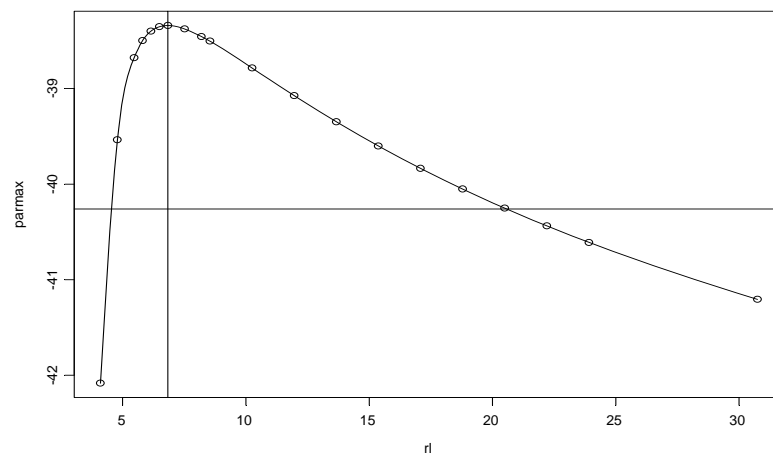
Parameter Estimates, Standard Errors and t-ratios:

	Value	Std.Error	t value
xi	0.1910	0.0695	2.7472
sigma	0.5021	0.0416	12.0701
mu	1.4013	0.0530	26.4583

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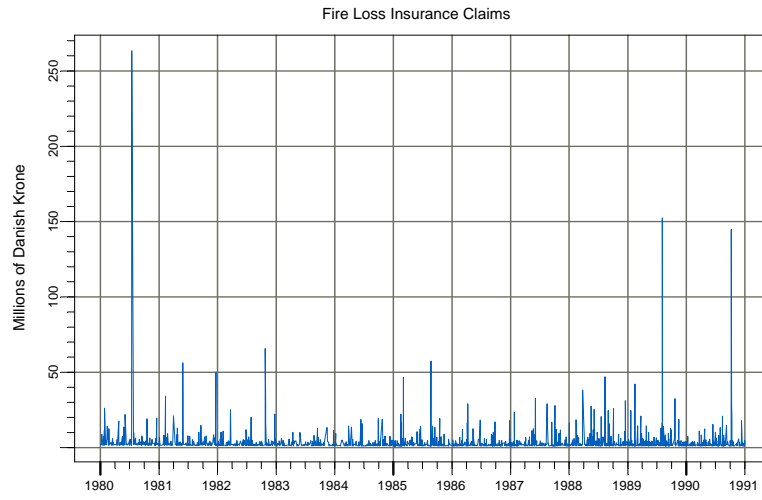
## Return level based on GEV fit to annual blocks



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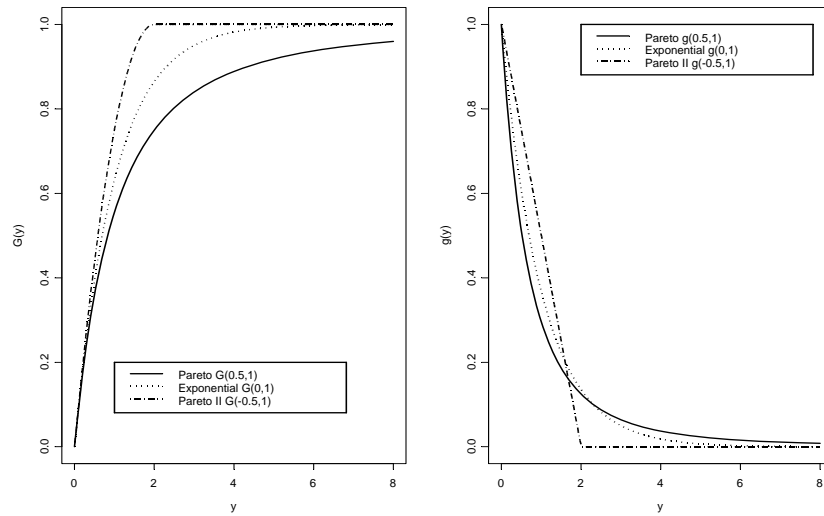
## Example Data: Fire Loss Insurance Claims



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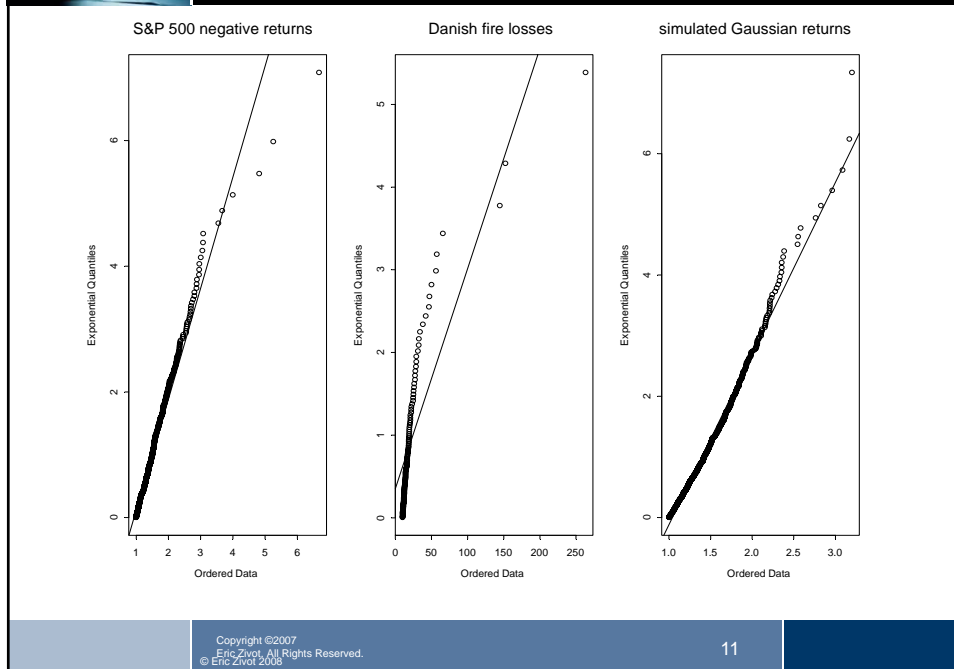
## Generalized Pareto Distribution



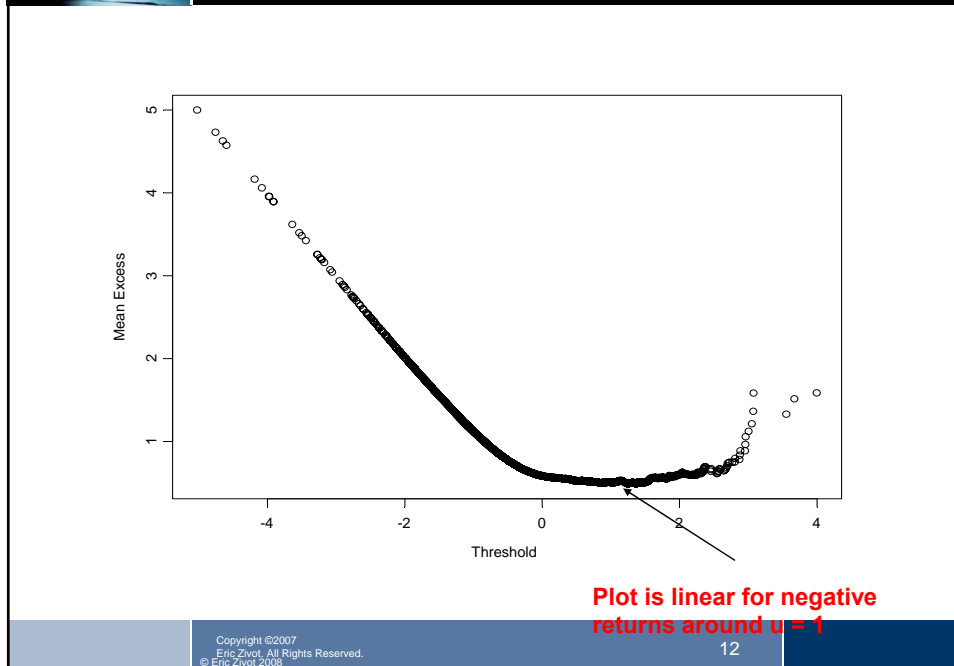
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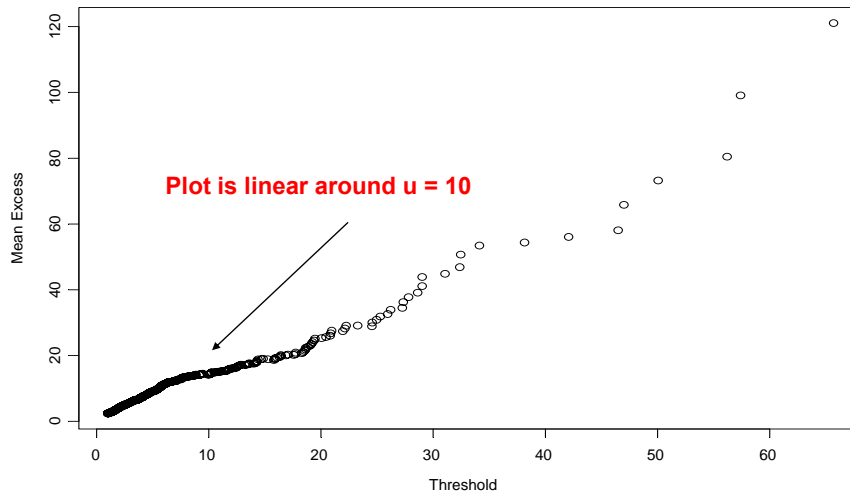
## QQ-Plots of Threshold Exceedences



## Mean excess plot for S&P 500 negative returns



## Mean excess plot for Danish fire loss data



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## GPD Fit to S&P 500 Negative Returns

```
> gpd.sp500.1 = gpd(-spto87,threshold=1)
> gpd.sp500.1
Generalized Pareto Distribution Fit --

Total of 6985 observations

Upper Tail Estimated with ml --
Upper Threshold at 1 or 8.518 % of the data
ML estimation converged.
Log-likelihood value: -183.6
```

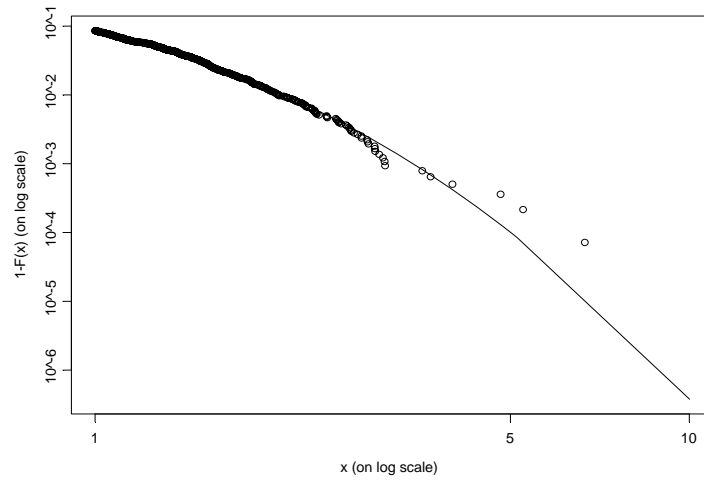
Parameter Estimates, Standard Errors and t-ratios:

	Value	Std.Error	t value
xi	0.0677	0.0397	1.7033
beta	0.4681	0.0267	17.5376

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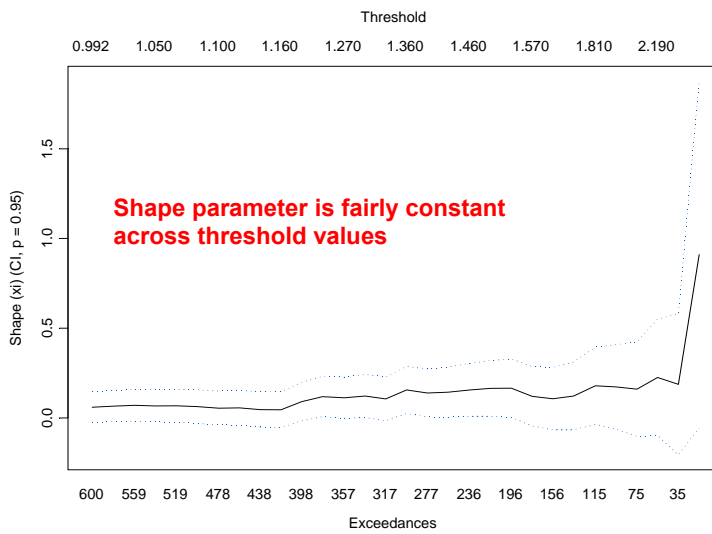
### Fitted GPD Tail Distribution



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### Shape parameter sensitivity to threshold value



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## Fit GPD to Danish Fire Loss Data

```
> gpd.danish.10 = gpd(danish,threshold=10)
> gpd.danish.10
Generalized Pareto Distribution Fit --
```

Total of 2167 observations

Upper Tail Estimated with ml --

Upper Threshold at 10 or 5.03 % of the data  
ML estimation converged.

Log-likelihood value: -374.9

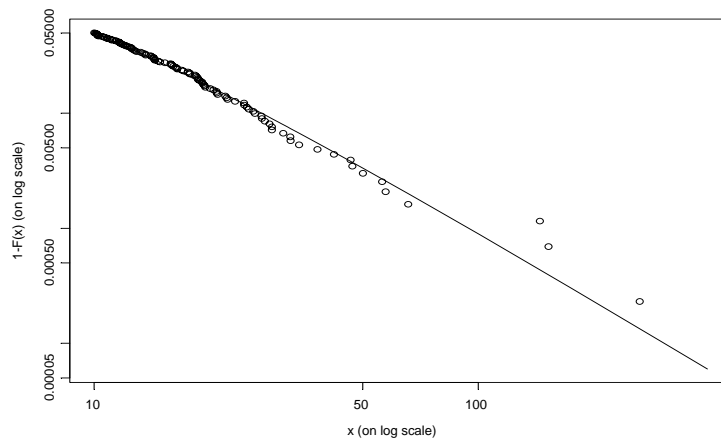
Parameter Estimates, Standard Errors and t-ratios:

	Value	Std.Error	t value
xi	0.4970	0.1363	3.6467
beta	6.9755	1.1135	6.2645

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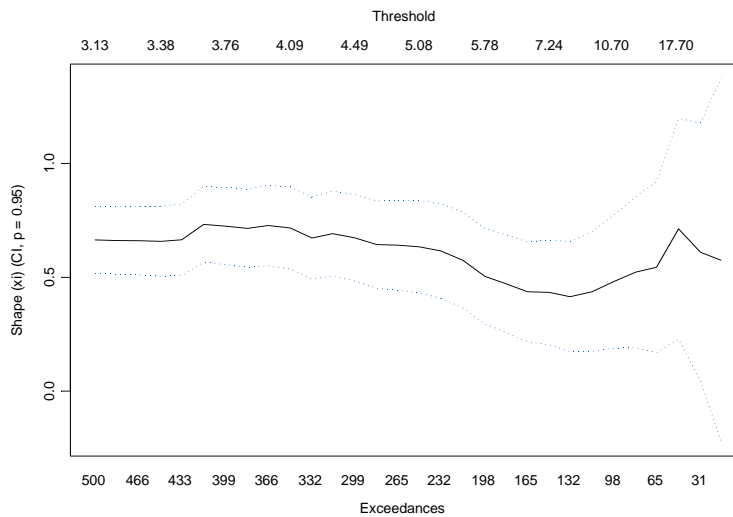
## Fitted GPD Tail



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## Shape parameter sensitivity to threshold value



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## Risk Measures for S&P 500

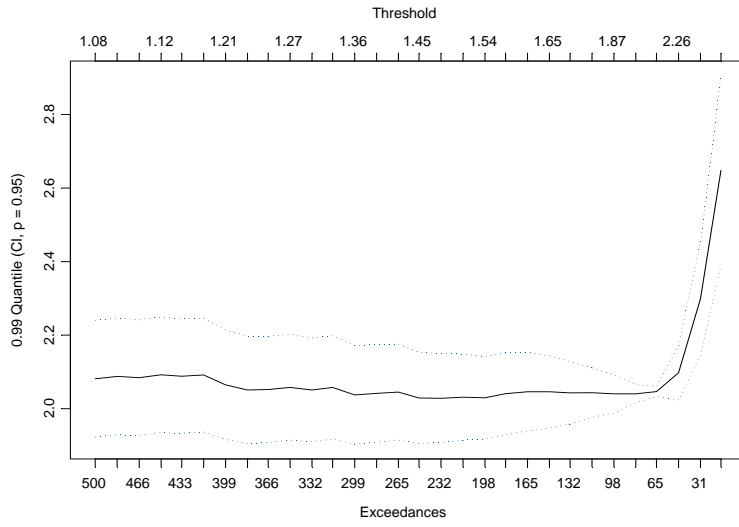
```
> riskmeasures.normal(-spto87)
      p quantile  sfall
[1,] 0.95 1.299051 1.635526
[2,] 0.99 1.847814 2.120681

> riskmeasures(gpd.sp500.1,p=c(0.95,0.99))
      p quantile  sfall
[1,] 0.95 1.253920 1.774384
[2,] 0.99 2.079005 2.659356
```

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# Sensitivity of VaR to threshold



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