



COMPUTATIONAL FINANCE & RISK MANAGEMENT

UNIVERSITY *of* WASHINGTON

Department of Applied Mathematics

Comparing Fitted Models with the `fit.models` Package

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History of `fit.models`

- ▶ `fit.models` originally a function in the S-PLUS Robust Library for fitting a model robustly and by maximum likelihood
- ▶ `fit.models` extended to support models fit using other *robust* packages: `robustbase`, `MASS::rlm`
- ▶ `fit.models` extended to compare nested models
- ▶ `fit.models` becomes its own package

Comparing Robust and MLE fits

```
library(factorAnalytics)
library(robust)
```

Robust fit single factor model

```
sf.rob <- lmRob(HAM1 ~ SP500.TR, data = managers)
```

Maximum likelihood fit single factor model

```
sf.mle <- lm(HAM1 ~ SP500.TR, data = managers)
```

Fit model both ways

```
sf.fm <- fit.models(c(Robust = "lmRob", MLE = "lm"),
                    HAM1 ~ SP500.TR,
                    data = managers)
```

Generic Functions: `summary(sf.fm)`

Calls:

```
Robust: lmRob(formula = HAM1 ~ SP500.TR, data = managers)
      MLE: lm(formula = HAM1 ~ SP500.TR, data = managers)
```

Residual Statistics:

	Min	1Q	Median	3Q	Max
Robust:	-0.03484	-0.01371	-0.001675	0.01168	0.04841
MLE:	-0.03457	-0.01450	-0.002416	0.01117	0.04748

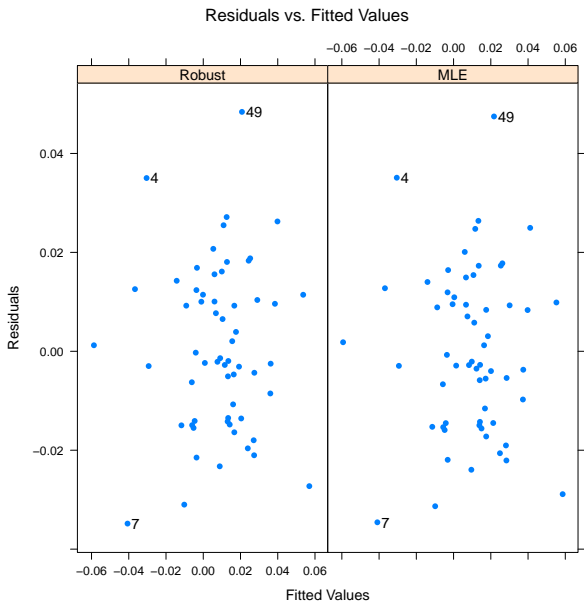
Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept): Robust:	0.005209	0.002324	2.241	0.0289
MLE:	0.005833	0.002216	2.632	0.0108
SP500.TR: Robust:	0.588114	0.065053	9.041	1.14e-12
MLE:	0.599475	0.061641	9.725	8.62e-14

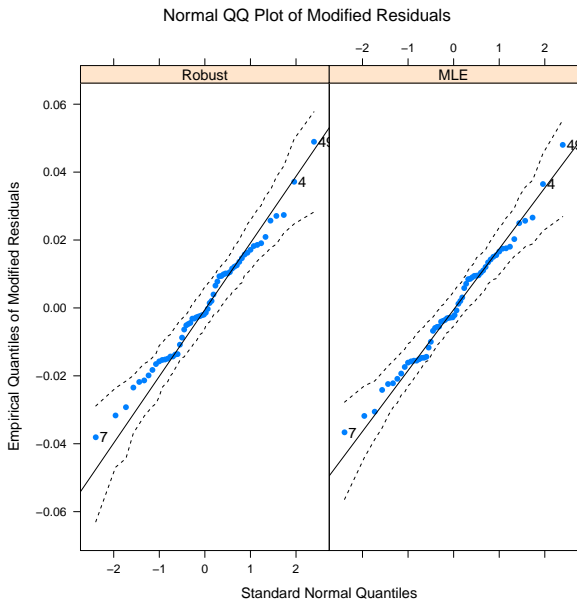
Residual Scale Estimates:

```
Robust: 0.01837 on 58 degrees of freedom
      MLE: 0.01695 on 58 degrees of freedom
```

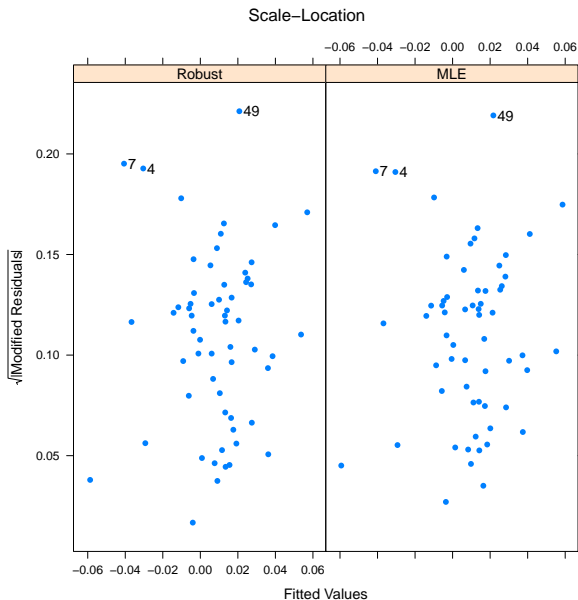
Generic Functions: `plot(sf.fm)`



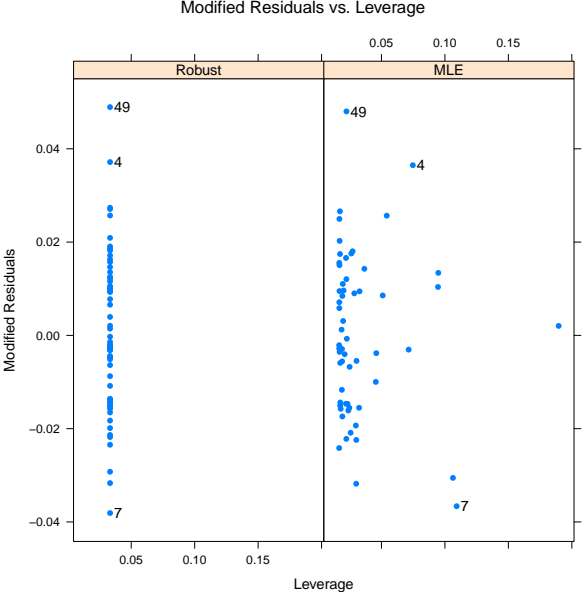
Generic Functions: `plot(sf.fm)`



Generic Functions: plot(sf.fm)



Generic Functions: plot(sf.fm)



Comparing Nested Models

Fit multifactor model

```
mf <- lm(HAM1 ~ EDHEC.LS.EQ + SP500.TR + US.10Y.TR,  
         data = managers)
```

Fit single factor model

```
sf <- lm(HAM1 ~ SP500.TR, data = managers)
```

Create fit.models object

```
nst.fm <- fit.models("TF" = mf, "SF" = sf)
```

Generic function: coef(nst.fm)

	(Intercept)	EDHEC.LS.EQ	SP500.TR	US.10Y.TR
TF	0.002359606	0.7839077	0.2967179	-0.07651597
SF	0.005832723	NA	0.5994746	NA

Generic Function: `summary(nst.fm)`

Calls:

```
TF: lm(formula = HAM1 ~ EDHEC.LS.EQ + SP500.TR + US.10Y.TR,  
      data = managers)
```

```
SF: lm(formula = HAM1 ~ SP500.TR, data = managers)
```

Coefficients:

		Estimate	Std. Error	t value	Pr(> t)
(Intercept):	TF:	0.002360	0.002234	1.056	0.295369
	SF:	0.005833	0.002216	2.632	0.010849
EDHEC.LS.EQ:	TF:	0.783908	0.190566	4.114	0.000129
	SF:				
SP500.TR:	TF:	0.296718	0.092981	3.191	0.002324
	SF:	0.599475	0.061641	9.725	8.62e-14
US.10Y.TR:	TF:	-0.076516	0.096338	-0.794	0.430407
	SF:				

Generic Function: `summary(nst.fm)`

Residual Statistics:

	Min	1Q	Median	3Q	Max
TF:	-0.03684	-0.01085	-0.0007224	0.009074	0.02905
SF:	-0.03457	-0.01450	-0.0024163	0.011172	0.04748

Residual Scale Estimates:

TF: 0.0151 on 56 degrees of freedom

SF: 0.01695 on 58 degrees of freedom

Multiple R-squared:

TF: 0.7089

SF: 0.6199

Times Series Factor Models for Asset Returns

Names of 6 hypothetical asset managers

```
assets <- paste("HAM", 1:6, sep = "")
```

Fit single factor model

```
sfm <- fitTsfm(assets, "SP500.TR", data = managers)
```

Fit 3 factor model

```
tfm <- fitTsfm(assets,  
              c("EDHEC.LS.EQ", "SP500.TR", "US.10Y.TR"),  
              data = managers)
```

Create fit.models object

```
fm <- fit.models(sfm, tfm)
```

Reference: Eric Zivot and Jiahui Wang (2006). *Modeling Financial Time Series with S-PLUS*. Chapter 15.

fitTsfm Output

Call:

```
fitTsfm(asset.names = assets, factor.names = "SP500.TR",  
        data = managers)
```

Model dimensions:

Factors	Assets	Periods
1	6	60

Regression Alphas:

	HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
(Intercept)	0.005833	0.002275	0.002375	0.007847	0.004777	0.007673

Factor Betas:

	HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
SP500.TR	0.5995	0.2159	0.5552	0.9233	0.3169	0.3264

R-squared values:

	HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
	0.6199	0.1490	0.6526	0.4245	0.1049	0.2521

fitTsfm Output

Residual Volatilities:

HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
0.01695	0.01863	0.01463	0.03882	0.03342	0.02030

fit.models Comparison

Calls:

```
sfm: fitTsfm(asset.names = assets,
             factor.names = "SP500.TR",
             data = managers)
tfm: fitTsfm(asset.names = assets,
             factor.names = c("EDHEC.LS.EQ", "SP500.TR",
                             "US.10Y.TR"),
             data = managers)
```

Model dimensions:

	Factors	Assets	Periods
sfm:	1	6	60
tfm:	3	6	60

Regression Alphas:

	HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
sfm:	0.005833	0.002275	0.0023750	0.0078470	0.004777	0.007673
tfm:	0.002360	-0.002316	-0.0008842	-0.0003243	-0.003801	0.001872

fit.models Comparison

Factor Betas:

		HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
EDHEC.LS.EQ:	sfm:						
	tfm:	0.7839	1.0739	0.7126	1.4861	1.3670	1.3421
SP500.TR:	sfm:	0.5995	0.2159	0.5552	0.9233	0.3169	0.3264
	tfm:	0.2967	-0.2065	0.2847	0.4226	-0.0947	-0.1986
US.10Y.TR:	sfm:						
	tfm:	-0.0765	-0.1350	-0.0512	0.1418	0.3223	-0.1571

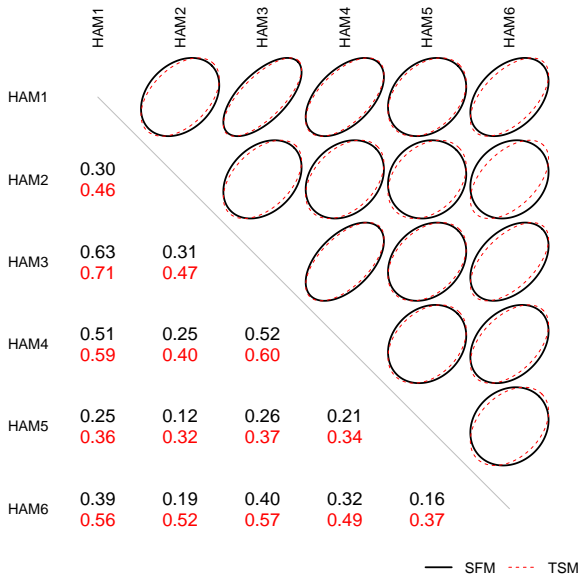
R-squared values:

	HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
sfm:	0.6199	0.1490	0.6526	0.4245	0.1049	0.2521
tfm:	0.7089	0.4630	0.7421	0.5226	0.3165	0.6134

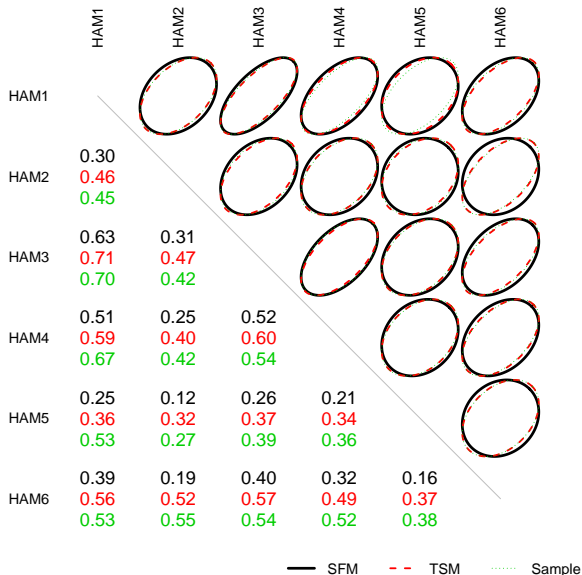
Residual Volatilities:

	HAM1	HAM2	HAM3	HAM4	HAM5	HAM6
sfm:	0.01695	0.01863	0.01463	0.03882	0.03342	0.02030
tfm:	0.01510	0.01506	0.01283	0.03598	0.02972	0.01485

Comparison of Estimated Correlation Matrices



Comparison of Estimated Correlation Matrices





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Thank You

https://r-forge.r-project.org/R/?group_id=86