

MGARCH

An R Package for Fitting Multivariate GARCH Models

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Outline.

1. Univariate GARCH
2. Multivariate GARCH
3. MGARCH Functionality
4. Further Functionality
5. mgarch in Progress

1. Univariate GARCH

Example: GARCH(1, 1).

- Model equations:

$$r_t = \mu_t + \epsilon_t,$$

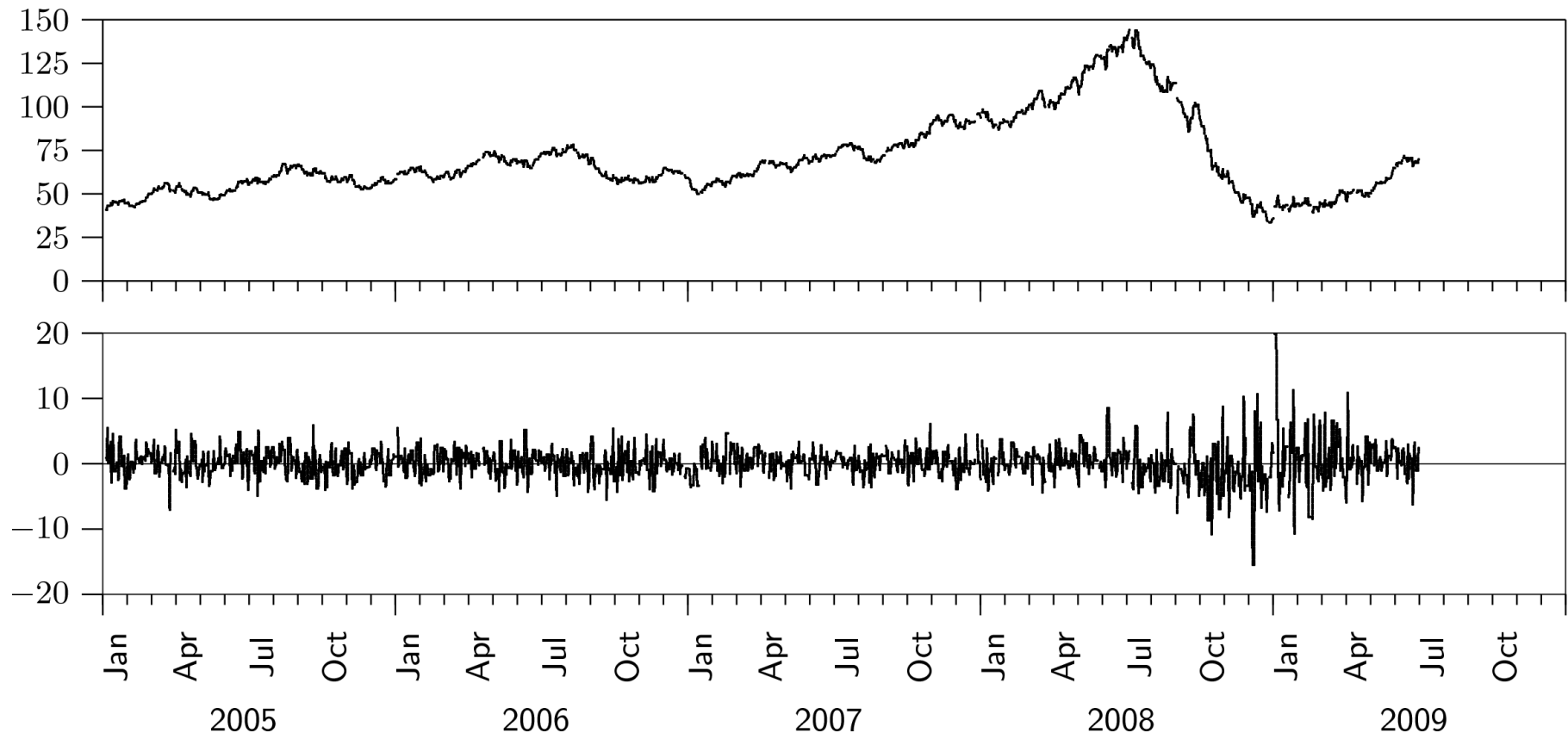
$$\epsilon_t = \nu_t \cdot \sqrt{h_t},$$

$$h_t = \alpha_0 + \underbrace{\alpha_1 \epsilon_{t-1}^2}_{\text{ARCH term}} + \underbrace{\beta_1 h_{t-1}}_{\text{GARCH term}}$$

- (ν_t) : white noise with $\sigma_\nu^2 = \text{var}(\nu_t) = 1$.
- Parameters $\alpha_0, \alpha_1, \beta_1 \geq 0$ such that $\alpha_1 + \beta_1 < 1$.

1. Univariate GARCH

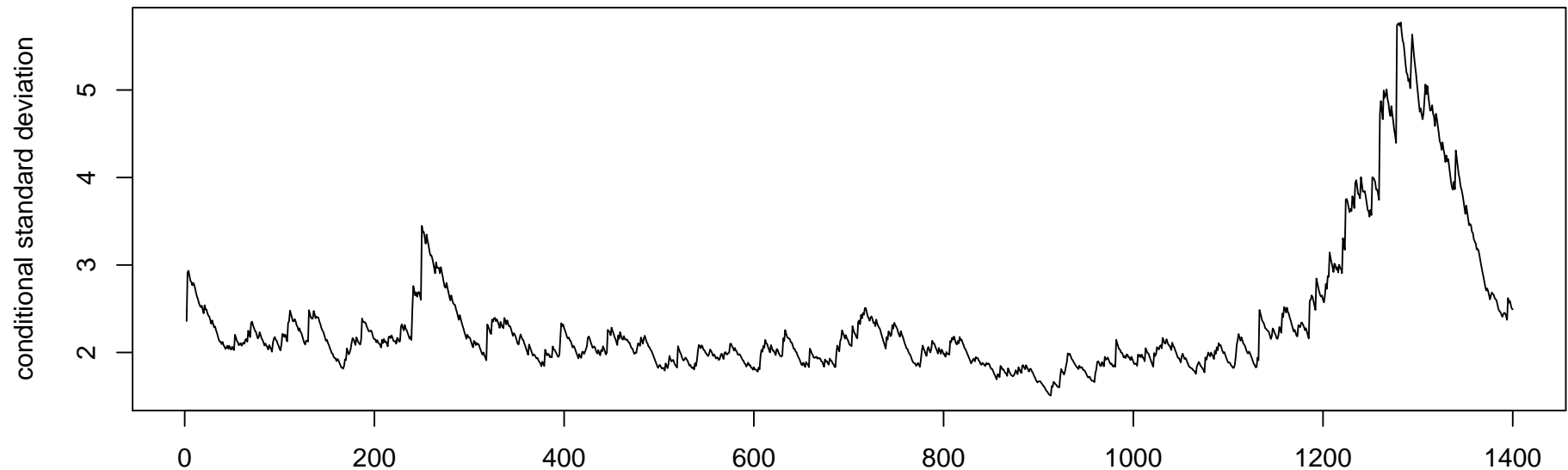
Example: The price of Brent crude oil (in USD).



1. Univariate GARCH

Example: The price of Brent crude oil (in USD).

Typical result: the series of conditional standard deviations.



(Obtained using `garch` from package `tseries`.)

2. Multivariate GARCH

Example: BEKK(1, 1).

- Model equations:

$$r_t = M_t + \epsilon_t,$$

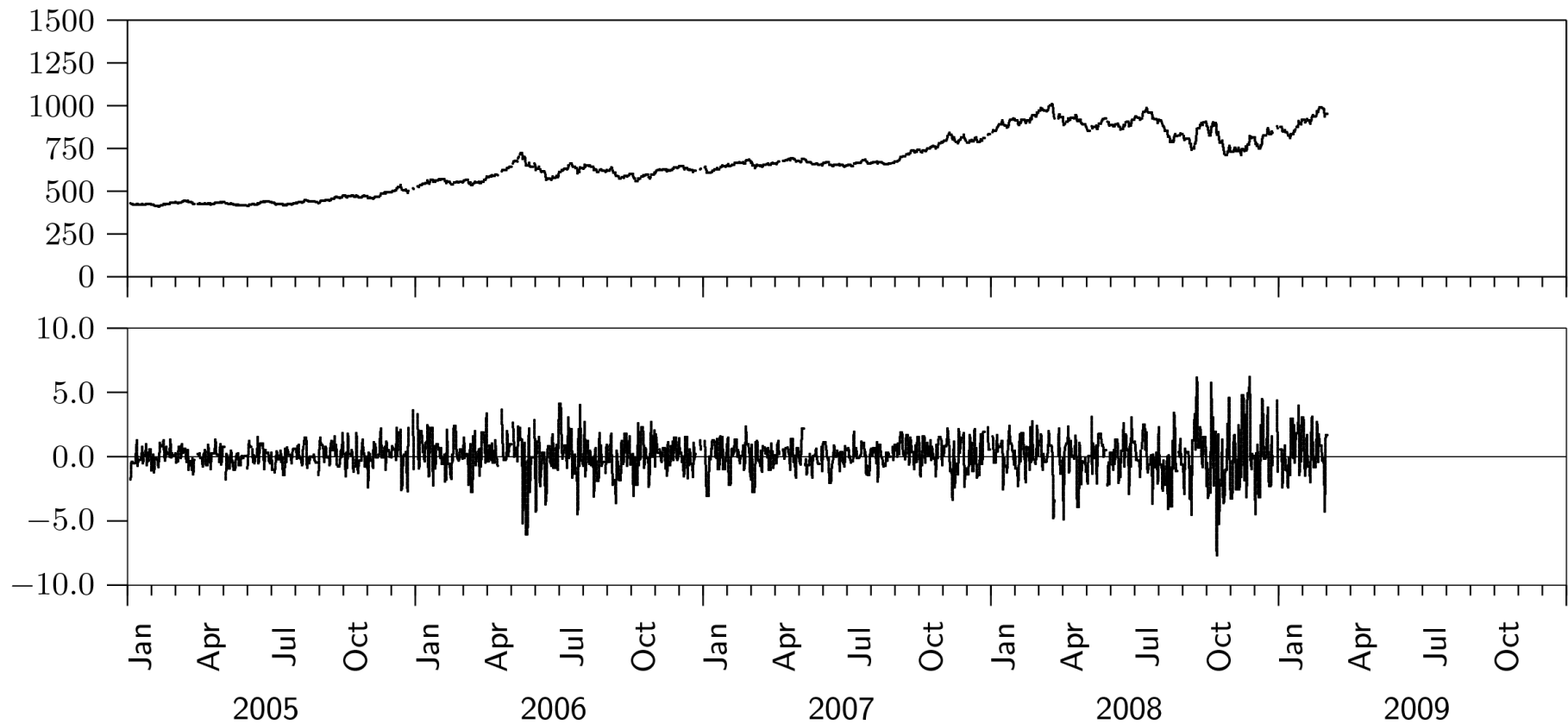
$$\epsilon_t = H_t^{1/2} \cdot \nu_t,$$

$$H_t = C'C + \underbrace{A'\epsilon_{t-1}\epsilon'_{t-1}A}_{\text{ARCH term}} + \underbrace{B'H_{t-1}B}_{\text{GARCH term}}$$

- (ν_t) : white noise with $\text{var}(\nu_t) = I$.
- Parameters matrices C, A, B.

2. Multivariate GARCH

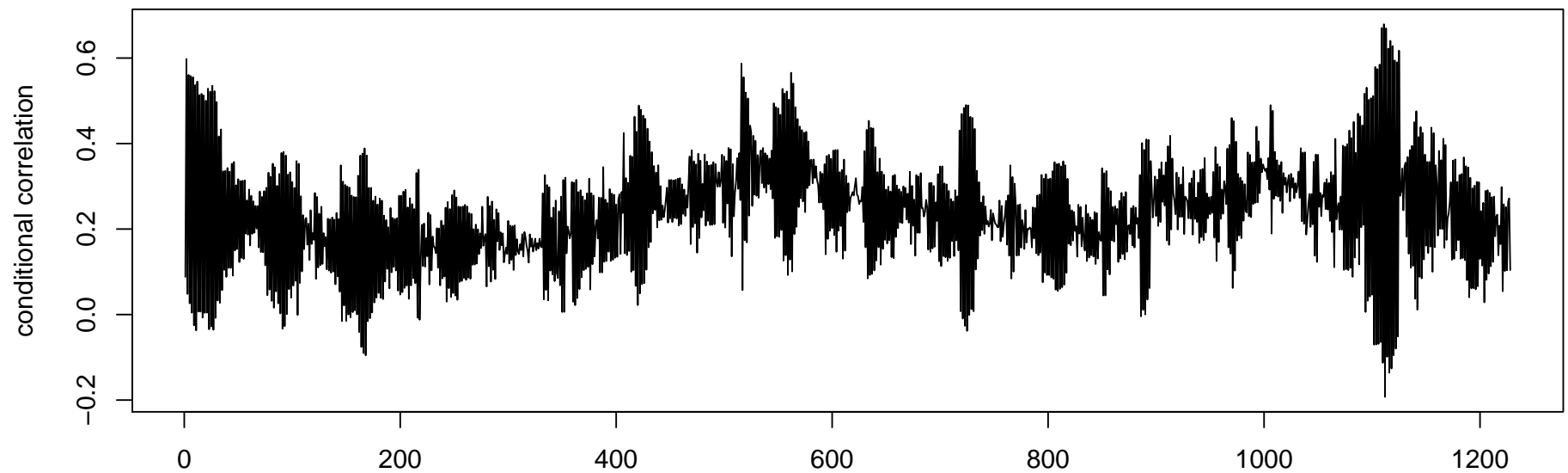
Example: The price of gold (in USD).



2. Multivariate GARCH

Example: Daily returns on Brent crude oil and on gold.

Typical result: the series of conditional correlations.



(Obtained using `mvBEKK.est` from package `mgarch`.)

3. MGARCH Functionality

So far:

- BEKK models:
 - fitting, diagnostics, simulation
 - any size, any order
- DCC models (Tse & Tsui):
 - fitting (still slow)
 - bivariate
- bivariate asymmetric quadratic GARCH:
 - fitting, diagnostics

4. Further Functionality

Comparing returns.

	brent	gold
first day	2004-01-02	2004-01-02
last day	2009-06-30	2009-03-02
observations	1400	1297
NAs	33	50
mean	0.08899	0.07151
std error	0.07038	0.03752
var	6.25734	1.77969
std deviation	2.50147	1.33405
skewness	0.38444	-0.25295
std error	0.37698	0.20818
kurtosis	5.72231	3.35217
std error	1.98225	0.63969
min	-15.49167	-7.66241
lower quartile	-1.28346	-0.52890
median	0.08206	0.07101
upper quartile	1.41644	0.75006
max	19.87716	6.19755
day of min	2008-12-05	2008-10-13
day of max	2009-01-02	2008-11-24

5. mgarch in Progress

How is mgarch being developed?

- mgarch is a Free and Open Source Software.
- Actively and collectively developed
- Multisite: Turkey, Germany, China and Singapore
- Hosted on *Sourceforge.net* (SF.net)

5. mgarch in Progress

How is mgarch being developed?

- Wikipedia says about SF.net:

SourceForge offers free access to hosting and tools for developers of free/open source software...

- Main mgarch webpage:

<http://mgarch.sf.net>

- SF.net mgarch page:

<https://sourceforge.net/projects/mgarch>

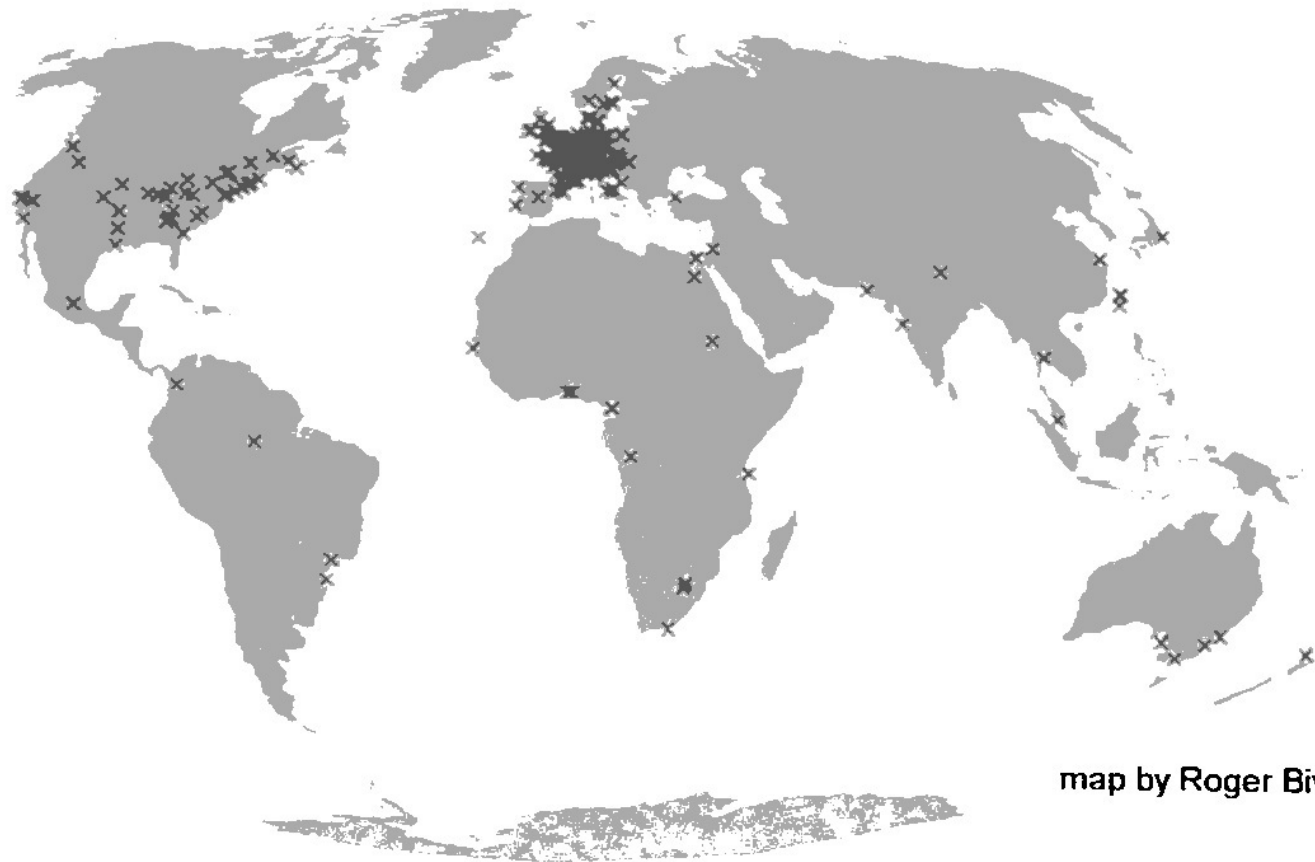
5. mgarch in Progress

What and how can you contribute?

- We design, code, test and document the mgarch package.
- You can do this, too.
- Become an mgarch contributor on SF.net:
 - Create an account on SF.net
 - Let us know your SF.net username:
 - Vehbi Sinan Tunalioğlu < vst@vsthost.com >
 - Harald Schmidbauer < harald@hs-stat.com >
 - Contribute!

5. mgarch in Progress

useR! world



map by Roger Bivand