

NAG Toolbox for MATLAB

g13fb

1 Purpose

g13fb forecasts the conditional variances h_t , for $t = T + 1, \dots, T + \xi$ from a type I AGARCH(p, q) sequence, where ξ is the forecast horizon and T is the current time (see Engle and Ng 1993).

2 Syntax

```
[fht, ifail] = g13fb(nt, ip, iq, theta, gamma, ht, et, 'num', num)
```

3 Description

Assume the GARCH(p, q) process can be represented by:

$$h_t = \alpha_0 + \sum_{i=1}^q \alpha_i (\epsilon_{t-i} + \gamma)^2 + \sum_{i=1}^p \beta_i h_{t-i}, \quad t = 1, \dots, T$$

where $\epsilon_t | \psi_{t-1} = N(0, h_t)$ or $\epsilon_t | \psi_{t-1} = S_t(df, h_t)$, has been modelled by g13fa and the estimated conditional variances and residuals are contained in the arrays **ht** and **et** respectively.

g13fb will then use the last $\max(p, q)$ elements of the arrays **ht** and **et** to estimate the conditional variance forecasts, $h_t | \psi_T$, where $t = T + 1, \dots, T + \xi$ and ξ is the forecast horizon.

4 References

- Bollerslev T 1986 Generalised autoregressive conditional heteroskedasticity *Journal of Econometrics* **31** 307–327
- Engle R 1982 Autoregressive conditional heteroskedasticity with estimates of the variance of United Kingdom inflation *Econometrica* **50** 987–1008
- Engle R and Ng V 1993 Measuring and Testing the Impact of News on Volatility *Journal of Finance* **48** 1749–1777
- Hamilton J 1994 *Time Series Analysis* Princeton University Press

5 Parameters

5.1 Compulsory Input Parameters

1: **nt – int32 scalar**

ξ , the forecast horizon.

Constraint: **nt** > 0.

2: **ip – int32 scalar**

The number of coefficients, β_i , for $i = 1, \dots, p$.

Constraints:

$$\max(\mathbf{ip}, \mathbf{iq}) \leq 20;$$

$$\mathbf{ip} \geq 0.$$

3: **iq – int32 scalar**

The number of coefficients, α_i , for $i = 1, \dots, q$.

Constraints:

$$\begin{aligned}\max(\mathbf{ip}, \mathbf{iq}) &\leq 20; \\ \mathbf{iq} &\geq 1.\end{aligned}$$

4: **theta(ip + iq + 1) – double array**

The first element must contain the coefficient α_o and the next **iq** elements must contain the coefficients α_i , for $i = 1, \dots, q$. The remaining **ip** elements must contain the coefficients β_j , for $j = 1, \dots, p$.

5: **gamma – double scalar**

The asymmetry parameter γ for the GARCH(p, q) sequence.

6: **ht(num) – double array**

The sequence of past conditional variances for the GARCH(p, q) process, h_t , for $t = 1, \dots, T$.

7: **et(num) – double array**

The sequence of past residuals for the GARCH(p, q) process, ϵ_t , for $t = 1, \dots, T$.

5.2 Optional Input Parameters

1: **num – int32 scalar**

Default: The dimension of the arrays **ht**, **et**. (An error is raised if these dimensions are not equal.)
the number of terms in the arrays **ht** and **et** from the modelled sequence.

Constraint: $\max(\mathbf{ip}, \mathbf{iq}) \leq \mathbf{num}$.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **fht(nt) – double array**

The forecast values of the conditional variance, h_t , for $t = T + 1, \dots, T + \xi$.

2: **ifail – int32 scalar**

0 unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

On entry, **num** < max(**ip**, **iq**),
or **iq** < 1,
or **ip** < 0,
or max(**ip**, **iq**) > 20,
or **nt** ≤ 0.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

```

nt = int32(4);
iseed = zeros(4, 1, 'int32');
iseed(1) = int32(111);
igen = int32(0);
rwsav = zeros(9, 1);
rvec = zeros(40, 1);
num = int32(1500);
param = [0.8; 0.6; 0.2; 0.1];
mean = 3;
bx = [1.5; 2.5; 3];
df = 4.1;
dist = 'N';
gamma = -0.4;
bx = [1.5; 2.5; 3];
copts = [true; true];
ip = int32(0);
iq = int32(3);
nreg = int32(0);
mn = int32(1);
isym = int32(1);
theta = [0.4;
         0.3;
         0.1;
         0.05;
         -0.2;
         0];
hp = 0;
maxit = int32(200);
tol = 1e-05;

x = zeros(num, 3);
for i = 1:num
    fac1 = double(i)*0.01;
    x(i,1) = 0.01 + 0.7*sin(fac1);
    x(i,2) = 0.5 + fac1*0.1;
    x(i,3) = 1.0;
end

[igen, iseed] = g05kb(igen, iseed);

fcall = true;
[ht, yt, rvec, iseed, rwsav, ifail] = ...
    g05hk(dist, num, ip, iq, param, gamma, df, fcall, rvec, igen, iseed,
    rwsav);

fcall = false;
[ht, yt, rvec, iseed, rwsav, ifail] = ...
    g05hk(dist, num, ip, iq, param, gamma, df, fcall, rvec, igen, iseed,
    rwsav);

for i = 1:num
    xterm = 0;
    for k = 1:nreg
        xterm = xterm + x(i,k)*bx(k);
    end
    if (mn == 1)
        yt(i) = mean + xterm + yt(i);
    else
        yt(i) = xterm + yt(i);
    end
end
end

```

```
[theta, se, sc, covar, hp, et, ht, lgf, ifail] = ...  
    g13fa(dist, yt, x, ip, iq, nreg, mn, isym, theta, hp, copts, maxit,  
tol);  
  
[fht, ifail] = g13fb(nt, ip, iq, theta, gamma, ht, et)  
  
fht =  
    1.6300  
    1.9669  
    2.3941  
    2.8040  
ifail =  
        0
```
