

NAG C Library Function Document

nag_forecast_garchGJR (g13ffc)

1 Purpose

nag_forecast_garchGJR (g13ffc) forecasts the conditional variances, h_t , $t = 1, \dots, \tau$ from a GJR GARCH(p, q) sequence, where τ is the forecast horizon (see Glosten, *et al.* (1993)).

2 Specification

```
#include <nag.h>
#include <nagg13.h>

void nag_forecast_garchGJR (Integer num, Integer nt, Integer p, Integer q,
    const double theta[], double gamma, double fht[], const double ht[],
    const double et[], NagError *fail)
```

3 Description

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

$$\epsilon_t | \psi_{t-1} \sim N(0, h_t)$$

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

where $S_t = 1$, if $\epsilon_t < 0$, and $S_t = 0$, if $\epsilon_t \geq 0$ has been modelled by nag_estimate_garchGJR (g13fec) and the estimated conditional variances and residuals are contained in the arrays **ht** and **et** respectively. Then nag_forecast_garchGJR will use the last $\max(p, q)$ elements of the arrays **ht** and **et** to estimate the conditional variance forecasts, $h_t | \psi_T$, where $t = T + 1, \dots, T + \tau$ and τ is the forecast horizon.

4 Parameters

- | | | |
|----|--|--------------|
| 1: | num – Integer | <i>Input</i> |
| | <i>On entry:</i> the number of terms in the arrays ht and et from the modelled sequence. | |
| | <i>Constraint:</i> $\max(\mathbf{p}, \mathbf{q}) \leq \mathbf{num}$, $\mathbf{num} \geq 0$. | |
| 2: | nt – Integer | <i>Input</i> |
| | <i>On entry:</i> the forecast horizon, τ . | |
| | <i>Constraint:</i> $\mathbf{nt} > 0$. | |
| 3: | p – Integer | <i>Input</i> |
| | <i>On entry:</i> the GARCH(p, q) parameter p . | |
| | <i>Constraint:</i> $0 < \max(\mathbf{p}, \mathbf{q}) \leq \mathbf{num}$, $\mathbf{p} \geq 0$. | |
| 4: | q – Integer | <i>Input</i> |
| | <i>On entry:</i> the GARCH(p, q) parameter q . | |
| | <i>Constraint:</i> $0 < \max(\mathbf{p}, \mathbf{q}) \leq \mathbf{num}$, $\mathbf{q} \geq 1$. | |
| 5: | theta[q+p+1] – const double | <i>Input</i> |
| | <i>On entry:</i> the first element contains the coefficient α_0 , the next q elements contain the coefficients α_i , $i = 1, \dots, q$. The remaining p elements are the coefficients β_j , $j = 1, \dots, p$. | |

- 6: **gamma** – double Input
On entry: the asymmetry parameter γ for the GARCH(p, q) sequence.
- 7: **fht[nt]** – double Output
On exit: the forecast values of the conditional variance, $h_t, t = 1, \dots, \tau$.
- 8: **ht[num]** – const double Input
On entry: the sequence of past conditional variances for the GARCH(p, q) process, $h_t, t = 1, \dots, T$.
- 9: **et[num]** – const double Input
On entry: the sequence of past residuals for the GARCH(p, q) process, $\epsilon_t, t = 1, \dots, T$.
- 10: **fail** – NagError * Input/Output
 The NAG error parameter (see the Essential Introduction).

5 Error Indicators and Warnings

NE_INT_ARG_LT

- On entry, **num** must not be less than 0: **num** = *<value>*.
- On entry, **p** must not be less than 0: **p** = *<value>*.
- On entry, **q** must not be less than 1: **q** = *<value>*.
- On entry, **nt** must not be less than 1: **nt** = *<value>*.

NE_2_INT_ARG_LT

- On entry, **num** = *<value>* while $\max(\mathbf{p}, \mathbf{q}) = \mathbf{num}$.
- These parameters must satisfy $\mathbf{num} \geq \max(\mathbf{p}, \mathbf{q})$.

NE_ALLOC_FAIL

- Memory allocation failed.

6 Further Comments

6.1 Accuracy

Not applicable.

6.2 References

- Engle R (1982) Autoregressive Conditional Heteroskedasticity with Estimates of the Variance of United Kingdom Inflation *Econometrica* **50** 987–1008
- Bollerslev T (1986) Generalised Autoregressive Conditional Heteroskedasticity *Journal of Econometrics* **31** 307–327
- 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
- Glosten L, Jagannathan R and Runkle D (1993) Relationship between the Expected Value and the Volatility of Nominal Excess Return on Stocks *Journal of Finance* **48** 1779–1801

7 See Also

None.

8 Example

See the example for `nag_estimate_agarchII` (g13ffc).
