NAG Library Function Document

nag_forecast_agarchII (g13fdc)

1 Purpose

nag_forecast_agarchII (g13fdc) forecasts the conditional variances, h_t, $t = 1, \ldots, \tau$ from a type II AGARCH(p, q) sequence, where τ is the forecast horizon (see Engle and Ng (1993)).

2 Specification

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

```
void nag_forecast_agarchII (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:

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

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

has been modelled by nag_estimate_agarchII (g13fcc) and the estimated conditional variances and residuals are contained in the arrays **ht** and **et** respectively. Then nag_forecast_agarchII (g13fdc) will use the last $\max(p, q)$ elements of the arrays **ht** and **et** to estimate the conditional variance forecasts, $h_t \mid \psi_T$, where $t = T + 1, \ldots, T + \tau$ and τ 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 Arguments

1: **num** – Integer *Input*

On entry: the number of terms in the arrays **ht** and **et** from the modelled sequence.

Constraint: $\max(\mathbf{p}, \mathbf{q}) \leq \mathbf{num}$.

2: **nt** – Integer *Input*

On entry: τ, the forecast horizon.

Constraint: $\mathbf{nt} > 0$.

3: **p** – Integer *Input*

On entry: the GARCH(p, q) argument p.

Constraint: $0 < \max(\mathbf{p}, \mathbf{q}) \leq \mathbf{num}$, $\mathbf{p} \geq 0$.

4: **q** – Integer *Input*

On entry: the GARCH(p, q) argument q.

Constraint: $0 < \max(\mathbf{p}, \mathbf{q}) \leq \mathbf{num}$, $\mathbf{q} \geq 1$.

5: **theta**[$\mathbf{q} + \mathbf{p} + \mathbf{1}$] – const double *Input*

On entry: the first element must contain the coefficient α_o and the next **q** elements must contain the coefficients α_i, for $i = 1, 2, \ldots, q$. The remaining **p** elements must contain the coefficients β_j, for $j = 1, 2, \ldots, p$.

6: **gamma** – double *Input*

On entry: the asymmetry argument γ for the GARCH(p, q) sequence.

7: **fht**[**nt**] – double *Output*

On exit: the forecast values of the conditional variance, h_t, for $t = 1, 2, \ldots, \tau$.

8: **ht**[**num**] – const double *Input*

On entry: the sequence of past conditional variances for the GARCH(p, q) process, h_t, for $t = 1, 2, \ldots, T$.

9: **et**[**num**] – const double *Input*

On entry: the sequence of past residuals for the GARCH(p, q) process, ϵ_t, for $t = 1, 2, \ldots, T$.

10: **fail** – NagError * *Input/Output*

The NAG error argument (see Section 3.6 in the Essential Introduction).

6 Error Indicators and Warnings

NE_2_INT_ARG_LT

On entry, **num** $= \langle value \rangle$ while $\max(\mathbf{p}, \mathbf{q}) = \langle value \rangle$. These arguments must satisfy $\mathbf{num} \geq \max(\mathbf{p}, \mathbf{q})$.

NE_ALLOC_FAIL

Dynamic memory allocation failed.

NE_INT_ARG_LT

On entry, **nt** $= \langle value \rangle$.
Constraint: $\mathbf{nt} \geq 1$.

On entry, **num** $= \langle value \rangle$.
Constraint: $\mathbf{num} \geq 0$.

On entry, **p** $= \langle value \rangle$.
Constraint: $\mathbf{p} \geq 0$.

On entry, **q** $= \langle value \rangle$.
Constraint: $\mathbf{q} \geq 1$.

7 Accuracy

Not applicable.

8 Parallelism and Performance

Not applicable.

9 Further Comments

None.

10 Example

See the example for nag_estimate_agarchII (g13fcc).