1 Purpose

nag_forecast_agarchI (g13fbc) forecasts the conditional variances, \( h_t \), \( t = 1, \ldots, \tau \) from a type I AGARCH\((p,q)\) sequence, where \( \tau \) is the forecast horizon (see Engle and Ng (1993)).

2 Specification

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

void nag_forecast_agarchI (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 standard \((\gamma = 0)\) GARCH\((p,q)\) process can be represented by:

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

\[
h_t = \alpha_0 + \sum_{i=1}^{q} \alpha_i \epsilon_{t-i}^2 + \sum_{i=1}^{p} \beta_i h_{t-i}, \quad t = 1, \ldots, T.
\]

or type I AGARCH\((p,q)\) process with conditional variance \( h_t \) given by:

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

has been modelled by nag_estimate_agarchI (g13fac) and the estimated conditional variances and residuals are contained in the arrays \( \mathbf{ht} \) and \( \mathbf{et} \) respectively. Then nag_forecast_agarchI (g13fbc) will use the last \( \max(p, q) \) elements of the arrays \( \mathbf{ht} \) and \( \mathbf{et} \) to estimate the conditional variance forecasts, \( h_t \mid \psi_T \), where \( t = T+1, \ldots, T+\tau \) and \( \tau \) is the forecast horizon.

4 References


5 Arguments

1: \textbf{num} – Integer

\textit{Input}

\textit{On entry:} the number of terms in the arrays \( \mathbf{ht} \) and \( \mathbf{et} \) from the modelled sequence.

\textit{Constraint:} \( \max(p, q) \leq \text{num} \).
2:  \textbf{nt} – Integer  
\textit{Input}  
\textit{On entry:} \( \tau \), the forecast horizon.  
\textit{Constraint:} \( \text{nt} > 0 \).

3:  \textbf{p} – Integer  
\textit{Input}  
\textit{On entry:} the GARCH\((p, q)\) argument \( p \).  
\textit{Constraint:} \( 0 < \max(p, q) \leq \text{num}, \ p \geq 0 \).

4:  \textbf{q} – Integer  
\textit{Input}  
\textit{On entry:} the GARCH\((p, q)\) argument \( q \).  
\textit{Constraint:} \( 0 < \max(p, q) \leq \text{num}, \ q \geq 1 \).

5:  \textbf{theta} \([q + p + 1]\) – const double  
\textit{Input}  
\textit{On entry:} the first element must contain the coefficient \( \alpha_0 \), and the next \( q \) elements must contain the coefficients \( \alpha_i \), for \( i = 1, 2, \ldots, q \). The remaining \( p \) elements must contain the coefficients \( \beta_j \), for \( j = 1, 2, \ldots, p \).

6:  \textbf{gamma} – double  
\textit{Input}  
\textit{On entry:} the asymmetry argument \( \gamma \) for the GARCH\((p, q)\) sequence.

7:  \textbf{fht} \([\text{nt}]\) – double  
\textit{Output}  
\textit{On exit:} the forecast values of the conditional variance, \( h_t \), for \( t = 1, 2, \ldots, \tau \).

8:  \textbf{ht} \([\text{num}]\) – const double  
\textit{Input}  
\textit{On entry:} the sequence of past conditional variances for the GARCH\((p, q)\) process, \( h_t \), for \( t = 1, 2, \ldots, \text{T} \).

9:  \textbf{et} \([\text{num}]\) – const double  
\textit{Input}  
\textit{On entry:} the sequence of past residuals for the GARCH\((p, q)\) process, \( \epsilon_t \), for \( t = 1, 2, \ldots, \text{T} \).

10:  \textbf{fail} – NagError *  
\textit{Input/Output}  
\textit{The NAG error argument (see Section 3.6 in the Essential Introduction).}

6  \textbf{Error Indicators and Warnings}

\textbf{NE_2_INT_ARG_LT}  
On entry, \textbf{num} = \langle \text{value} \rangle \text{ while } \max(p, q) = \langle \text{value} \rangle. \text{ These arguments must satisfy } \text{num} \geq \max(p, q).$

\textbf{NE_ALLOC_FAIL}  
Dynamic memory allocation failed.

\textbf{NE_INT_ARG_LT}  
On entry, \textbf{nt} = \langle \text{value} \rangle.  
\textit{Constraint:} \textbf{nt} \geq 1.  
On entry, \textbf{num} = \langle \text{value} \rangle.  
\textit{Constraint:} \textbf{num} \geq 0.  
On entry, \textbf{p} = \langle \text{value} \rangle.  
\textit{Constraint:} \textbf{p} \geq 0.
On entry, \( q = \langle\text{value}\rangle \).
Constraint: \( q \geq 1 \).

7 Accuracy
Not applicable.

8 Parallelism and Performance
Not applicable.

9 Further Comments
None.

10 Example
See the example for nag_estimate_agarchI (g13fac).