

NAG C Library Function Document

nag_generate_agarchI (g05hkc)

1 Purpose

nag_generate_agarchI (g05hkc) generates a given number of terms of a type I AGARCH(p, q) process (see Engle and Ng (1993)).

2 Specification

```
#include <nag.h>
#include <nagg05.h>

void nag_generate_agarchI (Integer num, Integer p, Integer q,
    const double theta[], double gamma, double ht[], double et[],
    Nag_Garch_Fcall_Type fcall, double rvec[], NagError *fail)
```

3 Description

A type I AGARCH(p, q) process can be represented by:

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

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

Here T is the number of observations in the sequence, ϵ_t is the *observed* value of the GARCH(p, q) process at time t , h_t is the conditional variance at time t , and ψ_t the information set of all information up to time t . Symmetric GARCH(p, q) sequences are generated when γ is zero, otherwise asymmetric GARCH(p, q) sequences are generated with γ specifying the amount by which positive (or negative) shocks are to be enhanced.

4 Parameters

- 1: **num** – Integer *Input*
On entry: the number of terms in the sequence, T .
Constraints:
num[] ≥ 1 ,
num[] $> \mathbf{p}[] + \mathbf{q}[] + 1$.
- 2: **p** – Integer *Input*
On entry: the GARCH(p, q) parameter p .
Constraint: **p**[] ≥ 0 .
- 3: **q** – Integer *Input*
On entry: the GARCH(p, q) parameter q .
Constraint: **q**[] ≥ 1 .
- 4: **theta**[**q+p+1**] – const double *Input*
On entry: 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 , $j = 1, \dots, p$.

- 5: **gamma** – double *Input*
On entry: the asymmetry parameter γ for the GARCH(p, q) sequence.
- 6: **ht[num]** – double *Output*
On exit: the conditional variances $h_t, t = 1, \dots, T$ for the GARCH(p, q) sequence.
- 7: **et[num]** – double *Output*
On exit: the observations $\epsilon_t, t = 1, \dots, T$ for the GARCH(p, q) sequence.
- 8: **fcall** – Nag_Garch_Fcall_Type *Input*
On entry: if **fcall**[] = **Nag_Garch_Fcall_True** then a new sequence is to be generated, else if **fcall**[] = **Nag_Garch_Fcall_False** a given sequence is to be continued using the information in **rvec**[].
- 9: **rvec[2*(p+q+1)]** – double *Input/Output*
On entry: the array contains information required to continue a sequence if **fcall**[] = **Nag_Garch_Fcall_False**.
On exit: contains information that can be used in a subsequent call of nag_generate_agarchI, with **fcall**[] = **Nag_Garch_Fcall_False**.
- 10: **fail** – NagError * *Input/Output*
The NAG error parameter (see the Essential Introduction).

5 Error Indicators and Warnings

NE_BAD_PARAM

On entry, parameter **fcall**[] had an illegal value.

NE_INT_ARG_LT

On entry, **p**[] must not be less than 0: **p**[] = *<value>*.

On entry, **q**[] must not be less than 1: **q**[] = *<value>*.

On entry, **num**[] must not be less than 1: **num**[] = *<value>*.

On entry, **num**[] = *<value>* while **p**[]+**q**[]+1 = *<value>*

These parameters must satisfy **num**[] \geq **p**[]+**q**[]+1.

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

7 See Also

None.

8 Example

See the example for `nag_estimate_agarchI` (`g13fac`).
