

## Title

**wntestq** — Portmanteau (Q) test for white noise

<a href="#">Description</a>	<a href="#">Quick start</a>	<a href="#">Menu</a>	<a href="#">Syntax</a>
<a href="#">Option</a>	<a href="#">Remarks and examples</a>	<a href="#">Stored results</a>	<a href="#">Methods and formulas</a>
<a href="#">References</a>	<a href="#">Also see</a>		

## Description

`wntestq` performs the portmanteau (or  $Q$ ) test for white noise.

## Quick start

Perform Portmanteau's test for white noise on series `y` using `tsset` data

```
wntestq y
```

As above, but calculate 10 autocorrelations

```
wntestq y, lags(10)
```

## Menu

Statistics > Time series > Tests > Portmanteau white-noise test

## Syntax

```
wntestq varname [if] [in] [, lags(#)]
```

You must `tsset` your data before using `wntestq`; see [\[TS\] `tsset`](#). Also the time series must be dense (nonmissing with no gaps in the time variable) in the specified sample.

*varname* may contain time-series operators; see [\[U\] 11.4.4 Time-series varlists](#).

## Option

`lags(#)` specifies the number of autocorrelations to calculate. The default is to use  $\min(\lfloor n/2 \rfloor - 2, 40)$ , where  $\lfloor n/2 \rfloor$  is the greatest integer less than or equal to  $n/2$ .

## Remarks and examples

[stata.com](#)

[Box and Pierce \(1970\)](#) developed a portmanteau test of white noise that was refined by [Ljung and Box \(1978\)](#). See also [Diggle \(1990, sec. 2.5\)](#).

## ▷ Example 1

In the [example](#) shown in [TS] **wntestb**, we generated two time series. One ( $x_1$ ) was a white-noise process, and the other ( $x_2$ ) was a white-noise process with an embedded cosine curve. Here we compare the output of the two tests.

```
. drop _all
. set seed 12393
. set obs 100
number of observations (_N) was 0, now 100
. generate x1 = rnormal()
. generate x2 = rnormal() + cos(2*_pi*(n-1)/10)
. generate time = n
. tsset time
      time variable:  time, 1 to 100
                delta:  1 unit

. wntestb x1, table
Cumulative periodogram white-noise test
-----
Bartlett's (B) statistic =      0.8038
Prob > B                  =      0.5380

. wntestq x1
Portmanteau test for white noise
-----
Portmanteau (Q) statistic =     31.0396
Prob > chi2(40)           =      0.8443

. wntestb x2, table
Cumulative periodogram white-noise test
-----
Bartlett's (B) statistic =      2.1653
Prob > B                  =      0.0002

. wntestq x2
Portmanteau test for white noise
-----
Portmanteau (Q) statistic =     225.6211
Prob > chi2(40)           =      0.0000
```

This example shows that both tests agree. For the first process, the Bartlett and portmanteau tests result in nonsignificant test statistics: a  $p$ -value of 0.5380 for **wntestb** and one of 0.8443 for **wntestq**.

For the second process, each test has a significant result to less than 0.0005.

◀

## Stored results

**wntestq** stores the following in **r()**:

Scalars

<b>r(stat)</b>	$Q$ statistic	<b>r(p)</b>	probability value
<b>r(df)</b>	degrees of freedom		

## Methods and formulas

The portmanteau test relies on the fact that if  $x(1), \dots, x(n)$  is a realization from a white-noise process. Then

$$Q = n(n+2) \sum_{j=1}^m \frac{1}{n-j} \hat{\rho}^2(j) \longrightarrow \chi_m^2$$

where  $m$  is the number of autocorrelations calculated (equal to the number of lags specified) and  $\longrightarrow$  indicates convergence in distribution to a  $\chi^2$  distribution with  $m$  degrees of freedom.  $\hat{\rho}_j$  is the estimated autocorrelation for lag  $j$ ; see [TS] [corrgram](#) for details.

## References

- Box, G. E. P., and D. A. Pierce. 1970. Distribution of residual autocorrelations in autoregressive-integrated moving average time series models. *Journal of the American Statistical Association* 65: 1509–1526.
- Diggle, P. J. 1990. *Time Series: A Biostatistical Introduction*. Oxford: Oxford University Press.
- Ljung, G. M., and G. E. P. Box. 1978. On a measure of lack of fit in time series models. *Biometrika* 65: 297–303.
- Sperling, R. I., and C. F. Baum. 2001. [sts19: Multivariate portmanteau \(Q\) test for white noise](#). *Stata Technical Bulletin* 60: 39–41. Reprinted in *Stata Technical Bulletin Reprints*, vol. 10, pp. 373–375. College Station, TX: Stata Press.

## Also see

- [TS] [tsset](#) — Declare data to be time-series data
- [TS] [corrgram](#) — Tabulate and graph autocorrelations
- [TS] [cumsp](#) — Cumulative spectral distribution
- [TS] [pergram](#) — Periodogram
- [TS] [wntestb](#) — Bartlett’s periodogram-based test for white noise