

Title

wntestq — Portmanteau (Q) test for white noise

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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

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[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 (`x1`) was a white-noise process, and the other (`x2`) 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

<code>r(stat)</code>	Q statistic	<code>r(p)</code>	probability value
<code>r(df)</code>	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 χ^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.
- Zhu, G., Z. Du, and J. C. Escanciano. 2017. [Automatic portmanteau tests with applications to market risk management](#). *Stata Journal* 17: 901–915.

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