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Description

`swilk` performs the Shapiro–Wilk W test for normality for each variable in the specified varlist. Likewise, `sfrancia` performs the Shapiro–Francia W' test for normality. See [\[MV\] mvtest normality](#) for multivariate tests of normality.

Quick start

Shapiro–Wilk test of normality

Shapiro–Wilk test for `v1`

```
swilk v1
```

Separate tests of normality for `v1` and `v2`

```
swilk v1 v2
```

Generate new variable `w` containing W test coefficients

```
swilk v1, generate(w)
```

Specify that average ranks should not be used for tied values

```
swilk v1 v2, noties
```

Test that `v3` is distributed lognormally

```
generate lnv3 = ln(v3)  
swilk lnv3
```

Shapiro–Francia test of normality

Shapiro–Francia test for `v1`

```
sfrancia v1
```

Separate tests of normality for `v1` and `v2`

```
sfrancia v1 v2
```

Same as above, but use the Box–Cox transformation

```
sfrancia v1 v2, boxcox
```

Specify that average ranks should not be used for tied values

```
sfrancia v1 v2, noties
```

Menu

swilk

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sfrancia

Statistics > Summaries, tables, and tests > Distributional plots and tests > Shapiro-Francia normality test

Syntax

Shapiro–Wilk normality test

```
swilk varlist [ if ] [ in ] [ , swilk_options ]
```

Shapiro–Francia normality test

```
sfrancia varlist [ if ] [ in ] [ , sfrancia_options ]
```

swilk_options	Description
Main	
generate(<i>newvar</i>)	create <i>newvar</i> containing W test coefficients
lnnormal	test for three-parameter lognormality
noties	do not use average ranks for tied values

sfrancia_options	Description
Main	
boxcox	use the Box–Cox transformation for W' ; the default is to use the log transformation
noties	do not use average ranks for tied values

by and collect are allowed with swilk and sfrancia; see [\[U\] 11.1.10 Prefix commands](#).

Options for swilk

Main

generate(*newvar*) creates new variable *newvar* containing the W test coefficients.

lnnormal specifies that the test be for three-parameter lognormality, meaning that $\ln(X - k)$ is tested for normality, where k is calculated from the data as the value that makes the skewness coefficient zero. When simply testing $\ln(X)$ for normality, do not specify this option. See [\[R\] lnskew0](#) for estimation of k .

noties suppresses use of averaged ranks for tied values when calculating the W test coefficients.

Options for sfrancia

Main

`boxcox` specifies that the Box–Cox transformation of [Royston \(1983\)](#) for calculating W' test coefficients be used instead of the default log transformation ([Royston 1993a](#)). Under the Box–Cox transformation, the normal approximation to the sampling distribution of W' , used by `sfrancia`, is valid for $5 \leq n \leq 1000$. Under the log transformation, it is valid for $10 \leq n \leq 5000$.

`noties` suppresses use of averaged ranks for tied values when calculating the W' test coefficients.

Remarks and examples

`swilk` can be used with $4 \leq n \leq 2000$ observations. `sfrancia` can be used with $10 \leq n \leq 5000$ observations; however, if the `boxcox` option is specified, it can be used with $5 \leq n \leq 1000$ observations.

Also see [\[R\] sktest](#) for the skewness and kurtosis test described by [D’Agostino, Belanger, and D’Agostino \(1990\)](#) with the empirical correction developed by [Royston \(1991b\)](#). While the Shapiro–Wilk and Shapiro–Francia tests for normality are, in general, preferred for nonaggregated data ([Gould and Rogers 1991](#); [Gould 1992b](#); [Royston 1991b](#)), the skewness and kurtosis test will permit more observations. Moreover, a normal quantile plot should be used with any test for normality; see [\[R\] Diagnostic plots](#) for more information.

► Example 1

Using our automobile dataset, we will test whether the variables `mpg` and `trunk` are normally distributed:

```
. use https://www.stata-press.com/data/r19/auto
(1978 automobile data)

. swilk mpg trunk
```

Variable	Obs	W	V	z	Prob>z
mpg	74	0.94821	3.335	2.627	0.00430
trunk	74	0.97921	1.339	0.637	0.26215

```
. sfrancia mpg trunk
```

Variable	Obs	W'	V'	z	Prob>z
mpg	74	0.94872	3.650	2.510	0.00604
trunk	74	0.98446	1.106	0.195	0.42271

We can reject the hypothesis that `mpg` is normally distributed, but we cannot reject that `trunk` is normally distributed.

The values reported under W and W' are the Shapiro–Wilk and Shapiro–Francia test statistics. The tests also report V and V' ([Royston 1991d](#)), which are more appealing indexes for departure from normality. The median values of V and V' are 1 for samples from normal populations. Large values indicate nonnormality. There is no more information in $V(V')$ than in $W(W')$ —one is just the transform of the other.

➤ Example 2

We have data on a variable called `studytime`, which we suspect is distributed lognormally:

```
. use https://www.stata-press.com/data/r19/cancer
(Patient survival in drug trial)
. generate lnstudytime = ln(studytime)
. swilk lnstudytime
```

Shapiro–Wilk W test for normal data					
Variable	Obs	W	V	z	Prob>z
lnstudytime	48	0.92731	3.311	2.547	0.00543

We can reject the lognormal assumption. We do *not* specify the `lnnormal` option when testing for lognormality. The `lnnormal` option is for three-parameter lognormality.



➤ Example 3

Having discovered that $\ln(\text{studytime})$ is not distributed normally, we now test that $\ln(\text{studytime} - k)$ is normally distributed, where k is chosen so that the resulting skewness is zero. We obtain the estimate for k from `lnskew0`; see [R] [lnskew0](#):

```
. lnskew0 lnstudytimek = studytime, level(95)
```

Transform	k	[95% conf. interval]		Skewness
ln(studytim-k)	-11.01181	-infinity	-.9477328	-.0000173

```
. swilk lnstudytimek, lnnormal
```

Shapiro–Wilk W test for 3-parameter lognormal data					
Variable	Obs	W	V	z	Prob>z
lnstudytimek	48	0.97064	1.337	1.261	0.10363

We cannot reject the hypothesis that $\ln(\text{studytime} + 11.01181)$ is distributed normally. We do specify the `lnnormal` option when using an estimated value of k .



Stored results

`swilk` and `sfrancia` store the following in `r()`:

Scalars

<code>r(N)</code>	number of observations	<code>r(W)</code>	W or W'
<code>r(p)</code>	p -value	<code>r(V)</code>	V or V'
<code>r(z)</code>	z statistic		

Methods and formulas

The Shapiro–Wilk test is based on [Shapiro and Wilk \(1965\)](#) with a new approximation accurate for $4 \leq n \leq 2000$ ([Royston 1992](#)). The calculations made by `swilk` are based on [Royston \(1982, 1992, 1993b\)](#).

The Shapiro–Francia test ([Shapiro and Francia 1972](#); [Royston 1983](#); [Royston 1993a](#)) is an approximate test that is similar to the Shapiro–Wilk test for very large samples.

The relative merits of the Shapiro–Wilk and Shapiro–Francia tests the versus skewness and kurtosis test have been a subject of debate. The interested reader is directed to the articles in the *Stata Technical Bulletin*. Our recommendation is to use the Shapiro–Francia test whenever possible, that is, whenever dealing with nonaggregated or ungrouped data ([Gould and Rogers 1991](#); [Gould 1992b](#)); see [\[R\] swilk](#). If normality is rejected, use `sktest` to determine the source of the problem. As both [D’Agostino, Belanger, and D’Agostino \(1990\)](#) and [Royston \(1991c\)](#) mention, researchers should also examine the normal quantile plot to determine normality rather than blindly relying on a few test statistics. See the `qnorm` command documented in [\[R\] Diagnostic plots](#) for more information on normal quantile plots.

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Acknowledgment

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Also see

- [R] [Inskew0](#) — Find zero-skewness log or Box–Cox transform
- [R] [lv](#) — Letter-value displays
- [R] [sktest](#) — Skewness and kurtosis tests for normality
- [R] [Diagnostic plots](#) — Distributional diagnostic plots
- [MV] [mvtest normality](#) — Multivariate normality tests

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