

**pcorr** — Partial and semipartial correlation coefficients[Description](#)[Remarks and examples](#)[References](#)[Quick start](#)[Stored results](#)[Also see](#)[Menu](#)[Methods and formulas](#)[Syntax](#)[Acknowledgment](#)

## Description

`pcorr` displays the partial and semipartial correlation coefficients of a specified variable with each variable in a varlist after removing the effects of all other variables in the varlist. The squared correlations and corresponding significance are also reported.

## Quick start

Partial and semipartial correlations of `v1` with `v2`, `v3`, and `v4`

```
pcorr v1 v2 v3 v4
```

Same as above, but for each level of categorical variable `catvar`

```
by catvar: pcorr v1 v2 v3 v4
```

Partial and semipartial correlations of `v5` with `v6`, `v7`, and `v8`, and a one-period lag of `v5` using

```
tsset data
```

```
pcorr v5 L.v5 v6 v7 v8
```

## Menu

Statistics > Summaries, tables, and tests > Summary and descriptive statistics > Partial correlations

## Syntax

```
pcorr varname varlist [if] [in] [weight]
```

*varlist* may contain factor variables; see [U] 11.4.3 **Factor variables**.

*varname* and *varlist* may contain time-series operators; see [U] 11.4.4 **Time-series varlists**.

*by* and *collect* are allowed; see [U] 11.1.10 **Prefix commands**.

*aweight*s and *fweight*s are allowed; see [U] 11.1.6 **weight**.

## Remarks and examples

[stata.com](http://www.stata.com)

Assume that  $y$  is determined by  $x_1, x_2, \dots, x_k$ . The partial correlation between  $y$  and  $x_1$  is an attempt to estimate the correlation that would be observed between  $y$  and  $x_1$  if the other  $x$ 's did not vary. The semipartial correlation, also called part correlation, between  $y$  and  $x_1$  is an attempt to estimate the correlation that would be observed between  $y$  and  $x_1$  after the effects of all other  $x$ 's are removed from  $x_1$  but not from  $y$ .

Both squared correlations estimate the proportion of the variance of  $y$  that is explained by each predictor. The squared semipartial correlation between  $y$  and  $x_1$  represents the proportion of variance in  $y$  that is explained by  $x_1$  only. This squared correlation can also be interpreted as the decrease in the model's  $R^2$  value that results from removing  $x_1$  from the full model. Thus, one could use the squared semipartial correlations as criteria for model selection. The squared partial correlation between  $y$  and  $x_1$  represents the proportion of variance in  $y$  not associated with any other  $x$ 's that is explained by  $x_1$ . Thus, the squared partial correlation gives an estimate of how much of the variance of  $y$  not explained by the other  $x$ 's is explained by  $x_1$ .

### ► Example 1

Using our automobile dataset (described in [U] 1.2.2 **Example datasets**), we can obtain the simple correlations between price, mpg, weight, and foreign from `correlate` (see [R] **correlate**):

```
. use https://www.stata-press.com/data/r18/auto
(1978 automobile data)
. correlate price mpg weight foreign
(obs=74)
```

|         | price   | mpg     | weight  | foreign |
|---------|---------|---------|---------|---------|
| price   | 1.0000  |         |         |         |
| mpg     | -0.4686 | 1.0000  |         |         |
| weight  | 0.5386  | -0.8072 | 1.0000  |         |
| foreign | 0.0487  | 0.3934  | -0.5928 | 1.0000  |

Although `correlate` gave us the full correlation matrix, our interest is in just the first column. We find, for instance, that the higher the mpg, the lower the price. We obtain the partial and semipartial correlation coefficients by using `pcorr`:

```
. pcorr price mpg weight foreign
(obs=74)
```

Partial and semipartial correlations of price with

| Variable | Partial corr. | Semipartial corr. | Partial corr.^2 | Semipartial corr.^2 | Significance value |
|----------|---------------|-------------------|-----------------|---------------------|--------------------|
| mpg      | 0.0352        | 0.0249            | 0.0012          | 0.0006              | 0.7693             |
| weight   | 0.5488        | 0.4644            | 0.3012          | 0.2157              | 0.0000             |
| foreign  | 0.5402        | 0.4541            | 0.2918          | 0.2062              | 0.0000             |

We now find that the partial and semipartial correlations of `price` with `mpg` are near 0. In the simple correlations, we found that `price` and `foreign` were virtually uncorrelated. In the partial and semipartial correlations, we find that `price` and `foreign` are positively correlated. The nonsignificance of `mpg` tells us that the amount in which  $R^2$  decreases by removing `mpg` from the model is not significant. We find that removing either `weight` or `foreign` results in a significant drop in the  $R^2$  of the model.

◀

## □ Technical note

Use caution when interpreting the above results. As we said at the outset, the partial and semipartial correlation coefficients are an *attempt* to estimate the correlation that would be observed if the effects of all other variables were taken out of both  $y$  and  $x$  or only  $x$ . `pcorr` makes it too easy to ignore the fact that we are fitting a model. In the example above, the model is

$$\text{price} = \beta_0 + \beta_1 \text{mpg} + \beta_2 \text{weight} + \beta_3 \text{foreign} + \epsilon$$

which is, in all honesty, a rather silly model. Even if we accept the implied economic assumptions of the model—that consumers value `mpg`, `weight`, and `foreign`—do we really believe that consumers place equal value on every extra 1,000 pounds of weight? That is, have we correctly parameterized the model? If we have not, then the estimated partial and semipartial correlation coefficients may not represent what they claim to represent. Partial and semipartial correlation coefficients are a reasonable way to summarize data if we are convinced that the underlying model is reasonable. We should not, however, pretend that there is no underlying model and that these correlation coefficients are unaffected by the assumptions and parameterization.

□

## Stored results

`pcorr` stores the following in `r()`:

### Scalars

`r(N)`            number of observations  
`r(df)`            degrees of freedom

### Matrices

`r(p_corr)`        partial correlation coefficient vector  
`r(sp_corr)`        semipartial correlation coefficient vector

## Methods and formulas

Results are obtained by fitting a linear regression of `varname` on `varlist`; see [R] `regress`. The partial correlation coefficient between `varname` and each variable in `varlist` is then calculated as

$$\frac{t}{\sqrt{t^2 + n - k}}$$

(Greene 2018, 39), where  $t$  is the  $t$  statistic,  $n$  is the number of observations, and  $k$  is the number of independent variables, including the constant but excluding any dropped variables.

The semipartial correlation coefficient between *varname* and each variable in *varlist* is calculated as

$$\text{sign}(t) \sqrt{\frac{t^2(1 - R^2)}{n - k}}$$

(Cohen et al. 2003, 89), where  $R^2$  is the model  $R^2$  value, and  $t$ ,  $n$ , and  $k$  are as described above.

The significance is given by  $2\Pr(t_{n-k} > |t|)$ , where  $t_{n-k}$  follows a Student's  $t$  distribution with  $n - k$  degrees of freedom.

## Acknowledgment

The addition of semipartial correlation coefficients to `pcorr` is based on the `pcorr2` command by Richard Williams of the Department of Sociology at the University of Notre Dame.

## References

- Cohen, J., P. Cohen, S. G. West, and L. S. Aiken. 2003. *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences*. 3rd ed. Hillsdale, NJ: Erlbaum.
- Greene, W. H. 2018. *Econometric Analysis*. 8th ed. New York: Pearson.

## Also see

- [R] `correlate` — Correlations of variables
- [R] `spearman` — Spearman's and Kendall's correlations

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