xtdata — Faster specification searches with xt data

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Description

`xtdata` produces a transformed dataset of the variables specified in *varlist* or of all the variables in the data. Once the data are transformed, Stata's `regress` command may be used to perform specification searches more quickly than `xtreg`; see [R] **regress** and [XT] **xtreg**. Using `xtdata, re` also creates a variable named `constant`. When using `regress` after `xtdata, re`, specify `noconstant` and include `constant` in the regression. After `xtdata, be` and `xtdata, fe`, you need not include `constant` or specify `regress`'s `noconstant` option.

Quick start

Convert data to a form suitable for random-effects estimation using `xtset` data

```
xtdata, re
```

Same as above, but convert only variables `v1`, `v2` and `v3`

```
xtdata v1 v2 v3, re
```

Convert all variables beginning with `prefix` to a form suitable for fixed-effects estimation

```
xtdata prefix*, fe
```

Convert data for between estimation if the dataset has changed since last `save`

```
xtdata, be clear
```

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Syntax

```
xtdata [varlist] [if] [in] [, options]
```

options	Description
Main	
`re`	convert data to a form suitable for random-effects estimation
`ratio(#)`	ratio of random effect to pure residual (standard deviations)
`be`	convert data to a form suitable for between estimation
`fe`	convert data to a form suitable for fixed-effects (within) estimation
`nodouble`	keep original variable type; default is to recast type as `double`
`clear`	overwrite current data in memory

A panel variable must be specified; use `xtset`; see [XT] **xtset**.

Options

Main

`re` specifies that the data be converted into a form suitable for random-effects estimation. `re` is the default if `be`, `fe`, or `re` is not specified. `ratio()` must also be specified.

`ratio(#)` (use with `xtdata, re` only) specifies the ratio $\sigma_\nu/\sigma_\epsilon$, which is the ratio of the random effect to the pure residual. This is the ratio of the standard deviations, not the variances.

`be` specifies that the data be converted into a form suitable for between estimation.

`fe` specifies that the data be converted into a form suitable for fixed-effects (within) estimation.

`nodouble` specifies that transformed variables keep their original types, if possible. The default is to recast variables to `double`.

Remember that `xtdata` transforms variables to be differences from group means, pseudodifferences from group means, or group means. Specifying `nodouble` will decrease the size of the resulting dataset but may introduce roundoff errors in these calculations.

`clear` specifies that the data may be converted even though the dataset has changed since it was last saved on disk.

Remarks and examples

If you have not read [XT] **xt** and [XT] **xtreg**, please do so.

The formal estimation commands of `xtreg`—see [XT] **xtreg**—do not produce results instantaneously, especially with large datasets. Equations (2), (3), and (4) of [XT] **xtreg** describe the data necessary to fit each of the models with OLS. The idea here is to transform the data once to the appropriate form and then use `regress` to fit such models more quickly.

▷ Example 1

We will use the example in [XT] **xtreg** demonstrating between-effects regression. Another way to estimate the between equation is to convert the data in memory to the between data:

```
. use https://www.stata-press.com/data/r19/nlswork
(National Longitudinal Survey of Young Women, 14-24 years old in 1968)
. generate age2=age^2
(24 missing values generated)
. generate ttl_exp2 = ttl_exp^2
. generate tenure2=tenure^2
(433 missing values generated)
. generate byte black = race==2
. xtdata ln_w grade age* ttl_exp* tenure* black not_smsa south, be clear
. regress ln_w grade age* ttl_exp* tenure* black not_smsa south
```

Source	SS	df	MS	Number of obs	=	4,697
				F(10, 4686)	=	450.23
Model	415.021613	10	41.5021613	Prob > F	=	0.0000
Residual	431.954995	4,686	.092179896	R-squared	=	0.4900
				Adj R-squared	=	0.4889
Total	846.976608	4,696	.180361288	Root MSE	=	.30361

ln_wage	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
grade	.0607602	.0020006	30.37	0.000	.0568382	.0646822
age	.0323158	.0087251	3.70	0.000	.0152105	.0494211
age2	-.0005997	.0001429	-4.20	0.000	-.0008799	-.0003194
(*output omitted*)						
south	-.0993378	.010136	-9.80	0.000	-.1192091	-.0794665
_cons	.3339113	.1210434	2.76	0.006	.0966093	.5712133

The output is the same as that produced by `xtreg, be`; the reported R^2 is the R^2 between. Using `xtdata` followed by just one `regress` does not save time. Using `xtdata` is justified when you intend to explore the specification of the model by running many alternative regressions.

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❑ Technical note

When using `xtdata`, you must eliminate any variables that you do not intend to use and that have missing values. `xtdata` follows a casewise-deletion rule, which means that an observation is excluded from the conversion if it is missing on any of the variables. In the example above, we specified that the variables be converted on the command line. We could also drop the variables first, and it might even be useful to preserve our estimation sample:

```
. use https://www.stata-press.com/data/r19/nlswork, clear
(National Longitudinal Survey of Young Women, 14-24 years old in 1968)
. generate age2=age^2
(24 missing values generated)
. generate ttl_exp2 = ttl_exp^2
. generate tenure2=tenure^2
(433 missing values generated)
. generate byte black = race==2
. keep id year ln_w grade age* ttl_exp* tenure* black not_smsa south
. save xtdatasmpl
file xtdatasmpl.dta saved
```

❑

Example 2

xtdata with the fe option converts the data so that results are equivalent to those from estimating by using xtreg with the fe option.

```
. xtdata, fe
. regress ln_w grade age* ttl_exp* tenure* black not_smsa south
note: grade omitted because of collinearity.
note: black omitted because of collinearity.
```

Source	SS	df	MS	Number of obs	=	28,091
				F(8, 28082)	=	732.64
Model	412.443881	8	51.5554852	Prob > F	=	0.0000
Residual	1976.12232	28,082	.070369714	R-squared	=	0.1727
				Adj R-squared	=	0.1724
Total	2388.5662	28,090	.085032617	Root MSE	=	.26527

ln_wage	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
grade	0	(omitted)				
age	.0359987	.0030903	11.65	0.000	.0299415	.0420558
age2	-.000723	.0000486	-14.88	0.000	-.0008183	-.0006277
ttl_exp	.0334668	.0027061	12.37	0.000	.0281627	.0387708
ttl_exp2	.0002163	.0001166	1.86	0.064	-.0000122	.0004447
tenure	.0357539	.0016871	21.19	0.000	.0324472	.0390606
tenure2	-.0019701	.0001141	-17.27	0.000	-.0021937	-.0017465
black	0	(omitted)				
not_smsa	-.0890108	.0086982	-10.23	0.000	-.1060597	-.0719619
south	-.0606309	.0099761	-6.08	0.000	-.0801845	-.0410772
_cons	1.03732	.0443093	23.41	0.000	.9504716	1.124168

The coefficients reported by regress after xtdata, fe are the same as those reported by xtreg, fe, but the standard errors are slightly smaller. This is because no adjustment has been made to the estimated covariance matrix for the estimation of the person means. The difference is small, however, and results are adequate for a specification search.

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Example 3

To use xtdata, re, you must specify the ratio $\sigma_\nu/\sigma_\epsilon$, which is the ratio of the standard deviations of the random effect and pure residual. Merely to show the relationship of regress after xtdata, re to xtreg, re, we will specify this ratio as $0.25790526/0.29068923 = 0.88721987$, which is the number xtreg reports when the model is fit from the outset; see the random-effects example in [XT] **xtreg**. For specification searches, however, it is adequate to specify this number more crudely, and, when performing the specification search for this manual entry, we used ratio(1).

```
. use https://www.stata-press.com/data/r19/xtdatasmpl, clear
(National Longitudinal Survey of Young Women, 14-24 years old in 1968)
. xtdata, clear re ratio(.88721987)
```

theta				
min	5%	median	95%	max
0.2520	0.2520	0.5499	0.7016	0.7206

xtdata reports the distribution of θ based on the specified ratio. If these were balanced data, θ would have been constant.

When running regressions with these data, you must specify the noconstant option and include the variable constant:

```
. regress ln_w grade age* ttl_exp* tenure* black not_smsa south constant,
> noconstant
```

Source	SS	df	MS	Number of obs	=	28,091
				F(11, 28080)	=	14302.56
Model	13271.7208	11	1206.52007	Prob > F	=	0.0000
Residual	2368.74223	28,080	.084356917	R-squared	=	0.8486
				Adj R-squared	=	0.8485
Total	15640.463	28,091	.556778435	Root MSE	=	.29044

ln_wage	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
grade	.0646499	.0017812	36.30	0.000	.0611587	.0681411
age	.0368059	.0031195	11.80	0.000	.0306915	.0429203
age2	-.0007133	.00005	-14.27	0.000	-.0008113	-.0006153
(*output omitted*)						
south	-.0868922	.0073032	-11.90	0.000	-.1012068	-.0725775
constant	.2387206	.049469	4.83	0.000	.141759	.3356822

Results are the same coefficients and standard errors that xtreg, re estimated in example 4 of [XT] **xtreg**. The summaries at the top, however, should be ignored, as they are expressed in terms of (4) of [XT] **xtreg**, and, moreover, for a model without a constant.

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❑ Technical note

Using xtdata requires some caution. The following guidelines may help:

1. xtdata is intended for use only during the specification search phase of analysis. Results should be estimated with xtreg on unconverted data.
2. After converting the data, you may use regress to obtain estimates of the coefficients and their standard errors. For regress after xtdata, fe, the standard errors are too small, but only slightly.
3. You may loosely interpret the coefficient's significance tests and confidence intervals. However, for results after xtdata, fe and re, an incorrect (but close to correct) distribution is assumed.
4. You should ignore the summary statistics reported at the top of regress's output.
5. After converting the data, you may form linear, but not nonlinear, combinations of regressors; that is, if your data contained age, it would not be correct to convert the data and then form age squared. All nonlinear transformations should be done before conversion. (For xtdata, be, you can get away with forming nonlinear combinations ex post, but the results will not be exact.)

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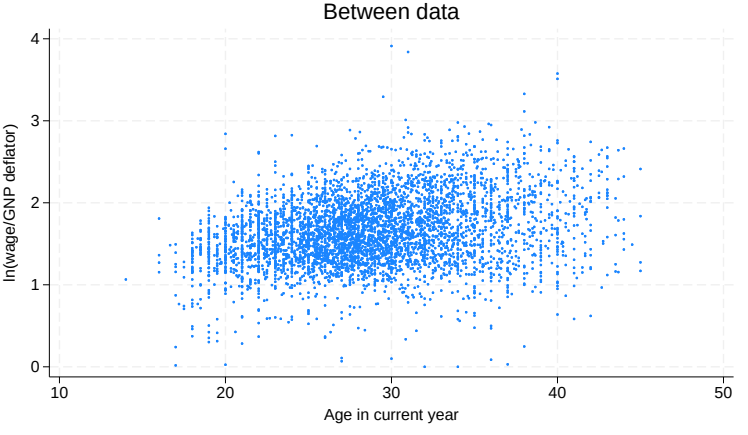
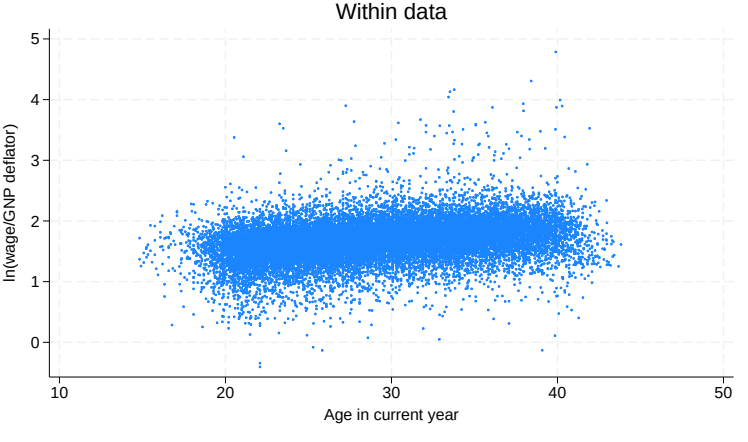
❑ Technical note

The xtdata command can be used to help you examine data, especially with scatter.

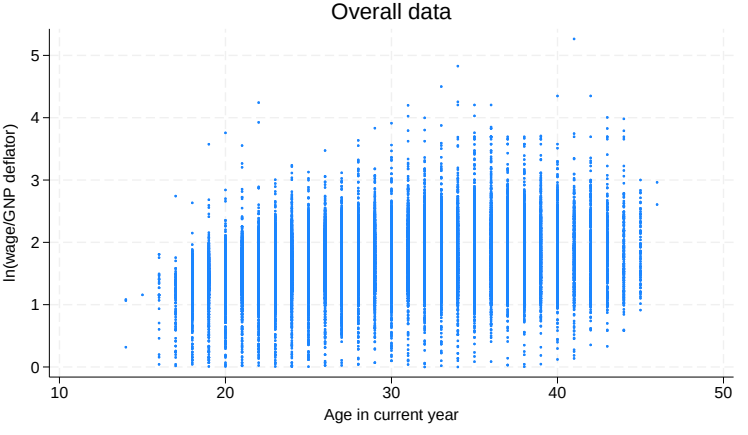
```
. use https://www.stata-press.com/data/r19/xtdatasmpl, clear
(National Longitudinal Survey of Young Women, 14-24 years old in 1968)
. xtdata, be
. scatter ln_wage age, title(Between data) msymbol(o) msize(tiny)
```




```
. use https://www.stata-press.com/data/r19/xtdatasmpl, clear
(National Longitudinal Survey of Young Women, 14-24 years old in 1968)
. xtdata, fe
. scatter ln_wage age, title(Within data) msymbol(o) msize(tiny)
```



```
. use https://www.stata-press.com/data/r19/xtdatasmpl, clear
(National Longitudinal Survey of Young Women, 14-24 years old in 1968)
. scatter ln_wage age, title(Overall data) msymbol(o) msize(tiny)
```



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Methods and formulas

(This section is a continuation of the *Methods and formulas* of [XT] **xtreg**.)

`xtdata, be`, `fe`, and `re` transform the data according to (2), (3), and (4), respectively, of [XT] **xtreg**, except that `xtdata, fe` adds back in the overall mean, thus forming the transformation

$$\mathbf{x}_{it} - \overline{x}_i + \overline{\overline{x}}$$

`xtdata, re` requires the user to specify r as an estimate of $\sigma_\nu/\sigma_\epsilon$. θ_i is calculated from

$$\theta_i = 1 - \frac{1}{\sqrt{T_i r^2 + 1}}$$

Also see

[XT] **xtsum** — Summarize xt data