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Stata tip 88: Efficiently evaluating elasticities with the margins command

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The new `margins` command, available in Stata 11, greatly simplifies many postestimation computations. Discussions of this command have justifiably highlighted its capabilities to work with factor variables and expressions involving factor-variable operators, such as `c.x#c.x`. But you may find another aspect of `margins` very useful: its ability to compute quantities such as elasticities and semielasticities with a much simpler command syntax than that previously available.

As discussed in [R] **margins**, under the section titled *Expressing derivatives as elasticities*, the elasticity of y with respect to x is the proportional change in y for a proportional change in x. A semielasticity such as `eydx` is the proportional change in y from a unit change in x.

For instance, we might estimate a linear regression equation for per capita expenditures on gasoline in the U.S. market from a time-series dataset:

```
. use http://fmwww.bc.edu/ec-p/data/Greene2008/GasolineMarket
. tsset Year, yearly
        time variable:  Year, 1953 to 2004
                delta:  1 year
. generate gaspc = GasExp/(Gasp*(Pop/1e6))
. generate lngaspc = log(gaspc)
. local allreg Income Gasp PNC PUC PPT PD PN PS
```



```
. regress gaspc `allreg´ Year
```

Source	SS	df	MS		
Model	56.7083042	9	6.30092268	Number of obs	= 52
Residual	.49854905	42	.011870215	F(9, 42)	= 530.82
				Prob > F	= 0.0000
				R-squared	= 0.9913
				Adj R-squared	= 0.9894
Total	57.2068532	51	1.121703	Root MSE	= .10895

gaspc	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
Income	.0002157	.0000518	4.17	0.000	.0001113	.0003202
Gasp	-.0110838	.0039781	-2.79	0.008	-.019112	-.0030557
PNC	.0005774	.0128441	0.04	0.964	-.0253432	.0264979
PUC	-.0058746	.0048703	-1.21	0.234	-.0157033	.0039541
PPT	.0069073	.0048361	1.43	0.161	-.0028524	.016667
PD	.0012289	.0118818	0.10	0.918	-.0227495	.0252072
PN	.0126905	.012598	1.01	0.320	-.0127333	.0381142
PS	-.0280278	.0079962	-3.51	0.001	-.0441649	-.0118907
Year	.0725037	.0141828	5.11	0.000	.0438816	.1011257
_cons	-140.4213	27.19985	-5.16	0.000	-195.3128	-85.5298

```
. estimates store a
```

Let us say that we wish to calculate elasticities for the year 2004, using the regressors' values in that year. Using pre–Stata 11 syntax, we must store the regression estimates (as above) so that we can use the e-class command `mean` to evaluate the regressors' values in that year and store them in a row vector, `x2004`. We can then restore the regression estimates and use `mfx compute, eyex` to compute the elasticities, with its `at()` option specifying the point in the regressors' space at which they are to be evaluated:

```
. // elasticities at means: compute at t=2004 the old way (with mfx)
. quietly mean `allreg´ Year if Year==2004
. matrix x2004 = e(b)
. estimates restore a
(results a are active now)
. mfx compute, eyex at(x2004)
Elasticities after regress
      y  = Fitted values (predict)
         =  6.1726971
```

variable	ey/ex	Std. Err.	z	P>|z|	[95% C.I.]		X
Income	.9476599	.2263	4.19	0.000	.504127	1.39119	27113
Gasp	-.2224796	.08093	-2.75	0.006	-.381102	-.063857	123.901
PNC	.0125245	.2786	0.04	0.964	-.533521	.55857	133.9
PUC	-.1268632	.10488	-1.21	0.226	-.332432	.078706	133.3
PPT	.2339837	.16441	1.42	0.155	-.08826	.556228	209.1
PD	.0228545	.22098	0.10	0.918	-.410256	.455965	114.8
PN	.3540265	.35281	1.00	0.316	-.337474	1.04553	172.2
PS	-1.011648	.29332	-3.45	0.001	-1.58654	-.436759	222.8
Year	23.53872	4.63929	5.07	0.000	14.4459	32.6316	2004

In contrast, what if we used `margins` to make this computation? We need not store the regression estimates, and one command does the job:

```
. // elasticities at means: compute at t=2004 the new way (with margins)
. margins if Year==2004, eyex(_all) at((means) _all)
Conditional marginal effects                      Number of obs   =          1
Model VCE    : OLS

Expression   : Linear prediction, predict()
ey/ex w.r.t. : Income Gasp PNC PUC PPT PD PN PS Year
at           : Income          =       27113 (mean)
               Gasp            =     123.901 (mean)
               PNC             =       133.9 (mean)
               PUC             =       133.3 (mean)
               PPT             =       209.1 (mean)
               PD              =       114.8 (mean)
               PN              =       172.2 (mean)
               PS              =       222.8 (mean)
               Year            =        2004 (mean)
```

	Delta-method ey/ex	Std. Err.	z	P>|z|	[95% Conf.	Interval]
Income	.9476599	.2262966	4.19	0.000	.5041268	1.391193
Gasp	-.2224796	.0809311	-2.75	0.006	-.3811017	-.0638575
PNC	.0125245	.2786	0.04	0.964	-.5335214	.5585704
PUC	-.1268632	.1048839	-1.21	0.226	-.332432	.0787055
PPT	.2339837	.1644132	1.42	0.155	-.0882602	.5562276
PD	.0228545	.2209787	0.10	0.918	-.4102557	.4559647
PN	.3540265	.3528127	1.00	0.316	-.3374737	1.045527
PS	-1.011648	.2933159	-3.45	0.001	-1.586536	-.4367592
Year	23.53872	4.639292	5.07	0.000	14.44587	32.63156

We merely indicate, with an `if` *exp* clause, that we want marginal effects for the year 2004; that elasticities are to be computed for `_all` regressors; and that they are to be computed at the regressors' means (which are, of course, single values for that year).

We would find it just as straightforward to compute elasticities over the range of regressors' values, for instance, at deciles of their respective distributions. The resulting estimates could be stored in a Stata matrix:

```
. // calculate elasticities at deciles over full sample:
. forvalues i=10(10)90 {
  2.         quietly margins, eyex(_all) at((p`i´) _all)
  3.         local rn "`rn´ p`i´"
  4.         matrix nu = nullmat(nu) \ r(b)
  5. }
. matrix rownames nu = `rn´
```

(*Continued on next page*)

```
. matrix list nu, format(%6.3f) ti("Elasticities")
nu[9,9]:  Elasticities
     Income    Gasp     PNC     PUC     PPT      PD      PN      PS    Year
p10   0.637  -0.063   0.009  -0.045   0.045   0.014   0.124  -0.196  43.934
p20   0.604  -0.057   0.008  -0.045   0.045   0.013   0.112  -0.192  38.315
p30   0.614  -0.051   0.007  -0.040   0.044   0.011   0.104  -0.187  31.412
p40   0.620  -0.052   0.006  -0.039   0.052   0.011   0.115  -0.214  27.265
p50   0.668  -0.098   0.008  -0.063   0.068   0.016   0.172  -0.334  26.614
p60   0.762  -0.149   0.011  -0.119   0.136   0.024   0.243  -0.547  26.836
p70   0.798  -0.149   0.012  -0.122   0.157   0.024   0.264  -0.650  25.338
p80   0.814  -0.150   0.013  -0.136   0.206   0.025   0.301  -0.791  25.029
p90   0.852  -0.150   0.013  -0.144   0.220   0.025   0.310  -0.854  23.397
```

We might also want to hold some regressors' values fixed and vary others across their decile ranges. This can be easily implemented with the `at()` option. For instance,

```
margins, eyex(_all) at((p25) Income (median) Gasp PNC PUC PPT PD PN PS)
```

would compute elasticities at the 25th percentile of `Income` and at the median values of other regressors.