## **STata** Features

# **Maximum likelihood estimation**

	🔄 regress - Linear regression — 🗌 🗙
• Over a thousand built-in estimators	Model by/if/in Weights SE/Robust Reporting
Intuitive and consistent syntax	Dependent variable: Independent variables: y v im x1 x2 v im
Survey data support	Treatment of constant
Program vour own estimators	Suppress constant term
e nogram your own estimators	Total SS with constant (advanced)
Numerical or analytical derivatives	
<ul> <li>Standard errors: OIM, OPG, Robust–Huber/White/sandwich, cluster–robust, bootstrap, jackknife, and more</li> </ul>	
Powerful postestimation features	
Use point and click or type commands	
	? C B OK Cancel Submit

## Stata offers over a thousand built-in ML estimators

All follow elegant and intuitive syntax and have consistent output. Learn one command, know how to use them all.

Linear regression

. regress y x1 x2

Logistic regression

. logistic y x1 x2

Poisson regression

. poisson y x1 x2

Poisson regression with identity link (GLM)

```
. glm y x1 x2, family(poisson) link(identity)
```

ARIMA/ARMAX

. arima y x1 x2, arima(2,1,3)

Logistic regression with survey data

. svy: logistic y x1 x2

After estimation, easily access powerful postestimation features.

#### . postest

Postestimation Selector –		X
Postestimation commands:		
Harginal effects, estimated means, interactions,	Laund	:h
Fests, contrasts, and comparisons of parameter estimates		
-Linear tests of parameter estimates		
- Nonlinear tests of parameter estimates		
Contrasts		
- Contrasts of margins		
- Pairwise comparisons		
Pairwise comparisons of margins		
-Linear expressions of parameter estimates		
- Nonlinear expressions of parameter estimates		
Likelihood-ratio test comparing models		
Seemingly unrelated regression by combining models		
E Specification, diagnostic, and goodness-of-fit analysis		
Predictions		
Other reports		
Hanage estimation results		
	1	
	Can	cel

## Write your own ML estimators

Stata offers a powerful environment for you to add your own ML estimators. For log likelihoods that can be written as simple expressions, just type the expression in the **mlexp** command. For more complicated expressions, you can write a program in Stata's scripting or matrix language and use the **ml** suite to do the rest for you. You can even turn your ML evaluator into a command.

### Type a simple expression

Use **mlexp** when your log likelihood can be expressed simply. For example, for normal linear regression, type

	ml1.smcl				_		×
view ml1.smcl	×						,
•					Dialog 👻 Als	o see 🕶 🛛 Jumj	o to •
<pre>mlexp (ln(ne</pre>	ormalden(y, {b	1}*x + {b0]	}, {sigma	})))			
aximum likel:	ihood estimati	.on					
aximum likel: og likelihoo	ihood estimati d = -195.38869	.on			Number d	of obs = 74	
aximum likel: og likelihood	ihood estimati d = -195.38869	.on			Number d	of obs = 74	
aximum likel: og likelihoo	ihood estimati d = -195.38869 Coefficient	.on Std. err.	z	P> z	Number o	of obs = 74 . interval]	+ -
aximum likel: og likelihood /b1	ihood estimati d = -195.38869 Coefficient 6008687	.on Std. err. .0510832	z -11.76	P> z  0.000	Number of [95% conf.	of obs = 74 . interval] 5007475	+ - -
aximum likel: og likelihoon /b1 /b0	<pre>ihood estimati d = -195.38869 Coefficient    6008687     39.44028</pre>	Std. err. .0510832 1.592043	z -11.76 24.77	P> z  0.000 0.000	Number of [95% conf. 7009899 36.31994	of obs = 74 . interval] 5007475 42.56063	+ - -

#### Write a program

Write a program to evaluate more complicated likelihood functions.

🧉 Do-file Editor	mynormal_lf				-		×
mynormal_lf	<						
1 Program m 2 versi 3 args 4 quiet 5 end	ynormal_lf on 18 lnfj xb sigma ly replace `lr	nfj' = lnno	rmalden(\$	ML_y1, `	xb', `sigma')		
		•			Line: 7, Col: 1	CAP NUM	OVR
Viewer - view	ml2.smcl						×
view ml2.smcl	×						
+					Dialog 👻 Als	o see 🖌 🛛 Ju	imp to
. ml model 1 <del>1</del> . ml display Log likelihoo	mynormal_l† ( d = -195.38869	(y = x) (sig	gma:), ma:	ximize	Number of o Wald chi2(1 Prob > chi2	bs = ) = 138. = 0.00	74 36 900
у	Coefficient	Std. err.	z	P> z	[95% conf	. interva	1]
eq1 x _cons	6008687 39.44028	.0510832 1.592043	-11.76 24.77	0.000	7009899 36.31994	50074 42.566	175 963
sigma _cons	3.392099	.2788288	12.17	0.000	2.845605	3,9385	594

#### Type a simple expression

With another small program, you can turn your likelihood-evaluation program into a full-fledged Stata command.

📔 Do-fil	e Editor -	mynormal				-		$\times$
mynorr	nal X							-
1 🖓 pr	rogram	mynormal						_
2	vers	ion 18						- 1
4	// P svnt	arse command s ax varlist [.	*1					- 1
5	gett	oken depvar xv	/ars : varl:	ist				- 1
6	// m	aximize the li	ikelihood					- 1
7	ml m	odel 1f mynorn maximi	nal_lf (`dep	ovar'= `	xvars')	(sigma:), ///		- 1
9	ml d	isplay	ize options	2				_
10 er	nd	1.1						
			•			Line: 12, Col: 1	AP NUM	OVR
(a) Vienne		al2 ana d						~
• viewe	er - view r	nis.smci						^
view ml	3.smcl	×						
+						Dialog 👻 Also	see 👻 🛛 Ju	imp to 🔻
. mynor	maly >	ĸ						
						Number of obs	S = - 139	74
Log lik	elihood	d = -195.38869				Prob > chi2	= 138.	000
	V	Coefficient	Std err	7	PNIZI	[95% conf	interva	
	y	coerricient	Sea. err.	2	12141	[55% com.	Incerve	
eq1								- 1
	×	6008687	.0510832	-11.76	0.000	7009899	50074	175
	_cons	39.44028	1.592043	24.77	0.000	36.31994	42.566	163
sigma								
-	_cons	3.392099	.2788288	12.17	0.000	2.845605	3.9385	594
						C/	AP NUM	INS

Your new command automatically has many nice features such as options for robust and cluster–robust standard errors without any extra programming effort.

- . mynormal y x, vce(robust)
- . mynormal y x, vce(cluster id)

With a few more lines of code, your command can even support survey data,

. svy: mynormal y x

Your command will also automatically work with postestimation features such as Wald tests, likelihood-ratio tests, contrasts, and much more.

## stata.com/mle

© 2023 StataCorp LLC | Stata is a registered trademark of StataCorp LLC, 4905 Lakeway Drive, College Station, TX 77845, USA.