
Practical Methods for Estimating Strategic Models

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Roadmap

- Programming your own routines
- STRAT
- Iterated method

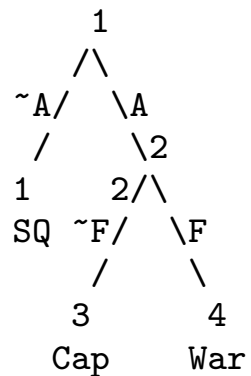
Programming

- Use a statistical program like Gauss, Stata, or R, that has a programming language and a built-in maximization procedure
- Elements
 - Main program – loads data, defines variables, sets starting values, identifies log-likelihood procedure
 - Log-likelihood procedure – takes estimates and data and returns log-likelihood value

Gauss Example of Deterrence Model

```
/******  
Extensive form game used here is very simple:
```

Attacker chooses between Not Attack and Attack. If Not Attack, then game ends at node 1, SQ. If Attack, then the Defender chooses between actions Not Fight and Fight. If Defender chooses Not Fight, then the outcome is node 3, Capitulation (or, possibly, Negotiation). If Defender chooses Fight, then the outcome is node 4, War.



Curt Signorino, Ahmer Tarar

```
*****/  
proc ldeter(b,data);  
  local y,b11,b14,b24,x11,x14,x24,u11,u13,u14,u23,u24,p1,p2,p3,p4,l1ik,  
        vDef,vAtt,b130,b140,b240;  
  
  y=data[.,1];  
  data=trimr(data',1,0)';  
  b11=b[1:_rSQ];
```

```

b=trimr(b,_rSQ,0);
b130=b[1];
b=trimr(b,1,0);
b14=b[1:_rAtt];
b24=b[_rAtt+1:_rAtt+_rDef];
x11=data[:,1:_rSQ];
x14=data[:,_rSQ+1:_rSQ+_rAtt];
x24=data[:,_rSQ+_rAtt+1:_rSQ+_rAtt+_rDef];
u11=x11*b11;
u13=b130;
u14=x14*b14;
u23=0;
u24=x24*b24;
p4=cdfn((u24-u23)./sqrt(2));
p3=1-p4;
p2=cdfn(((p3.*u13+p4.*u14)-u11)./sqrt(p3^2+p4^2+1));
p1=1-p2;

llik=(y.==1).*ln(p1)+(y.==3).*(ln(p2)+ln(p3))+(y.==4).*(ln(p2)+ln(p4));
retp(llik);
endp;

```

```
/******
```

```
Program to run payoff perturbation strategic probit on Huth 1988  
APSR paper data
```

```
Ahmer Tarar, Curt Signorino
```

```
*****/
```

```
new;
```

```
library maxlik;
```

```
clear nuclear, milallia, milarm, fortrade, pastdet, armed, capitu,  
  putdown, stalemat, diplo, firmflex, tft, ibf, sbf, lbf, outcome, deter,  
  _rsq,_ratt,_rdef;
```

```
maxset;
```

```
ds="huth";           @ dataset @  
let vSQ= tft;       @ sq vars @  
let vAtt=nuclear ibf sbf lbf ;   @ attacker vars @  
let vDef=nuclear ibf sbf lbf contigdp; @ defender vars @  
_rSQ=rows(vSQ);     @ # vars @  
_rAtt=rows(vAtt);  
_rDef=rows(vDef);  
let dep=outcome;   @ set dep var @  
ind=vSQ|vAtt|vDef;  
vars=dep|ind;      @ total vars to send @  
_max_parnames=vSQ|"b130"|vAtt|vDef; @ variable names @  
stval=rndu(rows(_max_parnames),1).*0.1; @ starting values @
```

```
{b,logl,g,vc,ret}=maxprt(maxlik(ds,vars,&ldeter,stval)); @ maximization @
```

STRAT

- Full Information Maximum Likelihood System Estimation
- Six models
- Agent error or Private info
- Estimated probabilities, graphs

To run:

- Install STRAT13.ZIP into c:\strat directory.
- type `gsrun` at command prompt, or double-click on it.
- type `run strat13.gcg` from within `gsrun`
- STRAT will appear in separate window

Iterated Method

So what do you do if you can't program in Gauss and if your model is not included in STRAT?

Signorino, Walker, & Bas paper

- Provides simple, iterated method for estimating strategic models
 - Use logit recursively up the tree
- Researcher only needs to know
 1. How to use logit or probit in a standard software package (e.g., Stata or SPSS)
 2. How to transform variables in that package
 3. How to use the “bootstrap” command in that package
- Example from Signorino, Walker, & Bas