

13.2) Three-Stage Least Squares (3SLS)

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Wooldridge (2010). **Econometric Analysis of Cross Section and Panel Data.** Ch 9

<https://ebookcentral.proquest.com/lib/wayne/detail.action?docID=3339196&>

Mroz (1987)

```
import pandas as pd
from linearmodels import IV2SLS, IV3SLS, IVSystemGMM

file="https://github.com/VitorKamada/ECO7110/raw/master/Data/mroz.dta"
df = pd.read_stata(file)
df.head()
```

	inlf	hours	kidslt6	kidsge6	age	educ	wage
0	1	1610	1	0	32	12	3.3540
1	1	1656	0	2	30	12	1.3889
2	1	1980	1	3	35	12	4.5455
3	1	456	0	3	34	12	1.0965

```
Eq1 = 'hours ~ educ + age + kidslt6 + nwifeinc + [lwage ~ exper + expersq]'
```

```
Hours = IV2SLS.from_formula(Eq1, df).fit()
```

	Parameter	Std. Err.	T-stat	P-value
educ	-99.304	53.620	-1.8520	0.0640
age	19.429	5.9719	3.2534	0.0011
kidslt6	-51.608	209.01	-0.2469	0.8050
nwifeinc	-11.444	5.2296	-2.1882	0.0287
lwage	1626.4	588.44	2.7638	0.0057

```
Eq2 = 'lwage ~ educ + exper + expersq + [hours ~ age + kidslt6 + nwifeinc]'
```

```
Lwage = IV2SLS.from_formula(Eq2, df).fit()
```

	Parameter	Std. Err.	T-stat	P-value
educ	0.0875	0.0181	4.8376	0.0000
exper	0.0524	0.0338	1.5479	0.1216
expersq	-0.0009	0.0007	-1.3496	0.1772
hours	-0.0003	0.0004	-0.7751	0.4383

```
Eq = dict(hours= Eq1, lwage = Eq2)
```

```
IV3SLS = IV3SLS.from_formula(Eq, df).fit(method='gls')
```

	Parameter	Std. Err.	T-stat	P-value
educ	-109.90	11.982	-9.1722	0.0000
age	13.651	4.2605	3.2041	0.0014
kidslt6	-196.61	101.76	-1.9320	0.0534
nwifeinc	-6.4128	4.7852	-1.3401	0.1802
lwage	1872.7	144.99	12.916	0.0000

	Parameter	Std. Err.	T-stat	P-value
educ	0.0859	0.0250	3.4288	0.0006
exper	0.0550	0.0484	1.1368	0.2556
expersq	-0.0010	0.0010	-1.0477	0.2948
hours	-0.0003	0.0005	-0.5235	0.6006

```
GMM = IVSystemGMM.from_formula(Eq, df,
                                weight_type='robust').fit(cov_type='robust')
```

	Parameter	Std. Err.	T-stat	P-value
educ	-122.62	58.608	-2.0922	0.0364
age	14.728	6.0138	2.4491	0.0143
kidslt6	-227.73	218.43	-1.0426	0.2971
nwifeinc	-8.2514	5.3129	-1.5531	0.1204
lwage	1989.5	600.74	3.3117	0.0009

	Parameter	Std. Err.	T-stat	P-value
educ	0.0954	0.0185	5.1535	0.0000
exper	0.0676	0.0355	1.9034	0.0570
expersq	-0.0013	0.0007	-1.7878	0.0738
hours	-0.0005	0.0004	-1.1472	0.2513