

# Statistics Methods in Finance

## Homework 6

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DUE 2020/12/10 00:00

# Outline

## **A. Introduction for Python-based Panel Regression**

## **B. HW6 Questions**

- 1.(25%) Pooled Regression.
- 2.(25%) Panel Regression with only effects that are fixed over time.
- 3.(25%) Panel Regression with only effects that are fixed over farms.
- 4.(25%) Panel Regression with both farm and time effect.

## **C. Model Comparisons**

# Python-based Panel Regression toolkit -- PanelOLS--1

The following illustration is from :

<https://bashtage.github.io/linearmodels/doc/panel/models.html>

Many models can be estimated. The most common included entity effects and can be described

$$y_{it} = \alpha_i + \beta' x_{it} + \epsilon_{it}$$

<=Q3: fixed over farms

where  $\alpha_i$  is included if `entity_effects=True`.

Time effect are also supported, which leads to a model of the form

$$y_{it} = \gamma_t + \beta' x_{it} + \epsilon_{it}$$

<=Q2: fixed over time

where  $\gamma_t$  is included if `time_effects=True`.

Both effects can be simultaneously used,

$$y_{it} = \alpha_i + \gamma_t + \beta' x_{it} + \epsilon_{it}$$

<=Q4: both time and farms effect

Additionally, arbitrary effects can be specified using categorical variables.

If both `entity_effect` and `time_effects` are `False`, and no other effects are included, the model reduces to `PooledOLS`.

^^^ Q1: pooled regression

# Python-based Panel Regression toolkit -- PanelOLS--2\_1

For fixed model effect, there are four ways to coding. The following are examples for time fixed effect:

## 1. Use PanelOLS.from\_formula ( "Fixed effects" form)

```
from linearmodels.panel import PanelOLS
panel_regressor_Tfe = PanelOLS.from_formula("YIT ~ 1 + COWS + LAND + LABOR + FEED + TimeEffects", data=df)
print(panel_regressor_Tfe.fit())
```

## 2. Use PanelOLS ( "Fixed effects" form)

```
from linearmodels.panel import PanelOLS
import statsmodels.api as sm
exog = sm.add_constant(df[['COWS', 'LAND', 'LABOR', 'FEED']])
panel_regressor_Tfe = PanelOLS(df['YIT'], exog, entity_effects=False, time_effects=True)
print(panel_regressor_Tfe.fit())
```

## 3. Use PanelOLS.from\_formula ( "Binary regressor" form)

```
from linearmodels.panel import PanelOLS
panel_regressor_Tfe = PanelOLS.from_formula("YIT ~ 1 + COWS + LAND + LABOR + FEED + YEAR", data=df)
print(panel_regressor_Tfe.fit())
```

Note:

1.) In next page, I will show the output comparisons for these four coding methods.

2.) For answering to the HW6 questions, I will only show the results by using method-1. And since the value range of the four factors is quite different, I use the scaled value X1~X4 instead of "COWS, LAND, LABOR, FEED" .

## 4. Use PooledOLS ( "Binary regressor" form)

```
from linearmodels.panel import PooledOLS
import statsmodels.api as sm
exog_vars = ['COWS', 'LAND', 'LABOR', 'FEED', 'YEAR']
exog = sm.add_constant(df[exog_vars])
mod = PooledOLS(df.YIT, exog)
pooled_Tfe = mod.fit()
print(pooled_Tfe)
```

# Python-based Panel Regression toolkit -- PanelOLS--2\_2

## 1. Use PanelOLS.from\_formula ( "Fixed effects" form)

Parameter Estimates						
Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI	
Intercept	10.407	0.0247	422.01	0.0000	10.358	10.455
COWS	0.0382	0.0018	21.769	0.0000	0.0348	0.0416
LAND	-0.0029	0.0016	-1.7766	0.0758	-0.0061	0.0003
LABOR	0.1230	0.0152	8.0968	0.0000	0.0932	0.1527
FEED	2.72e-06	3.48e-07	7.8157	0.0000	2.037e-06	3.403e-06

F-test for Poolability: 5.5272  
P-value: 0.0000  
Distribution: F(5,1472)  
Included effects: Time

## 2. Use PanelOLS ( "Fixed effects" form)

Parameter Estimates						
Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI	
const	10.407	0.0247	422.01	0.0000	10.358	10.455
COWS	0.0382	0.0018	21.769	0.0000	0.0348	0.0416
LAND	-0.0029	0.0016	-1.7766	0.0758	-0.0061	0.0003
LABOR	0.1230	0.0152	8.0968	0.0000	0.0932	0.1527
FEED	2.72e-06	3.48e-07	7.8157	0.0000	2.037e-06	3.403e-06

F-test for Poolability: 5.5272  
P-value: 0.0000  
Distribution: F(5,1472)  
Included effects: Time

## 3. Use PanelOLS.from\_formula ( "Binary regressor" form)

Parameter Estimates						
Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI	
Intercept	10.333	0.0300	345.02	0.0000	10.275	10.392
YEAR[T.94]	0.0498	0.0239	2.0825	0.0375	0.0029	0.0968
YEAR[T.95]	0.0868	0.0241	3.6047	0.0003	0.0395	0.1340
YEAR[T.96]	0.0986	0.0242	4.0710	0.0000	0.0511	0.1461
YEAR[T.97]	0.1006	0.0244	4.1267	0.0000	0.0528	0.1484
YEAR[T.98]	0.1045	0.0246	4.2459	0.0000	0.0562	0.1527
COWS	0.0382	0.0018	21.769	0.0000	0.0348	0.0416
LAND	-0.0029	0.0016	-1.7766	0.0758	-0.0061	0.0003
LABOR	0.1230	0.0152	8.0968	0.0000	0.0932	0.1527
FEED	2.72e-06	3.48e-07	7.8157	0.0000	2.037e-06	3.403e-06

## 4. Use PooledOLS ( "Binary regressor" form)

Parameter Estimates						
Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI	
const	10.333	0.0300	345.02	0.0000	10.275	10.392
COWS	0.0382	0.0018	21.769	0.0000	0.0348	0.0416
LAND	-0.0029	0.0016	-1.7766	0.0758	-0.0061	0.0003
LABOR	0.1230	0.0152	8.0968	0.0000	0.0932	0.1527
FEED	2.72e-06	3.48e-07	7.8157	0.0000	2.037e-06	3.403e-06
YEAR.94	0.0498	0.0239	2.0825	0.0375	0.0029	0.0968
YEAR.95	0.0868	0.0241	3.6047	0.0003	0.0395	0.1340
YEAR.96	0.0986	0.0242	4.0710	0.0000	0.0511	0.1461
YEAR.97	0.1006	0.0244	4.1267	0.0000	0.0528	0.1484
YEAR.98	0.1045	0.0246	4.2459	0.0000	0.0562	0.1527



# 1. Pooled Regression

```
pool_regressor = PanelOLS.from_formula("YIT ~ 1 + X1 + X2 + X3 + X4", data=df)
print(pool_regressor.fit())
```

PanelOLS Estimation Summary

Dep. Variable:	YIT	R-squared:	0.9525
Estimator:	PanelOLS	R-squared (Between):	0.9633
No. Observations:	1482	R-squared (Within):	0.8311
Date:	Wed, Dec 09 2020	R-squared (Overall):	0.9525
Time:	23:10:04	Log-likelihood	809.68
Cov. Estimator:	Unadjusted		
		F-statistic:	7412.2
Entities:	247	P-value	0.0000
Avg Obs:	6.0000	Distribution:	F(4,1477)
Min Obs:	6.0000		
Max Obs:	6.0000	F-statistic (robust):	7412.2
		P-value	0.0000
Time periods:	6	Distribution:	F(4,1477)
Avg Obs:	247.00		
Min Obs:	247.00		
Max Obs:	247.00		

Parameter Estimates

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Intercept	11.577	0.0036	3175.5	0.0000	11.570	11.585
X1	0.5952	0.0196	30.392	0.0000	0.5568	0.6336
X2	0.0231	0.0112	2.0539	0.0402	0.0010	0.0451
X3	0.0232	0.0130	1.7798	0.0753	-0.0024	0.0488
X4	0.4518	0.0108	41.889	0.0000	0.4306	0.4729

## Results:

1. The coefficients "X1, X2, X4" are statistically significant, while the coefficient "X3" is not.
2. "X1:COWS" and "X4:FEED" seem to be the most important two factors in this regression.

Y = YIT (log of MILK production)

Four X: COWS, X1 = log of, deviations from means (logs)  
LAND, X2 = same  
LABOR, X3 = same  
FEED, X4 = same

## 2. Panel Regression with only effects that are fixed over time

```
panel_regressor_Tfe = PanelOLS.from_formula("YIT ~ 1 + X1 + X2 + X3 + X4 + TimeEffects", data=df)
print(panel_regressor_Tfe.fit())
```

```
PanelOLS Estimation Summary
=====
Dep. Variable:          YIT      R-squared:                0.9509
Estimator:              PanelOLS  R-squared (Between):      0.9632
No. Observations:      1482      R-squared (Within):       0.8321
Date:                  Wed, Dec 09 2020  R-squared (Overall):     0.9525
Time:                  23:10:46      Log-likelihood           814.38
Cov. Estimator:        Unadjusted

Entities:               247      F-statistic:             7126.7
Avg Obs:                6.0000    P-value                  0.0000
Min Obs:                6.0000    Distribution:             F(4,1472)
Max Obs:                6.0000    F-statistic (robust):    7126.7
Time periods:           6        P-value                  0.0000
Avg Obs:                247.00    Distribution:             F(4,1472)
Min Obs:                247.00
Max Obs:                247.00

Parameter Estimates
=====

```

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Intercept	11.577	0.0036	3180.2	0.0000	11.570	11.585
X1	0.6007	0.0196	30.577	0.0000	0.5622	0.6393
X2	0.0236	0.0112	2.1023	0.0357	0.0016	0.0456
X3	0.0273	0.0131	2.0813	0.0376	0.0016	0.0530
X4	0.4444	0.0111	40.113	0.0000	0.4227	0.4662

```
=====
F-test for Poolability: 1.8754
P-value: 0.0956
Distribution: F(5,1472)
Included effects: Time
```

### Results:

1. The four coefficients are statistically significant.
2. "X1:COWS" and "X4:FEED" seem to be the most important two factors in this regression.

Y = YIT (log of MILK production)

Four X: COWS, X1 = log of, deviations from means (logs)  
LAND, X2 = same  
LABOR, X3 = same  
FEED, X4 = same

### 3. Panel Regression with only effects that are fixed over farms

```
panel_regressor_Efe = PanelOLS.from_formula("YIT ~ 1 + X1 + X2 + X3 + X4 + EntityEffects", data=df)
print(panel_regressor_Efe.fit())
```

```
PanelOLS Estimation Summary
=====
Dep. Variable:          YIT      R-squared:          0.8359
Estimator:              PanelOLS R-squared (Between):    0.9610
No. Observations:      1482     R-squared (Within):    0.8359
Date:                  Wed, Dec 09 2020 R-squared (Overall):  0.9509
Time:                  23:12:04  Log-likelihood        1751.6
Cov. Estimator:        Unadjusted

Entities:              247      F-statistic:      1568.1
Avg Obs:               6.0000   P-value          0.0000
Min Obs:               6.0000   Distribution:     F(4,1231)
Max Obs:               6.0000   F-statistic (robust): 1568.1
                                P-value          0.0000
Time periods:          6       Distribution:     F(4,1231)
Avg Obs:               247.00
Min Obs:               247.00
Max Obs:               247.00
```

```
Parameter Estimates
=====
Parameter  Std. Err.  T-stat  P-value  Lower CI  Upper CI
-----
Intercept  11.577    0.0021  5473.9  0.0000   11.573   11.582
X1         0.6620   0.0247  26.825  0.0000   0.6136   0.7104
X2         0.0374   0.0161  2.3153  0.0208   0.0057   0.0690
X3         0.0304   0.0232  1.3099  0.1905  -0.0151   0.0759
X4         0.3825   0.0120  31.831  0.0000   0.3589   0.4061
=====
```

```
F-test for Poolability: 12.836
P-value: 0.0000
Distribution: F(246,1231)
Included effects: Entity
```

#### Results:

1. The coefficients "X1, X2, X4" are statistically significant, while the coefficient "X3" is not.
2. "X1:COWS" seems to be more influential than "X4:FEED" in this regression.

Y = YIT (log of MILK production)

Four X: COWS, X1 = log of, deviations from means (logs)  
LAND, X2 = same  
LABOR, X3 = same  
FEED, X4 = same



## 4. Panel Regression with both farm and time effect

```
panel_regressor_ETfe = PanelOLS.from_formula("YIT ~ 1 + X1 + X2 + X3 + X4 + EntityEffects + TimeEffects", data=df)
print(panel_regressor_ETfe.fit())
```

PanelOLS Estimation Summary

Dep. Variable:	YIT	R-squared:	0.7095
Estimator:	PanelOLS	R-squared (Between):	0.9445
No. Observations:	1482	R-squared (Within):	0.8230
Date:	Wed, Dec 09 2020	R-squared (Overall):	0.9346
Time:	23:13:05	Log-likelihood	1826.2
Cov. Estimator:	Unadjusted		
		F-statistic:	748.65
Entities:	247	P-value	0.0000
Avg Obs:	6.0000	Distribution:	F(4,1226)
Min Obs:	6.0000		
Max Obs:	6.0000	F-statistic (robust):	748.65
		P-value	0.0000
Time periods:	6	Distribution:	F(4,1226)
Avg Obs:	247.00		
Min Obs:	247.00		
Max Obs:	247.00		

Parameter Estimates

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
Intercept	11.577	0.0020	5744.7	0.0000	11.574	11.581
X1	0.6380	0.0238	26.807	0.0000	0.5913	0.6847
X2	0.0413	0.0154	2.6725	0.0076	0.0110	0.0716
X3	0.0282	0.0222	1.2715	0.2038	-0.0153	0.0717
X4	0.3082	0.0132	23.300	0.0000	0.2822	0.3341

F-test for Poolability: 14.374  
P-value: 0.0000  
Distribution: F(251,1226)

Included effects: Entity, Time

### Results:

1. The coefficients "X1, X2, X4" are statistically significant, while the coefficient "X3" is not.
2. Similarly to the Q3 results, "X1:COWS" seems to be more and more influential than "X4:FEED" in this regression.

Y = YIT (log of MILK production)

Four X: COWS, X1 = log of, deviations from means (logs)  
LAND, X2 = same  
LABOR, X3 = same  
FEED, X4 = same

# Model Comparisons

Model Comparison				
	Pooled	Time-fixed	Entity-fixed	Both_T&E_Effects
Dep. Variable	YIT	YIT	YIT	YIT
Estimator	PanelOLS	PanelOLS	PanelOLS	PanelOLS
No. Observations	1482	1482	1482	1482
Cov. Est.	Unadjusted	Unadjusted	Unadjusted	Unadjusted
R-squared	0.9525	0.9509	0.8359	0.7095
R-Squared (Within)	0.8311	0.8321	0.8359	0.8230
R-Squared (Between)	0.9633	0.9632	0.9610	0.9445
R-Squared (Overall)	0.9525	0.9525	0.9509	0.9346
F-statistic	7412.2	7126.7	1568.1	748.65
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000
Intercept	11.577 (3175.5)	11.577 (3180.2)	11.577 (5473.9)	11.577 (5744.7)
X1	0.5952 (30.392)	0.6007 (30.577)	0.6620 (26.825)	0.6380 (26.807)
X2	0.0231 (2.0539)	0.0236 (2.1023)	0.0374 (2.3153)	0.0413 (2.6725)
X3	0.0232 (1.7798)	0.0273 (2.0813)	0.0304 (1.3099)	0.0282 (1.2715)
X4	0.4518 (41.889)	0.4444 (40.113)	0.3825 (31.831)	0.3082 (23.300)
Effects		Time	Entity	Entity Time
T-stats reported in parentheses				

```
'''Model Comparison'''
pool_regressor = pool_regressor.fit()
panel_regressor_Tfe = panel_regressor_Tfe.fit()
panel_regressor_Efe = panel_regressor_Efe.fit()
panel_regressor_ETfe = panel_regressor_ETfe.fit()

from linearmodels.panel import compare
print(compare({'Pooled':pool_regressor,
              'Time-fixed':panel_regressor_Tfe,
              'Entity-fixed':panel_regressor_Efe,
              'Both_T&E_Effects':panel_regressor_ETfe}))
```

## Results:

1. The number of COWS is the most influential factor for milk production, and then is the FEED.
2. The number of LABOR is almost unrelated to the milk production.

Y = YIT (log of MILK production)

Four X: COWS, X1 = log of, deviations from means (logs)  
 LAND, X2 = same  
 LABOR, X3 = same  
 FEED, X4 = same

以下是沒scale過的四個factor原值做regression，但看起來應該是錯的，例如：LABOR的值是最小的，所以其迴歸係數值最大，然後其檢定並非都是顯著的；另一方面FEED的值是最大的，所以其迴歸係數值最小，然後從頭到尾的檢定都是顯著的。

結論是用Python做panel regression時，input data都要scale過才好分析結果。



# 1. Pooled Regression

```
pool_regressor = PanelOLS.from_formula("YIT ~ COWS + LAND + LABOR + FEED", data=df)
print(pool_regressor.fit())
```

PanelOLS Estimation Summary

Dep. Variable:	YIT	R-squared:	0.9360
Estimator:	PanelOLS	R-squared (Between):	0.9421
No. Observations:	1482	R-squared (Within):	-23.141
Date:	Wed, Dec 09 2020	R-squared (Overall):	0.9360
Time:	00:07:37	Log-likelihood	-3697.2
Cov. Estimator:	Unadjusted		
		F-statistic:	5407.9
Entities:	247	P-value	0.0000
Avg Obs:	6.0000	Distribution:	F(4,1478)
Min Obs:	6.0000		
Max Obs:	6.0000	F-statistic (robust):	5407.9
		P-value	0.0000
Time periods:	6	Distribution:	F(4,1478)
Avg Obs:	247.00		
Min Obs:	247.00		
Max Obs:	247.00		

Parameter Estimates

	Parameter	Std. Err.	T-stat	P-value	Lower CI	Upper CI
COWS	0.1566	0.0191	8.2142	0.0000	0.1192	0.1940
LAND	0.1702	0.0173	9.8388	0.0000	0.1363	0.2041
LABOR	4.3894	0.1245	35.251	0.0000	4.1451	4.6337
FEED	-3.889e-05	3.591e-06	-10.832	0.0000	-4.594e-05	-3.185e-05

## Results:

1. The four coefficients are statistically significant.
2. The factor "LABOR" is the largest positive value, and the factor "FEED" is the smallest but negative.



## 2. Panel Regression with only effects that are fixed over time

```
panel_regressor_Tfe = PanelOLS.from_formula("YIT ~ COWS + LAND + LABOR + FEED + TimeEffects", data=df)
print(panel_regressor_Tfe.fit())
```

```
PanelOLS Estimation Summary
=====
Dep. Variable:          YIT      R-squared:                0.8236
Estimator:              PanelOLS  R-squared (Between):      0.1938
No. Observations:       1482     R-squared (Within):       0.6432
Date:                   Wed, Dec 09 2020  R-squared (Overall):      0.1940
Time:                   00:08:28  Log-likelihood            -133.14
Cov. Estimator:         Unadjusted
                          F-statistic:          1718.5
Entities:               247      P-value                  0.0000
Avg Obs:                6.0000  Distribution:             F(4,1472)
Min Obs:                6.0000
Max Obs:                6.0000  F-statistic (robust):     1718.5
                          P-value              0.0000
Time periods:           6      Distribution:             F(4,1472)
Avg Obs:                247.00
Min Obs:                247.00
Max Obs:                247.00

Parameter Estimates
=====
Parameter  Std. Err.  T-stat  P-value  Lower CI  Upper CI
-----
COWS       0.0382   0.0018  21.769  0.0000   0.0348   0.0416
LAND       -0.0029   0.0016  -1.7766 0.0758  -0.0061   0.0003
LABOR       0.1230   0.0152   8.0968  0.0000   0.0932   0.1527
FEED       2.72e-06 3.48e-07  7.8157  0.0000  2.037e-06 3.403e-06
=====

F-test for Poolability: 5.5272
P-value: 0.0000
Distribution: F(5,1472)

Included effects: Time
```

### Results:

1. The coefficients "COWS, LABOR, FEED" are statistically significant, while the coefficient "LAND" is not.
2. The factor "LABOR" is the largest positive value, and the factor "FEED" is the smallest value.

### 3. Panel Regression with only effects that are fixed over farms

```
panel_regressor_Efe = PanelOLS.from_formula("YIT ~ COWS + LAND + LABOR + FEED + EntityEffects", data=df)
print(panel_regressor_Efe.fit())
```

```
=====
PanelOLS Estimation Summary
=====
Dep. Variable:          YIT      R-squared:                0.6625
Estimator:              PanelOLS R-squared (Between):          0.1489
No. Observations:      1482     R-squared (Within):        0.6625
Date:                  Wed, Dec 09 2020 R-squared (Overall):      0.1490
Time:                  00:09:18 Log-likelihood            1217.1
Cov. Estimator:        Unadjusted
                        F-statistic:                604.12
Entities:              247      P-value                  0.0000
Avg Obs:               6.0000   Distribution:            F(4,1231)
Min Obs:               6.0000   F-statistic (robust):    604.12
Max Obs:               6.0000   P-value                  0.0000
                        Distribution:            F(4,1231)
Time periods:          6
Avg Obs:               247.00
Min Obs:               247.00
Max Obs:               247.00

Parameter Estimates
=====
Parameter  Std. Err.  T-stat  P-value  Lower CI  Upper CI
-----
COWS       0.0327   0.0017  19.781  0.0000   0.0294   0.0359
LAND       0.0017   0.0016   1.1002  0.2714  -0.0014   0.0048
LABOR      -0.0148   0.0210  -0.7046  0.4812  -0.0560   0.0264
FEED       2.831e-06 2.531e-07 11.185  0.0000   2.334e-06 3.327e-06
=====

F-test for Poolability: 26.530
P-value: 0.0000
Distribution: F(246,1231)

Included effects: Entity
```

#### Results:

1. The coefficients "COWS, FEED" are statistically significant, while the coefficient "LAND, LABOR" is not.
2. The factor "COWS" is the largest positive value, and the factor "FEED" is the smallest value.
3. Therefore, "COWS" seems to be the only and most influential factor.

## 4. Panel Regression with both farm and time effect

```
panel_regressor_ETfe = PanelOLS.from_formula("YIT ~ COWS + LAND + LABOR + FEED + EntityEffects + TimeEffects", data=df)
print(panel_regressor_ETfe.fit())
```

```
PanelOLS Estimation Summary
=====
Dep. Variable:          YIT      R-squared:                0.5038
Estimator:              PanelOLS  R-squared (Between):      0.1224
No. Observations:       1482     R-squared (Within):       0.6223
Date:                   Wed, Dec 09 2020  R-squared (Overall):     0.1225
Time:                   00:10:11  Log-likelihood           1429.5
Cov. Estimator:         Unadjusted
                               F-statistic:             311.25
Entities:               247      P-value                 0.0000
Avg Obs:                6.0000   Distribution:            F(4,1226)
Min Obs:                6.0000
Max Obs:                6.0000   F-statistic (robust):    311.25
                               P-value                 0.0000
Time periods:           6        Distribution:            F(4,1226)
Avg Obs:                247.00
Min Obs:                247.00
Max Obs:                247.00

Parameter Estimates
=====
Parameter  Std. Err.  T-stat  P-value  Lower CI  Upper CI
-----
COWS       0.0275   0.0015  18.787  0.0000   0.0247   0.0304
LAND       0.0028   0.0014  2.0552  0.0401   0.0001   0.0055
LABOR      -0.0112   0.0183  -0.6119  0.5407  -0.0471   0.0247
FEED       1.617e-06  2.284e-07  7.0791  0.0000   1.169e-06  2.065e-06
=====

F-test for Poolability: 36.114
P-value: 0.0000
Distribution: F(251,1226)

Included effects: Entity, Time
```

### Results:

1. The coefficients "COWS, LAND, FEED" are statistically significant, while the coefficient "LABOR" is not.
2. The factor "COWS" is the largest positive value, and the factor "FEED" is the smallest value.



# Model Comparisons

Model Comparison				
	Pooled	Time-fixed	Entity-fixed	Both_T&E_Effects
Dep. Variable	YIT	YIT	YIT	YIT
Estimator	PanelOLS	PanelOLS	PanelOLS	PanelOLS
No. Observations	1482	1482	1482	1482
Cov. Est.	Unadjusted	Unadjusted	Unadjusted	Unadjusted
R-squared	0.8275	0.8236	0.6625	0.5038
R-Squared (Within)	0.6409	0.6432	0.6625	0.6223
R-Squared (Between)	0.8439	0.8435	0.8117	0.7365
R-Squared (Overall)	0.8275	0.8272	0.7996	0.7272
F-statistic	1770.7	1718.5	604.12	311.25
P-value (F-stat)	0.0000	0.0000	0.0000	0.0000
Intercept	10.415 (420.04)	10.407 (422.01)	10.693 (250.03)	10.856 (282.15)
COWS	0.0375 (21.306)	0.0382 (21.769)	0.0327 (19.781)	0.0275 (18.787)
LAND	-0.0031 (-1.9018)	-0.0029 (-1.7766)	0.0017 (1.1002)	0.0028 (2.0552)
LABOR	0.1163 (7.6290)	0.1230 (8.0968)	-0.0148 (-0.7046)	-0.0112 (-0.6119)
FEED	3.084e-06 (9.0110)	2.72e-06 (7.8157)	2.831e-06 (11.185)	1.617e-06 (7.0791)
Effects		Time	Entity	Entity Time
T-stats reported in parentheses				