

## Advanced Econometrics – Lab 03 – Mock test

### Exercise 1

The factors affecting the investment behavior by firms were studied by Grunfeld<sup>1</sup> using a panel of data.

”There are several interesting and elaborate theories that seek to describe the determinants of the investment process for the firm. Most of these theories evolve to the conclusion that perceived profit opportunities (expected profits or present discounted value of future earnings) and desired capital stock are two important determinants of a firm’s fixed business investment. Unfortunately, neither of these variables are directly observable. Therefore, in formulating our economic model, we use observable proxies for these variables instead.

In terms of expected profits, one alternative is to identify the present discounted value of future earnings as the market value of the firm’s securities. The price of a firm’s stock represents and contains information about these expected profits. Consequently, the stock market value of the firm at the beginning of the year, denoted for firm ”i” in time period ”t” as  $V_{it}$ , may be used as a proxy for expected profits.

In terms of desired capital stock, expectations play a definite role. To catch these expectations effects, one possibility is to use a model that recognizes that actual capital stock in any period is the sum of a large number of past desired capital stocks. Thus, we use the beginning of the year actual capital stock, denoted for the  $i$ th firm as  $K_{it}$ , as a proxy for permanent desired capital stock.

Focusing on these explanatory variables, an economic model for describing gross firm investment for the  $i$ th firm in the  $t$ th time period, denoted  $INV_{it}$ , may be expressed as

$$INV_{it} = f(V_{it}, K_{it}) \quad (1)$$

Our concern is how we might take this general economic model and specify an econometric model that adequately represents a panel of real-world data. The data consist of  $T = 20$  years of data (1935–1954) for  $N = 11$  large firms.”<sup>2</sup>

variable name	variable label
i	GM=1 USS=2 GE=3 Chr=4 Rich=5 IBM=6 UnOil=7 West=8 Goodyr=9 Match=10
t	year, t=1 is 1935; t=20 is 1954
inv	= gross investment in plant and equipment, millions of \$1947
v	= value of common and preferred stock, millions of \$1947
k	= stock of capital, millions of \$1947

\_dta:

1. Source is H. D. Vinod and A. Ullah, *Recent Advances in Regression Models*, Marcel Dekker, Inc., 1981, Table 10.1

1. Decide which one of POLS, FE and RE model is appropriate for INV. Explain your answer.
2. Are the presented models balanced? Explain.

<sup>1</sup>Grunfeld, Y. (1958) *The Determinants of Corporate Investment*. Unpublished Ph.D. thesis, Department of Economics, University of Chicago,. Grunfeld, Y. and Z. Griliches (1960) ”Is Aggregation Necessarily Bad?” *Review of Economics and Statistics*, 42, 1-13.

<sup>2</sup>Principles of Econometrics, pages 384-385.

Call:

```
plm(formula = inv ~ value + capital, data = Grunfeld, model = "random",
     index = c("firm", "year"))
```

Balanced Panel: n = 10, T = 20, N = 200

Effects:

	var	std.dev	share
idiosyncratic	2784.46	52.77	0.282
individual	7089.80	84.20	0.718

theta: 0.8612

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-177.6063	-19.7350	4.6851	19.5105	252.8743

Coefficients:

	Estimate	Std. Error	z-value	Pr(> z )
(Intercept)	-57.834415	28.898935	-2.0013	0.04536 *
value	0.109781	0.010493	10.4627	< 2e-16 ***
capital	0.308113	0.017180	17.9339	< 2e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 2381400

Residual Sum of Squares: 548900

R-Squared: 0.7695

Adj. R-Squared: 0.76716

Chisq: 657.674 on 2 DF, p-value: < 2.22e-16

Call:

```
plm(formula = inv ~ value + capital, data = Grunfeld, model = "within",
     index = c("firm", "year"))
```

Balanced Panel: n = 10, T = 20, N = 200

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-184.00857	-17.64316	0.56337	19.19222	250.70974

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
value	0.110124	0.011857	9.2879	< 2.2e-16 ***
capital	0.310065	0.017355	17.8666	< 2.2e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 2244400

Residual Sum of Squares: 523480

R-Squared: 0.76676

Adj. R-Squared: 0.75311

F-statistic: 309.014 on 2 and 188 DF, p-value: < 2.22e-16

## Hausman Test

```
data: inv ~ value + capital
chisq = 2.3304, df = 2, p-value = 0.3119
alternative hypothesis: one model is inconsistent
```

## Pooling Model

Call:

```
plm(formula = inv ~ value + capital, data = Grunfeld, model = "pooling",
     index = c("firm", "year"))
```

Balanced Panel: n = 10, T = 20, N = 200

Residuals:

Min.	1st Qu.	Median	3rd Qu.	Max.
-291.6757	-30.0137	5.3033	34.8293	369.4464

Coefficients:

	Estimate	Std. Error	t-value	Pr(> t )
(Intercept)	-42.7143694	9.5116760	-4.4907	1.207e-05 ***
value	0.1155622	0.0058357	19.8026	< 2.2e-16 ***
capital	0.2306785	0.0254758	9.0548	< 2.2e-16 ***

---

Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares: 9359900

Residual Sum of Squares: 1755900

R-Squared: 0.81241

Adj. R-Squared: 0.8105

F-statistic: 426.576 on 2 and 197 DF, p-value: < 2.22e-16

```
> #individual effects for random effects?
```

```
> plmtest(OLS, type=c("bp"))
```

Lagrange Multiplier Test - (Breusch-Pagan) for balanced panels

```
data: inv ~ value + capital
```

```
chisq = 798.16, df = 1, p-value < 2.2e-16
```

```
alternative hypothesis: significant effects
```

```
>
```

```
> #individual effects for fixed effects?
```

```
> pFtest(fixed, OLS)
```

F test for individual effects

```
data: inv ~ value + capital
```

```
F = 49.177, df1 = 9, df2 = 188, p-value < 2.2e-16
```

```
alternative hypothesis: significant effects
```