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Specialty: International Commerce & Finance
Module: Advanced Econometric
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Pratical Work 3

Exercise 1

You are given panel data for **5 companies** (Company A, B, C, D, E) observed over **5 years** (2020–2024). The goal is to **analyze the impact** of: Capital investment, Training hours, Firm size on **Productivity,** the data is as follow:

Company	Year	Productivity	Capital Investment	Training Hours	Firm Size
A	2020	120	30000	50	100
A	2021	125	32000	55	105
A	2022	128	34000	58	108
A	2023	130	35000	60	110
A	2024	135	36000	63	112
B	2020	110	28000	40	95
B	2021	115	29000	42	96
B	2022	117	29500	44	98
B	2023	120	30500	46	100
B	2024	125	31500	49	102
C	2020	140	40000	60	120
C	2021	145	42000	63	125
C	2022	150	43000	66	130
C	2023	155	45000	68	135
C	2024	160	47000	70	140
D	2020	115	31000	48	90
D	2021	118	32000	50	92
D	2022	120	33000	53	95
D	2023	123	34000	55	98
D	2024	126	35000	58	100
E	2020	105	27000	38	85
E	2021	108	28000	40	88
E	2022	110	29000	42	90
E	2023	113	29500	44	92
E	2024	116	30500	47	95

Questions:

- Run a panel regression
- Based on the characteristics of the data and the Hausman test results, which model is more appropriate: **Fixed Effects** or **Random Effects**?
- Write down the appropriate regression model based on the selected type (fixed/random effects).
- Identify and present the **individual effects** (i.e., the specific effects for each company if you are using Fixed Effects, or Random effects).
- Interpret the **meaning of the individual effects**. *(What does it means for a company in terms of productivity?)*
- Interpret the estimated **coefficients** of the independent variables:
- **Perform diagnostic tests**:
    - Unit root test on panel data variables.
    - Check for cross sectional dependence test, serial correlation and heteroskedasticity.

Exercise 2

You are studying the **determinants of productivity** for a group of individuals over time.
You have panel data for **5 individuals** tracked over **10 years**. Assume you studying the effect of Years of Education (assumed mostly constant or slightly increasing) and years of Experience (increases over time) on *Productivity Score* (measured from job evaluations, changes over time).
Unobserved Individual Effects: *Personality, Family Background, Cultural Values* (fixed over time, but not observed)

ID	Year	Education	Experience	Productivity Score
1	1	12	1	60
1	2	12	2	62
1	3	12	3	64
1	4	12	4	66
1	5	12	5	68
1	6	12	6	70
1	7	13	7	73
1	8	13	8	75
1	9	13	9	77
1	10	13	10	79
2	1	14	2	65
2	2	14	3	67
2	3	14	4	69
2	4	14	5	71
2	5	14	6	73
2	6	15	7	76
2	7	15	8	78
2	8	15	9	80
2	9	15	10	82
2	10	15	11	84
3	1	13	1	58
3	2	13	2	60
3	3	13	3	63
3	4	13	4	65
3	5	13	5	67
3	6	13	6	69
3	7	14	7	71
3	8	14	8	73
3	9	14	9	75
3	10	14	10	77
4	1	16	3	70
4	2	16	4	73
4	3	16	5	75
4	4	16	6	77
4	5	16	7	79
4	6	17	8	82
4	7	17	9	84
4	8	17	10	86
4	9	17	11	88
4	10	17	12	90
5	1	11	0	55
5	2	11	1	57
5	3	11	2	59
5	4	11	3	61
5	5	11	4	63
5	6	12	5	66
5	7	12	6	68
5	8	12	7	70
5	9	12	8	72
5	10	12	9	74

1. Summarize the average years of education, average experience, and average productivity for all individuals over the 10 years. Which individual has the highest average productivity?
2. Plot the evolution of productivity over time for each individual.
3. Plot the relationship between experience and productivity.
4. Write the panel data regression model that explains productivity based on education and experience.
5. Estimate the panel data regression model
6. Interpret the individual effects obtained in the Fixed Effects model.
7. What can you say about the unobserved characteristics (e.g., personality, family background) based on the individual effects?
8. How does education affect productivity?
9. How does experience affect productivity?
10. Which variable appears more important for increasing productivity?
11. Based on your results, what would you recommend to improve individual productivity: investing more in education or providing more on-the-job experience?

Note: 👉 **The deadline for submitting the practical work is May 3.**