# Exercise Chapter 10

1. Using the data for Ghanaian firms - ‘Ghana\_Firms\_JDE04’ - estimate the following production function by OLS, FE, FD and RE:

where  is the natural logarithm (the ‘log’) of value-added,  is log employment,  is log capital stock, *union* is a dummy variable equal to one if the firm is unionised and zero if it has not,  is firm specific, time invariant and unobserved effect, *t* is time α is the intercept, the, are parameters.

The following Table summarises the results of this exercise. You can find the Stata code in Exercise\_Chapter\_10\_Question\_1.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| VARIABLES | OLS | FE | FE (CRS) | FD | FD (CRS) | RE |
|  |  |  |  |  |  |  |
| lk | 0.256\*\*\* | -0.251 | 0.504\*\*\* | 0.100 | 0.535\*\*\* | 0.267\*\*\* |
|  | (0.045) | (0.301) | (0.125) | (0.367) | (0.170) | (0.042) |
| ll | 0.584\*\*\* | 0.342\*\* |  | 0.411\*\* |  | 0.540\*\*\* |
|  | (0.093) | (0.137) |  | (0.193) |  | (0.084) |
| union | 1.065\*\*\* |  |  |  |  | 1.088\*\*\* |
|  | (0.276) |  |  |  |  | (0.225) |
| Constant | 9.737\*\*\* | 19.206\*\*\* | 6.260\*\*\* | 0.018 | 0.005 | 9.685\*\*\* |
|  | (0.588) | (4.985) | (1.652) | (0.105) | (0.101) | (0.552) |
|  |  |  |  |  |  |  |
| Observations | 676 | 676 | 676 | 533 | 533 | 676 |
| R-squared | 0.710 | 0.057 | 0.062 | 0.058 | 0.066 |  |
| Number of firms |  | 143 | 143 |  |  | 143 |
| F-test for CRS |  | 7.567 |  | 1.237 |  |  |
| Prob > F |  | 0.00615 |  | 0.268 |  |  |
|  |  |  |  |  |  |  |
| Chibar2 for Hausman test for fixed effects |  4.33 |  |  |  |  |
| Prob>chi2  | 0.741 |  |  |  |  |
| Chibar2 for Breusch and Pagan test for random effects |  |  |  |  |  217.47  |
| Prob>chi2 |  |  |  |  | 0.00 |
| F-test for Mundlak test for fixed effects | 21.47 |  |  |  |  |
| Prob > F | 0.00 |  |  |  |  |
| Robust standard errors in parentheses\*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |

2. Which estimator do you prefer and why?

The answer is the first differenced estimator with constant returns to scale (CRS) imposed. The reasons are given in Chapter 10.

3. In which of these equations can the affect of unionisation on the performance of the firm be identified and, where it can be, how large is the effect?

The answer is only in the OLS and RE and its effect is very large a roughly three-fold increase in TFP for unionized relative to non-unionised firms.

You are given three measures of human capital of the firm:

*eduwgt*: a weighted average of the education of the workers

*agewgt*: a weighted average of the age of the workers

*tenwgt*: a weighted average of the tenure of the workers

4. Incorporate these measures as determinants of TFP in addition to unionisation and estimate this equation using the pooled OLS, random effects, fixed effects and differenced estimator of this equation. How, and why, do your results differ from those obtained in (1).

The following Table summarises the results of this exercise. You can find the Stata code in Exercise\_Chapter\_10\_Question\_4.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) |
| VARIABLES | OLS | FE | FE (CRS) | FD | FD (CRS) | RE |
|  |  |  |  |  |  |  |
| lk | 0.202\*\*\* | -0.224 | 0.508\*\*\* | 0.102 | 0.519\*\*\* | 0.233\*\*\* |
|  | (0.049) | (0.296) | (0.124) | (0.361) | (0.169) | (0.044) |
| ll | 0.611\*\*\* | 0.342\*\* |  | 0.430\*\* |  | 0.548\*\*\* |
|  | (0.090) | (0.135) |  | (0.191) |  | (0.083) |
| eduwgt | 0.035 | 0.019 | 0.018 | 0.021 | 0.021 | 0.022 |
|  | (0.029) | (0.025) | (0.026) | (0.027) | (0.027) | (0.022) |
| agewgt | 0.195\*\*\* | 0.202\*\*\* | 0.207\*\*\* | 0.084\* | 0.086\* | 0.202\*\*\* |
|  | (0.061) | (0.053) | (0.053) | (0.047) | (0.049) | (0.045) |
| agesq | -0.003\*\*\* | -0.003\*\*\* | -0.003\*\*\* | -0.001\*\* | -0.001\*\* | -0.003\*\*\* |
|  | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) | (0.001) |
| tenwgt | 0.008 | 0.048\*\*\* | 0.048\*\*\* | 0.041\*\* | 0.041\*\* | 0.034\*\* |
|  | (0.018) | (0.018) | (0.018) | (0.018) | (0.018) | (0.015) |
| union | 0.999\*\*\* |  |  |  |  | 1.030\*\*\* |
|  | (0.253) |  |  |  |  | (0.227) |
| Constant | 6.897\*\*\* | 15.316\*\*\* | 2.683 | 0.032 | 0.019 | 6.684\*\*\* |
|  | (0.975) | (5.002) | (1.855) | (0.107) | (0.103) | (0.824) |
|  |  |  |  |  |  |  |
| Observations | 676 | 676 | 676 | 533 | 533 | 676 |
| R-squared | 0.722 | 0.097 | 0.102 | 0.071 | 0.080 |  |
| Number of firm |  | 143 | 143 |  |  | 143 |
| F-test for CRS |  | 7.381 |  | 1.182 |  |  |
| Prob > F |  | 0.00681 |  | 0.279 |  |  |
|  |  |  |  |  |  |  |
| Chibar2 for Hausman test for fixed effects | 8.27 |  |  |  |  |
| Prob>chi2  | 0.689 |  |  |  |  |
| Chibar2 for Breusch and Pagan test for random effects |  |  |  |  | 207.38 |
| Prob>chi2 |  |  |  |  | 0.00 |
| F-test for Mundlak test for fixed effects | 7.38 |  |  |  |  |
| Prob > F | 0.00 |  |  |  |  |
| Robust standard errors in parentheses\*\*\* p<0.01, \*\* p<0.05, \* p<0.1 |

The results do not differ from those above except insofar as they show that some dimensions of human capital do indeed affect productivity. The preferred specification remains first differences with constant returns to scale imposed. The implication is that human capital acts to raised TFP and appears not to affect the efficiency of capital in increasing output.

5. Which dimension of human capital is important in explaining TFP?

Age and tenure are significant at least at the 10 per cent significance level or lower. There is evidence for a quadratic form for age. There is no evidence that education is a significant determinant of 0.5 on the capital labour ratio is similar to that we obtained earlier for our macro production function. The fact that we can find no effect from education is striking. You should not conclude from that that education ‘does not matter’. You should conclude that *how* education impacts on productivity is a complex question. In the Stata do file for question 4 you will find at the end that if you use OLS and drop both the capital labour ratio and the unionisation variable you obtain a point estimate on education very close to 0.1 implying an additional year of education increases labour productivity by about 10 per cent. So, education and labour productivity are *correlated* but we have no evidence there is a *causal* link to productivity. One possibility is that the lack of evidence may be due to measurement issues with the education variable. Another possibility, suggested by the correlation between education and unionisation, is that any impact of education depends on how educated labour is managed. What the results do suggest is that we do not know, from this data and analysis, how education impacts on productivity. While that may be frustrating, knowing what you don’t know is an important step to finding it out.

6. Is there evidence that unions improve firm performance?

We cannot argue from our results that there is any *causal* effect from unions to TFP. We have very strong evidence that there is a *correlation* and that correlation is an important aspect of what drives differences in TFP across these firms. As the unionization variable does not change over time we can only identify a union effect from the OLS and the RE estimators and we have strong evidence both produce biased estimates. As with education we can certainly believe in its importance but investigating exactly how unionisation links to productivity requires further analysis.