Problem Set # 6

Empirical Model Estimation using R

The purpose of this research is to examine the impact of Foreign Direct Investment (FDI) on GDP of six South Asian Countries (Bangladesh, Bhutan, India, Pakistan, Nepal and Sri lanka) using the data for the period of 2001-2016. Here, the dependent variable is GDP and other covariates are Gross Fixed Capital Formation as percentage of GDP (GFCF), Employment to Population Ratio (EPR), and Exports of Goods and Services (EGS). We expect FDI to impact GDP of these countries positively from the theoretical perspective. Considering the framework of our production function, the evaluation of a pooled OLS regression can be specified as below,

$$GDP_{it} = \beta_0 + \beta_1 GFCF_{it} + \beta_2 EPR_{it} + \beta_3 EGS_{it} + \beta_4 FDI_{it} + \epsilon_{it} \tag{1}$$

Here, i denotes country, t denotes time and ϵ_{it} denotes the error term varying over country and time. Now, we can address countries' unobservable individual effects through using fixed effect model. In this case, we can use the following model,

$$GDP_{it} = \beta_0 + \beta_1 GFCF_{it} + \beta_2 EPR_{it} + \beta_3 EGS_{it} + \beta_4 FDI_{it} + \mu_i + \epsilon_{it} \tag{2}$$

In equation (2), μ_i represents countries' unobservable effects. In case of the random effect model, the equation (2) will be the same but assuming μ_i is uncorrelated with each of the explanatory variables.

Now, we log-transform the dependent variable (GDP), FDI and EGS to rescale the variables for easier and comprehensive interpretation of the estimates. After transforming the variables, we estimate all three models (Pooled, Fixed Effect, and Random Effect) and estimation results are given in the table 1.

Though the pooled OLS result gives significant FDI impact on GDP at 5 percent level of significance, it also gives highly significant GFCF with wrong sign. So, to improve the

result further we apply fixed effect model which returns significant effect of FDI on GDP. In fixed effect model EPR comes with wrong sign but it is statistically insignificant.

Table 1: Exploring the relationship between GDP and FDI for six South Asian Countries.

	Pooled	Fixed Effect	Random Effect
Intercept	1.84		3.04
	(0.99)		(1.55)
GFCF	-0.03***	0.01*	-0.01**
	(0.00)	(0.00)	(0.00)
EPR	0.03***	-0.02	0.02
	(0.00)	(0.01)	(0.01)
log(EGS)	0.95***	0.40***	0.91***
	(0.05)	(0.06)	(0.06)
log(FDI)	0.09*	0.06**	0.06
	(0.04)	(0.02)	(0.04)
R^2	0.98	0.74	0.90
Adj. R^2	0.98	0.72	0.89
Num. obs.	92	92	92
Hausman Test.			411.97***

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Table 2: Fixed Effect model: Constant for each country.

Country	Bangladesh	Bhutan	India	Nepal	Pakistan	Sri Lanka
Constant	16.42	13.55	17.46	16.57	15.67	15.86

Interpreting the estimates of fixed effect model from table 1, we can expect one percent

increase FDI to raise GDP by 0.06 percent. Here, all the estimates but EPR are statistically significant. For 1 percent increase in exports of goods and services we expect GDP to increase by 0.4 percent. Given one percentage point increase in GFCF, we expect GDP to increase by about 1 percentage.

The random effect model does not improve the result as it comes up with insignificant FDI impact along with significant but negative GFCF effect. Now, we can use Hausman test to examine the necessity of Random effect model in this case. Highly significant test statistic of Hausman test implies that we can reject the null hypothesis of preferred random effects model. So, we finally choose fixed effect model for the analysis.

Table 3: Fixed Effect(FE) Model: with and without non-linear FDI term.

	FE without squared log(FDI)	FE with squared log(FDI)
GFCF	0.01*	0.01
	(0.00)	(0.00)
EPR	-0.02	-0.02*
	(0.01)	(0.01)
log(EGS)	0.40***	0.32***
	(0.06)	(0.07)
log(FDI)	0.06**	0.06**
	(0.02)	(0.02)
log(FDI)*log(FDI)		0.003
		(0.002)
R^2	0.74	0.76
Adj. R^2	0.72	0.73
Num. obs.	92	89

$^{***}p < 0.001$, $^{**}p < 0.01$, $^{*}p < 0.05$

Extending the analysis further, we can observe how the addition of squared log(FDI) to the model changes our fixed effect outcome. Table 3 summarizes the experiment. From the table 3, we can conclude that addition of squared log(FDI) term does not improve our result. So, based on the analysis we can use the fixed effect model given in table 1 to explain the impact of FDI inflow on the GDP of six South Asian Countries.