

# Homework assignment #6

## Panel Data Analysis

MPP-C6: Statistics 2

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**Disclaimer:** This document sketches some brief responses to the questions of the homework assignment. It serves to provide students with some guidance. The document may include some flaws - those should be reported to me as students go through the responses.

### Project Description

The Environmental Kuznets Curve is at the heart of a long-standing discourse on the relationship between economic development and environmental quality. It hypothesizes an inverted U-shape relationship between indicators of environmental degradation and per capita income. While some have used the EKC to argue that growth policies are also superior for dealing with environmental problems, others have questioned the existence of EKCs for different indicators or stressed very high turning points. We aim to reproduce the results of Stern and Common (2001) which sought to investigate the presence of an environmental Kuznets curve (EKC) for sulfur emissions [1].

### Dataset

The dataset `stern2.dat` contains country data from 1960-1990. The dataset contains the following variables

- *year*: the year in which the country was observed
- *country*: numerical code that uniquely identifies each country (see table 1)
- *gdpppp*: GDP per capita (purchasing power parity) in real 1990 international dollars
- *pop*: population in 1000 residents

- *so*:  $SO_2$  emissions in tonnes
- *sopc*:  $SO_2$  emissions in tonnes per capita
- *oe*: dummy variable describing oecd membership where 1000 represents membership and 2000 represents non-membership

## Questions

1. Read the paper by Stern and Common. Explain the EKC hypothesis in your own words. What is the difference between sulfur and carbon emissions in the empirical discussion and why? What is the authors' perceived contribution to the discussion? What is the role of panel data therein? [conceptual question]
2. Start by examining your data. Try out some descriptive statistics of the `xt` command family and report relevant ones. What sort of distribution do our variables of interest display? What transformations could we apply to the data? If necessary, create new variables that are appropriately transformed.
3. Plot GDP per capita against sulfur emissions per capita (transformed if necessary). Describe the relationship you can see.
4. Write the equation for a model that could estimate an EKC for sulfur emissions. Create any extra variables that would be necessary to run this.
5. Carry out a pooled regression using the equation described in question 3. Interpret the coefficients. Run fixed-effects and random-effects models and interpret the results.
6. Test which of the three models is preferable. Perform other relevant diagnostics for the model of choice. Is it appropriate to include time-fixed effects in the model?
7. What is heterogeneity bias and is it relevant according to your results? [conceptual question]
8. A high Hausman statistic implies that there is correlation between country effects and income variables. What could be the most likely cause of this problem? [conceptual question]
9. Compute the relevant turning points of the estimated curves for the world, OECD and non-OECD regressions. Summarize your results in a table.
10. Discuss why first-differencing may be a more appropriate method for the data.
11. Estimate the model for the "world" using first-differences and interpret the results.
12. Comment on any differences between the models you have run.

13. Discuss whether we can observe an EKC for sulfur emissions with reference to your results.

```
. *regress using pooled ols
. reg lsopc lgdp lgdpsq
```

Source	SS	df	MS	Number of obs	=	2,294
Model	3019.46587	2	1509.73294	F(2, 2291)	=	679.91
Residual	5087.10815	2,291	2.22047497	Prob > F	=	0.0000
				R-squared	=	0.3725
				Adj R-squared	=	0.3719
Total	8106.57402	2,293	3.53535718	Root MSE	=	1.4901

  

lsopc	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lgdp	1.82093	.4380234	4.16	0.000	.9619664	2.679894
lgdpsq	-.0417549	.0271007	-1.54	0.124	-.0948993	.0113895
_cons	-17.02817	1.752482	-9.72	0.000	-20.46478	-13.59155

```
. est store pooled
```

## References

- [1] David I Stern and Michael S Common. Is there an environmental kuznets curve for sulfur? *Journal of Environmental Economics and Management*, 41(2):162–178, 2001.

Table 1: Country Codes

1	ALGERIA	95	JAPAN
14	EGYPT	97	KOREA,
18	GHANA	98	KUWAIT
22	KENYA	100	MALAYSIA
25	MADAGASCAR	102	MYANMAR
30	MOROCCO	106	PHILIPPINES
31	MOZAMBIQUE	108	SAUDI ARABIA
32	NAMIBIA	109	SINGAPORE
34	NIGERIA	110	SRI LANKA
41	SAFRICA	111	SYRIA
44	TANZANIA	112	TAIWAN
46	TUNISIA	113	THAILAND
48	ZAIRE	116	AUSTRIA
49	ZAMBIA	117	BELGIUM
50	ZIMBABWE	119	CYPRUS
52	BARBADOS	120	CZECHOSLOVAKIA
54	CANADA	121	DENMARK
60	GUATEMALA	122	FINLAND
62	HONDURAS	123	FRANCE
64	MEXICO	125	WGERMANY
65	NICARAGUA	126	GREECE
71	TRINIDAD&TOBAGO	129	IRELAND
72	U.S.A.	130	ITALY
73	ARGENTINA	131	LUXEMBOURG
74	BOLIVIA	133	NETHERLANDS
75	BRAZIL	134	NORWAY
76	CHILE	136	PORTUGAL
77	COLOMBIA	137	ROMANIA
81	PERU	138	SPAIN
83	URUGUAY	139	SWEDEN
84	VENEZUELA	140	SWITZERLAND
88	CHINA	141	TURKEY
89	HONG KONG	142	U.K.
90	INDIA	143	USSR
91	INDONESIA	144	YUGOSLAVIA
92	IRAN	145	AUSTRALIA
94	ISRAEL	147	NZ