EXCERSISES IN APPLIED PANEL DATA ANALYSIS #9

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1. Introduction

This exercises is designed to allow you to gain familiarity with the `pgmm` interface which will allow for estimation of the dynamic panel data model discussed in today's lecture.

2. Estimation of the Dynamic Unobserved Effects Model

For this exercise we will follow the study of Baltagi & Levin (1992), who estimate a dynamic demand model for cigarettes across 46 U.S. states from 1963 to 1992. Their demand equation is

$$\ln C_{it} = \beta_0 + \beta_1 \ln C_{i,t-1} + \beta_2 \ln P_{it} + \beta_3 \ln Y_{it} + \beta_4 \ln Pn_{it} + c_i + d_t + \varepsilon_{it}, \tag{1}$$

where C_{it} is cigarette sales per capita (smoking age) for state i in period t, P_{it} is the average price of cigarettes measured in real terms, Y_{it} is real per capit state income and Pn_{it} is the minimum retail price of cigarettes in all bordering states to state i.

Baltagi & Levin (1992) estimate the dynamic cigarette demand model in (1) using pooled OLS, the within estimator, EC2SLS, FE2SLS and the GMM estimator. We will follow suit and estimate these same models and compare their insights.

```
> library(plm)
> library(stargazer)
> ## Load Cigar dataset from Baltagi and Levin (1992)
> data("Cigar")
> ## Estimate pooled model
> cig.pool <- plm(log(sales)~lag(log(sales),1)+log(price)+
+                   log(ndi)+log(pimin),
+                 model="pooling",
+                 data=Cigar)
> ## Estimate within model
> cig.with <- plm(log(sales)~lag(log(sales),1)+log(price)+
+                   log(ndi)+log(pimin),
+                 model="within",
```

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```
+                 effect="twoways",
+                 data=Cigar)
> ## Estimate FE2SLS model
> cig.2SLS <- plm(log(sales)~lag(log(sales),1)+log(price)+
+                   log(ndi)+log(pimin)|log(price)+
+                   log(ndi)+log(pimin)+lag(log(price),1)+
+                   lag(log(ndi),1)+lag(log(pimin),1),
+                 model="within",
+                 effect="twoways",
+                 data=Cigar)
> ## Dynamic Panel Estimator
> ## One-step
> cig.dyn1 <- pgmm(log(sales)~lag(log(sales),1)+log(price)+
+                   log(ndi)+log(pimin)|log(price)+
+                   log(ndi)+log(pimin)+lag(log(sales),2:99),
+                 model="onestep",
+                 effect="twoways",
+                 data=Cigar)
> ## Two-step
> cig.dyn2 <- pgmm(log(sales)~lag(log(sales),1)+log(price)+
+                   log(ndi)+log(pimin)|log(price)+
+                   log(ndi)+log(pimin)+lag(log(sales),2:99),
+                 model="twosteps",
+                 effect="twoways",
+                 data=Cigar)
```

Table 1 provides the estimates from these five different estimators of the dynamic cigarette demand model in (1). We see that estimated price elasticity of cigarettes varies dramatically over the five different estimators. The long run price elasticities over the five models are -2.44, -1.72, -1.2, -1.87 and -0.72, respectively. The GMM estimators produce the lowest price elasticities of the competing methods while the pooled model produces the highest. This suggests that endogeneity present given the dynamics is important to correct for.

TABLE 1.

	Dependent variable:				
	log(sales)				
	Pool	FE	FE2SLS	GMM1	GMM2
ln C	0.956***	0.830***	0.568***	0.839***	0.345
	(0.006)	(0.013)	(0.036)	(0.070)	(0.261)
ln P	−0.106***	−0.292***	−0.517***	−0.302**	−0.473
	(0.015)	(0.023)	(0.039)	(0.144)	(0.341)
ln Y	0.028***	0.107***	0.228***	0.124	0.526**
	(0.007)	(0.023)	(0.031)	(0.158)	(0.236)
ln Pn	0.048***	0.035	−0.014	−0.013	−0.435
	(0.012)	(0.027)	(0.031)	(0.165)	(0.387)
Observations	1,334	1,334	1,334	1,334	1,334
R^2	0.967	0.860	0.830	0.860	0.674
Adjusted R^2	0.963	0.810	0.782	0.810	0.635
Note:					*p<0.1; **p<0.05; ***p<0.01

References

Baltagi, B. & Levin, D. (1992), 'Cigarette taxation: Raising revenues and reducing consumption', *Structural Change and Economic Dynamics* **3**, 321–335.