# Weiterführende Fragen der Ökonometrie

## Übungsaufgaben – Blatt 4

**Aufgabe 1**

(5 Punkte) In equation (13.14) in Wooldridge (2009) wird folgendes Modell betrachtet:

$$crmrte_{it} = \beta_0 + \delta_0 d87_t + \beta_1 unem_{it} + a_i + u_{it}.$$

Wir nehmen an, dass $\beta_1$ in diesem Modell positiv ist und $\Delta u_i$ und $\Delta unem_i$ negativ korreliert sind. Wie lautet dann die entstandene Verzerrung für den OLS Schätzer von $\beta_1$ in der First-Difference Regression?
Quelle: Wooldridge 3e & 4e Problem 13.4
Hinweis: Schreiben Sie $\Delta u_i$ als $\beta_2 \Delta x_i + \Delta v_i$, wobei $\Delta x_i$ die vergessene Variable repräsentiert.

**Aufgabe 2**

The data set `vote2.txt` includes panel data on House of Representative elections in 1988 and 1990. Only winners from 1988 who are also running in 1990 appear in the sample; these are the incumbents. An unobserved effects model explaining the share of the incumbent's vote in terms of expenditures by both candidates is

$$vote_{it} = \beta_0 + \delta_0 d90_t + \beta_1 \log(inexp_{it}) + \beta_2 \log(chexp_{it}) + \beta_3 incshr_{it} + a_i + u_{it},$$

where $incshr_{it}$ is the incumbent's share of total campaign spending (in percent form). The unobserved effect $a_i$ contains characteristics of the incumbent - such as "quality" - as well as things about the district that are constant. The incumbent's gender and party are constant over time, so these are subsumed in $a_i$. We are interested in the effect of campaign expenditures on election outcomes.

(i) (1 Punkt) Difference the given equation across the two years and estimate the differenced equation by OLS. Which variables are individually significant at the 5% level against a two-sided alternative?

(ii) (1 Punkt) In the equation from part (i), test for joint significance of $\Delta \log(inexp)$ and $\Delta \log(chexp)$. Report the $p$-value.

(iii) (2 Punkte) Reestimate the equation from part (i) using $\Delta incshr$ as the only independent variable. Interpret the coefficient on $\Delta incshr$. For example, if the incumbent's share of spending increases by 10 percentage points, how is this predicted to affect the incumbent's share of the vote?

(iv) (1 Punkt) Redo part (iii), but now use only the pairs that have repeat challengers. [This allows us to control for characteristics of the challengers as well, which would be in $a_i$. Levitt

(1995) conducts a much more extensive analysis.] (Hinweis: Verwenden Sie hierzu das Objekt *rptchall*.)

Quelle: Wooldridge 3e & 4e Computer Exercise C13.8

**Aufgabe 3**

(4 Punkte) Zeigen Sie, dass unter der Annahme seriell unkorrelierter $u_{it}$ mit konstanter Varianz $\text{Corr}[\Delta u_{it}, \Delta u_{i,t+1}] = -0.5$ gilt (vgl. Wooldridge 4e, S. 466).
Hinweis: Verwenden Sie die Formel $\text{Cov}[X, Y] = E[(X - E[X])(Y - E[Y])]$ sowie $\text{Var}[X_t - X_{t-1}] = Var(X_t) + Var(X_{t-1}) - 2\,Cov(X_t, X_{t-1})$.

**Aufgabe 4**

The file `mathpnl.txt` contains panel data on school districts in Michigan for the years 1992 through 1998. It is the district-level analogue of the school-level data used by Papke (2001). The response variable of interest in this question is $math4$, the percent of fourth graders in a district receiving a passing score on a standardized math test. The key explanatory variable is $rexpp$, which is real expeditures per pupil in the district. The amounts are in 1997 dollars. The spending variable will appear in logarithmic form.

(i) (1 Punkt) Consider the static unobserved effects model

$$\begin{aligned} math4_{it} = \delta_0 + \delta_1 y93_t + \ldots + \delta_6 y98_t + \beta_1 \log(rexpp_{it}) \\ + \beta_2 \log(enrol_{it}) + \beta_3 lunch_{it} + a_i + u_{it}, \end{aligned}$$

where $enrol_{it}$ is total district enrollment and $lunch_{it}$ is the percent of students in the district eligible for the school lunch program. (So $lunch_{it}$ is a pretty good measure of the district-wide poverty rate.) How would you in general interpret $\beta_1$ in this model?

(ii) (1 Punkt) Use first differencing to estimate the model in part (i). The simplest approach is to allow an intercept in the first-differenced equation and to include dummy variables for the years 1994 through 1998. Interpret the coefficient on the spending variable.

(iii) (2 Punkte) Now, add one lag of the spending variable to the model and reestimate using first differencing. Note that you lose another year of data, so you are only using changes starting in 1994. Discuss the coefficients and significance on the current and lagged spending variables.

(iv) (2 Punkte) Obtain heteroskedasticity-robust standard errors for the first-differenced regression in part (iii). How do these standard errors compare with those from part (iii) for the spending variables?

(v) (2 Punkte) Obtain heteroskedasticity-robust and autocorrelation-robust standard errors for the first-differenced regression in part (iii).

(vi) (2 Punkte) Verify that the differenced errors $r_{it} = \Delta u_{it}$ have negative serial correlation by carrying out a test of AR(1) serial correlation.

(vii) (4 Punkte) Based on a fully robust joint test, does it appear necessary to include the enrollment and lunch variables in the model? (*Hinweis:* Statt eines vollständig robusten Tests können Sie auch den heteroskedastie-robusten gemeinsamen Test durchführen, vgl. Wooldridge 4e, S.270)

Quelle: Wooldridge 3e & 4e Computer Exercise C13.11

**Aufgabe 5**

(4 Punkte) Zeigen Sie, dass es sinnvoll ist, die gewöhnlichen OLS-Standardfehler aus Aufgabe 4 (iii) durch die Autokorrelation- und Heteroskedastie-robusten Standardfehler zu ersetzen. Gehen Sie dabei auch kritisch auf die FD-Annahmen ein.