Supplerende materiale til kapitel 5, "Multilevel-analyse" af Henrik Lauridsen Lolle i:
Videregående kvantitative metoder af M. Azhar Hussain og Jørgen T. Lauridsen (red.),

Kapitel 5. Appendiks: Udvidede modeller med landeaggregerede variable

Her vises først et test for *cluster confounding* (tabel 5.7) via samme procedure som i kapitlet i øvrigt, nemlig *mixed*. Det viser, at de aggregerede variable er statistisk insignifikante, samt at effekterne fra individvariablene kun ændrer sig marginalt fra modellen uden de aggregerede variable. Jeg kan altså tolke effekterne fra individvariablene alene som *within*-effekter.

Tabel 5.7. Model med stokastisk konstantled og kontrol for *cluster confounding*, estimeret med *mixed*

```
. /* Random intercept, control for cluster confounding */
. mixed strangers edu_01c edu_01cm wealth_01c wealth_01cm || V2: if incl==1, mle variance

Performing EM optimization:

Performing gradient-based optimization:

Iteration 0:   log likelihood = -69370.332
Iteration 1:   log likelihood = -69370.332  (backed up)

Computing standard errors:

Mixed-effects ML regression                     Number of obs     =     62,401
Group variable: V2                              Number of groups  =         48

                                                Obs per group:
                                                              min =        652
                                                              avg =    1,300.0
                                                              max =      3,043

                                                Wald chi2(4)      =     241.72
Log likelihood = -69370.332                     Prob > chi2       =     0.0000
```

strangers	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
edu_01c	.0416951	.0112171	3.72	0.000	.01971	.0636802
edu_01cm	.1534167	.2792388	0.55	0.583	-.3938813	.7007148
wealth_01c	.1668505	.0130953	12.74	0.000	.1411841	.1925168
wealth_01cm	.4819031	.4250415	1.13	0.257	-.351163	1.314969
_cons	1.00879	.0375304	26.88	0.000	.9352317	1.082348

Random-effects Parameters	Estimate	Std. Err.	[95% Conf.	Interval]
V2: Identity				
var(_cons)	.0669527	.0137666	.0447453	.100182
var(Residual)	.5388168	.0030516	.5328689	.5448311

```
LR test vs. linear model: chibar2(01) = 6341.06       Prob >= chibar2 = 0.0000
```

```
. testparm edu_01cm wealth_01cm

 ( 1)  [strangers]edu_01cm = 0
 ( 2)  [strangers]wealth_01cm = 0

           chi2(  2) =    2.16
         Prob > chi2 =    0.3393
```

I det følgende viser jeg en sammenligning mellem modeller med faste og stokastiske effekter med en anden Stata-kommando og estimeringsmetode alene for at kunne sammenligne bedre. Først vises *random intercept*-modellen med de to individvariable (tabel 5.8). Dernæst vises en model med kontrol for *cluster confounding* (tabel 5.9), og endelig vises en fixed effect-model (tabel 5.10).

Tabel 5.8. Model med stokastisk konstantled, estimeret med *xtreg*

```
. /* Random intercept, lidt anderledes estimering */
. xtreg strangers edu_01c wealth_01c if incl==1, i(V2) re

Random-effects GLS regression                   Number of obs     =     62,401
Group variable: V2                              Number of groups  =         48

R-sq:                                           Obs per group:
     within  = 0.0038                                         min =        652
     between = 0.0735                                         avg =    1,300.0
     overall = 0.0074                                         max =      3,043

                                                Wald chi2(2)      =     239.45
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
  strangers |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------+-----------------------------------------------------------------
    edu_01c |   .0419485   .0112088     3.74   0.000     .0199797    .0639173
 wealth_01c |   .1672228   .0130896    12.78   0.000     .1415677    .1928779
      _cons |   1.011739   .0387224    26.13   0.000     .9358439    1.087633
------------+-----------------------------------------------------------------
    sigma_u |  .26742145
    sigma_e |  .73405306
        rho |  .11716958   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Kontrol for *cluster confounding*, der viser stort set samme effekter fra individ-variablene og ikke statistisk signifikante effekter fra de aggregerede variable ses i tabel 5.9.

Tabel 5.9. Model med kontrol for *cluster confounding*, estimeret med *xtreg*

```
. /* Kontrol for cluster confounding med lidt anderledes estimering */
. xtreg strangers edu_01c edu_01cm wealth_01c wealth_01cm if incl==1, i(V2) re

Random-effects GLS regression                   Number of obs     =     62,401
Group variable: V2                              Number of groups  =         48

R-sq:                                           Obs per group:
     within  = 0.0038                                         min =        652
     between = 0.0737                                         avg =    1,300.0
     overall = 0.0106                                         max =      3,043

                                                Wald chi2(4)      =     241.47
corr(u_i, X)   = 0 (assumed)                    Prob > chi2       =     0.0000

------------------------------------------------------------------------------
   strangers |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     edu_01c |   .0416951   .0112173     3.72   0.000     .0197097    .0636805
    edu_01cm |   .1534417   .2885182     0.53   0.595    -.4120436    .7189269
  wealth_01c |   .1668505   .0130955    12.74   0.000     .1411837    .1925172
 wealth_01cm |   .4819159   .4391753     1.10   0.273    -.3788519    1.342684
       _cons |   1.008796   .0387794    26.01   0.000     .9327897    1.084802
-------------+----------------------------------------------------------------
     sigma_u |  .26742145
     sigma_e |  .73405306
         rho |  .11716958   (fraction of variance due to u_i)
------------------------------------------------------------------------------

. testparm edu_01cm wealth_01cm

 ( 1)  edu_01cm = 0
 ( 2)  wealth_01cm = 0

           chi2(  2) =    2.03
         Prob > chi2 =    0.3633
```

Endelig vises fast effekt-model og Hausman-test (tabel 5.10), som viser helt enslydende resultater som ovenstående form for test/analyse.

Tabel 5.10. Fast effekt-model og Hausman-test

```
. /* Fixed effect model */
. xtreg strangers edu_01c wealth_01c if incl==1, i(V2) fe

Fixed-effects (within) regression               Number of obs     =     62,401
Group variable: V2                              Number of groups  =         48

R-sq:                                           Obs per group:
     within  = 0.0038                                         min =        652
     between = 0.0735                                         avg =    1,300.0
     overall = 0.0074                                         max =      3,043

                                                F(2,62351)        =     118.95
corr(u_i, Xb)  = 0.0720                         Prob > F          =     0.0000

------------------------------------------------------------------------------
   strangers |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
     edu_01c |   .0416951   .0112173     3.72   0.000     .0197092    .0636809
  wealth_01c |   .1668505   .0130955    12.74   0.000     .1411832    .1925178
       _cons |   .9982532   .0029385   339.71   0.000     .9924937    1.004013
-------------+----------------------------------------------------------------
     sigma_u |  .26836473
     sigma_e |  .73405306
         rho |  .11789999   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0: F(47, 62351) = 153.81                 Prob > F = 0.0000


. hausman fixed random

                 ---- Coefficients ----
             |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
             |      fixed        random       Difference          S.E.
-------------+----------------------------------------------------------------
     edu_01c |   .0416951     .0419485       -.0002534        .0004364
  wealth_01c |   .1668505     .1672228       -.0003724        .0003954
------------------------------------------------------------------------------
                           b = consistent under Ho and Ha; obtained from xtreg
            B = inconsistent under Ha, efficient under Ho; obtained from xtreg

    Test:  Ho:  difference in coefficients not systematic

                  chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =        2.03
                Prob>chi2 =      0.3633
```