**Lab session I Thursday – Chp. 17 – Discrete outcomes**

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name: <unnamed>

log: J:\Multilevel TA\discrete.log

log type: text

opened on: 19 Apr 2012, 07:53:10

.

. \*\*chap17\*\*

.

. clear all

. set more off

. use wvs\_evs\_small.dta, clear

.

. \*center continuous vars

. center age income hdi98 gini99

.

.

. \*Multilevel logistic regression

.

. \*Null model

. xtmelogit church || country:, var

Refining starting values:

Iteration 0: log likelihood = -7209.8155

Iteration 1: log likelihood = -7199.2013

Iteration 2: log likelihood = -7198.6213

Performing gradient-based optimization:

Iteration 0: log likelihood = -7198.6213

Iteration 1: log likelihood = -7198.4735

Iteration 2: log likelihood = -7198.473

Mixed-effects logistic regression Number of obs = 13535

Group variable: country Number of groups = 64

Obs per group: min = 69

avg = 211.5

max = 789

Integration points = 7 Wald chi2(0) = .

Log likelihood = -7198.473 Prob > chi2 = .

------------------------------------------------------------------------------

church | Coef. Std. Err. z P>|z| [95% Conf. Interval]

-------------+----------------------------------------------------------------

\_cons | -.9553012 .179673 -5.32 0.000 -1.307454 -.6031486

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Random-effects Parameters | Estimate Std. Err. [95% Conf. Interval]

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country: Identity |

var(\_cons) | 2.006364 .3802979 1.383783 2.909052

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LR test vs. logistic regression: chibar2(01) = 3156.21 Prob>=chibar2 = 0.0000

.

. xtmrho

Levels: country

level 1:

Intraclass correlation (ICC): rho1 = 0.37883

Median Odds Ratio (MOR): mor1 = 3.86176

.

. /\*Store the results\*/

. est store mod0

.

. /\*Store the complete model, including e(b) e(V)\*/

. est save mod0.ster, replace

file mod0.ster saved

.

. /\*To reload the model:

> est use mod0.ster

> estimates esample: /\*Variables in regression\*/

> \*/

.

. xtmelogit church female c\_age i.educ c\_income i.denom2 c\_hdi98 c\_gini99 || country:, var mle

Refining starting values:

Iteration 0: log likelihood = -6766.197 (not concave)

Iteration 1: log likelihood = -6739.135

Iteration 2: log likelihood = -6732.6973

Performing gradient-based optimization:

Iteration 0: log likelihood = -6732.6973

Iteration 1: log likelihood = -6732.5675

Iteration 2: log likelihood = -6732.5669

Mixed-effects logistic regression Number of obs = 13535

Group variable: country Number of groups = 64

Obs per group: min = 69

avg = 211.5

max = 789

Integration points = 7 Wald chi2(12) = 702.61

Log likelihood = -6732.5669 Prob > chi2 = 0.0000

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church | Coef. Std. Err. z P>|z| [95% Conf. Interval]

-------------+----------------------------------------------------------------

female | -.0907958 .0430345 -2.11 0.035 -.1751418 -.0064498

c\_age | .0186883 .0014719 12.70 0.000 .0158034 .0215732

|

educ |

2 | .0474363 .0533802 0.89 0.374 -.0571869 .1520595

3 | .1602462 .067724 2.37 0.018 .0275096 .2929829

|

c\_income | -.0440663 .010169 -4.33 0.000 -.0639971 -.0241354

|

denom2 |

2 | -.2830709 .0860577 -3.29 0.001 -.4517408 -.1144009

3 | -.4366988 .1414881 -3.09 0.002 -.7140103 -.1593872

4 | -1.453877 .1605006 -9.06 0.000 -1.768453 -1.139302

5 | .1427541 .110039 1.30 0.195 -.0729184 .3584265

6 | -2.583189 .1391984 -18.56 0.000 -2.856013 -2.310366

|

c\_hdi98 | -6.487386 .992762 -6.53 0.000 -8.433163 -4.541608

c\_gini99 | 4.078436 1.502815 2.71 0.007 1.132972 7.023899

\_cons | -.2443023 .1454774 -1.68 0.093 -.5294329 .0408283

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Random-effects Parameters | Estimate Std. Err. [95% Conf. Interval]

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country: Identity |

var(\_cons) | .8711204 .1748328 .5878183 1.290961

------------------------------------------------------------------------------

LR test vs. logistic regression: chibar2(01) = 944.98 Prob>=chibar2 = 0.0000

. est store mod1

. est save mod1.ster, replace

file mod1.ster saved

.

.

. xtmelogit church female c\_age i.educ c\_income i.denom2 c\_hdi98 c\_gini99 || country: c\_income, var

> mle cov(unstr)

Refining starting values:

Iteration 0: log likelihood = -6859.6039 (not concave)

Iteration 1: log likelihood = -6754.7713

Iteration 2: log likelihood = -6733.8406

Performing gradient-based optimization:

Iteration 0: log likelihood = -6733.8406

Iteration 1: log likelihood = -6726.6549

Iteration 2: log likelihood = -6725.6887

Iteration 3: log likelihood = -6725.6839

Iteration 4: log likelihood = -6725.6839

Mixed-effects logistic regression Number of obs = 13535

Group variable: country Number of groups = 64

Obs per group: min = 69

avg = 211.5

max = 789

Integration points = 7 Wald chi2(12) = 681.22

Log likelihood = -6725.6839 Prob > chi2 = 0.0000

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church | Coef. Std. Err. z P>|z| [95% Conf. Interval]

-------------+----------------------------------------------------------------

female | -.0959903 .0431906 -2.22 0.026 -.1806424 -.0113382

c\_age | .0185514 .0014797 12.54 0.000 .0156512 .0214515

|

educ |

2 | .0462215 .0537519 0.86 0.390 -.0591304 .1515734

3 | .1707776 .068229 2.50 0.012 .0370513 .3045039

|

c\_income | -.0467238 .0140585 -3.32 0.001 -.0742779 -.0191697

|

denom2 |

2 | -.2727192 .0866515 -3.15 0.002 -.4425529 -.1028854

3 | -.4235933 .141913 -2.98 0.003 -.7017378 -.1454489

4 | -1.445313 .1609834 -8.98 0.000 -1.760834 -1.129791

5 | .1652941 .1105865 1.49 0.135 -.0514514 .3820397

6 | -2.569975 .1397246 -18.39 0.000 -2.84383 -2.29612

|

c\_hdi98 | -6.466886 .9947758 -6.50 0.000 -8.41661 -4.517161

c\_gini99 | 4.045439 1.527204 2.65 0.008 1.052173 7.038705

\_cons | -.2577128 .1462726 -1.76 0.078 -.5444019 .0289763

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Random-effects Parameters | Estimate Std. Err. [95% Conf. Interval]

-----------------------------+------------------------------------------------

country: Unstructured |

var(c\_income) | .0035471 .0017303 .0013635 .0092278

var(\_cons) | .8732868 .1754705 .5890118 1.294762

cov(c\_income,\_cons) | .0026041 .0148797 -.0265595 .0317678

------------------------------------------------------------------------------

LR test vs. logistic regression: chi2(3) = 958.74 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. est store mod3

. est save mod3, replace

file mod3.ster saved

.

. \*Predictions of population means

. predict pchurch1, mu

. predict pchurch2, mu fixedonly

.

. table country, c(mean pchurch1 mean pchurch2) format(%9.2f)

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Country | mean(pchurch1) mean(pchurch2)

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alb | 0.23 0.28

alg | 0.49 0.42

arg | 0.28 0.34

aus | 0.24 0.22

a | 0.23 0.15

bd | 0.56 0.74

be | 0.18 0.12

BiH | 0.28 0.17

bra | 0.62 0.65

bul | 0.08 0.13

bel | 0.09 0.10

cda | 0.30 0.16

ch | 0.32 0.42

cro | 0.32 0.23

cze | 0.08 0.11

den | 0.02 0.16

est | 0.07 0.15

fin | 0.08 0.17

fra | 0.08 0.10

geo | 0.20 0.20

gre | 0.14 0.07

hu | 0.09 0.18

ice | 0.03 0.15

ind | 0.61 0.46

ira | 0.35 0.45

ire | 0.60 0.19

ita | 0.40 0.19

jo | 0.35 0.38

ltv | 0.11 0.24

lt | 0.22 0.28

lux | 0.19 0.13

mta | 0.80 0.20

mex | 0.52 0.43

mol | 0.18 0.25

mor | 0.52 0.60

nl | 0.15 0.10

nz | 0.27 0.27

nig | 0.96 0.88

nor | 0.10 0.17

pak | 0.78 0.53

per | 0.43 0.54

phi | 0.64 0.48

pol | 0.59 0.30

ro | 0.27 0.16

rus | 0.04 0.17

sk | 0.38 0.18

slo | 0.22 0.17

rsa | 0.64 0.69

zim | 0.79 0.76

esp | 0.18 0.19

swe | 0.05 0.14

tur | 0.34 0.42

ug | 0.81 0.88

ukr | 0.12 0.19

mac | 0.25 0.15

egy | 0.42 0.52

gb | 0.23 0.21

tan | 0.85 0.83

usa | 0.47 0.23

urg | 0.21 0.42

ven | 0.31 0.36

Ger-W | 0.16 0.17

Ger-E | 0.04 0.12

nir | 0.41 0.21

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.

.

. gen incXhdi=c\_income\*c\_hdi

.

. xtmelogit church female c\_age i.educ c\_income i.denom2 c\_hdi98 c\_gini99 incXhdi || country: c\_inco

> me, var mle cov(unstr)

Refining starting values:

Iteration 0: log likelihood = -6859.7066 (not concave)

Iteration 1: log likelihood = -6755.262

Iteration 2: log likelihood = -6735.5607

Performing gradient-based optimization:

Iteration 0: log likelihood = -6735.5607

Iteration 1: log likelihood = -6729.969

Iteration 2: log likelihood = -6725.6763

Iteration 3: log likelihood = -6725.4349

Iteration 4: log likelihood = -6725.433

Iteration 5: log likelihood = -6725.433

Mixed-effects logistic regression Number of obs = 13535

Group variable: country Number of groups = 64

Obs per group: min = 69

avg = 211.5

max = 789

Integration points = 7 Wald chi2(13) = 681.54

Log likelihood = -6725.433 Prob > chi2 = 0.0000

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church | Coef. Std. Err. z P>|z| [95% Conf. Interval]

-------------+----------------------------------------------------------------

female | -.0966405 .0431967 -2.24 0.025 -.1813045 -.0119764

c\_age | .0184891 .0014817 12.48 0.000 .0155849 .0213932

|

educ |

2 | .0440123 .0538264 0.82 0.414 -.0614856 .1495102

3 | .1690956 .0682795 2.48 0.013 .0352702 .3029211

|

c\_income | -.0462442 .0139809 -3.31 0.001 -.0736462 -.0188421

|

denom2 |

2 | -.2711472 .0866809 -3.13 0.002 -.4410386 -.1012558

3 | -.4217064 .141856 -2.97 0.003 -.6997391 -.1436737

4 | -1.44434 .1609043 -8.98 0.000 -1.759707 -1.128973

5 | .1657279 .1105722 1.50 0.134 -.0509897 .3824454

6 | -2.569596 .139746 -18.39 0.000 -2.843493 -2.295699

|

c\_hdi98 | -6.511295 .9979161 -6.52 0.000 -8.467175 -4.555416

c\_gini99 | 3.9895 1.530044 2.61 0.009 .9906695 6.98833

incXhdi | -.0806183 .1134196 -0.71 0.477 -.3029166 .1416801

\_cons | -.2556933 .146249 -1.75 0.080 -.5423361 .0309496

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Random-effects Parameters | Estimate Std. Err. [95% Conf. Interval]

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country: Unstructured |

var(c\_income) | .0034153 .0017169 .001275 .0091482

var(\_cons) | .87319 .1754402 .5889609 1.294587

cov(c\_income,\_cons) | .0053439 .0152766 -.0245976 .0352854

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LR test vs. logistic regression: chi2(3) = 958.55 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. est store mod4

. est save mod4, replace

file mod4.ster saved

.

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. \*Likelihood ratio tests\*

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. lrtest mod1 mod0

Likelihood-ratio test LR chi2(12) = 931.81

(Assumption: mod0 nested in mod1) Prob > chi2 = 0.0000

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. /\*

> Likelihood-ratio test LR chi2(12) = 931.81

> (Assumption: mod0 nested in mod1) Prob > chi2 = 0.0000

> \*/

.

. lrtest mod1 mod3

Likelihood-ratio test LR chi2(2) = 13.77

(Assumption: mod1 nested in mod3) Prob > chi2 = 0.0010

Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the

parameter space. If this is not true, then the reported test is conservative.

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. /\*

> Likelihood-ratio test LR chi2(2) = 13.77

> (Assumption: mod1 nested in mod3) Prob > chi2 = 0.0010

>

> Note: The reported degrees of freedom assumes the null hypothesis is not on the boundary of the

> parameter space. If this is not true, then the reported test is conservative.

> \*/

.

. lrtest mod4 mod3

Likelihood-ratio test LR chi2(1) = 0.50

(Assumption: mod3 nested in mod4) Prob > chi2 = 0.4787

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. /\*

> Likelihood-ratio test LR chi2(1) = 0.50

> (Assumption: mod3 nested in mod4) Prob > chi2 = 0.4787

> \*/

.

. est table mod0 mod1 mod3 mod4, star

------------------------------------------------------------------------------

Variable | mod0 mod1 mod3 mod4

-------------+----------------------------------------------------------------

eq1 |

female | -.09079583\* -.0959903\* -.09664048\*

c\_age | .01868829\*\*\* .01855135\*\*\* .01848907\*\*\*

|

educ |

2 | .0474363 .04622148 .04401226

3 | .16024623\* .17077761\* .16909563\*

|

c\_income | -.04406626\*\*\* -.04672379\*\*\* -.04624418\*\*\*

|

denom2 |

2 | -.28307086\*\* -.27271916\*\* -.27114718\*\*

3 | -.43669876\*\* -.42359331\*\* -.4217064\*\*

4 | -1.4538772\*\*\* -1.4453126\*\*\* -1.4443401\*\*\*

5 | .14275406 .16529414 .16572787

6 | -2.5831893\*\*\* -2.5699752\*\*\* -2.5695958\*\*\*

|

c\_hdi98 | -6.4873856\*\*\* -6.4668855\*\*\* -6.5112952\*\*\*

c\_gini99 | 4.0784359\*\* 4.045439\*\* 3.9895\*\*

incXhdi | -.08061827

\_cons | -.95530117\*\*\* -.2443023 -.25771282 -.25569326

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lns1\_1\_1 |

\_cons | .34816215\*\*\* -.06898754 -2.8208079\*\*\* -2.8397509\*\*\*

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lns1\_1\_2 |

\_cons | -.06774564 -.06780104

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atr1\_1\_1\_2 |

\_cons | .04682362 .09817128

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legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

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.

. /\*

> ------------------------------------------------------------------------------

> Variable | mod0 mod1 mod3 mod4

> -------------+----------------------------------------------------------------

> eq1 |

> female | -.09079583\* -.0959903\* -.09664048\*

> c\_age | .01868829\*\*\* .01855135\*\*\* .01848907\*\*\*

> |

> educ |

> 2 | .0474363 .04622148 .04401226

> 3 | .16024623\* .17077761\* .16909563\*

> |

> c\_income | -.04406626\*\*\* -.04672379\*\*\* -.04624418\*\*\*

> |

> denom2 |

> 2 | -.28307086\*\* -.27271916\*\* -.27114718\*\*

> 3 | -.43669876\*\* -.42359331\*\* -.4217064\*\*

> 4 | -1.4538772\*\*\* -1.4453126\*\*\* -1.4443401\*\*\*

> 5 | .14275406 .16529414 .16572787

> 6 | -2.5831893\*\*\* -2.5699752\*\*\* -2.5695958\*\*\*

> |

> c\_hdi98 | -6.4873856\*\*\* -6.4668855\*\*\* -6.5112952\*\*\*

> c\_gini99 | 4.0784359\*\* 4.045439\*\* 3.9895\*\*

> incXhdi | -.08061827

> \_cons | -.95530117\*\*\* -.2443023 -.25771282 -.25569326

> -------------+----------------------------------------------------------------

> lns1\_1\_1 |

> \_cons | .34816215\*\*\* -.06898754 -2.8208079\*\*\* -2.8397509\*\*\*

> -------------+----------------------------------------------------------------

> lns1\_1\_2 |

> \_cons | -.06774564 -.06780104

> -------------+----------------------------------------------------------------

> atr1\_1\_1\_2 |

> \_cons | .04682362 .09817128

> ------------------------------------------------------------------------------

> legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

> \*/

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.

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. \*Multilevel ordered logit

.

. tab unfit

Politicans who don't |

believe in god are unfit |

for office | Freq. Percent Cum.

---------------------------+-----------------------------------

strongly disagree | 2,235 16.51 16.51

disagree | 3,775 27.89 44.40

neither agree nor disagree | 2,090 15.44 59.84

agree | 2,519 18.61 78.46

strongly agree | 2,916 21.54 100.00

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Total | 13,535 100.00

. tab educ, gen(ed)

education | Freq. Percent Cum.

--------------------+-----------------------------------

lower | 4,945 36.53 36.53

middle | 5,749 42.48 79.01

upper | 2,841 20.99 100.00

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Total | 13,535 100.00

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. gllamm unfit female c\_age ed2 ed3 church , i(country) link(ologit) f(binom)

Iteration 0: log likelihood = -18931.607

Iteration 1: log likelihood = -18452.063 (not concave)

Iteration 2: log likelihood = -18425.429

Iteration 3: log likelihood = -18415.747

Iteration 4: log likelihood = -18414.285

Iteration 5: log likelihood = -18413.367

Iteration 6: log likelihood = -18413.247

Iteration 7: log likelihood = -18413.247

number of level 1 units = 13535

number of level 2 units = 64

Condition Number = 84.616147

gllamm model

log likelihood = -18413.247

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unfit | Coef. Std. Err. z P>|z| [95% Conf. Interval]

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unfit |

female | .2092589 .0319652 6.55 0.000 .1466082 .2719095

c\_age | .0061857 .0010302 6.00 0.000 .0041667 .0082048

ed2 | -.2793114 .0375955 -7.43 0.000 -.3529972 -.2056255

ed3 | -.5350529 .0451487 -11.85 0.000 -.6235428 -.4465631

church | .7228864 .0352979 20.48 0.000 .6537038 .7920691

-------------+----------------------------------------------------------------

\_cut11 |

\_cons | -2.20315 .0424026 -51.96 0.000 -2.286258 -2.120043

-------------+----------------------------------------------------------------

\_cut12 |

\_cons | -.3878643 .0384206 -10.10 0.000 -.4631674 -.3125613

-------------+----------------------------------------------------------------

\_cut13 |

\_cons | .4960896 .0385864 12.86 0.000 .4204617 .5717176

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\_cut14 |

\_cons | 1.766893 .0412067 42.88 0.000 1.686129 1.847656

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Variances and covariances of random effects

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\*\*\*level 2 (country)

var(1): .73239283 (.02422977)

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. est save ologit.ster, replace

file ologit.ster saved

.

. capture log close