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*****
* A Practical Guide to Using Panel Data
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* ISER, University of Essex
* Chapter 10
*****
```

```
-----
name: <unnamed>
log: C:\My Documents\\Example_Chapter10.log
log type: text
opened on: 31 Jul 2014, 16:28:31

.
.
. * 10.2.1 Modelling Unobserved Heterogeneity
. *-----
.
. foreach w in m n o p q r {
2.      use `w'hid pid `w'sex `w'mastat `w'age `w'qfachi `w'region2 ///
>      `w'jbstat `w'memorig `w'lfsato ///
>      using "$datadir/\`w'indresp", clear
3.      renpfix `w'
4.      capture rename id pid
5.      gen wave = index("abcdefghijklmnopqr", "`w'")
6.      if indexnot("m", "`w'") append using temp
7.      save temp, replace
8. }
file temp.dta saved
file temp.dta saved
file temp.dta saved
file temp.dta saved
file temp.dta saved
file temp.dta saved

. quietly mvdecode _all, mv(-9/-1)

.
. ** We create the same variables we created for Chapter 8, but now starting
. ** with the pooled dataset we created in Chapter 4
. recode jbstat (1 2 = 1) (3/10 = 0), gen(Employed)
(85846 differences between jbstat and Employed)

. label define Employed 1 "Employed/Self-Employed" 0 "Unemployed or Inactive"

. label value Employed Employed

.
. generate age2 = age*age
(4 missing values generated)

. label var age2 "age squared"

.
. generate Female = 1 if sex == 2
(43466 missing values generated)

. replace Female = 0 if sex == 1
(41372 real changes made)

. label var Female "Dummy for women"

.
. generate Married = 1 if mastat == 1 | mastat == 2 | mastat == 7
(33158 missing values generated)

. replace Married = 0 if (mastat >= 3 & mastat <= 6) | (mastat >= 8 & mastat < .)
(32894 real changes made)

. label var Married "Whether married or cohabiting"

.
```

```
. recode qfachi (1 = 2)
(qfachi: 2548 changes made)

. label define Q 2 "1st degree or higher" 3 "hnd,hnc,teaching" 4 "a level" ///
> 5 "o level" 6 "cse" 7 "none of these qualif", modify
```

```
.
. tabulate qfachi, gen(Q)
```

highest academic qualification	Freq.	Percent	Cum.
1st degree	12,117	14.20	14.20
hnd,hnc,teaching	5,961	6.99	21.19
a level	16,890	19.79	40.98
o level	21,837	25.59	66.57
cse	4,137	4.85	71.42
none of these	24,386	28.58	100.00
Total	85,328	100.00	

```
. label var Q1 "1st degree or higher"
```

```
. label var Q2 "hnd,hnc,teaching"
```

```
. label var Q3 "a level"
```

```
. label var Q4 "o level"
```

```
. label var Q5 "cse"
```

```
. label var Q6 "none of these qualif"
```

```
.
. tabulate region2, gen(R)
```

government office region	Freq.	Percent	Cum.
north east	2,271	2.47	2.47
north west	6,509	7.07	9.54
yorkshire & humber	4,994	5.43	14.97
east midlands	4,424	4.81	19.78
west midlands	4,518	4.91	24.69
east of england	5,242	5.70	30.39
london	4,168	4.53	34.92
south east	7,350	7.99	42.90
south west	5,001	5.44	48.34
wales	16,148	17.55	65.89
scotland	16,276	17.69	83.58
northern ireland	15,098	16.41	99.99
channel islands	12	0.01	100.00
Total	92,011	100.00	

```
. label var R1 "North East"
```

```
. label var R2 "North West"
```

```
. label var R3 "Yorkshire & Humber"
```

```
. label var R4 "East Midlands"
```

```
. label var R5 "West Midlands"
```

```
. label var R6 "East of England"
```

```
. label var R7 "London"
```

```
. label var R8 "South East"
```

```
. label var R9 "South West"
```

```

. label var R10 "Wales"

. label var R11 "Scotland"

. label var R12 "Northern Ireland"

.
. * Analysis sample
. keep if Female == 0
(50958 observations deleted)

. keep if Employed < . & age < . & Married < . & qfachi < . & region2 < 13
(3054 observations deleted)

.
. * define local macro of regressors
. local vlist c.age#c.age i.Married ib6.qfachi ib7.region2

```

```

.
.
. * 10.2.2 Pooled Estimations
. *-----
.
. regress Employed `vlist', vce(cluster pid)

```

```

Linear regression                                Number of obs =   38318
                                                F( 19, 8592) =  339.41
                                                Prob > F      =  0.0000
                                                R-squared     =  0.3964
                                                Root MSE     =  .37181

```

(Std. Err. adjusted for 8593 clusters in pid)

Employed	Coef.	Robust Std. Err.	t	P> t	[95% Conf. Interval]	
age	.0432976	.0012789	33.85	0.000	.0407906	.0458046
c.age#c.age	-.0005423	.0000131	-41.55	0.000	-.0005679	-.0005167
1.Married	.1243932	.0090452	13.75	0.000	.1066624	.1421241
qfachi						
1st degree	.0268292	.0174785	1.53	0.125	-.0074329	.0610912
hnd,hnc,teaching	-.0122428	.0200328	-0.61	0.541	-.0515118	.0270263
a level	-.0546138	.0174002	-3.14	0.002	-.0887223	-.0205053
o level	-.039106	.0173034	-2.26	0.024	-.0730248	-.0051872
none of these	-.1560469	.0191383	-8.15	0.000	-.1935626	-.1185312
region2						
north east	-.0510645	.0281465	-1.81	0.070	-.1062384	.0041094
north west	-.0337313	.0216238	-1.56	0.119	-.0761191	.0086565
yorkshire & humber	-.0195999	.0214729	-0.91	0.361	-.061692	.0224921
east midlands	-.0261037	.0228301	-1.14	0.253	-.0708562	.0186487
west midlands	-.0045885	.0232506	-0.20	0.844	-.0501653	.0409883
east of england	-.0115997	.0216967	-0.53	0.593	-.0541304	.0309311
south east	.0031628	.0201877	0.16	0.876	-.03641	.0427356
south west	.0123955	.0214287	0.58	0.563	-.0296099	.0544009
wales	-.0536591	.0187385	-2.86	0.004	-.0903911	-.0169272
scotland	-.0301515	.0183671	-1.64	0.101	-.0661553	.0058524
northern ireland	-.0590176	.0189569	-3.11	0.002	-.0961777	-.0218575
_cons	-.0087148	.0336781	-0.26	0.796	-.074732	.0573024

```

. margins, dydx(*)

```

```

Average marginal effects                                Number of obs   =   38318
Model VCE      : Robust

```

```

Expression      : Linear prediction, predict()
dy/dx w.r.t.    : age 1.Married 2.qfachi 3.qfachi 4.qfachi 5.qfachi 7.qfachi 1.region2 2.region2
3.region2 4.region2 5.region2 6.region2 8.region2

```

		Delta-method		z	P> z	[95% Conf. Interval]	
		dy/dx	Std. Err.				
	age	-.0066125	.0002518	-26.26	0.000	-.0071059	-.006119
	1.Married	.1243932	.0090452	13.75	0.000	.1066649	.1421216
	qfachi						
	1st degree	.0268292	.0174785	1.53	0.125	-.007428	.0610864
hnd,hnc,teaching		-.0122428	.0200328	-0.61	0.541	-.0515063	.0270208
	a level	-.0546138	.0174002	-3.14	0.002	-.0887175	-.0205101
	o level	-.039106	.0173034	-2.26	0.024	-.07302	-.005192
	none of these	-.1560469	.0191383	-8.15	0.000	-.1935573	-.1185365
	region2						
	north east	-.0510645	.0281465	-1.81	0.070	-.1062306	.0041016
	north west	-.0337313	.0216238	-1.56	0.119	-.0761131	.0086505
yorkshire & humber		-.0195999	.0214729	-0.91	0.361	-.0616861	.0224862
	east midlands	-.0261037	.0228301	-1.14	0.253	-.0708499	.0186424
	west midlands	-.0045885	.0232506	-0.20	0.844	-.0501588	.0409819
	east of england	-.0115997	.0216967	-0.53	0.593	-.0541244	.0309251
	south east	.0031628	.0201877	0.16	0.876	-.0364044	.04273
	south west	.0123955	.0214287	0.58	0.563	-.029604	.054395
	wales	-.0536591	.0187385	-2.86	0.004	-.0903859	-.0169324
	scotland	-.0301515	.0183671	-1.64	0.101	-.0661502	.0058473
northern ireland		-.0590176	.0189569	-3.11	0.002	-.0961724	-.0218627

Note: dy/dx for factor levels is the discrete change from the base level.

. probit Employed `vlist', vce(cluster pid)

Iteration 0: log pseudolikelihood = -24921.244  
 Iteration 1: log pseudolikelihood = -15465.335  
 Iteration 2: log pseudolikelihood = -15264.514  
 Iteration 3: log pseudolikelihood = -15263.522  
 Iteration 4: log pseudolikelihood = -15263.522

Probit regression

Number of obs	=	38318
Wald chi2(19)	=	2012.57
Prob > chi2	=	0.0000
Pseudo R2	=	0.3875

Log pseudolikelihood = -15263.522

(Std. Err. adjusted for 8593 clusters in pid)

		Robust		z	P> z	[95% Conf. Interval]	
		Coef.	Std. Err.				
	Employed						
	age	.2072335	.006876	30.14	0.000	.1937567	.2207102
	c.age#c.age	-.0026056	.0000809	-32.22	0.000	-.0027641	-.0024471
	1.Married	.5042921	.0382817	13.17	0.000	.4292613	.5793228
	qfachi						
	1st degree	.1426089	.0847909	1.68	0.093	-.0235781	.308796
hnd,hnc,teaching		.0028898	.0941268	0.03	0.976	-.1815953	.187375
	a level	-.1819399	.0781069	-2.33	0.020	-.3350267	-.0288532
	o level	-.1016864	.0787094	-1.29	0.196	-.2559541	.0525812
	none of these	-.5285454	.0834809	-6.33	0.000	-.692165	-.3649259
	region2						
	north east	-.2734279	.1183877	-2.31	0.021	-.5054635	-.0413922
	north west	-.1898539	.0953062	-1.99	0.046	-.3766506	-.0030572
yorkshire & humber		-.1160603	.0946521	-1.23	0.220	-.301575	.0694543
	east midlands	-.1873578	.0991349	-1.89	0.059	-.3816587	.0069431
	west midlands	-.0121379	.1091465	-0.11	0.911	-.2260611	.2017852
	east of england	-.0465118	.096344	-0.48	0.629	-.2353427	.142319
	south east	.0527849	.0948911	0.56	0.578	-.1331982	.238768
	south west	.0666554	.1000958	0.67	0.505	-.1295288	.2628396
	wales	-.2215828	.0830049	-2.67	0.008	-.3842693	-.0588962
	scotland	-.1483138	.0824146	-1.80	0.072	-.3098434	.0132159





R-sq: within = 0.0406  
between = 0.4252  
overall = 0.3846

Obs per group: min = 1  
avg = 4.5  
max = 6

corr(u\_i, X) = 0 (assumed) Wald chi2(19) = 7737.69  
Prob > chi2 = 0.0000

Employed	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.0476248	.0009331	51.04	0.000	.045796	.0494536
c.age#c.age	-.0005703	9.48e-06	-60.17	0.000	-.0005889	-.0005518
1.Married	.0665866	.0059779	11.14	0.000	.0548701	.078303
qfachi						
1st degree	.1275431	.0176437	7.23	0.000	.0929621	.1621242
hnd,hnc,teaching	.0195629	.0196935	0.99	0.321	-.0190355	.0581614
a level	-.0526734	.0165123	-3.19	0.001	-.085037	-.0203099
o level	-.0672662	.0164302	-4.09	0.000	-.0994689	-.0350635
none of these	-.155294	.0174149	-8.92	0.000	-.1894266	-.1211613
region2						
north east	-.0407373	.0250376	-1.63	0.104	-.0898101	.0083355
north west	-.0417252	.0191834	-2.18	0.030	-.0793239	-.0041265
yorkshire & humber	-.0312415	.0199062	-1.57	0.117	-.0702569	.007774
east midlands	-.0223575	.0201949	-1.11	0.268	-.0619388	.0172238
west midlands	-.0303487	.0207301	-1.46	0.143	-.0709789	.0102814
east of england	-.013134	.019292	-0.68	0.496	-.0509456	.0246777
south east	.0135225	.017739	0.76	0.446	-.0212452	.0482902
south west	.0108219	.0196866	0.55	0.583	-.0277632	.049407
wales	-.0521529	.0167853	-3.11	0.002	-.0850513	-.0192544
scotland	-.0360784	.0166034	-2.17	0.030	-.0686205	-.0035363
northern ireland	-.0606031	.0170832	-3.55	0.000	-.0940856	-.0271206
_cons	-.1183332	.0275168	-4.30	0.000	-.1722651	-.0644012
sigma_u	.3144136					
sigma_e	.21239087					
rho	.68666249	(fraction of variance due to u_i)				

. margins, dydx(\*)

Average marginal effects Number of obs = 38318  
Model VCE : Conventional

Expression : Linear prediction, predict()  
dy/dx w.r.t. : age 1.Married 2.qfachi 3.qfachi 4.qfachi 5.qfachi 7.qfachi 1.region2 2.region2  
3.region2 4.region2 5.region2 6.region2 8.region2  
9.region2 10.region2 11.region2 12.region2

	Delta-method		z	P> z	[95% Conf. Interval]	
	dy/dx	Std. Err.				
age	-.0048655	.0002111	-23.05	0.000	-.0052791	-.0044518
1.Married	.0665866	.0059779	11.14	0.000	.0548701	.078303
qfachi						
1st degree	.1275431	.0176437	7.23	0.000	.0929621	.1621242
hnd,hnc,teaching	.0195629	.0196935	0.99	0.321	-.0190355	.0581614
a level	-.0526734	.0165123	-3.19	0.001	-.085037	-.0203099
o level	-.0672662	.0164302	-4.09	0.000	-.0994689	-.0350635
none of these	-.155294	.0174149	-8.92	0.000	-.1894266	-.1211613
region2						
north east	-.0407373	.0250376	-1.63	0.104	-.0898101	.0083355
north west	-.0417252	.0191834	-2.18	0.030	-.0793239	-.0041265
yorkshire & humber	-.0312415	.0199062	-1.57	0.117	-.0702569	.007774
east midlands	-.0223575	.0201949	-1.11	0.268	-.0619388	.0172238
west midlands	-.0303487	.0207301	-1.46	0.143	-.0709789	.0102814

east of england	-.013134	.019292	-0.68	0.496	-.0509456	.0246777
south east	.0135225	.017739	0.76	0.446	-.0212452	.0482902
south west	.0108219	.0196866	0.55	0.583	-.0277632	.049407
wales	-.0521529	.0167853	-3.11	0.002	-.0850513	-.0192544
scotland	-.0360784	.0166034	-2.17	0.030	-.0686205	-.0035363
northern ireland	-.0606031	.0170832	-3.55	0.000	-.0940856	-.0271206

Note: dy/dx for factor levels is the discrete change from the base level.

```
. xtprobit Employed `vlist', re
```

Fitting comparison model:

```
Iteration 0: log likelihood = -24921.244
Iteration 1: log likelihood = -15465.335
Iteration 2: log likelihood = -15264.514
Iteration 3: log likelihood = -15263.522
Iteration 4: log likelihood = -15263.522
```

Fitting full model:

```
rho = 0.0 log likelihood = -15263.522
rho = 0.1 log likelihood = -13755.146
rho = 0.2 log likelihood = -12819.061
rho = 0.3 log likelihood = -12178.432
rho = 0.4 log likelihood = -11721.076
rho = 0.5 log likelihood = -11394.202
rho = 0.6 log likelihood = -11173.948
rho = 0.7 log likelihood = -11062.941
rho = 0.8 log likelihood = -11119.683
```

```
Iteration 0: log likelihood = -11057.057
Iteration 1: log likelihood = -10265.38
Iteration 2: log likelihood = -9945.552
Iteration 3: log likelihood = -9925.1365
Iteration 4: log likelihood = -9919.3957
Iteration 5: log likelihood = -9919.342
Iteration 6: log likelihood = -9919.342 (backed up)
Iteration 7: log likelihood = -9918.6767
Iteration 8: log likelihood = -9918.6765
```

```
Random-effects probit regression      Number of obs      =      38318
Group variable: pid                  Number of groups    =      8593
```

```
Random effects u_i ~ Gaussian        Obs per group: min =      1
                                      avg =      4.5
                                      max =      6
```

```
Integration method: mvaghermite      Integration points =      12
```

```
Wald chi2(19) = 3702.57
Log likelihood = -9918.6765           Prob > chi2 = 0.0000
```

Employed	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.6149917	.0128777	47.76	0.000	.5897518	.6402316
c.age#c.age	-.0075834	.0001481	-51.22	0.000	-.0078736	-.0072932
1.Married	.8182663	.0673814	12.14	0.000	.6862012	.9503314
qfachi						
1st degree	.7387439	.1684994	4.38	0.000	.4084911	1.068997
hnd,hnc,teaching	.1171093	.1837131	0.64	0.524	-.2429617	.4771803
a level	-.3629704	.1531174	-2.37	0.018	-.663075	-.0628659
o level	-.4088938	.152889	-2.67	0.007	-.7085508	-.1092368
none of these	-1.329894	.1645512	-8.08	0.000	-1.652408	-1.00738
region2						
north east	-.5950389	.2463405	-2.42	0.016	-1.077857	-.1122204
north west	-.5093541	.1908568	-2.67	0.008	-.8834265	-.1352817



yorkshire & humber	-.3887488	.2001168	-1.94	0.052	-.7809705	.003473
east midlands	-.3169917	.2043152	-1.55	0.121	-.7174421	.0834588
west midlands	-.2941037	.2051879	-1.43	0.152	-.6962646	.1080571
east of england	-.1199811	.1982107	-0.61	0.545	-.5084668	.2685047
south east	.1914191	.18606	1.03	0.304	-.1732517	.5560899
south west	.2189889	.1998518	1.10	0.273	-.1727134	.6106911
wales	-.5094115	.1694574	-3.01	0.003	-.841542	-.1772811
scotland	-.361053	.1678115	-2.15	0.031	-.6899574	-.0321486
northern ireland	-.5397469	.1721865	-3.13	0.002	-.8772262	-.2022676
_cons	-8.60628	.3012254	-28.57	0.000	-9.196671	-8.015889
/lnsig2u	1.931816	.0384229			1.856509	2.007124
sigma_u	2.627172	.0504718			2.530089	2.727981
rho	.8734503	.0042471			.8648895	.881543

Likelihood-ratio test of rho=0: chibar2(01) = 1.1e+04 Prob >= chibar2 = 0.000

. quadchk, nooutput

Refitting model intpoints() = 8

Refitting model intpoints() = 16

#### Quadrature check

	Fitted quadrature 12 points	Comparison quadrature 8 points	Comparison quadrature 16 points	
Log likelihood	-9918.6765	-9946.1055 .00276539	-9936.1756 -17.499142 .00176426	Difference Relative difference
Employed: age	.61499169	.69427778 .07928609 .12892222	.58160354 -.03338815 -.05429041	Difference Relative difference
Employed: c.age#c.age	-.00758338	-.00855426 -.00097088 .12802685	-.00718167 .00040171 -.05297202	Difference Relative difference
Employed: 1.Married	.81826632	.85601843 .03775211 .0461367	.80930207 -.00896425 -.01095518	Difference Relative difference
Employed: 2.qfachi	.73874391	.83261861 .0938747 .1270734	.76797966 .02923575 .03957494	Difference Relative difference
Employed: 3.qfachi	.1171093	.17326046 .05615116 .47947647	.11148825 -.00562106 -.04799838	Difference Relative difference
Employed: 4.qfachi	-.36297043	-.3548869 .00808353 -.02227049	-.37713915 -.01416873 .03903548	Difference Relative difference
Employed: 5.qfachi	-.40889379	-.44101553 -.03212174 .07855766	-.41935974 -.01046595 .02559578	Difference Relative difference
Employed: 7.qfachi	-1.329894	-1.4816127 -.15171872 .11408332	-1.2837958 .04609825 -.0346631	Difference Relative difference
Employed: 1.region2	-.5950389	-.62938917 -.03435027 .05772777	-.6030793 -.0080404 .0135124	Difference Relative difference
Employed: 2.region2	-.50935409	-.55540419 -.04605009 .0904088	-.51259158 -.00323749 .00635606	Difference Relative difference

-----				
Employed:	-.38874877	-.42999789	-.39383795	
3.region2		-.04124913	-.00508919	Difference
		.10610742	.0130912	Relative difference
-----				
Employed:	-.31699165	-.30934788	-.32781566	
4.region2		.00764377	-.010824	Difference
		-.02411349	.03414602	Relative difference
-----				
Employed:	-.29410374	-.34328435	-.28763227	
5.region2		-.04918061	.00647147	Difference
		.16722197	-.02200403	Relative difference
-----				
Employed:	-.11998105	-.13596225	-.12446747	
6.region2		-.0159812	-.00448642	Difference
		.13319773	.03739274	Relative difference
-----				
Employed:	.19141911	.22551316	.18767315	
8.region2		.03409405	-.00374596	Difference
		.17811205	-.01956942	Relative difference
-----				
Employed:	.21898887	.25377821	.21426257	
9.region2		.03478934	-.0047263	Difference
		.1588635	-.02158239	Relative difference
-----				
Employed:	-.50941154	-.54549006	-.51506112	
10.region2		-.03607853	-.00564959	Difference
		.07082393	.01109042	Relative difference
-----				
Employed:	-.36105298	-.39120378	-.3646385	
11.region2		-.0301508	-.00358552	Difference
		.08350798	.00993074	Relative difference
-----				
Employed:	-.5397469	-.57849604	-.53755487	
12.region2		-.03874914	.00219203	Difference
		.07179131	-.00406122	Relative difference
-----				
Employed:	-8.6062799	-9.648384	-8.1331812	
_cons		-1.0421041	.47309869	Difference
		.12108648	-.05497134	Relative difference
-----				
lnsig2u:	1.9318162	2.1780655	1.8347894	
_cons		.24624931	-.0970268	Difference
		.12747036	-.05022569	Relative difference
-----				

```
. xtprobit Employed `vlist', re intpoints(50)
```

Fitting comparison model:

```
Iteration 0:  log likelihood = -24921.244
Iteration 1:  log likelihood = -15465.335
Iteration 2:  log likelihood = -15264.514
Iteration 3:  log likelihood = -15263.522
Iteration 4:  log likelihood = -15263.522
```

Fitting full model:

```
rho = 0.0    log likelihood = -15263.522
rho = 0.1    log likelihood = -13755.146
rho = 0.2    log likelihood = -12819.059
rho = 0.3    log likelihood = -12178.43
rho = 0.4    log likelihood = -11721.106
rho = 0.5    log likelihood = -11394.226
rho = 0.6    log likelihood = -11173.946
rho = 0.7    log likelihood = -11057.594
rho = 0.8    log likelihood = -11072.158
```

```
Iteration 0:  log likelihood = -11057.595
Iteration 1:  log likelihood = -10262.193
Iteration 2:  log likelihood = -9957.4453
Iteration 3:  log likelihood = -9936.4833
Iteration 4:  log likelihood = -9936.1286
```

Iteration 5: log likelihood = -9936.1286  
 Iteration 6: log likelihood = -9936.1286

Random-effects probit regression  
 Group variable: pid  
 Random effects u\_i ~ Gaussian  
 Integration method: mvaghermite  
 Log likelihood = -9936.1286

Number of obs = 38318  
 Number of groups = 8593  
 Obs per group: min = 1  
 avg = 4.5  
 max = 6  
 Integration points = 50  
 Wald chi2(19) = 2127.11  
 Prob > chi2 = 0.0000

	Employed	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
	age	.6038392	.0157032	38.45	0.000	.5730614	.634617
	c.age#c.age	-.0074526	.0001835	-40.61	0.000	-.0078122	-.0070929
	1.Married	.8289547	.0717742	11.55	0.000	.6882798	.9696296
	qfachi						
	1st degree	.7812993	.1874155	4.17	0.000	.4139716	1.148627
hnd,hnc,teaching		.1241926	.2068055	0.60	0.548	-.2811387	.5295239
	a level	-.3842762	.169653	-2.27	0.024	-.7167899	-.0517625
	o level	-.4343384	.1693891	-2.56	0.010	-.766335	-.1023418
	none of these	-1.347033	.1817233	-7.41	0.000	-1.703204	-.9908618
	region2						
	north east	-.620542	.2691	-2.31	0.021	-1.147968	-.0931157
	north west	-.5276376	.2069742	-2.55	0.011	-.9332996	-.1219756
yorkshire & humber		-.4017928	.2185033	-1.84	0.066	-.8300514	.0264658
	east midlands	-.3268754	.2213306	-1.48	0.140	-.7606754	.1069246
	west midlands	-.2997847	.2224268	-1.35	0.178	-.7357331	.1361638
	east of england	-.1283834	.2143897	-0.60	0.549	-.5485796	.2918127
	south east	.1963778	.199719	0.98	0.325	-.1950642	.5878198
	south west	.2257779	.2157462	1.05	0.295	-.1970769	.6486326
	wales	-.5276039	.1831779	-2.88	0.004	-.8866259	-.1685819
	scotland	-.3711312	.1813563	-2.05	0.041	-.726583	-.0156793
northern ireland		-.5519109	.1862777	-2.96	0.003	-.9170085	-.1868134
	_cons	-8.432192	.3351655	-25.16	0.000	-9.089105	-7.77528
	/lnsig2u	1.906588	.0478111			1.81288	2.000296
	sigma_u	2.594241	.0620168			2.475494	2.718684
	rho	.8706353	.0053849			.8597096	.8808282

Likelihood-ratio test of rho=0: chibar2(01) = 1.1e+04 Prob >= chibar2 = 0.000

. quadchk, nooutput

Refitting model intpoints() = 34  
 Refitting model intpoints() = 66

#### Quadrature check

	Fitted quadrature 50 points	Comparison quadrature 34 points	Comparison quadrature 66 points	
Log likelihood	-9936.1286	-9936.2687	-9936.135	
		-.14010164	-.0064179	Difference
		.0000141	6.459e-07	Relative difference
Employed:	.60383921	.60334502	.6039366	
age		-.00049419	.00009739	Difference
		-.00081841	.00016128	Relative difference
Employed:	-.00745257	-.00744677	-.00745375	

c.age#c.age		5.806e-06	-1.178e-06	Difference
		-.00077902	.0001581	Relative difference
-----				
Employed:	.82895466	.82887891	.82907122	
1.Married		-.00007575	.00011656	Difference
		-.00009138	.00014061	Relative difference
-----				
Employed:	.78129925	.78302395	.78115623	
2.qfachi		.00172469	-.00014302	Difference
		.00220747	-.00018305	Relative difference
-----				
Employed:	.12419261	.1242719	.12425466	
3.qfachi		.00007928	.00006204	Difference
		.00063837	.00049957	Relative difference
-----				
Employed:	-.38427623	-.38503235	-.38445314	
4.qfachi		-.00075612	-.0001769	Difference
		.00196764	.00046036	Relative difference
-----				
Employed:	-.43433841	-.43519439	-.43453927	
5.qfachi		-.00085598	-.00020086	Difference
		.00197077	.00046245	Relative difference
-----				
Employed:	-1.3470329	-1.3463316	-1.3475397	
7.qfachi		.00070126	-.0005068	Difference
		-.00052059	.00037623	Relative difference
-----				
Employed:	-.62054202	-.62123331	-.62068742	
1.region2		-.00069129	-.0001454	Difference
		.001114	.0002343	Relative difference
-----				
Employed:	-.52763758	-.52804582	-.52771096	
2.region2		-.00040824	-.00007338	Difference
		.00077372	.00013908	Relative difference
-----				
Employed:	-.40179278	-.40237015	-.40179798	
3.region2		-.00057738	-5.201e-06	Difference
		.001437	.00001295	Relative difference
-----				
Employed:	-.32687545	-.32709653	-.32686332	
4.region2		-.00022108	.00001213	Difference
		.00067636	-.0000371	Relative difference
-----				
Employed:	-.29978466	-.2998909	-.29979505	
5.region2		-.00010624	-.00001039	Difference
		.0003544	.00003465	Relative difference
-----				
Employed:	-.12838344	-.12855009	-.1283699	
6.region2		-.00016665	.00001354	Difference
		.00129808	-.00010548	Relative difference
-----				
Employed:	.19637777	.19651322	.19641432	
8.region2		.00013545	.00003655	Difference
		.00068976	.00018614	Relative difference
-----				
Employed:	.22577785	.22596043	.22589145	
9.region2		.00018258	.0001136	Difference
		.00080867	.00050315	Relative difference
-----				
Employed:	-.5276039	-.5282228	-.52767128	
10.region2		-.00061891	-.00006738	Difference
		.00117305	.00012771	Relative difference
-----				
Employed:	-.37113116	-.37162409	-.37114929	
11.region2		-.00049293	-.00001813	Difference
		.00132819	.00004886	Relative difference
-----				
Employed:	-.55191093	-.55225649	-.55197844	
12.region2		-.00034556	-.00006751	Difference
		.00062612	.00012232	Relative difference
-----				
Employed:	-8.4321925	-8.4245255	-8.4333863	
_cons		.00766696	-.00119382	Difference



Random-effects logistic regression	Number of obs	=	38318
Group variable: pid	Number of groups	=	8593
Random effects u_i ~ Gaussian	Obs per group: min	=	1
	avg	=	4.5
	max	=	6
Integration method: mvaghermite	Integration points	=	12
	Wald chi2(19)	=	3159.18
Log likelihood = -9889.0729	Prob > chi2	=	0.0000

	Fitted quadrature 12 points	Comparison quadrature 8 points	Comparison quadrature 16 points	
Log likelihood	-9889.0729	-9905.2038 -16.130815 .00163118	-9910.804 -21.731051 .00219748	Difference Relative difference
Employed: age	1.0712286	1.2310672 .15983862	1.0488609 -.02236764	Difference

		.14921056	-.02088036	Relative difference
Employed:	-.01322034	-.01517391	-.01295896	
c.age#c.age		-.00195356	.00026139	Difference
		.14776941	-.01977169	Relative difference
Employed:	1.4830381	1.5623748	1.5108048	
1.Married		.0793367	.02776675	Difference
		.05349607	.01872288	Relative difference
Employed:	1.3315688	1.4819316	1.4037063	
2.qfachi		.15036283	.07213752	Difference
		.11292156	.05417484	Relative difference
Employed:	.19015551	.28644864	.19674628	
3.qfachi		.09629313	.00659077	Difference
		.5063915	.03465992	Relative difference
Employed:	-.64729556	-.62670132	-.70348688	
4.qfachi		.02059424	-.05619132	Difference
		-.03181582	.08680937	Relative difference
Employed:	-.71821039	-.78313808	-.77759976	
5.qfachi		-.06492769	-.05938937	Difference
		.09040205	.08269077	Relative difference
Employed:	-2.2947878	-2.5341196	-2.351899	
7.qfachi		-.23933183	-.05711122	Difference
		.10429366	.02488736	Relative difference
Employed:	-1.0549767	-1.0911217	-1.1177287	
1.region2		-.03614499	-.06275201	Difference
		.03426141	.05948189	Relative difference
Employed:	-.93171821	-1.024697	-.96761594	
2.region2		-.09297875	-.03589774	Difference
		.09979278	.03852853	Relative difference
Employed:	-.70828908	-.79467348	-.72315058	
3.region2		-.0863844	-.01486149	Difference
		.12196207	.02098224	Relative difference
Employed:	-.60460219	-.58931766	-.6236486	
4.region2		.01528453	-.01904641	Difference
		-.02528031	.03150238	Relative difference
Employed:	-.54494395	-.6358546	-.54894938	
5.region2		-.09091064	-.00400543	Difference
		.16682568	.00735016	Relative difference
Employed:	-.20763379	-.23323844	-.22252999	
6.region2		-.02560465	-.0148962	Difference
		.12331638	.07174265	Relative difference
Employed:	.31863033	.37448678	.32304399	
8.region2		.05585645	.00441366	Difference
		.17530173	.01385196	Relative difference
Employed:	.34271146	.4069343	.35552572	
9.region2		.06422285	.01281426	Difference
		.18739626	.03739081	Relative difference
Employed:	-.91945386	-.98160601	-.95289517	
10.region2		-.06215215	-.03344131	Difference
		.06759681	.03637084	Relative difference
Employed:	-.66415795	-.73063653	-.67424841	
11.region2		-.06647858	-.01009046	Difference
		.10009453	.01519286	Relative difference
Employed:	-.97814878	-1.0474947	-.99271831	
12.region2		-.06934588	-.01456954	Difference
		.07089503	.01489501	Relative difference

```

-----
Employed:    -15.034855    -17.19449    -14.660259
      _cons          -2.1596348    .37459595    Difference
                        .14364188    -.02491517    Relative difference
-----
lnsig2u:      3.0275874    3.2987276    2.9991716
      _cons          .27114011    -.02841588    Difference
                        .08955649    -.00938565    Relative difference
-----

```

```
. xtlogit Employed `vlist', re intpoints(50)
```

Fitting comparison model:

```

Iteration 0:    log likelihood = -24921.244
Iteration 1:    log likelihood = -15209.129
Iteration 2:    log likelihood = -15147.752
Iteration 3:    log likelihood = -15147.628
Iteration 4:    log likelihood = -15147.628

```

Fitting full model:

```

tau = 0.0      log likelihood = -15147.628
tau = 0.1      log likelihood = -14541.393
tau = 0.2      log likelihood = -13957.017
tau = 0.3      log likelihood = -13401.159
tau = 0.4      log likelihood = -12877.828
tau = 0.5      log likelihood = -12389.192
tau = 0.6      log likelihood = -11937.814
tau = 0.7      log likelihood = -11530.935
tau = 0.8      log likelihood = -11192.561

```

```

Iteration 0:    log likelihood = -11530.935
Iteration 1:    log likelihood = -10352.741
Iteration 2:    log likelihood = -9999.1769
Iteration 3:    log likelihood = -9909.5216
Iteration 4:    log likelihood = -9907.4678
Iteration 5:    log likelihood = -9907.463
Iteration 6:    log likelihood = -9907.463

```

```

Random-effects logistic regression      Number of obs      =      38318
Group variable: pid                    Number of groups    =      8593

```

```

Random effects u_i ~ Gaussian           Obs per group: min =      1
                                         avg  =      4.5
                                         max  =      6

```

```

Integration method: mvaghermite        Integration points =      50

```

```

Log likelihood = -9907.463              Wald chi2(19)      =      1973.66
                                         Prob > chi2        =      0.0000

```

```

-----
              Employed |      Coef.   Std. Err.      z    P>|z|      [95% Conf. Interval]
-----+-----
              age      |      1.098885   .0293226    37.48   0.000      1.041414      1.156357
              c.age#c.age |     -.0135677   .0003435   -39.49   0.000     -.014241     -.0128944
              1.Married |      1.540648   .1339779    11.50   0.000      1.278056      1.80324
              qfachi    |
1st degree          |      1.424031   .3402752     4.18   0.000      .757104      2.090958
hnd,hnc,teaching    |      .2225392   .3752402     0.59   0.553     -.512918      .9579965
              a level   |     -.693804   .3072645    -2.26   0.024     -1.296031     -.0915767
              o level   |     -.7839168   .306808    -2.56   0.011     -1.385249     -.1825842
              none of these |     -2.443259   .3300875    -7.40   0.000     -3.090219     -1.7963
              region2   |
north east          |     -1.129849   .4885396    -2.31   0.021     -2.087369     -.1723288
north west          |     -.9877462   .3763174    -2.62   0.009     -1.725315     -.2501777
yorkshire & humber   |     -.7395821   .3980645    -1.86   0.063     -1.519774      .0406101
east midlands       |     -.6184952   .4040202    -1.53   0.126     -1.41036      .1733698
-----

```



west midlands	- .5763159	.4058969	-1.42	0.156	-1.371859	.2192274
east of england	- .228451	.3910278	-0.58	0.559	-.9948514	.5379493
south east	.3358652	.3656141	0.92	0.358	-.3807252	1.052456
south west	.3695682	.3955796	0.93	0.350	-.4057535	1.14489
wales	-.9663107	.3339831	-2.89	0.004	-1.620906	-.3117159
scotland	-.6848658	.3310538	-2.07	0.039	-1.333719	-.0360124
northern ireland	-1.013426	.3396893	-2.98	0.003	-1.679205	-.3476471
_cons	-15.35734	.6167925	-24.90	0.000	-16.56623	-14.14845
/lnsig2u	3.086158	.0492891			2.989554	3.182763
sigma_u	4.678976	.1153113			4.458341	4.910529
rho	.8693599	.0055979			.8579914	.8799457

Likelihood-ratio test of rho=0: chibar2(01) = 1.0e+04 Prob >= chibar2 = 0.000

. quadchk, nooutput

Refitting model intpoints() = 34

Refitting model intpoints() = 66

#### Quadrature check

	Fitted quadrature 50 points	Comparison quadrature 34 points	Comparison quadrature 66 points	
Log likelihood	-9907.463	-9907.8421 -.37915073 .00003827	-9907.4366 .0264141 -2.666e-06	Difference Relative difference
Employed: age	1.0988854	1.1003668 .00148143 .00134812	1.0996127 .00072728 .00066183	Difference Relative difference
Employed: c.age#c.age	-.01356768	-.01358581 -.00001813 .00133638	-.01357633 -8.650e-06 .00063755	Difference Relative difference
Employed: 1.Married	1.540648	1.5452705 .00462247 .00300034	1.5410968 .00044882 .00029132	Difference Relative difference
Employed: 2.qfachi	1.4240311	1.4244463 .00041515 .00029153	1.4229289 -.00110224 -.00077403	Difference Relative difference
Employed: 3.qfachi	.22253923	.22343459 .00089536 .00402337	.22220124 -.00033799 -.00151878	Difference Relative difference
Employed: 4.qfachi	-.69380397	-.70013485 -.00633089 .00912489	-.69290414 .00089983 -.00129695	Difference Relative difference
Employed: 5.qfachi	-.78391681	-.79069644 -.00677963 .00864841	-.78293713 .00097968 -.00124972	Difference Relative difference
Employed: 7.qfachi	-2.4432594	-2.4573949 -.0141355 .00578551	-2.444712 -.00145251 .0005945	Difference Relative difference
Employed: 1.region2	-1.1298488	-1.1361259 -.00627712 .00555572	-1.1296608 .000188 -.00016639	Difference Relative difference
Employed: 2.region2	-.98774617	-.99134859 -.00360242 .00364711	-.98773843 7.742e-06 -7.838e-06	Difference Relative difference
Employed:	-.73958212	-.7411527	-.73932973	



west midlands	- .5763159	.4058969	-1.42	0.156	-1.371859	.2192274
east of england	- .228451	.3910278	-0.58	0.559	-.9948514	.5379493
south east	.3358652	.3656141	0.92	0.358	-.3807252	1.052456
south west	.3695682	.3955796	0.93	0.350	-.4057535	1.14489
wales	-.9663107	.3339831	-2.89	0.004	-1.620906	-.3117159
scotland	-.6848658	.3310538	-2.07	0.039	-1.333719	-.0360124
northern ireland	-1.013426	.3396893	-2.98	0.003	-1.679205	-.3476471

Note: dy/dx for factor levels is the discrete change from the base level.

```
.
.
.
. * 10.2.4 Fixed Effects Estimators
. *-----
.
. xtreg    Employed `vlist', fe
```

```
Fixed-effects (within) regression           Number of obs   =    38318
Group variable: pid                        Number of groups =    8593

R-sq:  within = 0.0556                     Obs per group:  min =     1
        between = 0.2826                      avg   =    4.5
        overall = 0.2530                      max   =     6

                                           F(19,29706)      =    92.11
corr(u_i, Xb) = -0.2033                     Prob > F         =    0.0000
```

	Employed	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
	age	.0388825	.0020734	18.75	0.000	.0348186	.0429465
	c.age#c.age	-.0004665	.0000202	-23.05	0.000	-.0005062	-.0004269
	1.Married	.0086075	.007647	1.13	0.260	-.006381	.023596
	qfachi						
	1st degree	.6162655	.0463146	13.31	0.000	.5254867	.7070442
hnd,hnc,teaching		.3965048	.051124	7.76	0.000	.2962996	.49671
	a level	.1568052	.0435374	3.60	0.000	.0714699	.2421405
	o level	.024555	.0432379	0.57	0.570	-.0601932	.1093032
	none of these	.0703935	.0493975	1.43	0.154	-.0264278	.1672148
	region2						
	north east	-.0002505	.0567421	-0.00	0.996	-.1114674	.1109665
	north west	-.0610296	.041849	-1.46	0.145	-.1430556	.0209963
yorkshire & humber		-.0664431	.0399399	-1.66	0.096	-.1447271	.0118409
	east midlands	-.051137	.0383883	-1.33	0.183	-.1263797	.0241058
	west midlands	-.167806	.0427132	-3.93	0.000	-.2515258	-.0840863
	east of england	-.0816076	.0344393	-2.37	0.018	-.1491102	-.014105
	south east	.021631	.0301911	0.72	0.474	-.0375449	.080807
	south west	-.0444085	.0364615	-1.22	0.223	-.1158746	.0270577
	wales	-.0446138	.0424055	-1.05	0.293	-.1277305	.0385029
	scotland	-.0567224	.045463	-1.25	0.212	-.1458318	.032387
northern ireland		.013485	.1430718	0.09	0.925	-.2669419	.2939119
	_cons	-.1445232	.0723495	-2.00	0.046	-.2863313	-.0027151
	sigma_u	.38838716					
	sigma_e	.21239087					
	rho	.76979405	(fraction of variance due to u_i)				

F test that all u\_i=0: F(8592, 29706) = 10.20 Prob > F = 0.0000

```
. margins, dydx(*)
```

```
Average marginal effects           Number of obs   =    38318
Model VCE      : Conventional
```

```
Expression      : Linear prediction, predict()
dy/dx w.r.t.    : age 1.Married 2.qfachi 3.qfachi 4.qfachi 5.qfachi 7.qfachi 1.region2 2.region2
3.region2 4.region2 5.region2 6.region2 8.region2
```

		Delta-method				[95% Conf. Interval]	
		dy/dx	Std. Err.	z	P> z		
	age	-.0040561	.0007026	-5.77	0.000	-.0054332	-.0026789
	1.Married	.0086075	.007647	1.13	0.260	-.0063804	.0235954
	qfachi						
	1st degree	.6162655	.0463146	13.31	0.000	.5254904	.7070405
hnd,hnc,teaching		.3965048	.051124	7.76	0.000	.2963036	.4967059
	a level	.1568052	.0435374	3.60	0.000	.0714734	.242137
	o level	.024555	.0432379	0.57	0.570	-.0601898	.1092998
	none of these	.0703935	.0493975	1.43	0.154	-.0264239	.1672109
	region2						
	north east	-.0002505	.0567421	-0.00	0.996	-.1114629	.1109619
	north west	-.0610296	.041849	-1.46	0.145	-.1430522	.020993
yorkshire & humber		-.0664431	.0399399	-1.66	0.096	-.144724	.0118377
	east midlands	-.051137	.0383883	-1.33	0.183	-.1263766	.0241027
	west midlands	-.167806	.0427132	-3.93	0.000	-.2515224	-.0840897
	east of england	-.0816076	.0344393	-2.37	0.018	-.1491074	-.0141078
	south east	.021631	.0301911	0.72	0.474	-.0375425	.0808046
	south west	-.0444085	.0364615	-1.22	0.223	-.1158717	.0270548
	wales	-.0446138	.0424055	-1.05	0.293	-.1277271	.0384995
	scotland	-.0567224	.045463	-1.25	0.212	-.1458282	.0323833
northern ireland		.013485	.1430718	0.09	0.925	-.2669305	.2939005

Note: dy/dx for factor levels is the discrete change from the base level.

```
.
. xtlogit Employed `vlist', fe or
note: multiple positive outcomes within groups encountered.
note: 7130 groups (30832 obs) dropped because of all positive or
      all negative outcomes.
note: 12.region2 omitted because of no within-group variance.
```

```
Iteration 0: log likelihood = -2680.58
Iteration 1: log likelihood = -2270.8087
Iteration 2: log likelihood = -2265.9408
Iteration 3: log likelihood = -2265.8526
Iteration 4: log likelihood = -2265.8525
```

```
Conditional fixed-effects logistic regression   Number of obs   =       7486
Group variable: pid                           Number of groups =       1463

Obs per group: min =         2
               avg =        5.1
               max =         6

LR chi2(18) = 1103.35
Log likelihood = -2265.8525                    Prob > chi2      =    0.0000
```

	Employed	OR	Std. Err.	z	P> z	[95% Conf. Interval]	
	age	2.469028	.1216819	18.34	0.000	2.241692	2.719418
	c.age#c.age	.9876368	.0005531	-22.22	0.000	.9865534	.9887214
	1.Married	1.154252	.206279	0.80	0.422	.813168	1.638403
	qfachi						
	1st degree	286.2441	309.7567	5.23	0.000	34.3254	2387.027
hnd,hnc,teaching		43.13426	49.82531	3.26	0.001	4.48313	415.0147
	a level	10.35401	10.06398	2.40	0.016	1.540814	69.57716
	o level	1.421602	1.321424	0.38	0.705	.2299106	8.790161
	none of these	2.092251	2.225395	0.69	0.488	.2601625	16.82608
	region2						
	north east	.5965647	.6733639	-0.46	0.647	.0652944	5.450536
	north west	.3760586	.3109192	-1.18	0.237	.0743868	1.901145

yorkshire & humber	.2331227	.2316946	-1.47	0.143	.0332352	1.635202
east midlands	1.098137	.871029	0.12	0.906	.2320031	5.197797
west midlands	.1625821	.1333611	-2.21	0.027	.032573	.8114976
east of england	.3624298	.2620743	-1.40	0.160	.087845	1.495308
south east	1.983101	1.389928	0.98	0.329	.5020529	7.833219
south west	.7664997	.5666354	-0.36	0.719	.1799951	3.264099
wales	.6194918	.5679473	-0.52	0.601	.1027207	3.736055
scotland	.3523899	.2866363	-1.28	0.200	.0715567	1.735387
northern ireland	1	(omitted)				

```

.
. xtlogit Employed `vlist', fe
note: multiple positive outcomes within groups encountered.
note: 7130 groups (30832 obs) dropped because of all positive or
      all negative outcomes.
note: 12.region2 omitted because of no within-group variance.

```

```

Iteration 0:  log likelihood =  -2680.58
Iteration 1:  log likelihood = -2270.8087
Iteration 2:  log likelihood = -2265.9408
Iteration 3:  log likelihood = -2265.8526
Iteration 4:  log likelihood = -2265.8525

```

Conditional fixed-effects logistic regression	Number of obs	=	7486
Group variable: pid	Number of groups	=	1463
	Obs per group: min	=	2
	avg	=	5.1
	max	=	6
	LR chi2(18)	=	1103.35
Log likelihood = -2265.8525	Prob > chi2	=	0.0000

	Employed	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
age		.9038244	.0492833	18.34	0.000	.8072309 1.000418
c.age#c.age		-.0124403	.00056	-22.22	0.000	-.0135378 -.0113427
1.Married		.1434521	.1787123	0.80	0.422	-.2068175 .4937218
qfachi						
1st degree		5.656845	1.082142	5.23	0.000	3.535886 7.777804
hnd,hnc,teaching		3.764318	1.155121	3.26	0.001	1.500321 6.028314
a level		2.337374	.9719886	2.40	0.016	.432311 4.242436
o level		.3517841	.9295318	0.38	0.705	-1.470065 2.173633
none of these		.7382407	1.063637	0.69	0.488	-1.346449 2.82293
region2						
north east		-.5165676	1.128736	-0.46	0.647	-2.728849 1.695714
north west		-.9780104	.826784	-1.18	0.237	-2.598477 .6424565
yorkshire & humber		-1.45619	.9938738	-1.47	0.143	-3.404147 .4917666
east midlands		.0936151	.7931879	0.12	0.906	-1.461005 1.648235
west midlands		-1.816572	.8202692	-2.21	0.027	-3.42427 -.2088738
east of england		-1.014925	.7231036	-1.40	0.160	-2.432182 .4023323
south east		.6846618	.7008862	0.98	0.329	-.6890498 2.058373
south west		-.2659209	.7392506	-0.36	0.719	-1.714826 1.182984
wales		-.4788559	.9167955	-0.52	0.601	-2.275742 1.31803
scotland		-1.043017	.8134066	-1.28	0.200	-2.637265 .5512305
northern ireland		0	(omitted)			

```

.
. clogit Employed `vlist', group(pid)
note: multiple positive outcomes within groups encountered.
note: 7130 groups (30832 obs) dropped because of all positive or
      all negative outcomes.
note: 12.region2 omitted because of no within-group variance.

```

```

Iteration 0:  log likelihood =  -2680.58
Iteration 1:  log likelihood = -2270.8087

```

Conditional (fixed-effects) logistic regression	Number of obs	=	7486
	LR chi2(18)	=	1103.35
	Prob > chi2	=	0.0000
Log likelihood = -2265.8525	Pseudo R2	=	0.1958

```
. bysort pid: egen check1 = mean(Employed & Employed < .)

. bysort pid: egen check2 = mean(R12 & R12 < .)

. * identify the first observation for each person
. bysort pid (wave): generate firstobs = 1 if _n == 1
(29725 missing values generated)

. * How many individuals for whom check is 0 or 1
. tabulate check1 if firstobs == 1 & inlist(check1,0,1)
```

```
. tabulate check2 if firstobs == 1
```

```
.
.
. clogit Employed `vlist', group(pid) or
note: multiple positive outcomes within groups encountered.
note: 7130 groups (30832 obs) dropped because of all positive or
```

all negative outcomes.  
note: 12.region2 omitted because of no within-group variance.

Iteration 0: log likelihood = -2680.58  
Iteration 1: log likelihood = -2270.8087  
Iteration 2: log likelihood = -2265.9408  
Iteration 3: log likelihood = -2265.8526  
Iteration 4: log likelihood = -2265.8525

Conditional (fixed-effects) logistic regression      Number of obs      =      7486  
LR chi2(18)      =      1103.35  
Prob > chi2      =      0.0000  
Pseudo R2      =      0.1958  
Log likelihood = -2265.8525

	Employed	Odds Ratio	Std. Err.	z	P> z	[95% Conf. Interval]	
	age	2.469028	.1216819	18.34	0.000	2.241692	2.719418
	c.age#c.age	.9876368	.0005531	-22.22	0.000	.9865534	.9887214
	1.Married	1.154252	.206279	0.80	0.422	.813168	1.638403
	qfachi						
	1st degree	286.2441	309.7567	5.23	0.000	34.3254	2387.027
hnd,hnc,teaching		43.13426	49.82531	3.26	0.001	4.48313	415.0147
	a level	10.35401	10.06398	2.40	0.016	1.540814	69.57716
	o level	1.421602	1.321424	0.38	0.705	.2299106	8.790161
	none of these	2.092251	2.225395	0.69	0.488	.2601625	16.82608
	region2						
	north east	.5965647	.6733639	-0.46	0.647	.0652944	5.450536
	north west	.3760586	.3109192	-1.18	0.237	.0743868	1.901145
yorkshire & humber		.2331227	.2316946	-1.47	0.143	.0332352	1.635202
	east midlands	1.098137	.871029	0.12	0.906	.2320031	5.197797
	west midlands	.1625821	.1333611	-2.21	0.027	.032573	.8114976
	east of england	.3624298	.2620743	-1.40	0.160	.087845	1.495308
	south east	1.983101	1.389928	0.98	0.329	.5020529	7.833219
	south west	.7664997	.5666354	-0.36	0.719	.1799951	3.264099
	wales	.6194918	.5679473	-0.52	0.601	.1027207	3.736055
	scotland	.3523899	.2866363	-1.28	0.200	.0715567	1.735387
northern ireland		1	(omitted)				

```
.
.
. * 10.2.5 Mundlak Correction
. *-----
.
. tabulate(wave), gen(Wave)
```

wave	Freq.	Percent	Cum.
13	6,848	17.87	17.87
14	6,540	17.07	34.94
15	6,445	16.82	51.76
16	6,403	16.71	68.47
17	6,142	16.03	84.50
18	5,940	15.50	100.00
Total	38,318	100.00	

```
. foreach v of varlist age age2 Married Q1-Q5 R1-R6 R8-R12 Wave* {
2.     bysort pid: egen M_`v'=mean(`v')
3. }
```

```
. xtprobit Employed `vlist' Wave2-Wave6 M_*, re
note: M_Wave6 omitted because of collinearity
```

Fitting comparison model:

Iteration 0: log likelihood = -24921.244  
Iteration 1: log likelihood = -15397.046

Iteration 2: log likelihood = -15138.351  
 Iteration 3: log likelihood = -15136.719  
 Iteration 4: log likelihood = -15136.719

Fitting full model:

rho = 0.0 log likelihood = -15136.719  
 rho = 0.1 log likelihood = -13625.736  
 rho = 0.2 log likelihood = -12688.159  
 rho = 0.3 log likelihood = -12046.911  
 rho = 0.4 log likelihood = -11589.642  
 rho = 0.5 log likelihood = -11263.477  
 rho = 0.6 log likelihood = -11044.534  
 rho = 0.7 log likelihood = -10935.733  
 rho = 0.8 log likelihood = -10995.247

Iteration 0: log likelihood = -10929.841  
 Iteration 1: log likelihood = -10110.119  
 Iteration 2: log likelihood = -9784.8156  
 Iteration 3: log likelihood = -9760.9239  
 Iteration 4: log likelihood = -9751.1837  
 Iteration 5: log likelihood = -9751.131  
 Iteration 6: log likelihood = -9751.131 (backed up)  
 Iteration 7: log likelihood = -9750.3281  
 Iteration 8: log likelihood = -9750.3278

Random-effects probit regression Number of obs = 38318  
 Group variable: pid Number of groups = 8593

Random effects u\_i ~ Gaussian Obs per group: min = 1  
 avg = 4.5  
 max = 6

Integration method: mvaghermite Integration points = 12

Log likelihood = -9750.3278 Wald chi2(48) = 3718.66  
 Prob > chi2 = 0.0000

	Employed	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
age		.5652383	.0728419	7.76	0.000	.4224707 .7080059
c.age#c.age		-.0065835	.000288	-22.86	0.000	-.0071479 -.006019
1.Married		.099356	.0959195	1.04	0.300	-.0886428 .2873548
qfachi						
1st degree		4.232658	.5683376	7.45	0.000	3.118737 5.346579
hnd,hnc,teaching		2.742956	.6076877	4.51	0.000	1.55191 3.934002
a level		1.465578	.5166143	2.84	0.005	.4530322 2.478123
o level		.3419753	.5059538	0.68	0.499	-.6496758 1.333626
none of these		.6970707	.5697084	1.22	0.221	-.4195372 1.813679
region2						
north east		-.2571044	.6259599	-0.41	0.681	-1.483963 .9697544
north west		-.6277304	.464556	-1.35	0.177	-1.538243 .2827825
yorkshire & humber		-.8222363	.516536	-1.59	0.111	-1.834628 .1901556
east midlands		-.227214	.4831074	-0.47	0.638	-1.174087 .7196591
west midlands		-1.343629	.4674112	-2.87	0.004	-2.259738 -.4275198
east of england		-.867251	.4225616	-2.05	0.040	-1.695457 -.0390454
south east		.3716063	.3850623	0.97	0.335	-.383102 1.126315
south west		-.2320666	.4154851	-0.56	0.576	-1.046403 .5822693
wales		-.3728875	.5028273	-0.74	0.458	-1.358411 .612636
scotland		-.6053441	.4694039	-1.29	0.197	-1.525359 .3146707
northern ireland		-.0945145	2.195178	-0.04	0.966	-4.396983 4.207955
Wave2		-.0127722	.0861709	-0.15	0.882	-.1816641 .1561197
Wave3		-.064411	.1487782	-0.43	0.665	-.356011 .227189
Wave4		-.1717028	.215537	-0.80	0.426	-.5941475 .250742
Wave5		-.1678775	.2843942	-0.59	0.555	-.7252799 .3895249
Wave6		-.3050086	.3526126	-0.86	0.387	-.9961166 .3860994
M_age		.0269993	.0738535	0.37	0.715	-.1177508 .1717495





Wave2	-.0127722	.0861709	-0.15	0.882	-.1816641	.1561197
Wave3	-.064411	.1487782	-0.43	0.665	-.356011	.227189
Wave4	-.1717028	.215537	-0.80	0.426	-.5941475	.250742
Wave5	-.1678775	.2843942	-0.59	0.555	-.7252799	.3895249
Wave6	-.3050086	.3526126	-0.86	0.387	-.9961166	.3860994
M_age	.0269993	.0738535	0.37	0.715	-.1177508	.1717495
M_age2	-.0008513	.0003129	-2.72	0.007	-.0014645	-.0002381
M_Married	1.547793	.1351774	11.45	0.000	1.28285	1.812736
M_Q1	-1.862458	.418599	-4.45	0.000	-2.682897	-1.042019
M_Q2	-.680823	.4962341	-1.37	0.170	-1.653424	.2917779
M_Q3	.1856125	.3475439	0.53	0.593	-.495561	.8667859
M_Q4	1.599123	.3449014	4.64	0.000	.9231291	2.275118
M_Q5	2.277463	.5988547	3.80	0.000	1.103729	3.451196
M_R1	-.3844818	.685642	-0.56	0.575	-1.728315	.9593519
M_R2	.1035439	.5140415	0.20	0.840	-.903959	1.111047
M_R3	.4946604	.5670241	0.87	0.383	-.6166865	1.606007
M_R4	-.2686875	.5367452	-0.50	0.617	-1.320689	.7833137
M_R5	1.251751	.5257902	2.38	0.017	.2212208	2.282281
M_R6	.8594509	.4843154	1.77	0.076	-.0897898	1.808692
M_R8	-.2853319	.4432984	-0.64	0.520	-1.154181	.583517
M_R9	.4628407	.4804751	0.96	0.335	-.4788732	1.404555
M_R10	-.1976931	.5391961	-0.37	0.714	-1.254498	.8591118
M_R11	.277421	.5078214	0.55	0.585	-.7178907	1.272733
M_R12	-.412574	2.203971	-0.19	0.852	-4.732279	3.907131
M_Wave1	.8542302	.4500008	1.90	0.058	-.0277553	1.736216
M_Wave2	.9750289	.4444655	2.19	0.028	.1038926	1.846165
M_Wave3	1.733483	.4265557	4.06	0.000	.8974489	2.569516
M_Wave4	1.360311	.4033028	3.37	0.001	.5698517	2.150769
M_Wave5	1.132871	.4463236	2.54	0.011	.2580927	2.007649
M_Wave6	0	(omitted)				

-----  
Note: dy/dx for factor levels is the discrete change from the base level.

```
.
.
. * 10.2.6 Comparing Different Models
. *-----
.
. * Hausman tests
. xtlogit Employed `vlist', fe
note: multiple positive outcomes within groups encountered.
note: 7130 groups (30832 obs) dropped because of all positive or
      all negative outcomes.
note: 12.region2 omitted because of no within-group variance.
```

```
Iteration 0:  log likelihood =  -2680.58
Iteration 1:  log likelihood = -2270.8087
Iteration 2:  log likelihood = -2265.9408
Iteration 3:  log likelihood = -2265.8526
Iteration 4:  log likelihood = -2265.8525
```

```
Conditional fixed-effects logistic regression   Number of obs   =       7486
Group variable: pid                           Number of groups =       1463
```

```
Obs per group: min =         2
                avg  =        5.1
                max  =         6
```

```
Log likelihood = -2265.8525                LR chi2(18)      =    1103.35
                                           Prob > chi2     =     0.0000
```

Employed	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
age	.9038244	.0492833	18.34	0.000	.8072309	1.000418
c.age#c.age	-.0124403	.00056	-22.22	0.000	-.0135378	-.0113427
1.Married	.1434521	.1787123	0.80	0.422	-.2068175	.4937218
qfachi						
1st degree	5.656845	1.082142	5.23	0.000	3.535886	7.777804
hnd,hnc,teaching	3.764318	1.155121	3.26	0.001	1.500321	6.028314



hnd,hnc,teaching	.2225392	.3752402	0.59	0.553	-.512918	.9579965
a level	-.693804	.3072645	-2.26	0.024	-1.296031	-.0915767
o level	-.7839168	.306808	-2.56	0.011	-1.385249	-.1825842
none of these	-2.443259	.3300875	-7.40	0.000	-3.090219	-1.7963
region2						
north east	-1.129849	.4885396	-2.31	0.021	-2.087369	-.1723288
north west	-.9877462	.3763174	-2.62	0.009	-1.725315	-.2501777
yorkshire & humber	-.7395821	.3980645	-1.86	0.063	-1.519774	.0406101
east midlands	-.6184952	.4040202	-1.53	0.126	-1.41036	.1733698
west midlands	-.5763159	.4058969	-1.42	0.156	-1.371859	.2192274
east of england	-.228451	.3910278	-0.58	0.559	-.9948514	.5379493
south east	.3358652	.3656141	0.92	0.358	-.3807252	1.052456
south west	.3695682	.3955796	0.93	0.350	-.4057535	1.14489
wales	-.9663107	.3339831	-2.89	0.004	-1.620906	-.3117159
scotland	-.6848658	.3310538	-2.07	0.039	-1.333719	-.0360124
northern ireland	-1.013426	.3396893	-2.98	0.003	-1.679205	-.3476471
_cons	-15.35734	.6167925	-24.90	0.000	-16.56623	-14.14845
-----						
/lnsig2u	3.086158	.0492891			2.989554	3.182763
-----						
sigma_u	4.678976	.1153113			4.458341	4.910529
rho	.8693599	.0055979			.8579914	.8799457
-----						

Likelihood-ratio test of rho=0: chibar2(01) = 1.0e+04 Prob >= chibar2 = 0.000

. estimates store efficient

. hausman consistent efficient

Note: the rank of the differenced variance matrix (17) does not equal the number of coefficients being tested (18); be sure this is what you

expect, or there may be problems computing the test. Examine the output of your estimators for anything unexpected and possibly consider scaling your variables so that the coefficients are on a similar scale.

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	consistent	efficient	Difference	S.E.
-----				
age	.9038244	1.098885	-.195061	.039611
c.age#c.age	-.0124403	-.0135677	.0011274	.0004422
1.Married	.1434521	1.540648	-1.397196	.118271
qfachi				
2	5.656845	1.424031	4.232814	1.027251
3	3.764318	.2225392	3.541778	1.092474
4	2.337374	-.693804	3.031178	.9221445
5	.3517841	-.7839168	1.135701	.8774385
7	.7382407	-2.443259	3.1815	1.011121
region2				
1	-.5165676	-1.129849	.6132812	1.017533
2	-.9780104	-.9877462	.0097358	.7361773
3	-1.45619	-.7395821	-.716608	.9106754
4	.0936151	-.6184952	.7121103	.6825795
5	-1.816572	-.5763159	-1.240256	.7128038
6	-1.014925	-.228451	-.7864736	.6082566
8	.6846618	.3358652	.3487967	.5979697
9	-.2659209	.3695682	-.6354892	.6245064
10	-.4788559	-.9663107	.4874549	.8537969
11	-1.043017	-.6848658	-.3581513	.7429897
-----				

b = consistent under Ho and Ha; obtained from xtlogit  
B = inconsistent under Ha, efficient under Ho; obtained from xtlogit

Test: Ho: difference in coefficients not systematic

chi2(17) = (b-B)'[(V\_b-V\_B)^(-1)](b-B)  
= 242.51  
Prob>chi2 = 0.0000

.

```

. * 10.3 Panel Data Methods for Ordered Outcomes
. *-----
.
. generate Unemployed = 1 if jbstat == 3
(36806 missing values generated)

. replace Unemployed = 0 if jbstat == 1 | jbstat == 2
(24722 real changes made)

.
. tabulate lfsato

satisfaction with: life |
                        | overall | Freq.   Percent   Cum.
-----+-----
not satisfied at all    |         | 377      1.02      1.02
                        | 2       | 773      2.09      3.12
                        | 3       | 2,166    5.87      8.99
not satis/dissat        |         | 4,777    12.95     21.93
                        | 5       | 11,510   31.19     53.12
                        | 6       | 12,867   34.87     87.99
completely satisfied    |         | 4,430    12.01     100.00
-----+-----
                        | Total  | 36,900   100.00

.
. reoprob lfsato Unemployed age age2 Married R1-R6 R8-R12 ///
>           M_age M_age2 M_Married M_R* ///
>           if age >= 23, i(pid)

```

Fitting constant-only model:

```

Iteration 0:  log likelihood = -31821.781
Iteration 1:  log likelihood = -29745.874
Iteration 2:  log likelihood = -29647.379
Iteration 3:  log likelihood = -29646.651
Iteration 4:  log likelihood = -29646.651

```

Fitting full model:

```

Iteration 0:  log likelihood = -31365.225
Iteration 1:  log likelihood = -29445.339
Iteration 2:  log likelihood = -29325.613
Iteration 3:  log likelihood = -29325.06
Iteration 4:  log likelihood = -29325.06

```

Random Effects Ordered Probit	Number of obs	=	23262
	LR chi2(29)	=	643.18
Log likelihood = -29325.06	Prob > chi2	=	0.0000

lfsato	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
eq1						
Unemployed	-.641458	.0490029	-13.09	0.000	-.7375018	-.5454142
age	-.0742783	.0189455	-3.92	0.000	-.1114108	-.0371457
age2	.0006848	.0002133	3.21	0.001	.0002667	.001103
Married	.4906649	.0494225	9.93	0.000	.3937986	.5875312
R1	.2336418	.4287209	0.54	0.586	-.6066358	1.073919
R2	.4014544	.3133202	1.28	0.200	-.212642	1.015551
R3	.1814236	.2609375	0.70	0.487	-.3300045	.6928518
R4	-.1458973	.2538105	-0.57	0.565	-.6433567	.3515621
R5	.0197443	.3239403	0.06	0.951	-.615167	.6546557
R6	-.0669416	.2245717	-0.30	0.766	-.5070941	.3732109
R8	.1158148	.19703	0.59	0.557	-.2703569	.5019864
R9	-.0272	.2505617	-0.11	0.914	-.5182919	.4638919
R10	.2156521	.3364839	0.64	0.522	-.4438443	.8751485
R11	-.1963634	.3123421	-0.63	0.530	-.8085427	.415816
R12	1.6997	1.093874	1.55	0.120	-.4442543	3.843654
M_age	-.0306304	.0202042	-1.52	0.130	-.0702298	.0089691
M_age2	.000595	.000227	2.62	0.009	.0001501	.0010399
M_Married	.0439069	.0690544	0.64	0.525	-.0914373	.1792511
M_R1	-.2811159	.457199	-0.61	0.539	-1.177209	.6149776



R4	-.1063485	.1715688	-0.62	0.535	-.4426402	.2299433
R5	-.0014966	.227366	-0.01	0.995	-.4471562	.4441631
R6	-.0881974	.1544208	-0.57	0.568	-.3908774	.2144825
R8	.0823724	.1333633	0.62	0.537	-.1790328	.3437776
R9	-.0378014	.1727258	-0.22	0.827	-.3763609	.3007581
R10	.1780359	.2336383	0.76	0.446	-.2799181	.6359899
R11	-.1404468	.2143477	-0.66	0.512	-.5605892	.2796957
R12	1.298868	.747108	1.74	0.082	-.1655374	2.763273
_cons	4.884714	.3276756	14.91	0.000	4.242437	5.52699

sigma_u	1.0222044	
sigma_e	.74913496	
rho	.65058128	(fraction of variance due to u_i)

F test that all u\_i=0: F(5564, 17682) = 5.27 Prob > F = 0.0000

```
. recode lfsato (0/3 = 0) (4/7 = 1), gen(satisf_dummy)
(23166 differences between lfsato and satisf_dummy)
```

```
. xtlogit satisf_dummy i.Unemployed age age2 i.Married ib7.region2 ///
> if age >= 23, or fe
note: multiple positive outcomes within groups encountered.
note: 3755 groups (14109 obs) dropped because of all positive or
all negative outcomes.
```

```
Iteration 0: log likelihood = -3448.1331
Iteration 1: log likelihood = -3433.8999
Iteration 2: log likelihood = -3433.4332
Iteration 3: log likelihood = -3433.3401
Iteration 4: log likelihood = -3433.3184
Iteration 5: log likelihood = -3433.3142
Iteration 6: log likelihood = -3433.3135
Iteration 7: log likelihood = -3433.3133
Iteration 8: log likelihood = -3433.3133
Iteration 9: log likelihood = -3433.3133
```

Conditional fixed-effects logistic regression	Number of obs	=	9153
Group variable: pid	Number of groups	=	1810

Obs per group: min	=	2
avg	=	5.1
max	=	6

Log likelihood = -3433.3133	LR chi2(15)	=	87.90
	Prob > chi2	=	0.0000

satisf_dummy	OR	Std. Err.	z	P> z	[95% Conf. Interval]	
1.Unemployed	.4211356	.0636212	-5.72	0.000	.3132063	.5662569
age	.9282021	.0526572	-1.31	0.189	.8305268	1.037365
age2	1.000681	.0006532	1.04	0.297	.9994015	1.001962
1.Married	2.372028	.3311549	6.19	0.000	1.804201	3.118564
region2						
north east	2585503	2.14e+09	0.02	0.986	0	.
north west	.692595	.8979902	-0.28	0.777	.0545565	8.792499
yorkshire & humber	.7396605	.5531982	-0.40	0.687	.1707701	3.203709
east midlands	.4059811	.3432847	-1.07	0.286	.0774028	2.129388
west midlands	.361013	.3678241	-1.00	0.317	.0490074	2.6594
east of england	.4168293	.3150113	-1.16	0.247	.0947715	1.833322
south east	.8397615	.5860959	-0.25	0.802	.2138335	3.29789
south west	.3565604	.2561083	-1.44	0.151	.0872442	1.457235
wales	1.112934	1.070098	0.11	0.911	.1690559	7.326703
scotland	.8132682	1.000055	-0.17	0.867	.0730354	9.055958
northern ireland	8.84e+12	1.56e+16	0.02	0.986	0	.

```
.
.
. erase temp.dta
```

```
. log close
  name: <unnamed>
  log: C:\My Documents\\Example_Chapter10.log
  log type: text
  closed on: 31 Jul 2014, 18:32:25
```

---