**. glm MR `part\_penalty\_point\_vars' `covariates' ib(freq).state ib(freq).time if sample\_pp, family(poisson) link(log) vce(cl mineid) exposure(hours) iter(50) eform**

Iteration 0: log pseudolikelihood = -10798.877

Iteration 1: log pseudolikelihood = -10052.291

Iteration 2: log pseudolikelihood = -10046.126

Iteration 3: log pseudolikelihood = -10046.122

Iteration 4: log pseudolikelihood = -10046.122

Generalized linear models No. of obs = 14,895

Optimization : ML Residual df = 14,838

Scale parameter = 1

Deviance = 11231.05179 (1/df) Deviance = .7569114

Pearson = 79431.05979 (1/df) Pearson = 5.353219

Variance function: V(u) = u [Poisson]

Link function : g(u) = ln(u) [Log]

AIC = 1.356579

Log pseudolikelihood = -10046.12235 BIC = -131344

(Std. Err. adjusted for 879 clusters in mineid)

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

| Robust

MR | IRR Std. Err. z P>|z| [95% Conf. Interval]

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

p47\_pp | .9981349 .0016903 -1.10 0.270 .9948273 1.001453

p48\_pp | 1.000006 .000249 0.03 0.980 .9995184 1.000495

p71\_pp | .9994614 .0012728 -0.42 0.672 .9969698 1.001959

p72\_pp | 1.000703 .0008926 0.79 0.431 .9989548 1.002454

p75\_pp | 1.000038 .0000121 3.15 0.002 1.000014 1.000062

p77\_pp | .9999139 .0001966 -0.44 0.661 .9995287 1.000299

mine\_time | .9973325 .002169 -1.23 0.219 .9930903 1.001593

onsite\_insp\_hours | .9995755 .00019 -2.23 0.025 .9992032 .9999478

|

state |

AL | 1.324742 .1746592 2.13 0.033 1.02307 1.715367

AR | 2.397076 .1678805 12.48 0.000 2.089621 2.749769

CO | .7167867 .1030085 -2.32 0.021 .5408351 .9499812

IL | 1.229753 .1160454 2.19 0.028 1.022102 1.47959

IN | .9519282 .190514 -0.25 0.806 .6430565 1.409157

KY | 1.069033 .0722598 0.99 0.323 .9363866 1.220469

MD | 1.203177 .1526345 1.46 0.145 .9383099 1.54281

MT | .7504373 .0427777 -5.04 0.000 .6711086 .8391432

NM | .8470289 .0537647 -2.62 0.009 .7479432 .9592412

OH | 1.068187 .1591386 0.44 0.658 .7976919 1.430406

OK | .7633001 .344268 -0.60 0.549 .3153418 1.847605

PA | .8809434 .1020291 -1.09 0.274 .7020428 1.105433

TN | 1.182548 .199804 0.99 0.321 .8491795 1.64679

UT | .6273945 .1258291 -2.32 0.020 .4234725 .9295145

VA | .6766388 .0735356 -3.59 0.000 .5468274 .8372661

WY | 1.04513 .053703 0.86 0.390 .9450009 1.155869

|

time |

2007 | 1.27189 .1409691 2.17 0.030 1.023546 1.58049

2007.25 | 1.117797 .1358848 0.92 0.360 .8808192 1.418532

2007.5 | 1.213728 .1252658 1.88 0.061 .9914508 1.485839

2007.75 | 1.178715 .1294738 1.50 0.134 .9504083 1.461866

2008 | 1.016052 .1109745 0.15 0.884 .8202512 1.258593

2008.25 | 1.05262 .1178524 0.46 0.647 .8452208 1.31091

2008.5 | 1.206901 .125002 1.82 0.069 .9851685 1.47854

2009 | .9813009 .0993359 -0.19 0.852 .8047039 1.196653

2009.25 | .9277658 .1048321 -0.66 0.507 .7434599 1.157762

2009.5 | 1.120454 .1294571 0.98 0.325 .8934007 1.405212

2009.75 | .851907 .096592 -1.41 0.157 .6821503 1.063908

2010 | .9207239 .1089488 -0.70 0.485 .7301417 1.161052

2010.25 | .9408064 .1140457 -0.50 0.615 .7418507 1.19312

2010.5 | 1.091316 .1220002 0.78 0.434 .8765833 1.358651

2010.75 | .8947179 .0991911 -1.00 0.316 .7199783 1.111867

2011 | .9981741 .1090707 -0.02 0.987 .8057407 1.236566

2011.25 | 1.014985 .1099733 0.14 0.891 .8207901 1.255125

2011.5 | 1.108273 .1209744 0.94 0.346 .8948149 1.372652

2011.75 | .9274275 .1092105 -0.64 0.522 .7362844 1.168192

2012 | 1.141586 .1238579 1.22 0.222 .9229038 1.412085

2012.25 | .9948799 .108748 -0.05 0.963 .8030226 1.232576

2012.5 | 1.096056 .1150553 0.87 0.382 .8922376 1.346435

2012.75 | .9374483 .1153037 -0.53 0.599 .736634 1.193007

2013 | 1.005608 .1107777 0.05 0.960 .8103269 1.247949

2013.25 | .8655471 .1066643 -1.17 0.241 .6798206 1.102014

2013.5 | 1.148449 .1318194 1.21 0.228 .9170873 1.438179

2013.75 | .9144056 .1085006 -0.75 0.451 .7246661 1.153825

2014 | .8671248 .1200546 -1.03 0.303 .6610459 1.137448

2014.25 | .9767298 .1260101 -0.18 0.855 .7585059 1.257737

2014.5 | 1.00672 .1177596 0.06 0.954 .8004618 1.266125

2014.75 | 1.015772 .1207231 0.13 0.895 .8046968 1.282214

2015 | .9438545 .1106395 -0.49 0.622 .7501125 1.187637

2015.25 | 1.002136 .1315548 0.02 0.987 .7747929 1.296187

2015.5 | 1.270506 .1604376 1.90 0.058 .9919468 1.627291

2015.75 | .785418 .1112597 -1.71 0.088 .5950076 1.036762

2016 | 1.086725 .1351372 0.67 0.504 .8516684 1.386657

|

\_cons | 9.62e-06 9.46e-07 -117.57 0.000 7.94e-06 .0000117

ln(hours) | 1 (exposure)

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

. estat gof

Deviance goodness-of-fit = 11407.9

Prob > chi2(14850) = 1.0000

Pearson goodness-of-fit = 81986.88

Prob > chi2(14850) = 0.0000

**. glm MR `part\_penalty\_point\_vars' `covariates' ib(freq).state ib(freq).time if sample\_pp, family(nbinomial) link(log) vce(cl mineid) exposure(hours) iter(50) eform**

Iteration 0: log pseudolikelihood = -10368.061

Iteration 1: log pseudolikelihood = -10214.989

Iteration 2: log pseudolikelihood = -10214.831

Iteration 3: log pseudolikelihood = -10214.831

Generalized linear models No. of obs = 14,895

Optimization : ML Residual df = 14,838

Scale parameter = 1

Deviance = 7715.045368 (1/df) Deviance = .5199518

Pearson = 73897.74193 (1/df) Pearson = 4.980303

Variance function: V(u) = u+(1)u^2 [Neg. Binomial]

Link function : g(u) = ln(u) [Log]

AIC = 1.379232

Log pseudolikelihood = -10214.83138 BIC = -134860

(Std. Err. adjusted for 879 clusters in mineid)

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

| Robust

MR | IRR Std. Err. z P>|z| [95% Conf. Interval]

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

p47\_pp | .9983307 .0018427 -0.91 0.365 .9947257 1.001949

p48\_pp | .9999101 .0003612 -0.25 0.803 .9992024 1.000618

p71\_pp | .9992651 .0011852 -0.62 0.535 .9969447 1.001591

p72\_pp | 1.000181 .0009499 0.19 0.849 .9983213 1.002045

p75\_pp | 1.000044 .000013 3.38 0.001 1.000018 1.000069

p77\_pp | 1 .0002226 0.00 1.000 .9995639 1.000436

mine\_time | .9978778 .0018286 -1.16 0.246 .9943003 1.001468

onsite\_insp\_hours | .9995581 .0001704 -2.59 0.010 .9992241 .9998921

|

state |

AL | 1.282958 .1719445 1.86 0.063 .9865809 1.668369

AR | 2.171386 .1332163 12.64 0.000 1.925374 2.448832

CO | .6797194 .102656 -2.56 0.011 .5055629 .9138693

IL | 1.198558 .1120692 1.94 0.053 .9978588 1.439625

IN | .928221 .182229 -0.38 0.704 .6317466 1.363829

KY | .9870389 .0596451 -0.22 0.829 .876794 1.111146

MD | 1.163092 .146301 1.20 0.230 .9089593 1.488276

MT | .7225417 .041001 -5.73 0.000 .6464889 .8075413

NM | .8216432 .0470844 -3.43 0.001 .7343533 .9193089

OH | .8510858 .1471549 -0.93 0.351 .6064547 1.194396

OK | .7542954 .360021 -0.59 0.555 .2959837 1.922274

PA | .9000007 .1034192 -0.92 0.359 .7185073 1.127339

TN | 1.159884 .1883004 0.91 0.361 .8437755 1.594418

UT | .6162187 .128386 -2.32 0.020 .4096297 .9269969

VA | .6631756 .0601779 -4.53 0.000 .5551225 .792261

WY | 1.00655 .0476699 0.14 0.890 .9173236 1.104455

|

time |

2007 | 1.278613 .1553016 2.02 0.043 1.007747 1.622284

2007.25 | 1.17137 .1470616 1.26 0.208 .9158593 1.498165

2007.5 | 1.295589 .1527111 2.20 0.028 1.028338 1.632294

2007.75 | 1.23667 .1468951 1.79 0.074 .9798188 1.560853

2008 | 1.034027 .1188894 0.29 0.771 .8253972 1.29539

2008.25 | 1.133037 .1447189 0.98 0.328 .8821107 1.455342

2008.5 | 1.238734 .139567 1.90 0.057 .9932848 1.544835

2009 | .9639077 .1071049 -0.33 0.741 .7752717 1.198442

2009.25 | .9419042 .1141365 -0.49 0.621 .7427818 1.194407

2009.5 | 1.121015 .1426274 0.90 0.369 .8735994 1.438501

2009.75 | .8579284 .1094159 -1.20 0.230 .6681794 1.101562

2010 | .9179014 .1119715 -0.70 0.483 .722705 1.165819

2010.25 | .9580041 .1213557 -0.34 0.735 .7473791 1.227987

2010.5 | 1.199946 .155374 1.41 0.159 .9309889 1.546603

2010.75 | .9239699 .1156206 -0.63 0.527 .723008 1.18079

2011 | 1.086547 .1271554 0.71 0.478 .863843 1.366665

2011.25 | 1.056501 .125019 0.46 0.642 .8378079 1.332279

2011.5 | 1.160313 .1342368 1.29 0.199 .9249098 1.455629

2011.75 | .9326609 .1114662 -0.58 0.560 .7378925 1.178839

2012 | 1.148603 .1289239 1.23 0.217 .9217807 1.43124

2012.25 | .9893732 .1160934 -0.09 0.927 .7861037 1.245204

2012.5 | 1.168461 .1397176 1.30 0.193 .9243421 1.477053

2012.75 | .9238432 .1212895 -0.60 0.546 .7142425 1.194953

2013 | .9485091 .111644 -0.45 0.653 .7530973 1.194626

2013.25 | .8274825 .1086245 -1.44 0.149 .6397653 1.070279

2013.5 | 1.049774 .127372 0.40 0.689 .8275942 1.331602

2013.75 | .9095718 .1144813 -0.75 0.451 .7107263 1.16405

2014 | .7968033 .1058519 -1.71 0.087 .6141475 1.033783

2014.25 | .9235679 .1178664 -0.62 0.533 .7191804 1.186041

2014.5 | .949029 .1188951 -0.42 0.676 .742404 1.213162

2014.75 | .9621473 .1217845 -0.30 0.760 .7507583 1.233057

2015 | .9157616 .1149206 -0.70 0.483 .7160834 1.17112

2015.25 | .9931786 .1373714 -0.05 0.961 .7573446 1.30245

2015.5 | 1.250002 .1568738 1.78 0.075 .9774303 1.598584

2015.75 | .760067 .1109265 -1.88 0.060 .5709854 1.011763

2016 | 1.063177 .1440016 0.45 0.651 .8152949 1.386424

|

\_cons | 9.75e-06 9.93e-07 -113.27 0.000 7.99e-06 .0000119

ln(hours) | 1 (exposure)

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

**. nbreg MR `part\_penalty\_point\_vars' `covariates' ib(freq).state ib(freq).time if sample\_pp, vce(cl mineid) exposure(hours) iter(50) irr**

Fitting Poisson model:

Iteration 0: log pseudolikelihood = -10255.846

Iteration 1: log pseudolikelihood = -10049.207

Iteration 2: log pseudolikelihood = -10046.145

Iteration 3: log pseudolikelihood = -10046.122

Iteration 4: log pseudolikelihood = -10046.122

Fitting constant-only model:

Iteration 0: log pseudolikelihood = -10314.872

Iteration 1: log pseudolikelihood = -10136.883

Iteration 2: log pseudolikelihood = -10132.52

Iteration 3: log pseudolikelihood = -10132.509

Iteration 4: log pseudolikelihood = -10132.509

Fitting full model:

Iteration 0: log pseudolikelihood = -9993.2933

Iteration 1: log pseudolikelihood = -9986.5492

Iteration 2: log pseudolikelihood = -9986.4222

Iteration 3: log pseudolikelihood = -9986.4222

Negative binomial regression Number of obs = 14,895

Wald chi2(56) = .

Dispersion = mean Prob > chi2 = .

Log pseudolikelihood = -9986.4222 Pseudo R2 = 0.0144

(Std. Err. adjusted for 879 clusters in mineid)

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| Robust

MR | IRR Std. Err. z P>|z| [95% Conf. Interval]

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

p47\_pp | .9981655 .0017363 -1.06 0.291 .9947683 1.001574

p48\_pp | .9999579 .0002804 -0.15 0.881 .9994085 1.000508

p71\_pp | .999378 .0011989 -0.52 0.604 .9970309 1.001731

p72\_pp | 1.000509 .0008947 0.57 0.569 .9987571 1.002264

p75\_pp | 1.000039 .0000124 3.17 0.002 1.000015 1.000064

p77\_pp | .9999344 .0002056 -0.32 0.750 .9995316 1.000337

mine\_time | .9974978 .0019999 -1.25 0.211 .9935859 1.001425

onsite\_insp\_hours | .9995735 .00018 -2.37 0.018 .9992207 .9999264

|

state |

AL | 1.305265 .1748205 1.99 0.047 1.003907 1.697088

AR | 2.317124 .1509781 12.90 0.000 2.039328 2.632761

CO | .7001672 .1016878 -2.45 0.014 .5267187 .9307323

IL | 1.210015 .110568 2.09 0.037 1.011603 1.447343

IN | .9422652 .1868263 -0.30 0.764 .6388551 1.389773

KY | 1.033584 .0661638 0.52 0.606 .9117104 1.171749

MD | 1.185046 .1506523 1.34 0.182 .9236852 1.520361

MT | .7408694 .0411492 -5.40 0.000 .6644533 .8260739

NM | .834644 .0498265 -3.03 0.002 .7424827 .9382449

OH | .9817048 .156473 -0.12 0.908 .7183047 1.341693

OK | .7571993 .3444515 -0.61 0.541 .3104537 1.846815

PA | .8854181 .1007826 -1.07 0.285 .7083705 1.106716

TN | 1.16942 .1935012 0.95 0.344 .8455205 1.617398

UT | .6188614 .1249788 -2.38 0.017 .4165754 .9193759

VA | .6711214 .0682487 -3.92 0.000 .5498438 .8191488

WY | 1.028036 .0501723 0.57 0.571 .9342571 1.131229

|

time |

2007 | 1.279005 .1467952 2.14 0.032 1.021357 1.601649

2007.25 | 1.146576 .1413864 1.11 0.267 .9004081 1.460044

2007.5 | 1.246066 .1350002 2.03 0.042 1.007676 1.540853

2007.75 | 1.211939 .1366341 1.70 0.088 .9716638 1.511629

2008 | 1.031518 .1137642 0.28 0.778 .8309973 1.280426

2008.25 | 1.079547 .1270633 0.65 0.515 .8571458 1.359654

2008.5 | 1.230675 .1306486 1.96 0.051 .9994932 1.51533

2009 | .9783562 .1021254 -0.21 0.834 .797342 1.200465

2009.25 | .9414879 .1072079 -0.53 0.596 .7531609 1.176906

2009.5 | 1.130032 .1347224 1.03 0.305 .8945622 1.427483

2009.75 | .859033 .1015915 -1.28 0.199 .6813096 1.083117

2010 | .9215028 .107657 -0.70 0.484 .7329136 1.158619

2010.25 | .9539618 .1158651 -0.39 0.698 .7518771 1.210362

2010.5 | 1.132437 .1332782 1.06 0.291 .8991557 1.426242

2010.75 | .9055423 .1042087 -0.86 0.389 .7226925 1.134655

2011 | 1.037006 .1147985 0.33 0.743 .8347403 1.288281

2011.25 | 1.0328 .1138017 0.29 0.770 .832194 1.281764

2011.5 | 1.137005 .1256461 1.16 0.245 .915586 1.411969

2011.75 | .9268386 .106775 -0.66 0.510 .7395079 1.161624

2012 | 1.152812 .1236512 1.33 0.185 .9342392 1.422521

2012.25 | .9890483 .1082968 -0.10 0.920 .7980211 1.225803

2012.5 | 1.125901 .1224892 1.09 0.276 .9096956 1.393491

2012.75 | .9367798 .1165394 -0.52 0.600 .7340817 1.195448

2013 | .9906737 .1098801 -0.08 0.933 .7971132 1.231236

2013.25 | .8551579 .1065888 -1.26 0.209 .6698086 1.091797

2013.5 | 1.112718 .1293828 0.92 0.358 .8859527 1.397526

2013.75 | .9143314 .1088601 -0.75 0.452 .7240353 1.154643

2014 | .8458267 .1126195 -1.26 0.209 .6515477 1.098036

2014.25 | .9540905 .1184656 -0.38 0.705 .747996 1.21697

2014.5 | .9907902 .1167824 -0.08 0.937 .786416 1.248277

2014.75 | .999147 .1195312 -0.01 0.994 .7903099 1.263169

2015 | .9308637 .1093674 -0.61 0.542 .7393979 1.171909

2015.25 | .9926765 .1277082 -0.06 0.954 .7714367 1.277365

2015.5 | 1.260014 .1538094 1.89 0.058 .991904 1.600594

2015.75 | .7756016 .1086035 -1.81 0.070 .5894532 1.020535

2016 | 1.085485 .1382342 0.64 0.519 .8457174 1.39323

|

\_cons | 9.68e-06 9.56e-07 -116.93 0.000 7.97e-06 .0000117

ln(hours) | 1 (exposure)

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

/lnalpha | -1.573492 .1714426 -1.909514 -1.237471

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

alpha | .2073199 .0355435 .1481524 .290117

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

**. lrtest pois nbin, stats force**

Likelihood-ratio test LR chi2(13) = 296.25

(Assumption: pois nested in nbin) Prob > chi2 = 0.0000

Akaike's information criterion and Bayesian information criterion

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

Model | Obs ll(null) ll(model) df AIC BIC

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

pois | 14,895 -10237.37 -10134.55 45 20359.1 20701.49

nbin | 14,895 -10132.51 -9986.422 58 20088.84 20530.15

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

Note: N=Obs used in calculating BIC; see [R] BIC note.

**. summ MR pcpp1\_yhat**

Variable | Obs Mean Std. Dev. Min Max

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

MR | 30,289 .4096207 .9550592 0 14

pcpp1\_yhat | 28,337 .360235 .562157 9.23e-06 8.224944