April_25_20_Sharp_RD_with_Stata_and_R

April 25, 2020

- Name: Jikhan Jeong
- Ref: https://www.masteringmetrics.com/resources/ (Stata)
- Ref: https://jrnold.github.io/masteringmetrics/mlda-regression-discontinuity.html (R)
- Ref: Matering Metrics: Chapter 4. RD analysis of the minimum legal drinking age (MLDA).
- Table 4.1 and Figures 4.2, 4.4, and 4.5 in Mastering Metrics.
- Table 4.1 presents sharp RD estimates of the effect of the minimum legal drinking age (MLDA) on mortality.
- Paper(2009, AEJ) : http://masteringmetrics.com/wp-content/uploads/2015/01/Carpenter-and-Dobkin-2009.pdf
- Paper(2011, JEP) : http://masteringmetrics.com/wp-content/uploads/2015/01/Carpenter-and-Dobkin-2011.pdf
-

0.1 DF: AEJfigs.dta

[1]:
```
!pwd
```

```
/data/cahnrs/jikhan.jeong/stata kernel
```

- gives you the type of presentation you see in academic papers.
- Ref: : https://www.princeton.edu/~otorres/Outreg2.pdf
- Ref: https://www.masteringmetrics.com/resources/
-

0.2 Ref: http://masteringmetrics.com/wp-content/uploads/2015/01/master_cd_rd.do (do file)

[1]:
```
use "AEJfigs.dta", clear
```

[2]:
```
sum
```

```
    Variable |        Obs        Mean    Std. Dev.       Min        Max
```

```
-------------+--------------------------------------------------------
     agecell |         50          21    1.126957   19.06849   22.93151
         all |         48    95.67272    3.831062   88.42776   105.2683
   allfitted |         50    95.80284    3.286415   91.70615   102.8918
    internal |         48    20.28529    2.253907   15.97709   24.37291
internalfi~d |         50     20.2813    1.994682   16.73813   24.04378
-------------+--------------------------------------------------------
    external |         48    75.38743    2.986008   71.34142   83.33099
externalfi~d |         50    75.52154    2.269976   73.15786   81.78372
     alcohol |         48    1.257337    .3503116    .639138   2.519309
alcoholfit~d |         50    1.267447    .2598618   .7943445   1.817361
    homicide |         48    16.91207    .7299822   14.94773   18.41097
-------------+--------------------------------------------------------
homicidefi~d |         50    16.95311    .4534175   16.26115   17.76202
     suicide |         48    12.35198    1.063468   10.88936   14.83189
suicidefit~d |         50    12.36285    .7597357    11.5921   13.54707
         mva |         48    31.62298    2.384977   26.85506    36.3852
   mvafitted |         50    31.67968    2.003196   27.86828   34.81778
-------------+--------------------------------------------------------
       drugs |         48     4.24966    .6155793   3.202071   5.564563
 drugsfitted |         50    4.255325    .5214404   3.448835   5.130238
externalot~r |         48    9.598514    .7483688   7.972546   11.48252
externalot~d |         50    9.610208     .465128   8.388236    10.3534
```

[3]:
```
list in 1/5
```

```
     +-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-----------------------------------------------------+
     |  agecell        all   allfit~d   internal   intern~d   external
extern..    alcohol   alcoho~d   homicide   homici~d    suicide   suicid~d
mva   mvafit~d      drugs   drugsf~d   extern~r   ~rfitted |
     |-------------------------------------------------------------------------------
-------------------------------------------------------------------------------
-----------------------------------------------------|
  1. | 19.06849    92.8254   91.70615   16.61759   16.73813   76.20782
74.96801    .639138   .7943445   16.31682   16.28457   11.20371    11.5921
35.82933   34.81778   3.872425   3.448835   8.534373   8.388236 |
  2. | 19.15068   95.10074   91.88372   18.32768   16.92065   76.77306
74.96307   .6774093   .8375749   16.85996    16.2707   12.19337   11.59361
35.63926   34.63389   3.236511   3.470022   8.655786   8.530174 |
  3. | 19.23288   92.14429   92.04906   18.91105   17.09884   73.23324
74.95023   .8664426   .8778347   15.21925   16.26288   11.71581   11.59513
34.20565   34.44674   3.202071   3.492069   8.513741   8.662681 |
  4. | 19.31507   88.42776   92.20214   16.10177   17.27268   72.32598
74.92947   .8673084   .9151149   16.74282   16.26115   11.27501   11.59665
32.27896    34.2563   3.280689    3.51498   8.258285   8.785728 |
```

```
  5. | 19.39726   88.70494   92.34292   17.36352   17.44216   71.34142
74.90076   1.019163   .9494066   14.94773   16.26551   10.98431   11.59819
32.65097   34.06259   3.548198   3.538755   8.417533   8.899288 |
     +------------------------------------------------------------------------
------------------------------------------------------------------------------
-----------------------------------------------------+
```

[4]:
```
* All = all deaths
gen age = agecell - 21
gen over21 = agecell >= 21
```

[5]:
```
* age2 = age square
* over_age = interation term between over21 dummy and age
gen age2 = age^2
gen over_age = over21*age
gen over_age2 = over21*age2
```

- linear trend, and linear on each side
-

0.3 Minimm legal drinking age (MLDA) cutoff in age 21, cutoff dummy is a function of age (=running variable)

[6]:
```
reg all age over21
predict allfitlin
```

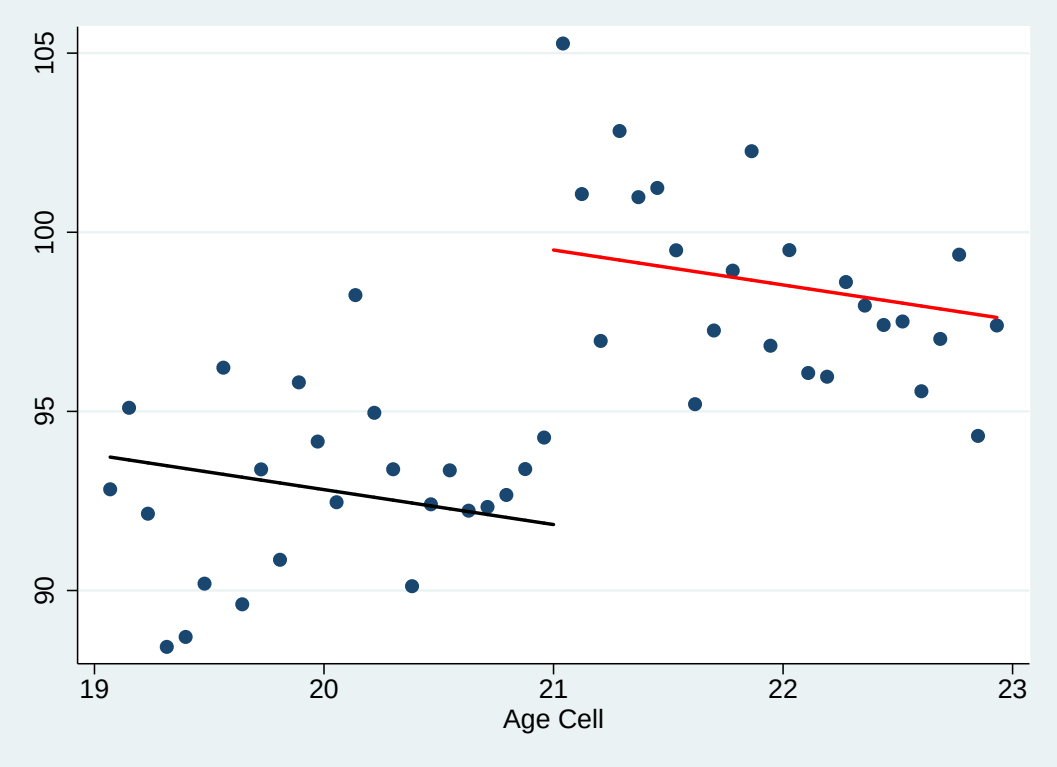
```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(2, 45)        =     32.99
       Model |  410.138151         2  205.069075   Prob > F        =    0.0000
    Residual |  279.682408        45  6.21516463   R-squared       =    0.5946
-------------+----------------------------------   Adj R-squared   =    0.5765
       Total |  689.820559        47  14.6770332   Root MSE        =     2.493

------------------------------------------------------------------------------
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.9746843   .6324613    -1.54   0.130    -2.248527    .2991581
      over21 |   7.662709   1.440286     5.32   0.000     4.761824    10.56359
       _cons |   91.84137   .8050394   114.08   0.000     90.21994     93.4628
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

[7]:
```
reg all age over21 over_age
predict allfitlini
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(3, 44)        =     29.47
       Model |  460.574058         3  153.524686   Prob > F        =    0.0000
    Residual |  229.246501        44  5.21014775   R-squared       =    0.6677
-------------+----------------------------------   Adj R-squared   =    0.6450
       Total |  689.820559        47  14.6770332   Root MSE        =    2.2826

------------------------------------------------------------------------------
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .8269952   .8189316     1.01   0.318     -.823453    2.477443
      over21 |   7.662709   1.318704     5.81   0.000     5.005035    10.32038
    over_age |  -3.603359   1.158144    -3.11   0.003    -5.937445   -1.269273
       _cons |   93.61837   .9324647   100.40   0.000     91.73911    95.49763
------------------------------------------------------------------------------
```

(option xb assumed; fitted values)

[8]:
```
* Figure 4.2. Linear Sharp RD
twoway (scatter all agecell) (line allfitlin agecell if age < 0,  lcolor(black)␣
 ↪    lwidth(medthick)) ///
                            (line allfitlin agecell if age >= 0, lcolor(red)␣
 ↪lwidth(medthick medthick)), legend(off)
graph save "./fig42", replace
graph save "./fig42.eps", replace
```




```
(note: file ./fig42 not found)
(file ./fig42 saved)

(note: file ./fig42.eps not found)
(file ./fig42.eps saved)
```

[9]:
```
* Quadratic sharp RD
reg all age age2 over21
predict allfitq
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(3, 44)        =     28.12
       Model |  453.339903         3  151.113301   Prob > F        =    0.0000
    Residual |  236.480656        44  5.37456037   R-squared       =    0.6572
-------------+----------------------------------   Adj R-squared   =    0.6338
       Total |  689.820559        47  14.6770332   Root MSE        =    2.3183
```

```
------------------------------------------------------------------------------
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.9746843   .5881378    -1.66   0.105    -2.159998    .2106296
        age2 |  -.8186505   .2887482    -2.84   0.007    -1.400584   -.2367167
      over21 |   7.662709   1.339349     5.72   0.000     4.963428    10.36199
       _cons |   92.90274   .8370061   110.99   0.000     91.21587    94.58962
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

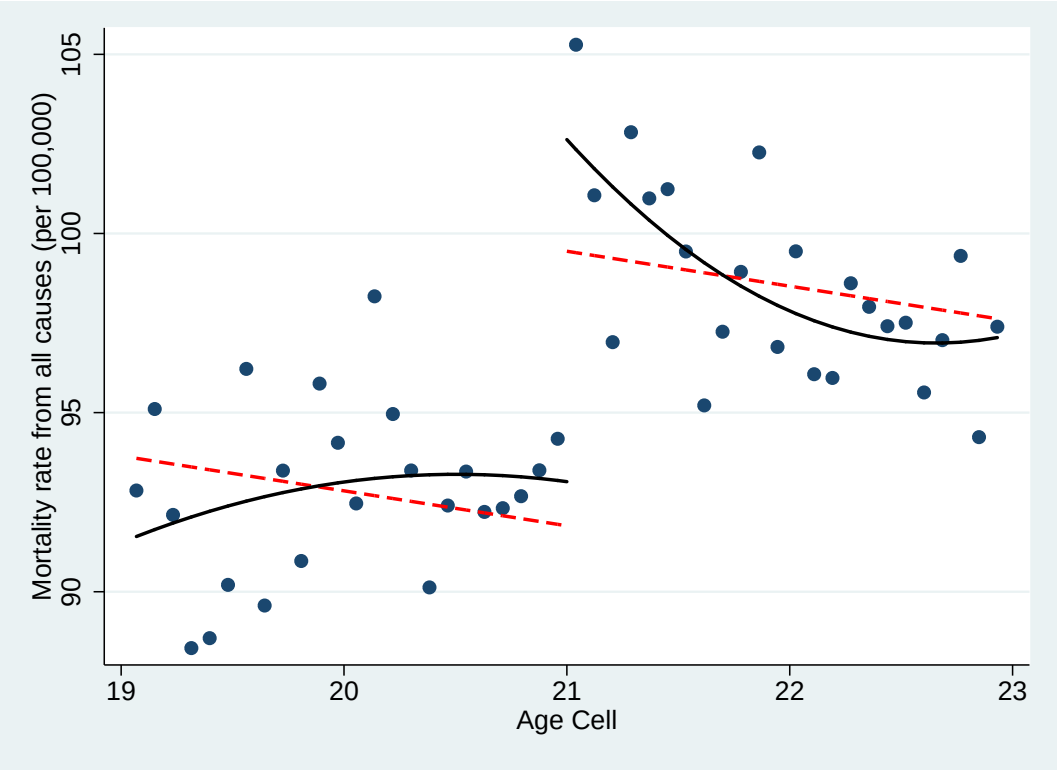
[10]:
```
* Quadratic sharp RD with interaction
reg all age age2 over21 over_age over_age2
predict allfitqi
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(5, 42)        =     18.02
       Model |  470.512104         5  94.1024207   Prob > F        =    0.0000
    Residual |  219.308455        42  5.22162989   R-squared       =    0.6821
-------------+----------------------------------   Adj R-squared   =    0.6442
       Total |  689.820559        47  14.6770332   Root MSE        =    2.2851

------------------------------------------------------------------------------
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.8305828   3.290064    -0.25   0.802    -7.470202    5.809036
        age2 |  -.8402999   1.615268    -0.52   0.606    -4.100043    2.419443
      over21 |   9.547789   1.985277     4.81   0.000     5.541337    13.55424
   over_age  |  -6.017014   4.652854    -1.29   0.203    -15.40685    3.372824
  over_age2  |   2.904189   2.284334     1.27   0.211    -1.705784    7.514162
       _cons |   93.07294   1.403803    66.30   0.000     90.23995    95.90593
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

[11]:
```
label variable all       "Mortality rate from all causes (per 100,000)"
label variable allfitlin "Mortality rate from all causes (per 100,000)"
label variable allfitqi  "Mortality rate from all causes (per 100,000)"
```

[12]:
```
* Figure 4.4.                Comparing RDD fited Y with linear and␣
 ↪quartractic(with interaction)
* allfitlin : all fitted linear regression (Red)
* allfitqi : all fitted quardartic age variable regression (Black)
twoway (scatter all agecell) (line allfitlin allfitqi agecell if age < 0, ␣
 ↪lcolor(red black) lwidth(medthick medthick) lpattern(dash)) ///
```

```
                              (line allfitlin allfitqi agecell if age >= 0,␣
↪lcolor(red black) lwidth(medthick medthick) lpattern(dash)), legend(off)

graph save "./fig44", replace
graph save "./fig44.eps", replace
```




```
(note: file ./fig44 not found)
(file ./fig44 saved)

(note: file ./fig44.eps not found)
(file ./fig44.eps saved)
```

[13]:
```
* "Motor Vehicle Accidents (MVA) " on linear
reg mva age over21
predict exfitlin
```

```
      Source |       SS           df       MS      Number of obs   =        48
```

```
-------------+----------------------------------   F(2, 45)        =     53.14
       Model |  187.819794         2   93.909897   Prob > F        =    0.0000
    Residual |  79.5215648        45  1.76714588   R-squared       =    0.7025
-------------+----------------------------------   Adj R-squared   =    0.6893
       Total |  267.341359        47  5.68811402   Root MSE        =    1.3293

------------------------------------------------------------------------------
         mva |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -3.148829   .3372437    -9.34   0.000    -3.828073   -2.469585
      over21 |   4.534033   .7679953     5.90   0.000     2.987211    6.080855
       _cons |   29.35597   .4292665    68.39   0.000     28.49138    30.22055
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

[14]:
```
*  "Motor Vehicle Accidents (MVA) " on quadratic
reg mva age age2 over21 over_age over_age2
predict exfitqi
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(5, 42)        =     21.86
       Model |   193.13755         5    38.62751   Prob > F        =    0.0000
    Residual |  74.2038088        42  1.76675735   R-squared       =    0.7224
-------------+----------------------------------   Adj R-squared   =    0.6894
       Total |  267.341359        47  5.68811402   Root MSE        =    1.3292

------------------------------------------------------------------------------
         mva |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -2.933014    1.91377    -1.53   0.133    -6.795159    .9291307
        age2 |  -.1852363    .939572    -0.20   0.845    -2.081369    1.710897
      over21 |   4.662859   1.154799     4.04   0.000     2.332379    6.993338
    over_age |  -.8231342    2.70648    -0.30   0.763    -6.285032    4.638763
   over_age2 |   .1984711   1.328755     0.15   0.882    -2.483066    2.880008
       _cons |   29.80898   .8165665    36.51   0.000     28.16109    31.45688
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

[15]:
```
* sucide ~ age + over21
reg suicide age over21
predict sufitlin
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(2, 45)        =     20.39
       Model |  25.2717131         2  12.6358566   Prob > F        =    0.0000
    Residual |  27.8835665        45  .619634811   R-squared       =    0.4754
-------------+----------------------------------   Adj R-squared   =    0.4521
       Total |  53.1552796        47   1.1309634   Root MSE        =    .78717

------------------------------------------------------------------------------
     suicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.1814086   .1996988    -0.91   0.369    -.5836227    .2208055
      over21 |   1.794289   .4547684     3.95   0.000     .8783385    2.71024
       _cons |   11.45484   .2541902    45.06   0.000     10.94287    11.9668
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

[16]:
```
* Linear
reg internal age over21
predict infitlin
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(2, 45)        =     89.64
       Model |  190.857614         2  95.4288068   Prob > F        =    0.0000
    Residual |  47.9069341        45  1.06459854   R-squared       =    0.7994
-------------+----------------------------------   Adj R-squared   =    0.7904
       Total |  238.764548        47  5.08009676   Root MSE        =    1.0318

------------------------------------------------------------------------------
    internal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.600067   .2617584     6.11   0.000     1.072859    2.127275
      over21 |   .3919185   .5960948     0.66   0.514     -.808678    1.592515
       _cons |   20.08933   .3331837    60.30   0.000     19.41826     20.7604
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

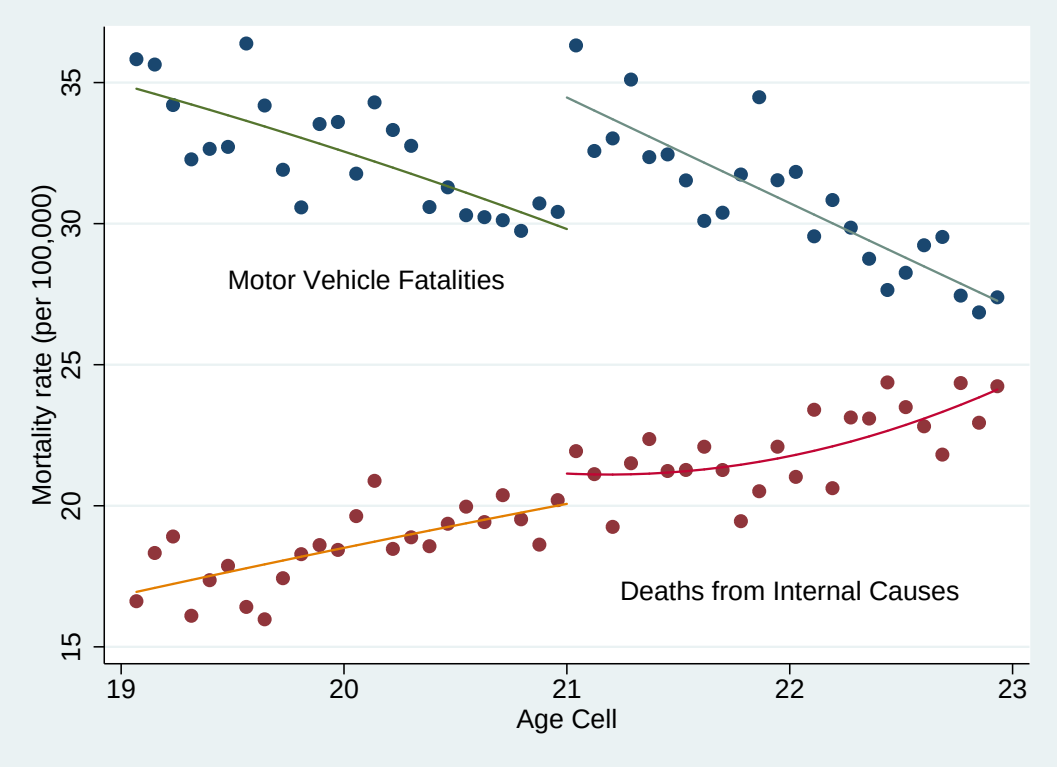
[17]:
```
* Quardratic
reg internal age age2 over21 over_age over_age2
predict infitqi
```

```
      Source |       SS           df       MS      Number of obs   =        48
-------------+----------------------------------   F(5, 42)        =     35.26
```

```
       Model |  192.829423         5  38.5658847   Prob > F        =    0.0000
    Residual |  45.9351244        42  1.09369344   R-squared       =    0.8076
-------------+----------------------------------   Adj R-squared   =    0.7847
       Total |  238.764548        47  5.08009676   Root MSE        =    1.0458

------------------------------------------------------------------------------
    internal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.499653   1.505737     1.00   0.325    -1.539047    4.538354
        age2 |  -.0601118   .7392467    -0.08   0.936    -1.551972    1.431748
      over21 |   1.073201   .9085858     1.18   0.244    -.7603996    2.906801
    over_age |  -1.869609   2.129434    -0.88   0.385    -6.166981    2.427762
   over_age2 |   1.049596   1.045453     1.00   0.321    -1.060213    3.159405
       _cons |   20.06823   .6424672    31.24   0.000     18.77168    21.36478
------------------------------------------------------------------------------

(option xb assumed; fitted values)
```

[18]:
```
label variable mva  "Mortality rate (per 100,000)"
label variable infitqi  "Mortality rate (per 100,000)"
label variable exfitqi  "Mortality rate (per 100,000)"
```

[19]:
```
twoway (scatter  mva internal agecell) (line exfitqi infitqi agecell if agecell␣
↪< 21) ///
                                       (line exfitqi infitqi agecell if agecell␣
↪>= 21), ///
                                                                              ␣
↪legend(off) text(28 20.1 "Motor Vehicle Fatalities") ///
                                                                                ␣
↪       text(17 22 "Deaths from Internal Causes")
graph save "./fig45", replace
graph save "./fig45.eps", replace
```




```
(note: file ./fig45 not found)
(file ./fig45 saved)

(note: file ./fig45.eps not found)
(file ./fig45.eps saved)
```

[34]:
```
ssc install outreg2
```

```
checking outreg2 consistency and verifying not already installed…
installing into /home/jikhan.jeong/ado/plus/…
installation complete.
```

[20]:
```
* dummy for first month after 21st birthday
gen exactly21 = agecell >= 21 & agecell < 21.1
```

[21]:
```
* doesn't change
* drop if agecell>20.99 & agecell<21.01
```

[22]:
```
* Other causes
gen ext_oth = external - homicide - suicide - mva
```

(2 missing values generated)

[23]:
```
* Iteration to produce table in each different dependent from 'all' to 'alchol'
foreach x in all mva suicide homicide ext_oth internal alcohol {

reg `x' age over21, robust
if ("`x'"=="all"){
        outreg2 over21 using ./table41.xls, replace bdec(2) sdec(2) noaster␣
 ↪excel
}
else{
        outreg2 over21 using ./table41.xls, append  bdec(2) sdec(2) noaster␣
 ↪excel
}

reg `x' age age2 over21 over_age over_age2, robust
outreg2 over21 using ./table41.xls, append bdec(2) sdec(2) noaster excel

reg `x' age over21 if agecell >= 20 & agecell <= 22, robust
outreg2 over21 using ./table41.xls, append bdec(2) sdec(2) noaster excel

reg␣
 ↪`x' age age2 over21 over_age over_age2 if agecell >= 20 & agecell <= 22, robust
outreg2 over21 using ./table41.xls, append bdec(2) sdec(2) noaster excel

}
```

```
Linear regression                               Number of obs     =         48
                                                F(2, 45)          =      32.55
                                                Prob > F          =     0.0000
                                                R-squared         =     0.5946
                                                Root MSE          =      2.493

------------------------------------------------------------------------------
             |               Robust
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.9746843    .663873    -1.47   0.149    -2.311793    .3624247
      over21 |   7.662709   1.514233     5.06   0.000     4.612886    10.71253
       _cons |   91.84137   .7090399   129.53   0.000     90.41329    93.26945
------------------------------------------------------------------------------
./table41.xls
```

```
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =      19.90
                                                Prob > F          =     0.0000
                                                R-squared         =     0.6821
                                                Root MSE          =     2.2851

------------------------------------------------------------------------------
             |               Robust
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.8305828   2.850182    -0.29   0.772    -6.582484    4.921318
        age2 |  -.8402999   1.540545    -0.55   0.588    -3.949245    2.268645
      over21 |   9.547789   1.829703     5.22   0.000     5.855299    13.24028
    over_age |  -6.017014   4.527834    -1.33   0.191    -15.15455    3.120524
   over_age2 |   2.904189   2.256836     1.29   0.205     -1.65029    7.458668
       _cons |   93.07294   .7799418   119.33   0.000     91.49895    94.64692
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(2, 21)          =      25.34
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7029
                                                Root MSE          =     2.3624

------------------------------------------------------------------------------
             |               Robust
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -3.256257   1.918101    -1.70   0.104    -7.245167    .7326533
      over21 |   9.753311    2.06443     4.72   0.000     5.460094    14.04653
       _cons |   91.71302   .9673647    94.81   0.000     89.70128    93.72477
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(5, 18)          =      15.06
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7517
                                                Root MSE          =     2.3326

------------------------------------------------------------------------------
             |               Robust
         all |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
```

```
-------------+----------------------------------------------------------------
         age |   9.398777   7.003331     1.34   0.196    -5.314675    24.11223
        age2 |   11.16331    8.81694     1.27   0.222     -7.36039    29.68702
      over21 |   9.611077   2.291093     4.19   0.001     4.797668    14.42449
    over_age |  -24.44781   11.75759    -2.08   0.052    -49.14958    .2539658
   over_age2 |  -.8742369   13.10782    -0.07   0.948    -28.41273    26.66426
       _cons |   94.34029    .854749   110.37   0.000     92.54453    96.13605
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(2, 45)          =      60.81
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7025
                                                Root MSE          =     1.3293

------------------------------------------------------------------------------
             |               Robust
         mva |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -3.148829   .3094685   -10.17   0.000    -3.772131   -2.525527
      over21 |   4.534033   .7172984     6.32   0.000      3.08932    5.978746
       _cons |   29.35597   .3409441    86.10   0.000     28.66927    30.04266
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =      33.21
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7224
                                                Root MSE          =     1.3292

------------------------------------------------------------------------------
             |               Robust
         mva |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -2.933014   1.625218    -1.80   0.078    -6.212838    .3468095
        age2 |  -.1852363   .8247072    -0.22   0.823    -1.849563     1.47909
      over21 |   4.662859   1.092857     4.27   0.000     2.457384    6.868333
    over_age |  -.8231342   2.730162    -0.30   0.765    -6.332825    4.686557
   over_age2 |   .1984711   1.304084     0.15   0.880    -2.433277    2.830219
       _cons |   29.80898   .4868663    61.23   0.000     28.82645    30.79152
------------------------------------------------------------------------------
./table41.xls
dir : seeout
```

```
Linear regression                               Number of obs     =         24
                                                F(2, 21)          =      10.54
                                                Prob > F          =     0.0007
                                                R-squared         =     0.4736
                                                Root MSE          =     1.3414

------------------------------------------------------------------------------
             |               Robust
         mva |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -3.468309   1.088291    -3.19   0.004    -5.731534   -1.205084
      over21 |   4.759284   1.081625     4.40   0.000      2.50992    7.008647
       _cons |   29.58616   .5359734    55.20   0.000     28.47155    30.70078
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(5, 18)          =       7.67
                                                Prob > F          =     0.0005
                                                R-squared         =     0.6029
                                                Root MSE          =     1.2584

------------------------------------------------------------------------------
             |               Robust
         mva |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .6801167   3.816214     0.18   0.861    -7.337451    8.697684
        age2 |   4.459867   4.715611     0.95   0.357    -5.447264      14.367
      over21 |   5.892489   1.329178     4.43   0.000      3.09999    8.684988
    over_age |  -15.16667   6.350687    -2.39   0.028    -28.50897   -1.824368
   over_age2 |    6.96523   7.052903     0.99   0.336     -7.85237    21.78283
       _cons |    30.1883   .5619943    53.72   0.000      29.0076    31.36901
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(2, 45)          =      19.99
                                                Prob > F          =     0.0000
                                                R-squared         =     0.4754
                                                Root MSE          =     .78717

------------------------------------------------------------------------------
             |               Robust
     suicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.1814086   .2111302    -0.86   0.395    -.6066467    .2438294
```

```
      over21 |   1.794289   .4960862     3.62   0.001     .7951202    2.793458
       _cons |   11.45484    .236895    48.35   0.000      10.9777    11.93197
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =       7.79
                                                Prob > F          =     0.0000
                                                R-squared         =     0.4887
                                                Root MSE          =      .8044

------------------------------------------------------------------------------
             |               Robust
     suicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .1382259   .6147566     0.22   0.823    -1.102403    1.378855
        age2 |   .0555234   .3039805     0.18   0.856     -.557934    .6689809
      over21 |   1.814332    .782268     2.32   0.025     .2356513    3.393013
    over_age |  -.7001801   1.735563    -0.40   0.689    -4.202687    2.802327
   over_age2 |   .0308786   .8340787     0.04   0.971     -1.65236    1.714118
       _cons |   11.69811   .2852942    41.00   0.000     11.12236    12.27385
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(2, 21)          =      12.49
                                                Prob > F          =     0.0003
                                                R-squared         =     0.5409
                                                Root MSE          =     .84656

------------------------------------------------------------------------------
             |               Robust
     suicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0054221   .6210454    -0.01   0.993    -1.296957    1.286112
      over21 |   1.724426   .7331671     2.35   0.029     .1997217     3.24913
       _cons |   11.64025   .3476599    33.48   0.000     10.91725    12.36324
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(5, 18)          =       4.44
                                                Prob > F          =     0.0082
                                                R-squared         =     0.5480
                                                Root MSE          =     .90732
```

```
------------------------------------------------------------------------------
             |               Robust
     suicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.483894   2.041657     0.73   0.477    -2.805468    5.773255
        age2 |   1.406693   2.125001     0.66   0.516     -3.05777    5.871155
      over21 |   1.296599   1.139562     1.14   0.270    -1.097533     3.69073
    over_age |  -.3850182   4.892971    -0.08   0.938    -10.66477    9.894732
   over_age2 |  -2.629635   4.555603    -0.58   0.571     -12.2006    6.941331
       _cons |   11.91936   .3317131    35.93   0.000     11.22245    12.61626
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(2, 45)          =       4.76
                                                Prob > F          =     0.0133
                                                R-squared         =     0.1713
                                                Root MSE          =     .67912

------------------------------------------------------------------------------
             |               Robust
    homicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .2218874   .1967917     1.13   0.265    -.1744715    .6182463
      over21 |   .1043579   .4497449     0.23   0.818    -.8014748    1.010191
       _cons |   16.85989   .2450709    68.80   0.000     16.36629    17.35349
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =       4.69
                                                Prob > F          =     0.0017
                                                R-squared         =     0.3943
                                                Root MSE          =     .60098

------------------------------------------------------------------------------
             |               Robust
    homicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.321966   .8347311     1.58   0.121    -.3625895    3.006521
        age2 |   .2673265    .416655     0.64   0.525    -.5735173     1.10817
      over21 |   .2002209   .5023706     0.40   0.692     -.813604    1.214046
    over_age |  -2.491488   1.102971    -2.26   0.029    -4.717373   -.2656018
   over_age2 |   .1476884   .5535036     0.27   0.791    -.9693271    1.264704
       _cons |   17.59831   .3803027    46.27   0.000     16.83083    18.36579
```

```
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(2, 21)          =       1.27
                                                Prob > F          =     0.3019
                                                R-squared         =     0.0945
                                                Root MSE          =     .66504

------------------------------------------------------------------------------
             |               Robust
    homicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .2211324   .4797948     0.46   0.650    -.7766556     1.21892
      over21 |   .1638189   .5893898     0.28   0.784    -1.061884    1.389522
       _cons |   17.10312   .3435573    49.78   0.000     16.38865    17.81759
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(5, 18)          =       1.58
                                                Prob > F          =     0.2150
                                                R-squared         =     0.2927
                                                Root MSE          =     .63486

------------------------------------------------------------------------------
             |               Robust
    homicide |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   4.437454   2.896132     1.53   0.143    -1.647093      10.522
        age2 |   3.441949   2.611607     1.32   0.204    -2.044834    8.928732
      over21 |  -.4526931   .9268679    -0.49   0.631     -2.39997    1.494584
    over_age |  -4.695171   4.191576    -1.12   0.277    -13.50135    4.111004
   over_age2 |  -3.789381   3.782756    -1.00   0.330    -11.73666    4.157893
       _cons |   18.06824   .6704247    26.95   0.000     16.65973    19.47675
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(2, 45)          =      30.30
                                                Prob > F          =     0.0000
                                                R-squared         =     0.5803
                                                Root MSE          =     .87207

------------------------------------------------------------------------------
```

```
             |               Robust
     ext_oth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .5335982   .1877507     2.84   0.007     .1554489    .9117476
      over21 |   .8381123   .4249421     1.97   0.055     -.017765    1.693989
       _cons |   14.08134   .2154729    65.35   0.000     13.64736    14.51533
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =      27.91
                                                Prob > F          =     0.0000
                                                R-squared         =     0.6422
                                                Root MSE          =     .83347

------------------------------------------------------------------------------
             |               Robust
     ext_oth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.8574098   1.174666    -0.73   0.469    -3.227981    1.513162
        age2 |  -.9177998   .5684979    -1.61   0.114    -2.065075    .2294754
      over21 |    1.79718   .5631014     3.19   0.003     .6607949    2.933564
    over_age |  -.1326175   1.610339    -0.08   0.935    -3.382412    3.117177
   over_age2 |   1.477557   .7794358     1.90   0.065    -.0954079    3.050522
       _cons |   13.89931   .4008398    34.68   0.000     13.09038    14.70824
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(2, 21)          =      10.98
                                                Prob > F          =     0.0005
                                                R-squared         =     0.4763
                                                Root MSE          =     .79539

------------------------------------------------------------------------------
             |               Robust
     ext_oth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0057589   .6375004     0.01   0.993    -1.319996    1.331513
      over21 |   1.413522   .5938869     2.38   0.027     .1784668    2.648577
       _cons |   13.89479   .3229814    43.02   0.000     13.22312    14.56647
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
```

```
                                                F(5, 18)          =       4.82
                                                Prob > F          =     0.0057
                                                R-squared         =     0.5269
                                                Root MSE          =     .81659

------------------------------------------------------------------------------
             |               Robust
     ext_oth |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0495123   2.902777     0.02   0.987    -6.048996     6.14802
        age2 |  -.7644889   3.053148    -0.25   0.805    -7.178915    5.649937
      over21 |   1.625275    .749856     2.17   0.044      .049886    3.200664
    over_age |  -1.371213   4.247653    -0.32   0.751     -10.2952    7.552774
   over_age2 |   1.301536   4.581178     0.28   0.780    -8.323163    10.92623
       _cons |   14.16384   .5111747    27.71   0.000      13.0899    15.23778
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(2, 45)          =      84.50
                                                Prob > F          =     0.0000
                                                R-squared         =     0.7994
                                                Root MSE          =     1.0318

------------------------------------------------------------------------------
             |               Robust
    internal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.600067   .2472443     6.47   0.000     1.102091    2.098042
      over21 |   .3919185   .5430902     0.72   0.474    -.7019214    1.485758
       _cons |   20.08933    .273033    73.58   0.000     19.53941    20.63925
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =      35.58
                                                Prob > F          =     0.0000
                                                R-squared         =     0.8076
                                                Root MSE          =     1.0458

------------------------------------------------------------------------------
             |               Robust
    internal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   1.499653   1.339859     1.12   0.269    -1.204292    4.203599
        age2 |  -.0601118   .6886446    -0.09   0.931    -1.449853    1.329629
```

```
      over21 |   1.073201   .8015423     1.34   0.188     -.544377    2.690779
    over_age |  -1.869609   2.014794    -0.93   0.359    -5.935628     2.19641
   over_age2 |   1.049596   .9882146     1.06   0.294    -.9447017    3.043894
       _cons |   20.06823   .4899727    40.96   0.000     19.07942    21.05703
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(2, 21)          =      10.35
                                                Prob > F          =     0.0007
                                                R-squared         =     0.4938
                                                Root MSE          =     .91073

------------------------------------------------------------------------------
             |               Robust
    internal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.0094185   .6917679    -0.01   0.989    -1.448029    1.429192
      over21 |   1.692263   .7448802     2.27   0.034     .1431993    3.241326
       _cons |    19.4887   .3774137    51.64   0.000     18.70382    20.27357
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(5, 18)          =       4.13
                                                Prob > F          =     0.0113
                                                R-squared         =     0.5077
                                                Root MSE          =     .97014

------------------------------------------------------------------------------
             |               Robust
    internal |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   2.747812   2.548893     1.08   0.295    -2.607214    8.102838
        age2 |   2.619305    2.51303     1.04   0.311    -2.660375    7.898985
      over21 |    1.24941   1.012008     1.23   0.233    -.8767397    3.375559
    over_age |   -2.82976   4.225938    -0.67   0.512    -11.70813    6.048607
   over_age2 |  -2.721989   4.301021    -0.63   0.535     -11.7581    6.314122
       _cons |   20.00056   .6134096    32.61   0.000     18.71183    21.28928
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(2, 45)          =      17.35
                                                Prob > F          =     0.0000
```

```
                                                R-squared         =     0.4222
                                                Root MSE          =     .27214

------------------------------------------------------------------------------
             |               Robust
     alcohol |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .0040971    .088112     0.05   0.963    -.1733696    .1815637
      over21 |    .442357   .2060135     2.15   0.037     .0274245    .8572895
       _cons |   1.036159   .0879096    11.79   0.000     .8590996    1.213218
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         48
                                                F(5, 42)          =      13.88
                                                Prob > F          =     0.0000
                                                R-squared         =     0.5260
                                                Root MSE          =     .25514

------------------------------------------------------------------------------
             |               Robust
     alcohol |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.4208805   .2436486    -1.73   0.091    -.9125832    .0708222
        age2 |  -.2853848   .1129688    -2.53   0.015    -.5133651   -.0574045
      over21 |   .7992282   .3240426     2.47   0.018     .1452838    1.453173
    over_age |  -.2345868   .6863237    -0.34   0.734    -1.619644     1.15047
   over_age2 |   .5498025   .3092787     1.78   0.083    -.0743473    1.173952
       _cons |   .9870015   .1060055     9.31   0.000     .7730737    1.200929
------------------------------------------------------------------------------
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(2, 21)          =       6.34
                                                Prob > F          =     0.0070
                                                R-squared         =     0.4161
                                                Root MSE          =     .28965

------------------------------------------------------------------------------
             |               Robust
     alcohol |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |  -.3267959   .2654614    -1.23   0.232    -.8788532    .2252614
      over21 |     .74045   .3325104     2.23   0.037     .0489568    1.431943
       _cons |   .9132887   .1410297     6.48   0.000     .6200014    1.206576
------------------------------------------------------------------------------
```

```
./table41.xls
dir : seeout

Linear regression                               Number of obs     =         24
                                                F(5, 18)          =       3.59
                                                Prob > F          =     0.0199
                                                R-squared         =     0.5841
                                                Root MSE          =     .26402

------------------------------------------------------------------------------
             |               Robust
     alcohol |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
         age |   .3572718   .5263514     0.68   0.506    -.7485515    1.463095
        age2 |   .3448061    .486452     0.71   0.488    -.6771916    1.366804
      over21 |   1.027679   .4126053     2.49   0.023     .1608272     1.89453
    over_age |  -3.109398   1.755207    -1.77   0.093    -6.796951    .5781557
   over_age2 |   1.765446   1.597773     1.10   0.284    -1.591351    5.122244
       _cons |   1.139023   .1202988     9.47   0.000     .8862848    1.391762
------------------------------------------------------------------------------
./table41.xls
dir : seeout
```

- figure42.eps (Figure 4.2)
- figure44.eps (Figure 4.4)
- figure45.eps (Figure 4.5)
-

0.4 table41.xls (Table 4.1) This is table format in excel

-

0.5 This replication don't cover Fuzzy RD

-

0.6 Ref: https://rpubs.com/cuborican/RDD

[3]:
```
install.packages('rdd')
```

```
Installing package into '/home/jikhan.jeong/lib/R_libs'
(as 'lib' is unspecified)
```

[1]:
```
library(AER)
```

```
Loading required package: car
Loading required package: carData
```

```
Loading required package: lmtest
Loading required package: zoo

Attaching package: ‘zoo’

The following objects are masked from ‘package:base’:

    as.Date, as.Date.numeric

Loading required package: sandwich
Loading required package: survival
```

[4]:
```
library(foreign)
```

[5]:
```
library(rdd)
```

```
Loading required package: Formula
```

[7]:
```
# Hlavac, Marek (2015). stargazer: Well-Formatted Regression and Summary␣
 ↪Statistics Tables
library(stargazer)
```

[9]:
```
AEJfigs=read.dta("AEJfigs.dta")
```

[13]:
```
head(AEJfigs)
```

agecell	all	allfitted	internal	internalfitted	external	externalfitted	alcohol	alcoholfitted
19.06849	92.82540	91.70615	16.61759	16.73813	76.20782	74.96801	0.6391380	0.7943445
19.15068	95.10074	91.88372	18.32768	16.92065	76.77306	74.96307	0.6774093	0.8375749
19.23288	92.14429	92.04906	18.91105	17.09884	73.23324	74.95023	0.8664426	0.8778347
19.31507	88.42776	92.20214	16.10177	17.27268	72.32598	74.92947	0.8673084	0.9151149
19.39726	88.70494	92.34292	17.36352	17.44216	71.34142	74.90076	1.0191631	0.9494066
19.47945	90.19179	92.47134	17.87210	17.60725	72.31968	74.86409	1.1713219	0.9807007

[15]:
```
print(dim(AEJfigs))
```

```
[1] 50 19
```

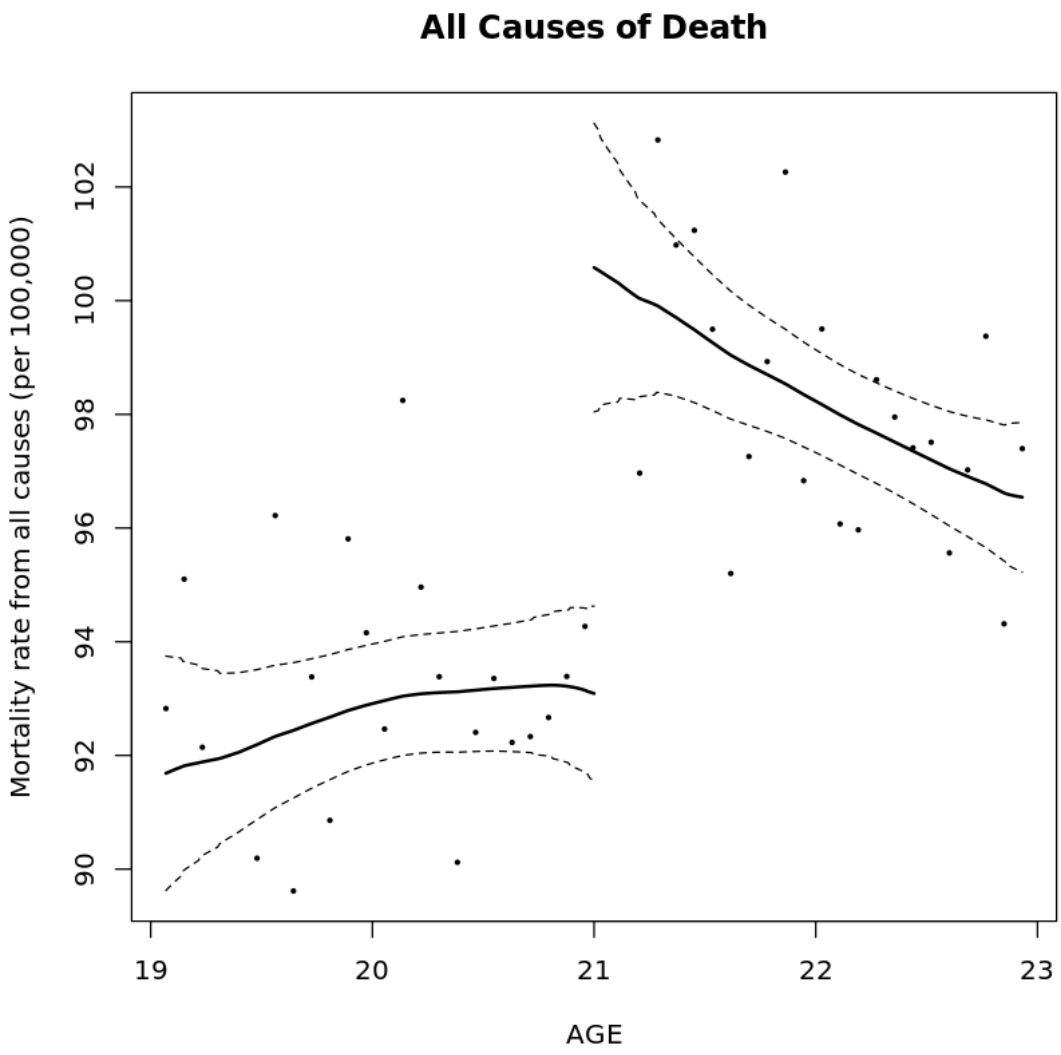
[16]:
```
# Generating centered age (age is a running variable)
AEJfigs$age = AEJfigs$agecell - 21
```

[17]:
```
# Treatment Dummy
AEJfigs$over21 = ifelse(AEJfigs$agecell >= 21,1,0)
```

[18]:
```
# Linear Sharp RDD
# all = all deapth as dependent variable
# agecell = age variable not centered
# cutpoint = age 21
```

```
reg.1=RDestimate(all~agecell,data=AEJfigs,cutpoint = 21)
```

[19]:
```
plot(reg.1)
title(main="All Causes of Death", xlab="AGE",ylab="Mortality rate from all␣
 ↪causes (per 100,000)")
```

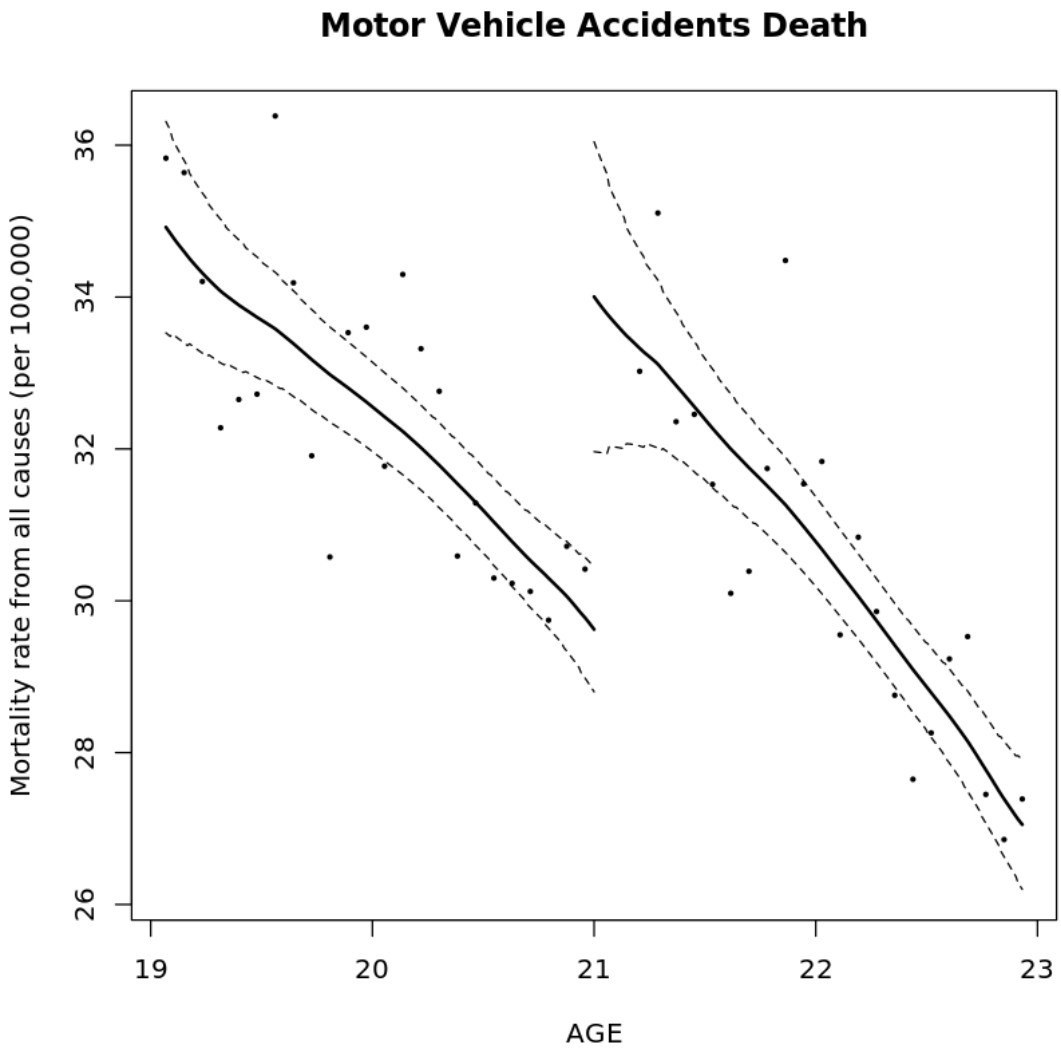


[20]:
```
# Linear Sharp RDD
# LATE = local average treatment : Estimate 9.001
summary(reg.1)
```

```
Call:
RDestimate(formula = all ~ agecell, data = AEJfigs, cutpoint = 21)
```

```
Type:
sharp

Estimates:
           Bandwidth  Observations  Estimate  Std. Error  z value  Pr(>|z|)
LATE       1.6561     40            9.001     1.480       6.080    1.199e-09
Half-BW    0.8281     20            9.579     1.914       5.004    5.609e-07
Double-BW  3.3123     48            7.953     1.278       6.223    4.882e-10

LATE       ***
Half-BW    ***
Double-BW  ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

F-statistics:
           F      Num. DoF  Denom. DoF  p
LATE       33.08  3         36          3.799e-10
Half-BW    29.05  3         16          2.078e-06
Double-BW  32.54  3         44          6.129e-11
```

[21]:
```
# Linear Sharp RDD with Motor Vehicle Accidents Death (MVA)
reg.2=RDestimate(mva~agecell,data=AEJfigs,cutpoint = 21)
plot(reg.2)
title(main="Motor Vehicle Accidents Death", xlab="AGE",ylab="Mortality rate␣
 ↪from all causes (per 100,000)")
```

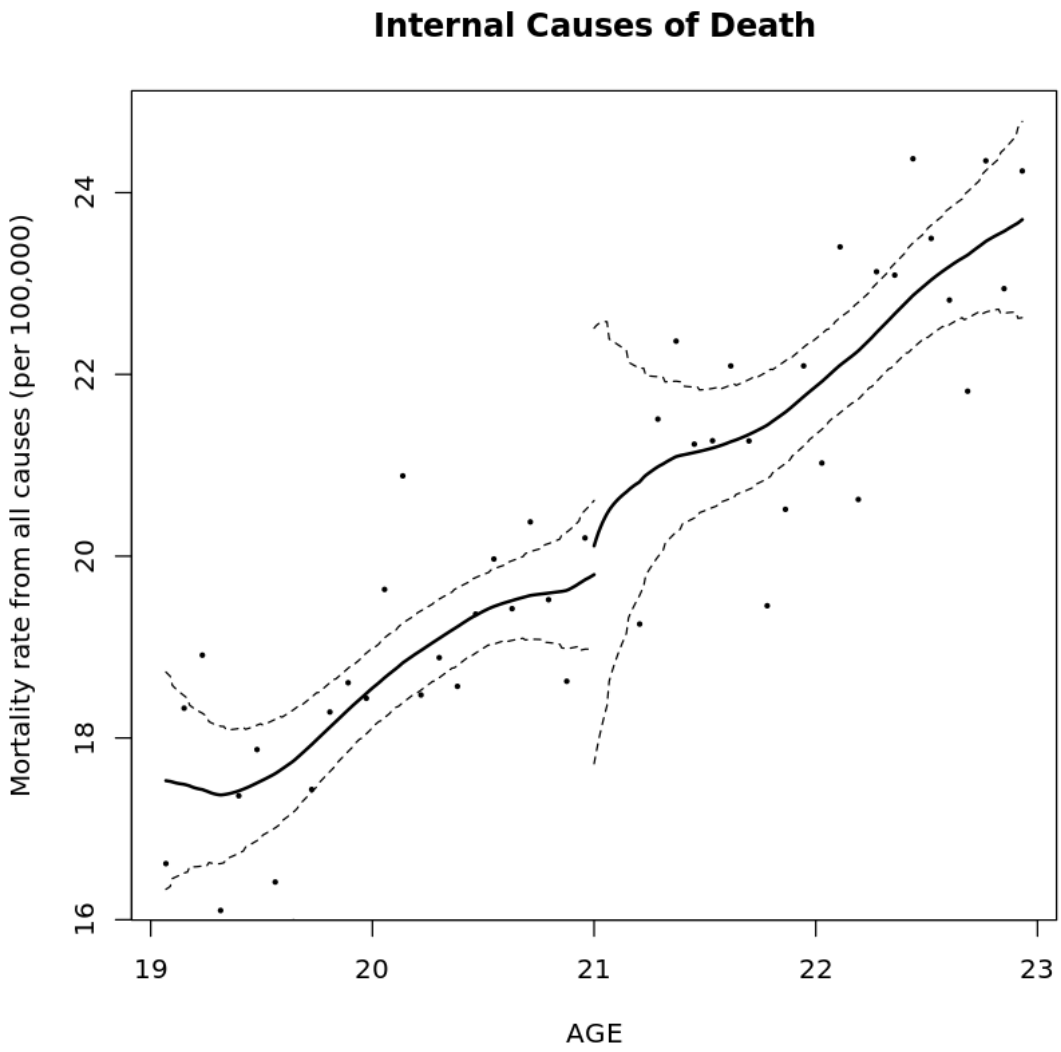


[24]:
```
summary(reg.2)
```

```
Call:
RDestimate(formula = mva ~ agecell, data = AEJfigs, cutpoint = 21)

Type:
sharp

Estimates:
          Bandwidth  Observations  Estimate  Std. Error  z value  Pr(>|z|)
LATE      1.2109     30            4.977     1.0590      4.700    2.607e-06
Half-BW   0.6054     14            4.956     1.3767      3.600    3.182e-04
```

```
Double-BW  2.4218     48            4.566     0.7086      6.444    1.162e-10

LATE       ***
Half-BW    ***
Double-BW  ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

F-statistics:
           F      Num. DoF  Denom. DoF  p
LATE       13.32  3         26          3.692e-05
Half-BW    12.76  3         10          1.879e-03
Double-BW  26.99  3         44          9.322e-10
```

[22]:
```
# Linear Sharp RDD with Internal Causes of Death (such as disease)
reg.3=RDestimate(internal~agecell,data=AEJfigs,cutpoint = 21)
plot(reg.3)
title(main="Internal Causes of Death", xlab="AGE",ylab="Mortality rate from all␣
 ↪causes (per 100,000)")
```



[23]:
```
summary(reg.3)
```

```
Call:
RDestimate(formula = internal ~ agecell, data = AEJfigs, cutpoint = 21)

Type:
sharp

Estimates:
           Bandwidth  Observations  Estimate  Std. Error  z value  Pr(>|z|)
LATE       0.8809     22            1.4128    0.8206      1.722    0.08513   .
Half-BW    0.4405     10            1.8691    1.0203      1.832    0.06698   .
```

```
Double-BW  1.7618     42            0.7652    0.6179      1.239    0.21553
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

F-statistics:
           F       Num. DoF  Denom. DoF  p
LATE        6.830  3         18          5.734e-03
Half-BW     1.765  3          6          5.068e-01
Double-BW  22.695  3         38          2.750e-08
```

- Example of R is much limited

[ ]: