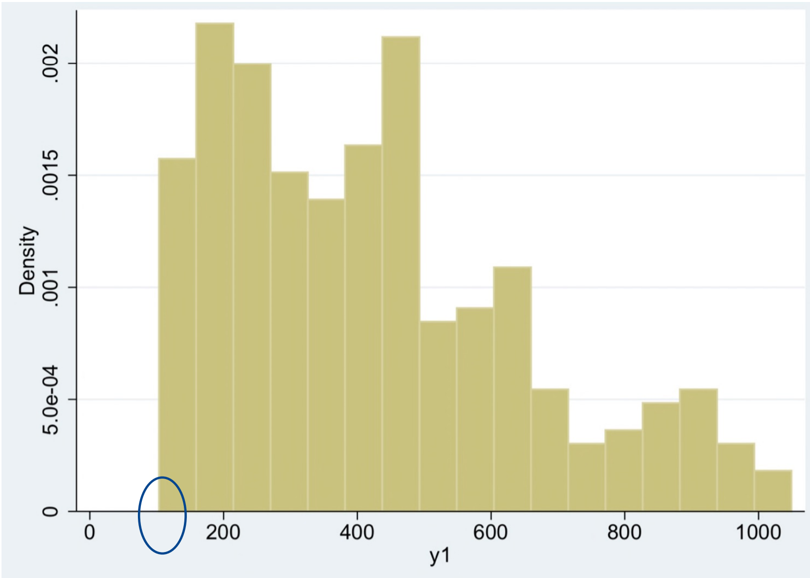
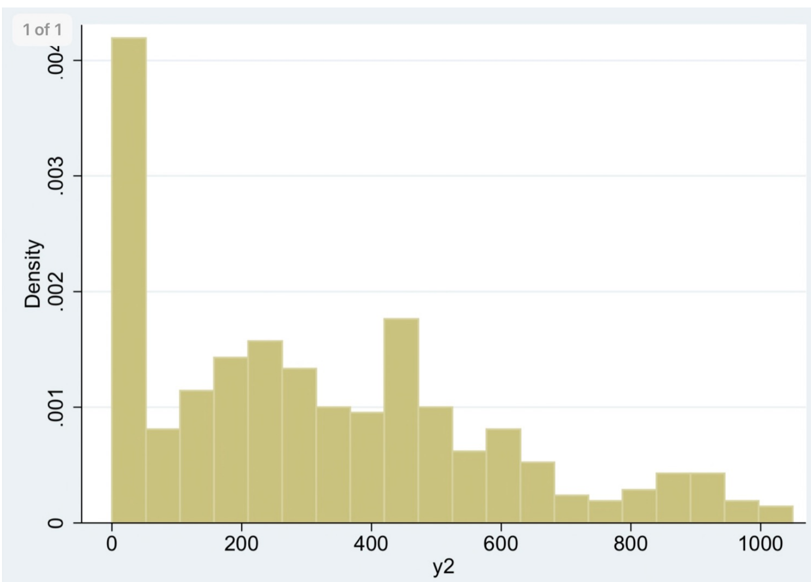
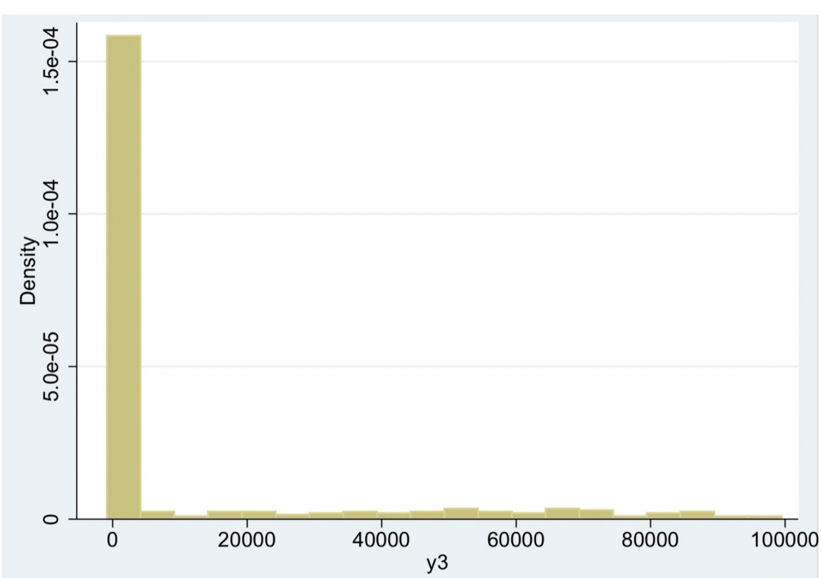
Plot histogram of y_{1i}, y_{2i}, y_{3i}, compute descriptive statistics of these three variables, then determine limitation of these three dependent variables.



Y_1 : truncated at its minimum



Y_2 : censored at zero



Y_3 : outliers

2 Estimate the model (1) for y_{1i}, y_{2i}, y_{3i} using OLS, using truncated regression model, Tobit model, determine the most appropriated models for each y_{ki}.

```
. reg y1 x

      Source |       SS           df       MS      Number of obs   =       297
-------------+----------------------------------   F(1, 295)       =     30.30
       Model |  1431905.59         1  1431905.59   Prob > F        =    0.0000
    Residual |  13941534.7       295  47259.4396   R-squared       =    0.0931
-------------+----------------------------------   Adj R-squared   =    0.0901
       Total |  15373440.3       296  51937.2982   Root MSE        =    217.39

------------------------------------------------------------------------------
          y1 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   123.1693   22.37637     5.50   0.000     79.13176    167.2069
       _cons |   69.01677   65.56422     1.05   0.293    -60.01611    198.0496
------------------------------------------------------------------------------

. sum y1

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
          y1 |        297    423.1683    227.8976   103.4663   1049.314

. scalar miny1=round(r(min))

. truncreg y1 x, ll(miny1) nolog
(note: 0 obs. truncated)

Truncated regression
Limit:   lower =        103                     Number of obs     =        297
         upper =       +inf                     Wald chi2(1)      =      23.38
Log likelihood = -1973.9423                     Prob > chi2       =     0.0000

------------------------------------------------------------------------------
          y1 |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   249.6062   51.61679     4.84   0.000     148.4392    350.7733
       _cons |  -456.6913   178.5338    -2.56   0.011    -806.6112   -106.7714
-------------+----------------------------------------------------------------
      /sigma |   306.4488   26.46552    11.58   0.000     254.5774    358.3203
------------------------------------------------------------------------------

. predict truncated, e(0,.)

. est store trunc1

. mfx compute, predict(e(0,.)) at(mean)

Marginal effects after truncreg
      y  = E(y1|y1>0) (predict, e(0,.))
         =  366.96443
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
       x |   146.2602      26.102    5.60   0.000   95.1014  197.419   2.87532
------------------------------------------------------------------------------

. mfx compute, predict(e(0,.)) at(median)

Marginal effects after truncreg
      y  = E(y1|y1>0) (predict, e(0,.))
         =  364.18865
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
       x |   145.1256      25.703    5.65   0.000   94.7479  195.503   2.85627
------------------------------------------------------------------------------
```

```
16 . mfx compute, predict(e(0,.)) at(0)

   Marginal effects after truncreg
         y  = E(y1|y1>0) (predict, e(0,.))
            =  134.87926
   ------------------------------------------------------------------------------
   variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
   ---------+--------------------------------------------------------------------
          x |    37.5304      3.27981   11.44   0.000   31.1021  43.9587         0
   ------------------------------------------------------------------------------

17 . lrtest ols1 trunc1, force

   Likelihood-ratio test                                 LR chi2(1)  =     89.69
   (Assumption: ols1 nested in trunc1)                   Prob > chi2 =    0.0000

18 . reg y2 x

         Source |       SS           df       MS      Number of obs   =       400
   -------------+----------------------------------   F(1, 398)       =     76.58
          Model |  4567087.34         1  4567087.34   Prob > F        =    0.0000
       Residual |  23737174.2       398  59641.1413   R-squared       =    0.1614
   -------------+----------------------------------   Adj R-squared   =    0.1592
          Total |  28304261.6       399  70937.9989   Root MSE        =    244.22

   ------------------------------------------------------------------------------
             y2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   -------------+----------------------------------------------------------------
              x |   179.8325   20.55046     8.75   0.000     139.4315    220.2335
          _cons |  -179.3679   58.08821    -3.09   0.002     -293.566   -65.1698
   ------------------------------------------------------------------------------

19 . est store ols2

20 . tobit y2 x, ll(0)

   Refining starting values:

   Grid node 0:   log likelihood = -2400.6048

   Fitting full model:

   Iteration 0:   log likelihood = -2400.6048
   Iteration 1:   log likelihood = -2389.6871
   Iteration 2:   log likelihood = -2389.3078
   Iteration 3:   log likelihood = -2389.3077

   Tobit regression                                Number of obs     =        400
                                                      Uncensored     =        328
   Limits: lower = 0                                  Left-censored  =         72
           upper = +inf                               Right-censored =          0

                                                   LR chi2(1)        =      73.17
                                                   Prob > chi2       =     0.0000
   Log likelihood = -2389.3077                     Pseudo R2         =     0.0151

   ------------------------------------------------------------------------------
             y2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   -------------+----------------------------------------------------------------
              x |    219.156   24.86468     8.81   0.000     170.2739    268.0382
          _cons |  -318.6258   70.93088    -4.49   0.000    -458.0707   -179.1808
   -------------+----------------------------------------------------------------
        var(e.y2)|   81171.96   6591.132                      69195.6    95221.18
   ------------------------------------------------------------------------------
```

< 0.05 ; Truncated Regression Model is more appropriated for y1

```
21 . est store y2t

22 . mfx compute, predict(ystar(0,.)) at(mean)

   Marginal effects after tobit
         y  = E(y2*|y2>0) (predict, ystar(0,.))
            =   310.4088
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
       x |   184.7743      20.984    8.81   0.000   143.647  225.902   2.76346
------------------------------------------------------------------------------

23 . mfx compute, predict(ystar(0,.)) at(median)

   Marginal effects after tobit
         y  = E(y2*|y2>0) (predict, ystar(0,.))
            =  308.36854
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
       x |   184.3247      20.885    8.83   0.000    143.39  225.259    2.7524
------------------------------------------------------------------------------

24 . mfx compute, predict(ystar(0,.)) at(0)

   Marginal effects after tobit
         y  = E(y2*|y2>0) (predict, ystar(0,.))
            =  18.851271
------------------------------------------------------------------------------
variable |      dy/dx    Std. Err.     z    P>|z|  [    95% C.I.   ]      X
---------+--------------------------------------------------------------------
       x |   28.86475     8.52313    3.39   0.001   12.1597  45.5698         0
------------------------------------------------------------------------------

25 . lrtest ols2 y2t, force

   Likelihood-ratio test                                 LR chi2(1)  =    752.97
   (Assumption: ols2 nested in y2t)                      Prob > chi2 =    0.0000
```

Reject H_0

∴ Tobit Model is better for Y_2

```
26 . reg y3 x

      Source |       SS           df       MS      Number of obs   =       400
-------------+----------------------------------   F(1, 398)       =     26.43
       Model |  1.3359e+10         1  1.3359e+10   Prob > F        =    0.0000
    Residual |  2.0115e+11       398   505402183   R-squared       =    0.0623
-------------+----------------------------------   Adj R-squared   =    0.0599
       Total |  2.1451e+11       399   537616802   Root MSE        =     22481

------------------------------------------------------------------------------
          y3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
           x |   9726.042   1891.765     5.14   0.000     6006.941    13445.14
       _cons |  -16431.39   5347.288    -3.07   0.002    -26943.85   -5918.932
------------------------------------------------------------------------------
```

```
27 . predict y3_hat
   (option xb assumed; fitted values)

28 . est store y3

29 . sum y3

       Variable |        Obs        Mean    Std. Dev.       Min        Max
   -------------+---------------------------------------------------------
             y3 |        400     10446.1    23186.57  -866.3348   99508.07

30 . reg y3 x if y3<=500

         Source |       SS           df       MS      Number of obs   =       314
   -------------+----------------------------------   F(1, 312)       =     30.33
          Model |  1748440.94         1  1748440.94   Prob > F        =    0.0000
       Residual |  17984963.6       312  57644.1141   R-squared       =    0.0886
   -------------+----------------------------------   Adj R-squared   =    0.0857
          Total |  19733404.5       313  63046.0209   Root MSE        =    240.09

   ------------------------------------------------------------------------------
             y3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   -------------+----------------------------------------------------------------
              x |   130.1676   23.63496     5.51   0.000     83.66353    176.6717
          _cons |  -188.1423   64.52556    -2.92   0.004    -315.1025   -61.18199
   ------------------------------------------------------------------------------

31 . predict y3_hat_1
   (option xb assumed; fitted values)

32 . est store y3_1

33 . tobit y3 x, ul(500) nolog

   Tobit regression                                Number of obs     =        400
                                                      Uncensored     =        314
   Limits: lower = -inf                               Left-censored  =          0
           upper = 500                                Right-censored =         86

                                                   LR chi2(1)        =      67.20
                                                   Prob > chi2       =     0.0000
   Log likelihood = -2305.4404                     Pseudo R2         =     0.0144

   ------------------------------------------------------------------------------
             y3 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
   -------------+----------------------------------------------------------------
              x |   216.5213   25.84758     8.38   0.000     165.7069    267.3358
          _cons |  -325.0374   72.09183    -4.51   0.000    -466.7647   -183.3101
   -------------+----------------------------------------------------------------
       var(e.y3)|   85472.85   7109.987                      72578.21    100658.4
   ------------------------------------------------------------------------------

34 . est store y3t
```

```
39 . lrtest y3 y3t, force

   Likelihood-ratio test                                 LR chi2(1)  =   4538.61
   (Assumption: y3 nested in y3t)                        Prob > chi2 =    0.0000
```

Tobit Model

< 0.05 ; is better for y3

```
40 . est tab ols1 trunc1 ols2 y2t y3 y3_1 y3t, star(.1 .05 .01) stat(N N_cens rss ll rmse F chi2 r2 r2_a)
```

Variable	ols1	trunc1	ols2	y2t	y3	y3_1
_						
x	123.16931***		179.83253***		9726.0419***	130.1676***
_cons	69.01677		-179.36788***		-16431.393***	-188.14225***
eq1						
x		249.60624***				
_cons		-456.6913**				
/sigma		306.44885***				
var(e.y2)				81171.961***		
var(e.y3)						
y2						
x				219.156***		
_cons				-318.62579***		
y3						
x						
_cons						
Statistics						
N	297	297	400	400	400	314
N_cens						
rss	13941535		23737174		2.012e+11	17984964
ll	-2018.7874	-1973.9423	-2765.7931	-2389.3077	-4574.7459	-2165.5843
rmse	217.39236		244.21536		22481.152	240.09189
F	30.298827		76.576122		26.432484	30.331647
chi2		23.384541		73.173596		
r2	.09314152		.16135688		.06227724	.08860311
r2_a	.09006742		.15924974		.05992115	.08568196

legend: * p<.1; ** p<.05; *** p<.01

Variable	y3t
_	
x	
_cons	
eq1	
x	
_cons	
/sigma	
var(e.y2)	
var(e.y3)	**85472.849*** **
y2	
x	
_cons	
y3	
x	**216.52134*** **
_cons	**-325.03736*** **
Statistics	
N	**400**
N_cens	
rss	
ll	**-2305.4404**
rmse	
F	
chi2	**67.204135**
r2	
r2_a	

legend: * p<.1; ** p<.05; *** p<.01

```
41 . log close
      name:  <unnamed>
       log:  C:\Users\a\Desktop\426\426=a11.smcl
  log type:  smcl
 closed on:  19 Apr 2021, 23:46:30
```

```
42 .
```