

```

-----
name: <unnamed>
  log: D:\Jason\workshop\multiple imputation\2022\code2.log
  log type: text
  opened on: 13 Jun 2022, 11:33:21

.
.
. *****
. * Change the working directory
. *****
.
. cd "D:\Jason\workshop\multiple imputation\2022"
D:\Jason\workshop\multiple imputation\2022

.
.
. *****
. * Use a Stata data file with an arbitrary missing-data pattern (p.220 of Stata Manual)
. *****
. use https://www.stata-press.com/data/r17/mhouses1993, clear
(Albuquerque home prices Feb15-Apr30, 1993)

.
.
. *****
. * Examine the patterns of missing variables in the data
. *****
.
. misstable pattern

Missing-value patterns
(1 means complete)

Percent | Pattern
        | 1 2
-----+-----
56%     | 1 1
        |
35      | 1 0
7       | 0 0
2       | 0 1
-----+-----
100%   |

Variables are (1) tax (2) age

. misstable sum, all

                                         Obs<.
Variable | Obs=.  Obs>.  Obs<. | Unique values  Min  Max
-----+-----+-----+-----+-----+-----
price | 117    117    117 | 99             540 2150
sgft | 117    117    117 | 104            837 3750
age | 49     68     68 | 30             1   53
nfeatures | 117    117    117 | 9              0   8
ne | 117    117    117 | 2              0   1
custom | 117    117    117 | 2              0   1
corner | 117    117    117 | 2              0   1
tax | 10     107    107 | 95            223 1765
-----+-----+-----+-----+-----+-----

```

```

. misstable nested

1. tax(10)
2. age(49)

.
.
*****
. * Normalize the highly skewed variables with missing values
. *****
.
. sktest age tax

                Skewness/Kurtosis tests for Normality
----- joint -----
Variable |      Obs  Pr(Skewness)  Pr(Kurtosis)  adj  chi2(2)  Prob>chi2
-----+-----
    age |         68    0.0002      0.1458      13.13      0.0014
    tax |        107    0.0001      0.0264      16.71      0.0002

. generate lnage = ln(age)
(49 missing values generated)

. generate lntax = ln(tax)
(10 missing values generated)

. sktest lnage lntax

                Skewness/Kurtosis tests for Normality
----- joint -----
Variable |      Obs  Pr(Skewness)  Pr(Kurtosis)  adj  chi2(2)  Prob>chi2
-----+-----
   lnage |         68    0.3338      0.7194       1.10      0.5781
   lntax |        107    0.2726      0.1097       3.86      0.1452

.
. *****
. *Specify the data format and variable types
. *****
. mi set mlong

. mi register imputed lnage lntax
(51 m=0 obs. now marked as incomplete)

. mi register regular price sqft nfeatures ne custom corner

. mi register passive tax age

. mi describe

Style:  mlong
      last mi update 13jun2022 11:33:21, 0 seconds ago

Obs.:  complete      66
      incomplete     51  (M = 0 imputations)
-----
      total          117

Vars.:  imputed:  2; lnage(49) lntax(10)

      passive:  2; tax(10) age(49)

      regular:  6; price sqft nfeatures ne custom corner

      system:   3; mi_m mi_id mi_miss

      (there are no unregistered variables)

. save "example1.dta", replace
file example1.dta saved

```

```

. *****
. * Imputation using Multiple Imputation by Chained Equations (MICE)
. *****
.
. *****
. *read in the data
. *****
. use "example1.dta", clear
(Albuquerque home prices Feb15-Apr30, 1993)
.
. *****
. * Impute the data
. *****
. mi impute chained (regress) lnage lntax = price sqft nfeatures ne custom corner, add(20)
rseed(23)

```

Conditional models:

```

lnage: regress lnage price sqft nfeatures ne custom corner
lntax: regress lntax price sqft nfeatures ne custom corner

```

Performing chained iterations ...

```

Multivariate imputation          Imputations =      20
Chained equations                added =      20
Imputed: m=1 through m=20       updated =       0

Initialization: monotone        Iterations =     200
                                burn-in =      10

```

```

lnage: linear regression
lntax: linear regression

```

```

-----
                | Observations per m
                |-----|-----|-----|
Variable | Complete  Incomplete  Imputed  | Total
-----+-----+-----+-----+
lnage |          68          49          49 |    117
lntax |          107          10          10 |    117
-----+-----+-----+-----+

```

(complete + incomplete = total; imputed is the minimum across m of the number of filled-in observations.)

```

. * mi impute chained (regress) lnage (pmm,knn(3)) lntax = price sqft nfeatures ne custom corner,
add(20) rseed(23)

```

```

.
.
. tab1 age tax if _mi_m ==0, mis

```

-> tabulation of age if \_mi\_m ==0

```

Home age |
(years) |      Freq.      Percent      Cum.
-----+-----+-----+-----+
  1 |          2          1.71          1.71
  2 |          1          0.85          2.56
  . |
  . |
 40 |          2          1.71          53.85
 41 |          1          0.85          54.70
 43 |          1          0.85          55.56
 45 |          1          0.85          56.41
 46 |          1          0.85          57.26
 53 |          1          0.85          58.12
. |          49         41.88         100.00
-----+-----+-----+-----+
Total |          117         100.00

```

-> tabulation of tax if \_mi\_m ==0

Tax amount (dollars)	Freq.	Percent	Cum.
223	1	0.85	0.85
225	1	0.85	1.71
.			
.			
1639	1	0.85	89.74
1732	1	0.85	90.60
1765	1	0.85	91.45
.	10	8.55	100.00
Total	117	100.00	

. by \_mi\_m: sum age tax lnage lntax if \_mi\_m ~=0

-> \_mi\_m = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
age	2	10	7.071068	5	15
tax	41	665.9756	248.8798	223	1265
lnage	51	3.022248	.9008899	1.609438	5.054752
lntax	51	6.427765	.375489	5.407172	7.142828

-> \_mi\_m = 2

Variable	Obs	Mean	Std. Dev.	Min	Max
age	2	10	7.071068	5	15
tax	41	665.9756	248.8798	223	1265
lnage	51	2.921267	1.112895	1.182402	5.997126
lntax	51	6.412569	.3881544	5.407172	7.142828

-> \_mi\_m = 3

Variable	Obs	Mean	Std. Dev.	Min	Max
age	2	10	7.071068	5	15
tax	41	665.9756	248.8798	223	1265
lnage	51	3.314512	1.103918	1.280663	6.666093
lntax	51	6.419942	.3774007	5.407172	7.142828

.  
.  
.

-> \_mi\_m = 20

Variable	Obs	Mean	Std. Dev.	Min	Max
age	2	10	7.071068	5	15
tax	41	665.9756	248.8798	223	1265
lnage	51	3.153359	1.206266	.4527072	6.472569
lntax	51	6.473906	.3842498	5.407172	7.152384

```

.
. *****
. * save the data
. *****
. save "mice.dta", replace
file mice.dta saved

.
.
. *****
. *** Analysis using imputed data sets
. *****
.
. use mice.dta, clear
(Albuquerque home prices Feb15-Apr30, 1993)

.
. *****
. * Conduct Regression Analysis
. *****
. quietly mi passive: replace age = exp(lnage)
. quietly mi passive: replace tax = exp(lntax)

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates          Imputations = 20
Linear regression                     Number of obs = 117
                                      Average RVI = 0.2125
                                      Largest FMI = 0.5121
                                      Complete DF = 109
DF adjustment: Small sample           DF: min = 32.13
                                      avg = 74.46
                                      max = 103.04
Model F test: Equal FMI               F( 7, 102.7) = 57.51
Within VCE type: OLS                  Prob > F = 0.0000

-----+-----
      price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
      sqft |   .2523628   .0865809     2.91   0.006   .0773634   .4273621
      age |  -.2370655   .8738794    -0.27   0.788  -2.016813   1.542682
 nfeatures |   6.18904   13.48005     0.46   0.647  -20.59321   32.97129
      ne |   6.189092   34.42526     0.18   0.858  -62.10399   74.48217
  custom |  138.5032   43.77608     3.16   0.002   51.65099   225.3554
  corner | -68.26704   40.40571    -1.69   0.094  -148.4019   11.86777
      tax |   .6124866   .141715     4.32   0.000   .3271798   .8977933
      _cons |  125.6485   68.78702     1.83   0.071  -11.12307   262.4201
-----+-----

.
. *****
. * Post-estimation test
. *****
.
. *****
. * Test if both age and tax both are significantly different from zero
. *****
. mi test age tax
note: assuming equal fractions of missing information

( 1) age = 0
( 2) tax = 0

      F( 2, 68.4) = 11.41
      Prob > F = 0.0001.

```

```

. *****
. * Test if both the coefficients of AGE and TAX are equal
. *****
. mi estimate (diff: _b[age]-_b[tax]): regress price sqft age nfeatures ne custom corner tax

```

```

Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs    =     117
                                   Average RVI      =     0.2125
                                   Largest FMI     =     0.5121
                                   Complete DF     =     109
DF adjustment: Small sample       DF: min         =     32.13
                                   avg             =     74.46
                                   max             =    103.04
Model F test: Equal FMI          F( 7, 102.7)    =     57.51
Within VCE type: OLS              Prob > F         =     0.0000

```

```

-----+-----
price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
sqft |      .2523628   .0865809     2.91  0.006     .0773634   .4273621
age |     -.2370655   .8738794    -0.27  0.788    -2.016813  1.542682
nfeatures |      6.18904  13.48005     0.46  0.647    -20.59321  32.97129
ne |      6.189092  34.42526     0.18  0.858    -62.10399  74.48217
custom |     138.5032  43.77608     3.16  0.002     51.65099  225.3554
corner |    -68.26704  40.40571    -1.69  0.094    -148.4019  11.86777
tax |     .6124866   .141715     4.32  0.000     .3271798  .8977933
_cons |     125.6485  68.78702     1.83  0.071    -11.12307  262.4201
-----+-----

```

```

Transformations                    Average RVI      =     0.8351
                                   Largest FMI     =     0.4739
                                   Complete DF     =     109
DF adjustment: Small sample       DF: min         =     35.66
                                   avg             =     35.66
                                   max             =     35.66
Within VCE type: OLS
diff: _b[age]-_b[tax]

```

```

-----+-----
price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
diff |    -.8495521   .7975684    -1.07  0.294    -2.467629  .7685249
-----+-----

```

```

. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

```

```

Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs    =     117
                                   Average RVI      =     0.2125
                                   Largest FMI     =     0.5121
                                   Complete DF     =     109
DF adjustment: Small sample       DF: min         =     32.13
                                   avg             =     74.46
                                   max             =    103.04
Model F test: Equal FMI          F( 7, 102.7)    =     57.51
Within VCE type: OLS              Prob > F         =     0.0000

```

```

-----+-----
price |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----+-----
sqft |      .2523628   .0865809     2.91  0.006     .0773634   .4273621
age |     -.2370655   .8738794    -0.27  0.788    -2.016813  1.542682
nfeatures |      6.18904  13.48005     0.46  0.647    -20.59321  32.97129
ne |      6.189092  34.42526     0.18  0.858    -62.10399  74.48217
custom |     138.5032  43.77608     3.16  0.002     51.65099  225.3554
corner |    -68.26704  40.40571    -1.69  0.094    -148.4019  11.86777
tax |     .6124866   .141715     4.32  0.000     .3271798  .8977933
_cons |     125.6485  68.78702     1.83  0.071    -11.12307  262.4201
-----+-----

```

```
. mi estimate (diff: _b[age]- _b[tax]) using mice_result.dta
```

```
Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs    =     117
                                   Average RVI      =     0.2125
                                   Largest FMI     =     0.5121
                                   Complete DF     =     109
DF adjustment:  Small sample      DF:   min      =     32.13
                                   avg        =     74.46
                                   max        =    103.04
Model F test:      Equal FMI     F( 7, 102.7)   =     57.51
Within VCE type:  OLS            Prob > F       =     0.0000
```

```
-----+-----
price |      Coef.   Std. Err.   t   P>|t|   [95% Conf. Interval]
-----+-----
sqft |   .2523628   .0865809   2.91  0.006   .0773634   .4273621
age |  -.2370655   .8738794  -0.27  0.788  -2.016813  1.542682
nfeatures |  6.18904   13.48005   0.46  0.647  -20.59321  32.97129
ne |  6.189092   34.42526   0.18  0.858  -62.10399  74.48217
custom | 138.5032   43.77608   3.16  0.002   51.65099  225.3554
corner | -68.26704   40.40571  -1.69  0.094  -148.4019  11.86777
tax |   .6124866   .141715   4.32  0.000   .3271798   .8977933
_cons | 125.6485   68.78702   1.83  0.071  -11.12307  262.4201
-----+-----
```

```
Transformations      Average RVI      =     0.8351
                    Largest FMI     =     0.4739
                    Complete DF     =     109
DF adjustment:  Small sample      DF:   min      =     35.66
                                   avg        =     35.66
                                   max        =     35.66
Within VCE type:  OLS
```

```
diff: _b[age]- _b[tax]
```

```
-----+-----
price |      Coef.   Std. Err.   t   P>|t|   [95% Conf. Interval]
-----+-----
diff |  -.8495521   .7975684  -1.07  0.294  -2.467629   .7685249
-----+-----
```

```
. *****
. * Test if the coefficients of AGE, TAX, and NE are equal
. *****
```

```
. mi estimate (diff1: _b[age]- _b[tax]) (diff2: _b[age]- _b[ne]) using mice_result.dta
```

```
Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs    =     117
                                   Average RVI      =     0.2125
                                   Largest FMI     =     0.5121
                                   Complete DF     =     109
DF adjustment:  Small sample      DF:   min      =     32.13
                                   avg        =     74.46
                                   max        =    103.04
Model F test:      Equal FMI     F( 7, 102.7)   =     57.51
Within VCE type:  OLS            Prob > F       =     0.0000
```

```
-----+-----
price |      Coef.   Std. Err.   t   P>|t|   [95% Conf. Interval]
-----+-----
sqft |   .2523628   .0865809   2.91  0.006   .0773634   .4273621
age |  -.2370655   .8738794  -0.27  0.788  -2.016813  1.542682
nfeatures |  6.18904   13.48005   0.46  0.647  -20.59321  32.97129
ne |  6.189092   34.42526   0.18  0.858  -62.10399  74.48217
custom | 138.5032   43.77608   3.16  0.002   51.65099  225.3554
corner | -68.26704   40.40571  -1.69  0.094  -148.4019  11.86777
tax |   .6124866   .141715   4.32  0.000   .3271798   .8977933
_cons | 125.6485   68.78702   1.83  0.071  -11.12307  262.4201
-----+-----
```

```

Transformations                Average RVI      =      0.4433
                               Largest FMI       =      0.4739
                               Complete DF        =      109
DF adjustment:  Small sample   DF:   min      =      35.66
                               avg              =      68.21
Within VCE type:              OLS                max      =      100.76

```

```

diff1: _b[age]-_b[tax]
diff2: _b[age]-_b[ne]

```

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
diff1	-.8495521	.7975684	-1.07	0.294	-2.467629	.7685249
diff2	-6.426157	34.44465	-0.19	0.852	-74.75704	61.90472

```
. mi testtransform diff1 diff2
```

```
note: assuming equal fractions of missing information
```

```

diff1: _b[age]-_b[tax]
diff2: _b[age]-_b[ne]

```

```

( 1) diff1 = 0
( 2) diff2 = 0

```

```

F( 2, 78.0) = 0.73
Prob > F = 0.4867

```

```

. *****
. * Test if the ratio of coefficients of AGE and TAX
. *****
. mi estimate (ratio: _b[age]/_b[tax]) using mice_result.dta

```

```

Multiple-imputation estimates      Imputations      =      20
Linear regression                 Number of obs    =      117
                                   Average RVI      =      0.2125
                                   Largest FMI     =      0.5121
                                   Complete DF     =      109
DF adjustment:  Small sample      DF:   min      =      32.13
                                   avg              =      74.46
                                   max              =      103.04
Model F test:   Equal FMI        F( 7, 102.7)    =      57.51
Within VCE type: OLS              Prob > F        =      0.0000

```

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sqft	.2523628	.0865809	2.91	0.006	.0773634	.4273621
age	-.2370655	.8738794	-0.27	0.788	-2.016813	1.542682
nfeatures	6.18904	13.48005	0.46	0.647	-20.59321	32.97129
ne	6.189092	34.42526	0.18	0.858	-62.10399	74.48217
custom	138.5032	43.77608	3.16	0.002	51.65099	225.3554
corner	-68.26704	40.40571	-1.69	0.094	-148.4019	11.86777
tax	.6124866	.141715	4.32	0.000	.3271798	.8977933
_cons	125.6485	68.78702	1.83	0.071	-11.12307	262.4201

```

Transformations                Average RVI      =      1.1199
                               Largest FMI       =      0.5497
                               Complete DF        =      109
DF adjustment:  Small sample   DF:   min      =      28.99
                               avg              =      28.99
Within VCE type:              OLS                max      =      28.99

```

```
ratio: _b[age]/_b[tax]
```

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
-------	-------	-----------	---	------	----------------------	--



```
-----+-----
ratio | -.5245539  1.678354  -0.31  0.757  -3.95721  2.908102
-----+-----
```

```
.
. *****
.
.
.
.
. *****
. * Imputation using multivariate normal model (MVN)
. *****
.
. *****
. *read in the data
. *****
.
. use "example1.dta", clear
(Albuquerque home prices Feb15-Apr30, 1993)
```

```
.
. *****
. * Impute the data
. *****
```

```
. mi impute mvn lnage lntax = price sqft nfeatures ne custom corner, add(20) rseed(23)
```

Performing EM optimization:

note: 8 observations omitted from EM estimation because of all imputation variables missing  
observed log likelihood = 112.1464 at iteration 48

Performing MCMC data augmentation ...

```
Multivariate imputation          Imputations =    20
Multivariate normal regression    added =    20
Imputed: m=1 through m=20        updated =    0

Prior: uniform                    Iterations =   2000
                                   burn-in =    100
                                   between =    100
```

```
-----+-----
Variable | Observations per m
          |-----+-----
          | Complete  Incomplete  Imputed  | Total
-----+-----
lnage    |          68          49          49  |   117
lntax    |          107          10          10  |   117
-----+-----
```

(complete + incomplete = total; imputed is the minimum across m of the number of filled-in observations.)

```
. tab1 age tax if _mi_m ==0, mis
```

-> tabulation of age if \_mi\_m ==0

```
Home age |
(years)  | Freq.   Percent   Cum.
-----+-----
1 |         2     1.71     1.71
2 |         1     0.85     2.56
3 |         2     1.71     4.27
.
.
45 |         1     0.85    56.41
46 |         1     0.85    57.26
53 |         1     0.85    58.12
```

```

. | 49          41.88      100.00
-----+-----
Total |          117      100.00

```

-> tabulation of tax if \_mi\_m ==0

```

Tax amount |          Freq.      Percent      Cum.
(dollars) |-----+-----
      223 |             1          0.85         0.85
      225 |             1          0.85         1.71
          .
          .
      1635 |             1          0.85        88.89
      1639 |             1          0.85        89.74
      1732 |             1          0.85        90.60
      1765 |             1          0.85        91.45
. | 10          8.55        100.00
-----+-----
Total |          117      100.00

```

. by \_mi\_m: sum age tax lnage lntax if \_mi\_m ~ =0

-> \_mi\_m = 0

```

-----+-----
Variable |          Obs          Mean      Std. Dev.      Min      Max
-----+-----
      age |             0             0             0             0             0
      tax |             0             0             0             0             0
      lnage |            00             0             0             0             0
      lntax |            00             0             0             0             0

```

-> \_mi\_m = 1

```

-----+-----
Variable |          Obs          Mean      Std. Dev.      Min      Max
-----+-----
      age |             2             10      7.071068           5          15
      tax |            41      665.9756      248.8798          223          1265
      lnage |            51      3.068994      .8872078      1.470505      4.869784
      lntax |            51      6.438456      .3687993      5.407172      7.142828

```

-> \_mi\_m = 2

```

-----+-----
Variable |          Obs          Mean      Std. Dev.      Min      Max
-----+-----
      age |             2             10      7.071068           5          15
      tax |            41      665.9756      248.8798          223          1265
      lnage |            51       2.77053      1.116184      .4688766      7.032046
      lntax |            51      6.460148      .403052      5.407172      7.755703

```

-> \_mi\_m = 3

```

-----+-----
Variable |          Obs          Mean      Std. Dev.      Min      Max
-----+-----
      age |             2             10      7.071068           5          15
      tax |            41      665.9756      248.8798          223          1265
      lnage |            51      2.850727      1.16971      .4243881      5.597603
      lntax |            51      6.477283      .3792646      5.407172      7.142828

```

```

.
.
-----
-> _mi_m = 20

-----
Variable |      Obs      Mean   Std. Dev.   Min      Max
-----+-----
      age |         2         10   7.071068     5        15
      tax |        41   665.9756  248.8798     223     1265
      lnage |        51   3.161854   1.009757   1.487378   7.113717
      lntax |        51   6.471601   .3916801   5.407172   7.142828

.
.
. *****
. * save the data
. *****
. save "mvn.dta", replace
file mvn.dta saved

.
.
. *****
. * Estimating the model
. *****

.
.
. use mvn.dta, clear
(Albuquerque home prices Feb15-Apr30, 1993)

.
. *****
. * Conduct Regression Analysis
. *****
. quietly mi passive: replace age = exp(lnage)
. quietly mi passive: replace tax = exp(lntax)

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs     =     117
                                   Average RVI       =     0.4571
                                   Largest FMI       =     0.7221
                                   Complete DF      =     109
DF adjustment: Small sample       DF: min          =     17.68
                                   avg              =     67.83
                                   max              =     99.29
Model F test: Equal FMI           F( 7, 94.9)     =     47.31
Within VCE type: OLS              Prob > F         =     0.0000

-----
      price |      Coef.   Std. Err.   t   P>|t|   [95% Conf. Interval]
-----+-----
      sqft |   .2766459   .0958146    2.89  0.007   .0812592   .4720327
      age |  -.4829652   1.110544   -0.43  0.669  -2.819119   1.853189
      nfeatures |  6.725736  13.31512    0.51  0.615  -19.71336  33.16483
      ne |   5.149933   35.0918    0.15  0.884  -64.50671  74.80657
      custom | 139.1709   44.65217    3.12  0.002   50.50909  227.8326
      corner | -64.86531   40.95969   -1.58  0.116  -146.1353  16.40467
      tax |   .5664649   .1557932    3.64  0.001   .2497561   .8831736
      _cons | 123.0308    69.85319    1.76  0.082  -16.04884  262.1104
-----

```

```

. *****
. * Post-estimation test
. *****
.
. *****
. * Test if both age and tax both are significantly different from zero
. *****
. mi test age tax
note: assuming equal fractions of missing information

( 1) age = 0
( 2) tax = 0

      F( 2, 42.7) =    7.24
      Prob > F =    0.0020

.
. *****
. * Test if both the coefficients of AGE and TAX are equal
. *****
. mi estimate (diff: _b[age]-_b[tax]): regress price sqft age nfeatures ne custom corner tax

Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs    =     117
                                   Average RVI      =     0.4571
                                   Largest FMI     =     0.7221
                                   Complete DF     =     109
DF adjustment: Small sample      DF:   min      =     17.68
                                   avg          =     67.83
                                   max          =     99.29
Model F test: Equal FMI          F( 7, 94.9)    =     47.31
Within VCE type: OLS             Prob > F       =     0.0000

-----+-----
      price |      Coef.   Std. Err.   t    P>|t|   [95% Conf. Interval]
-----+-----
      sqft |   .2766459   .0958146    2.89  0.007   .0812592   .4720327
      age |  -4.829652   1.110544   -0.43  0.669  -2.819119   1.853189
      nfeatures |  6.725736   13.31512    0.51  0.615  -19.71336   33.16483
      ne |   5.149933   35.0918    0.15  0.884  -64.50671   74.80657
      custom |  139.1709   44.65217    3.12  0.002   50.50909   227.8326
      corner | -64.86531   40.95969   -1.58  0.116  -146.1353   16.40467
      tax |   5.664649   .1557932    3.64  0.001   .2497561   .8831736
      _cons |  123.0308   69.85319    1.76  0.082  -16.04884   262.1104
-----+-----

Transformations                    Average RVI      =     2.2977
                                   Largest FMI     =     0.7210
                                   Complete DF     =     109
DF adjustment: Small sample      DF:   min      =     17.74
                                   avg          =     17.74
                                   max          =     17.74
Within VCE type: OLS

      diff: _b[age]-_b[tax]

-----+-----
      price |      Coef.   Std. Err.   t    P>|t|   [95% Conf. Interval]
-----+-----
      diff |  -1.04943   1.035636   -1.01  0.325  -3.227471   1.128611
-----+-----

.
. mi estimate, saving(mice_result.dta, replace): regress price sqft age nfeatures ne custom
corner tax

Multiple-imputation estimates      Imputations      =      20
Linear regression                  Number of obs    =     117
                                   Average RVI      =     0.4571
                                   Largest FMI     =     0.7221
                                   Complete DF     =     109
DF adjustment: Small sample      DF:   min      =     17.68

```



```

Largest FMI = 0.7221
Complete DF = 109
DF adjustment: Small sample
DF: min = 17.68
      avg = 67.83
      max = 99.29
Model F test: Equal FMI F( 7, 94.9) = 47.31
Within VCE type: OLS Prob > F = 0.0000

```

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sqft	.2766459	.0958146	2.89	0.007	.0812592	.4720327
age	-.4829652	1.110544	-0.43	0.669	-2.819119	1.853189
nfeatures	6.725736	13.31512	0.51	0.615	-19.71336	33.16483
ne	5.149933	35.0918	0.15	0.884	-64.50671	74.80657
custom	139.1709	44.65217	3.12	0.002	50.50909	227.8326
corner	-64.86531	40.95969	-1.58	0.116	-146.1353	16.40467
tax	.5664649	.1557932	3.64	0.001	.2497561	.8831736
_cons	123.0308	69.85319	1.76	0.082	-16.04884	262.1104

```

Transformations
Average RVI = 1.1858
Largest FMI = 0.7210
Complete DF = 109
DF adjustment: Small sample
DF: min = 17.74
      avg = 56.53
      max = 95.32
Within VCE type: OLS

```

```

diff1: _b[age]- _b[tax]
diff2: _b[age]- _b[ne]

```

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
diff1	-1.04943	1.035636	-1.01	0.325	-3.227471	1.128611
diff2	-5.632898	35.22648	-0.16	0.873	-75.5633	64.2975

```

. mi testtransform diff1 diff2

```

note: assuming equal fractions of missing information

```

diff1: _b[age]- _b[tax]
diff2: _b[age]- _b[ne]

```

```

( 1) diff1 = 0
( 2) diff2 = 0

```

```

F( 2, 48.6) = 0.77
Prob > F = 0.4665

```

```

. *****
. * Test if the ratio of coefficients of AGE and TAX differs from zero
. *****
. mi estimate (ratio: _b[age]/_b[tax]) using mice_result.dta

```

```

Multiple-imputation estimates
Linear regression
Imputations = 20
Number of obs = 117
Average RVI = 0.4571
Largest FMI = 0.7221
Complete DF = 109
DF adjustment: Small sample
DF: min = 17.68
      avg = 67.83
      max = 99.29
Model F test: Equal FMI F( 7, 94.9) = 47.31
Within VCE type: OLS Prob > F = 0.0000

```

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
sqft	.2766459	.0958146	2.89	0.007	.0812592	.4720327

age	-0.4829652	1.110544	-0.43	0.669	-2.819119	1.853189
nfeatures	6.725736	13.31512	0.51	0.615	-19.71336	33.16483
ne	5.149933	35.0918	0.15	0.884	-64.50671	74.80657
custom	139.1709	44.65217	3.12	0.002	50.50909	227.8326
corner	-64.86531	40.95969	-1.58	0.116	-146.1353	16.40467
tax	0.5664649	.1557932	3.64	0.001	.2497561	.8831736
_cons	123.0308	69.85319	1.76	0.082	-16.04884	262.1104

```

-----
Transformations                                Average RVI      =      1.9124
                                                Largest FMI     =      0.6807
                                                Complete DF     =      109
DF adjustment:  Small sample                 DF:   min      =      20.04
                                                avg           =      20.04
Within VCE type:      OLS                    max           =      20.04

```

ratio: \_b[age]/\_b[tax]

price	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
ratio	-1.098728	2.373171	-0.46	0.648	-6.048432 3.850977

```

.
.
. log close
  name: <unnamed>
  log:  D:\Jason\workshop\multiple imputation\2022\code2.log
  log type: text
  closed on: 13 Jun 2022, 11:33:33
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```