Economics 102: Analysis of Economic Data
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EXTRA QUESTION FOR MIDTERM 2 PREPARATION MULTIPLE REGRESSION QUESTION

Based on Question 4 of Fall 2022 Final Exam (A)

Consider data on monthly family expenditure on food and monthly family income for families in South Africa in 1993.

Dependent Variable

`food` = Monthly family expenditure on food **in South African Rand**.
`lnfood` = Natural logarithm of variable `food`.

Regressors

`income` = Annual family income **in South African Rand**.
`lnincome` = Natural logarithm of variable `income`.
`metro` = 1 if live in metro area and 0 otherwise
`urban` = 1 if live in urban area and 0 otherwise
`rural` = 1 if live in rural area and 0 otherwise
`fedu` = Father's education (highest grade attended)
`medu` = Mother's education (highest grade attended)

Note: People live in exactly one out of metro, urban or rural areas.

Use the two pages of output provided at the end of this exam on:

1. Various t critical values.
2. Various descriptive statistics output and correlations for all variables.
3. Three regressions and a test.

Part of the following questions involves deciding which output to use.
You can use the output that gets the correct answer in the quickest possible way.

4. In this question both regressions where `food` is the dependent variable are relevant.

(a) In the second model, what is the impact on family food expenditure of a one standard deviation change in mother's education?

(b) Are income, living in a metro area or rural area, and parental education jointly statistically significant at 5 percent? **Explain your answer.**

(c) Is living in a metro or rural area jointly statistically significant at the 5% level?
If there is insufficient information to answer this question then say so. **Explain your answer.**

(d) Using an appropriate measure of goodness-of-fit, which model explains the data better - the second model (with five regressors) or the first model (with one regressor)? **Explain your answer.**

```
KEY CRITICAL VALUES FOR THIS EXAM
t_1115,.005 = 2.580  t_1114,.005 = 2.580  t_1113,.005 = 2.580  t_1109,.005 = 2.580
t_1115,.01  = 2.330  t_1114,.01  = 2.330  t_1113,.01  = 2.330  t_1109,.01  = 2.330
t_1115,.025 = 1.962  t_1114,.025 = 1.962  t_1113,.025 = 1.962  t_1109,.025 = 1.962
t_1115,.05  = 1.646  t_1114,.05  = 1.646  t_1113,.05  = 1.646  t_1109,.05  = 1.646
t_1115,.10  = 1.282  t_1114,.10  = 1.282  t_1113,.10  = 1.282  t_1109,.10  = 1.282

. sum income lnincome food lnfood metro urban rural fedu medu

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
      income |      1,115    1694.653    1649.817   13.76042     8612.5
    lnincome |      1,115    7.001659    .9995433   2.621796    9.06097
        food |      1,115    676.7994    436.4025     33.551       3775
      lnfood |      1,115    6.353889    .5743955   3.513067   8.236156
       metro |      1,115    .0618834    .2410518          0          1
-------------+---------------------------------------------------------
       urban |      1,115    .1112108     .314534          0          1
       rural |      1,115    .8269058    .3784984          0          1
        fedu |      1,115    1.403587    2.813214          0         16
        medu |      1,115    3.109417    3.598156          0         12

. mean food

Mean estimation                   Number of obs   =      1,115

--------------------------------------------------------------
             |       Mean   Std. Err.     [95% Conf. Interval]
-------------+------------------------------------------------
        food |   676.7994   13.06922      651.1563    702.4425
--------------------------------------------------------------

. sum food, detail

                  93: HH Total Food Month Exp
-------------------------------------------------------------
      Percentiles      Smallest
 1%          137         33.551
 5%          222          65.57
10%          295         78.495       Obs               1,115
25%          415             97       Sum of Wgt.       1,115

50%          574                      Mean           676.7994
                        Largest       Std. Dev.      436.4025
75%          837            3369
90%         1147            3369       Variance       190447.2
95%         1407        3705.289       Skewness       2.671434
99%         2270            3775       Kurtosis       14.79689

. sum food if metro==1

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        food |         69    681.7391    327.0024    99.3875       1496

. sum food if metro==0

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
        food |      1,046    676.4736    442.7892     33.551       3775

. correlate income lnincome food lnfood metro urban rural fedu medu
(obs=1,115)

             |   income lnincome     food   lnfood    metro    urban    rural     fedu     medu
-------------+---------------------------------------------------------------------------------
      income |   1.0000
    lnincome |   0.8378   1.0000
        food |   0.3205   0.3084   1.0000
      lnfood |   0.3301   0.3745   0.8905   1.0000
       metro |   0.1699   0.1576   0.0029   0.0177   1.0000
       urban |   0.1587   0.1847  -0.0132  -0.0064  -0.0909   1.0000
       rural |  -0.2401  -0.2538   0.0091  -0.0060  -0.5614  -0.7731   1.0000
        fedu |   0.0981   0.1057   0.1413   0.1453  -0.0144   0.0436  -0.0271   1.0000
        medu |   0.0760   0.0872   0.1034   0.1414   0.0688   0.0931  -0.1212   0.2125   1.0000
```

```
. regress food income
```

Source	SS	df	MS		
Model	21794243.6	1	21794243.6	Number of obs	= 1,115
Residual	190363908	1,113	171036.755	F(1, 1113)	= 127.42
				Prob > F	= 0.0000
				R-squared	= 0.1027
				Adj R-squared	= 0.1019
Total	212158151	1,114	190447.174	Root MSE	= 413.57

food	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	.0847798	.0075105	11.29	0.000	.0700436	.0995161
_cons	533.127	17.75918	30.02	0.000	498.2817	567.9722

```
. regress food income metro rural fedu medu
```

Source	SS	df	MS		
Model	27034486.6	5	5406897.31	Number of obs	= 1,115
Residual	185123665	1,109	166928.462	F(5, 1109)	= 32.39
				Prob > F	= 0.0000
				R-squared	= 0.1274
				Adj R-squared	= 0.1235
Total	212158151	1,114	190447.174	Root MSE	= 408.57

food	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
income	.0871842	.0076894	11.34	0.000	.0720967	.1022717
metro	-1.965244	61.47301	-0.03	0.975	-122.5818	118.6513
rural	113.8298	39.87293	2.85	0.004	35.59489	192.0647
fedu	15.00759	4.473403	3.35	0.001	6.230304	23.78488
medu	8.470908	3.507814	2.41	0.016	1.588207	15.35361
_cons	387.6434	43.27632	8.96	0.000	302.7307	472.5561

```
. test metro rural

 ( 1)  metro = 0
 ( 2)  rural = 0

       F(  2,  1109) =    5.84
            Prob > F =    0.0030
```

```
. regress lnfood lnincome metro rural fedu medu
```

Source	SS	df	MS		
Model	62.5314393	5	12.5062879	Number of obs	= 1,115
Residual	305.01077	1,109	.275032254	F(5, 1109)	= 45.47
				Prob > F	= 0.0000
				R-squared	= 0.1701
				Adj R-squared	= 0.1664
Total	367.542209	1,114	.32993017	Root MSE	= .52444

lnfood	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lnincome	.2201653	.0163539	13.46	0.000	.1880773	.2522534
metro	.0384121	.0788383	0.49	0.626	-.116277	.1931012
rural	.1745908	.0514147	3.40	0.001	.0737097	.2754719
fedu	.0176357	.0057446	3.07	0.002	.0063642	.0289072
medu	.0163607	.004504	3.63	0.000	.0075235	.025198
_cons	4.589994	.1315801	34.88	0.000	4.33182	4.848168