Economics 113 Professor Spearot — Introduction to Econometrics
Spring 2014 – Midterm 2

Name _____ ID_____

Midterm 2 –60 Points

You must answer all questions. Please write your name on every page. The exam is closed book and closed notes. You may use calculators, but they must not be graphing calculators. No cell phones. Do not use your own scratch paper.

You must show your work to receive full credit

I have neither given nor received unauthorized aid on this examination, nor have I concealed any similar misconduct by others.

*Signature*_____

Problem 1

Smoking has severe health consequences, and many polices are meant to curb smoking behavior. To begin our study of smoking behavior, we focus on a sample of expectant mothers to evaluate their smoking habits as a function of their family characteristics. To establish a baseline, we evaluate impact of respective education levels (in years) of the expectant mother and the father, *motheduc* and *fatheduc*, on the number of cigarette packs consumed per day, *packs*.

$$packs = \beta_0 + \beta_1 motheduc + \beta_2 fatheduc + u$$

Education levels are in years. The results from this regression are below.

```
      Source |       SS       df       MS              Number of obs =    1191
-------------+------------------------------           F(  2,  1188) =   31.14
       Model |   4.2315727     2  2.11578635           Prob > F      =  0.0000
    Residual |  80.7221848  1188  .067947967           R-squared     =  0.0498
-------------+------------------------------           Adj R-squared =  0.0482
       Total |  84.9537575  1190  .071389712           Root MSE      =  .26067
------------------------------------------------------------------------------
       packs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    motheduc |  -.0190001   .0040835    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
    fatheduc |  -.0067882   .0036011    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
       _cons |   .4273789   .0436991    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
------------------------------------------------------------------------------
```

a.) Do the variables of the model jointly tell us anything about the expectant mother's smoking behavior? Please test this hypothesis at the 95% level, clearly stating your null and alternative hypotheses. **(10 Points)**

b.) Using the 98% confidence level, please test whether the coefficient on *fatheduc* is significantly different from zero. State your null and alternative hypotheses, and show your work! **(10 Points)**

c.) Please **derive** an equation that allows me to test whether the effect of the expectant mother's education on her own smoking behavior is the same as the father's education. Along with the derivation, please state the null and alternative hypothesis, and write down any Stata commands required to generate new variables and run the regression. Show your work! **(10 Points)**

Problem 2

Adding to the regression in Problem 1a, we include market and policy variables that may be important for influencing smoking behavior. Specifically, we include the pre-tax price of cigarettes (in cents), *cigprice*, and the tax on cigarettes (in cents), *cigtax*, as follows:

$$packs = \beta_0 + \beta_1 motheduc + \beta_2 fatheduc + \beta_3 cigprice + \beta_4 cigtax + u$$

The results from estimating this equation are below:

```
      Source |       SS       df       MS              Number of obs =    1191
-------------+------------------------------           F(  4,  1186) =   16.19
       Model |  4.39816711     4  1.09954178           Prob > F      =  0.0000
    Residual |  80.5555904  1186  .067922083           R-squared     =  0.0518
-------------+------------------------------           Adj R-squared =  0.0486
       Total |  84.9537575  1190  .071389712           Root MSE      =  .26062
------------------------------------------------------------------------------
       packs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    motheduc |  -.0189956   .0040828    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
    fatheduc |  -.0069949   .0036096    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
    cigprice |  -.0012073   .0015401    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
      cigtax |   .0027044   .0020261    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
       _cons |   .5348374   .1710825    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
------------------------------------------------------------------------------
```

a. Is this model preferred to the model in Problem 1? Please test this at the 95% level, stating your null and alternative hypotheses. Show your work!!! **(10 Points)**

You argue that "cents are cents", and the value that matters for consumption is the pre-tax price plus the tax, not each of them individually. So, you suggest a new variable, *price*, which is *cigprice+cigtax*, and insist on the following new regression.

$$packs = \beta_0 + \beta_1 motheduc + \beta_2 fatheduc + \beta_5 cigtax + \beta_6 price + u$$

```
      Source |       SS       df       MS              Number of obs =    1191
-------------+------------------------------           F(  4,  1186) =   16.19
       Model |  4.39816718     4  1.09954179           Prob > F      =  0.0000
    Residual |  80.5555903  1186  .067922083           R-squared     =  0.0518
-------------+------------------------------           Adj R-squared =  0.0486
       Total |  84.9537575  1190  .071389712           Root MSE      =  .26062

------------------------------------------------------------------------------
       packs |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
    motheduc |  -.0189956   .0040828    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
    fatheduc |  -.0069949   .0036096    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
      cigtax |   .0039117   .0034592    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
       price |  -.0012073   .0015401    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
       _cons |   .5348375   .1710825    xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
------------------------------------------------------------------------------
```

b. Using the above table, please construct a 95% confidence interval for the effect of the mother's education on her cigarette consumption. Please interpret this confidence interval. **(10 Points)**

c. Using the regression results in **'**b', I claim that the effects of a cigarette tax (*cigtax*) are different than the effects of the pre-tax cigarette price (*cigprice),* thereby rejecting the claim that "cents are cents" when it comes to tax policy. What is the probability that I'm wrong? Along with calculating this probability, please indicate the null and alternative hypotheses to which the statement is referring. **(10 Points)**

Have a great weekend!

Normal Distribution from -oo to Z

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990

TABLE G.3b

5% Critical Values of the *F* Distribution

	Numerator Degrees of Freedom									
	1	2	3	4	5	6	7	8	9	10
∞	3.84	3.00	2.60	2.37	2.21	2.10	2.01	1.94	1.88	1.83

Example: The 5% critical value for numerator $df = 4$ and large denominator df (∞) is 2.37.

Source: This table was generated using the Stata® function invFtail.