

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

Based on Question 4 of Winter19 Final Exam (A)

Consider data on annual outpatient health expenditures for individuals in the U.S. Outpatient spending is for health services that did not require admission to a hospital. The data come from the Rand health insurance experiment where different individuals were assigned to one of four different levels of health insurance - see variables `coins0`, `coins25`, `coins50` and `coins95` below.

Dependent Variable

`outspend` = Annual outpatient health expenditures (paid through insurance or out-of-pocket)
`lnout` = Natural logarithm of variable `outspend`

Regressors

`age` = age in years
`lnage` = Natural logarithm of variable `age`
`education` = years of schooling
`coins0` = 1 if individual's share of health spending is 0% (free) and = 0 otherwise
`coins25` = 1 if individuals share of health spending is 25% and = 0 otherwise
`coins50` = 1 if individuals share of health spending is 50% and = 0 otherwise
`coins95` = 1 if individuals share of health spending is 95% and = 0 otherwise

Note: People have exactly one of 0%, 25%, 50% and 95% coinsurance.

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 **outspend** is the dependent variable are relevant.

(a) In the second model, based on its coefficient (and not on statistical significance) is education an important determinant of outpatient spending? **Explain your answer.**

(b) Are age, education and the health insurance indicator variables jointly statistically significant at 5 percent? **Explain your answer.**

(c) Are the included three levels of health insurance 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_1950,.005 = 2.578 t_1949,.005 = 2.578 t_1948,.005 = 2.578 t_1944,.005 = 2.578
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. sum outspend lnout age lnage education coins0 coins25 coins50 coins95

Variable	Obs	Mean	Std. Dev.	Min	Max
outspend	1,950	1629.187	2256.877	5.291	21107.11
lnout	1,950	6.679373	1.27082	1.666007	9.957365
age	1,950	37.77128	11.28151	21	62
lnage	1,950	3.587219	.2981845	3.044523	4.127134
education	1,950	12.28769	3.066068	0	25
coins0	1,950	.4558974	.4981789	0	1
coins25	1,950	.2512821	.4338616	0	1
coins50	1,950	.0835897	.2768426	0	1
coins95	1,950	.2092308	.4068638	0	1

. mean outspend

Mean estimation Number of obs = 1,950

	Mean	Std. Err.	[95% Conf. Interval]	
outspend	1629.187	51.10819	1528.954	1729.419

. sum outspend if coins0==1

variable	Obs	Mean	Std. Dev.	Min	Max
outspend	889	1883.468	2287.072	5.291	19134.94

. sum outspend if coins0==0

Variable	Obs	Mean	Std. Dev.	Min	Max
outspend	1,061	1416.127	2209.907	9.570001	21107.11

. correlate outspend lnout age lnage education coins0 coins25 coins50 coins95
 (obs=1,950)

	outspend	lnout	age	lnage	educat~n	coins0	coins25	coins50	coins95
outspend	1.0000								
lnout	0.7624	1.0000							
age	0.0402	0.0897	1.0000						
lnage	0.0437	0.0904	0.9907	1.0000					
education	0.0394	0.0590	-0.2123	-0.2002	1.0000				
coins0	0.1032	0.1786	0.0054	-0.0012	-0.0543	1.0000			
coins25	-0.0495	-0.0576	0.0059	0.0109	0.0343	-0.5303	1.0000		
coins50	-0.0521	-0.0858	0.0042	0.0049	0.0176	-0.2765	-0.1750	1.0000	
coins95	-0.0380	-0.0988	-0.0157	-0.0134	0.0179	-0.4708	-0.2980	-0.1554	1.0000

. sum lnout, detail

		lnout	
Percentiles		Smallest	
1%	3.643359	1.666007	
5%	4.461069	2.258633	
10%	4.973298	Obs	1,950
25%	5.864171	Sum of wgt.	1,950
50%	6.756061	Mean	6.679373
		Std. Dev.	1.27082
75%	7.572927	Largest	
		9.777963	
90%	8.27102	Variance	1.614984
95%	8.692378	Skewness	-.2593892
99%	9.372543	Kurtosis	2.966688

. regress outspend age

Source	SS	df	MS	Number of obs	=	1,950
Model	16055842	1	16055842	F(1, 1948)	=	3.16
Residual	9.9112e+09	1,948	5087864.54	Prob > F	=	0.0758
Total	9.9272e+09	1,949	5093492.03	R-squared	=	0.0016
				Adj R-squared	=	0.0011
				Root MSE	=	2255.6

outspend	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
age	8.045322	4.52892	1.78	0.076	-.8367169	16.92736
_cons	1325.305	178.5266	7.42	0.000	975.1813	1675.428

. regress outspend age education coins25 coins50 coins95

Source	SS	df	MS	Number of obs	=	1,950
Model	157414231	5	31482846.2	F(5, 1944)	=	6.26
Residual	9.7698e+09	1,944	5025618.18	Prob > F	=	0.0000
Total	9.9272e+09	1,949	5093492.03	R-squared	=	0.0159
				Adj R-squared	=	0.0133
				Root MSE	=	2241.8

outspend	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
age	10.36179	4.606929	2.25	0.025	1.32675	19.39683
education	41.37921	16.97463	2.44	0.015	8.088812	74.6696
coins25	-462.7932	126.2862	-3.66	0.000	-710.4638	-215.1226
coins50	-659.371	191.112	-3.45	0.001	-1034.177	-284.565
coins95	-428.764	134.1436	-3.20	0.001	-691.8443	-165.6837
_cons	990.4725	305.762	3.24	0.001	390.8168	1590.128

. test coins25 coins50 coins95

- (1) coins25 = 0
- (2) coins50 = 0
- (3) coins95 = 0

F(3, 1944) = 7.79
 Prob > F = 0.0000

. regress lnout lnage education coins25 coins50 coins95

Source	SS	df	MS	Number of obs	=	1,950
Model	158.317781	5	31.6635562	F(5, 1944)	=	20.59
Residual	2989.28621	1,944	1.53769867	Prob > F	=	0.0000
Total	3147.60399	1,949	1.61498409	R-squared	=	0.0503
				Adj R-squared	=	0.0479
				Root MSE	=	1.24

lnout	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
lnage	.4622027	.0961673	4.81	0.000	.2736008	.6508045
education	.0375138	.0093656	4.01	0.000	.0191461	.0558814
coins25	-.3907023	.0698611	-5.59	0.000	-.5277129	-.2536918
coins50	-.6245889	.1057155	-5.91	0.000	-.8319164	-.4172613
coins95	-.4994225	.0741998	-6.73	0.000	-.6449421	-.3539029
_cons	4.815274	.3863439	12.46	0.000	4.057582	5.572966