

### Midterm 2 – 90 Points

You must answer all the 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. Do not use your own scratch paper.

#### You must show your work to receive full credit

1. (45 Points) You wish to predict wage outcomes. Specifically, you estimate the following specification:

$$\log(\text{wage}) = \beta_0 + \beta_{educ} \text{educ} + \beta_{tenure} \text{tenure} + \beta_{exper} \text{exper} + \beta_{iq} \text{iq} + \beta_{age} \text{age} + u$$

The results from running this regression are below:

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. regress lwage educ exper tenure iq age
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Source	SS	df	MS			
Model	31.0173305	5	6.2034661	Number of obs =	935	
Residual	134.638964	929	.144928917	F( 5, 929) =	42.80	
				Prob > F =	0.0000	
				R-squared =	0.1872	
				Adj R-squared =	0.1829	
Total	165.656294	934	.177362199	Root MSE =	.3807	

  

lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
educ	.0510835	.0075279	xxxxxxx	xxxxxx	xxxxxxxxx	xxxxxxxxx
exper	.0109616	.003867	xxxxxxx	xxxxxx	xxxxxxxxx	xxxxxxxxx
tenure	.0114158	.0025823	xxxxxxx	xxxxxx	xxxxxxxxx	xxxxxxxxx
iq	.0056152	.000971	xxxxxxx	xxxxxx	xxxxxxxxx	xxxxxxxxx
age	.0108734	.0048769	xxxxxxx	xxxxxx	xxxxxxxxx	xxxxxxxxx
_cons	4.953231	.166183	xxxxxxx	xxxxxx	xxxxxxxxx	xxxxxxxxx

a. Please construct a 90% confidence interval for the coefficient on iq. (10 points)

b. Professor Spearot is 29. He will be 30 in January (boooo!!!). Holding all other variables constant, what is the effect on Professor Spearot's wage in going from year 29 to year 30? **(5 points)**

c. Under the null hypothesis that age has no effect on the log wage, what is the two-sided p-value for the coefficient on *age*? How do we interpret this value? **(10 points)**

Suppose that instead of the specification in (a), I estimate

$$\log(wage) = \beta_0 + \beta_{educ} educ + \beta_{tenure} tenure + \beta_{exper} exper + u$$

Source	SS	df	MS			
Model	25.6953278	3	8.56510927	Number of obs =	935	
Residual	139.960966	931	.150334013	F( 3, 931) =	56.97	
Total	165.656294	934	.177362199	Prob > F =	0.0000	
				R-squared =	0.1551	
				Adj R-squared =	0.1524	
				Root MSE =	.38773	

  

lwage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
educ	.0748638	.0065124	11.50	0.000	.062083	.0876446
exper	.0153285	.0033696	4.55	0.000	.0087156	.0219413
tenure	.0133748	.0025872	5.17	0.000	.0082974	.0184522
_cons	5.496696	.1105282	49.73	0.000	5.279782	5.713609

d.) Is this model preferred to the previous model (in a)? Please use an appropriate test (95% confidence) to evaluate the restrictions that  $\beta_{iq} = \beta_{age} = 0$ . Be sure to state your null and alternative hypotheses. Show your work!!! (10 points)

Now consider the following specification

$$wage = Cons + \beta_{educ}(educ - 10) + \beta_{exper}(exper - 3) + \beta_{tenure}(tenure - 1) + u$$

where wage is monthly earnings. The results of estimating the model are as follows.

Source	SS	df	MS			
Model	22278193.8	3	7426064.59	Number of obs =	935	
Residual	130437974	931	140105.236	F( 3, 931) =	53.00	
Total	152716168	934	163507.675	Prob > F =	0.0000	
				R-squared =	0.1459	
				Adj R-squared =	0.1431	
				Root MSE =	374.31	

  

wage	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
educ-10	74.41486	6.286993	11.84	0.000	62.07654	86.75318
exper-3	14.89164	3.25292	4.58	0.000	8.507732	21.27554
tenure-1	8.256811	2.497628	3.31	0.001	3.355178	13.15844
Cons	520.8399	43.85672	11.88	0.000	434.7704	606.9094

e.) Please interpret the estimate of the constant term, *Cons*. (10 points)

2. (45 points) Using data from Fall 2007, I regress the final exam grade on section attendance and homework performance:

$$final = \beta_0 + \beta_{section} section + \beta_{hw} hw + u$$

Here, all variables are in percentage points. That is, *final* reports the percentage-point score on the final (1 to 100), *section* reports the percentage point score in sections (1 to 100), and *hw* reports the percentage-point score on homework (1 to 100). The results from running this regression are below:

Source	SS	df	MS			
Model	4702.56728	2	2351.28364	Number of obs =	142	
Residual	28562.9694	139	205.488989	F( 2, 139) =	11.44	
Total	33265.5367	141	235.925792	Prob > F =	0.0000	
				R-squared =	0.1414	
				Adj R-squared =	0.1290	
				Root MSE =	14.335	

  

final	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
section	.0502133	.0674966	XX		
hw	.3485204	.0813444	XX		
_cons	41.38418	7.755672	XX		

a. Using the 95% confidence level, test whether the coefficient on section,  $\beta_{section}$ , is significantly different from zero. Please state your null and alternative hypotheses, and briefly interpret the result. **(10 Points)**

b. I have not included any measure of student ability, since it is unobserved. Assuming that ability is positively correlated with homework scores, and higher abilities increase your grade, in what direction is the bias in  $\beta_{hw}$ , and why? What assumption is violated? **(10 Points)**

Suppose that I adjust the regression in (a) and estimate the following

$$final = \beta_0 + \beta_{mt1} mt1 + \beta_{section} section + \beta_{hw} hw + u$$

Here, *mt1* reports the percentage point score on the first midterm (1 to 100), *section* reports the percentage point score in sections (1 to 100), and *hw* reports the percent point score on homework (1 to 100). The results from running this regression are below:

Source	SS	df	MS			
Model	12155.6037	3	4051.86791	Number of obs =	142	
Residual	21109.933	138	152.970529	F( 3, 138) =	26.49	
				Prob > F =	0.0000	
				R-squared =	0.3654	
				Adj R-squared =	0.3516	
Total	33265.5367	141	235.925792	Root MSE =	12.368	

  

final	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
mt1	.4671107	.0669202	6.98	0.000	.3347892	.5994322
section	.0795122	.058387	1.36	0.175	-.0359367	.1949611
hwtotal	.235302	.0720338	3.27	0.001	.0928692	.3777347
_cons	14.46427	7.723413	1.87	0.063	-.8072673	29.7358

c. Do the variables of the model tell use anything about the dependent variable, *final*? Please state your null and alternative hypotheses, test the hypothesis at the 95% level, and show your work. **(5 Points)**

d. I hypothesize that scores on the first midterm and homework scores have the same effect on the final exam grade. Please write this hypothesis in terms of model parameters. Derive a new regression equation that enables me to test this hypothesis. Please include all STATA commands to run such a regression. **(10 points)**

e. Suppose that I want to adjust the regression in (c) to estimate the effect of a percentage-change in midterm scores on the percentage point final exam score. How should I adjust the regression in (c)? **(10 points)**



## Normal Distribution from $-\infty$ 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