

Answer Sheet Cover Page
Final Examination Semester 2/2020

(Readable handwriting and printed version are acceptable)

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Course ID EE426 Course Title Econometrics

Lecturer Assoc. prof. Dr. Tatre Jantarakolka

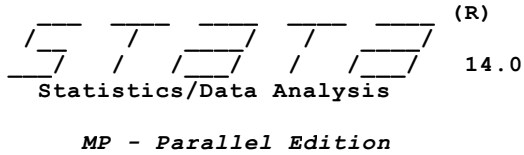
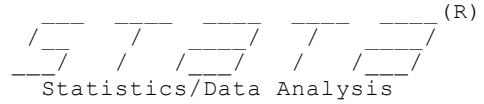
Exam date 28/5/21 Time 9.00-15.00

Total pages 34

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3. Maximum number of variables is set to 5000; see [help set maxvar](#).

```
1 . use "C:\Users\com\Documents\Final_q1-1_4.dta", clear
2 . log using "C:\Users\com\Documents\final_q1-1_4.smcl"
```

```
name: <unnamed>
log: C:\Users\com\Documents\final_q1-1_4.smcl
log type: smcl
opened on: 28 May 2021, 09:03:46
```

1. a.

```
. mlogit y x1 x2 x3 x4, base(0) nolog
```

```
Multinomial logistic regression
Number of obs = 170
LR chi2(8) = 88.31
Prob > chi2 = 0.0000
Log likelihood = -106.49133
Pseudo R2 = 0.2931
```

	y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
0		(base outcome)					
1	x1	-.7577563	.6194405	-1.22	0.221	-1.971837	.4563247
	x2	-.7556866	.769247	-0.98	0.326	-2.263383	.7520099
	x3	-.427155	.6115412	-0.70	0.485	-1.625754	.7714438
	x4	.5759241	.2475575	2.33	0.020	.0907204	1.061128
	_cons	-6.697704	3.534695	-1.89	0.058	-13.62558	.2301706
2	x1	-.8552545	.6845579	-1.25	0.212	-2.196963	.4864543
	x2	-1.699252	.8021577	-2.12	0.034	-3.271452	-.1270513
	x3	.8464951	.6676663	1.27	0.205	-.4621069	2.155097
	x4	1.781968	.306451	5.81	0.000	1.181335	2.382601
	_cons	-25.72809	4.593653	-5.60	0.000	-34.73148	-16.7247

```
. est store m1
```

```
. mlogit y x1 x2 x3 x4 if y!=2, base(0) nolog
```

```
Multinomial logistic regression
Number of obs = 63
LR chi2(4) = 6.49
Prob > chi2 = 0.1655
Log likelihood = -35.324084
Pseudo R2 = 0.0841
```

y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
0	(base outcome)					
1						
	x1	-.6041432	.601131	-1.01	0.315	-1.782338 .5740519
	x2	-.5114184	.754524	-0.68	0.498	-1.990258 .9674213
	x3	-.2692158	.6316639	-0.43	0.670	-1.507254 .9688226
	x4	.5338047	.2465122	2.17	0.030	.0506496 1.01696
	_cons	-6.4123	3.664639	-1.75	0.080	-13.59486 .7702618

14 . est store m2

15 . hausman m1 m2, alleqs constant

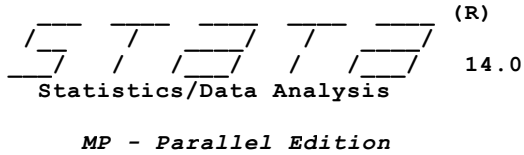
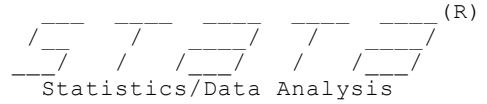
	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) m1	(B) m2		
x1	-.7577563	-.6041432	-.1536131	.1494925
x2	-.7556866	-.5114184	-.2442682	.1497819
x3	-.427155	-.2692158	-.1579392	.
x4	.5759241	.5338047	.0421194	.022725
_cons	-6.697704	-6.4123	-.2854049	.

b = consistent under Ho and Ha; obtained from mlogit
 B = inconsistent under Ha, efficient under Ho; obtained from mlogit

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)' [(V_b-V_B)^(-1)] (b-B)
 = 0.75
 Prob>chi2 = 0.9803
 (V_b-V_B is not positive definite)

*H₀ isn't rejected, IIA isn't violate. In this case multinomial logit is appropriated.
 IIA is important because, if IIA doesn't hold comparison between cases and base case will not give a solution
 In this case it is appropriate because, from Hausman test it is satisfied.*



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```
1 . use "C:\Users\com\Documents\Final_q1-1_4.dta", clear
2 . oprobit y x1 x2 x3 x4, nolog
```

9.6

```
Ordered probit regression      Number of obs      =      170
                              LR chi2(4)                =      81.13
                              Prob > chi2                 =      0.0000
Log likelihood = -110.08031    Pseudo R2           =      0.2693
```

y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
x1	-.1905566	.2304268	-0.83	0.408	-.6421849	.2610716
x2	-.5291408	.2375734	-2.23	0.026	-.9947761	-.0635055
x3	.538883	.2172077	2.48	0.013	.1131636	.9646023
x4	.673598	.0924375	7.29	0.000	.4924238	.8547721
/cut1	9.236202	1.408198			6.476183	11.99622
/cut2	10.53614	1.460959			7.672711	13.39957

```
3 . tab y
```

y	Freq.	Percent	Cum.
0	19	11.18	11.18
1	44	25.88	37.06
2	107	62.94	100.00
Total	170	100.00	

```
4 . g y01=y>0
```

```
5 . g y12=y>1
```

6 . tab y y01

y	y01		Total
	0	1	
0	19	0	19
1	0	44	44
2	0	107	107
Total	19	151	170

7 . tab y y12

y	y12		Total
	0	1	
0	19	0	19
1	44	0	44
2	0	107	107
Total	63	107	170

8 . probit y01 x1 x2, nolog

```

Probit regression                               Number of obs   =       170
                                                LR chi2(2)      =       1.56
                                                Prob > chi2     =       0.4577
Log likelihood = -58.750694                 Pseudo R2      =       0.0131
    
```

y01	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
x1	.1323922	.2764879	0.48	0.632	-.4095141 .6742986
x2	-.3411469	.2941186	-1.16	0.246	-.9176088 .2353149
_cons	1.408587	.2702588	5.21	0.000	.8788892 1.938284

9 . est store probit01

10 . probit y12 x1 x2, nolog

```

Probit regression                               Number of obs   =       170
                                                LR chi2(2)      =       9.46
                                                Prob > chi2     =       0.0088
Log likelihood = -107.3471                 Pseudo R2      =       0.0422
    
```

y12	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
x1	.5287984	.2151891	2.46	0.014	.1070355 .9505612
x2	-.4569633	.2197789	-2.08	0.038	-.8877219 -.0262046
_cons	.430861	.1944446	2.22	0.027	.0497566 .8119653

```
11 . est store probit12
12 . suest probit01 probit12
```

Simultaneous results for probit01, probit12

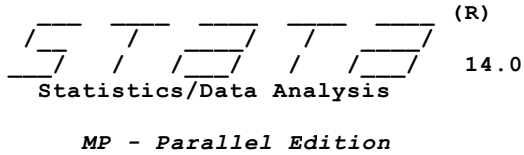
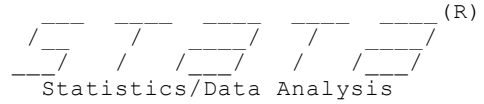
Number of obs = 170

	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
probit01_y01						
x1	.1323922	.2918939	0.45	0.650	-.4397093	.7044938
x2	-.3411469	.2989296	-1.14	0.254	-.9270382	.2447443
_cons	1.408587	.2628834	5.36	0.000	.8933447	1.923829
probit12_y12						
x1	.5287984	.2284575	2.31	0.021	.0810299	.9765668
x2	-.4569633	.223097	-2.05	0.041	-.8942253	-.0197012
_cons	.430861	.1960813	2.20	0.028	.0465486	.8151733

```
13 . test [probit01_y01]x1=[probit12_y12]x1
( 1) [probit01_y01]x1 - [probit12_y12]x1 = 0
      chi2( 1) = 2.05
      Prob > chi2 = 0.1518 > 0.05
```

```
14 . test [probit01_y01]x2=[probit12_y12]x2
( 1) [probit01_y01]x2 - [probit12_y12]x2 = 0
      chi2( 1) = 0.18
      Prob > chi2 = 0.6733 > 0.05
```

15 . It is appropriate, because, from the tests above both of the tests are accept which means that this data have the same set of β , So the data is an order data.



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```
1 . use "C:\Users\com\Documents\Final_q1-2_4.dta", clear
2 . log using "C:\Users\com\Documents\final_q1-2_4.smcl"
```

```
name: <unnamed>
log: C:\Users\com\Documents\final_q1-2_4.smcl
log type: smcl
opened on: 28 May 2021, 09:30:08
```

```
3 . probit y1 x*, nolog
```

Probit regression

Number of obs	=	550
LR chi2(4)	=	29.15
Prob > chi2	=	0.0000
Pseudo R2	=	0.0384

Log likelihood = -364.55625

y1	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
x1	1.362352	.3989431	3.41	0.001	.5804376	2.144266
x2	-.757248	.38529	-1.97	0.049	-1.512402	-.0020935
x3	.6197762	.1768516	3.50	0.000	.2731535	.9663989
x4	.2276991	.1898473	1.20	0.230	-.1443948	.599793
_cons	-.8192658	.3026259	-2.71	0.007	-1.412402	-.2261299

P.C

```
4 . probit y2 x*, nolog
```

Probit regression

Number of obs	=	550
LR chi2(4)	=	15.40
Prob > chi2	=	0.0039
Pseudo R2	=	0.0210

Log likelihood = -359.43363

y2	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
x1	-.6258134	.3812967	-1.64	0.101	-1.373141	.1215143
x2	-.7263539	.3772514	-1.93	0.054	-1.465753	.0130451
x3	-.2544974	.1760464	-1.45	0.148	-.599542	.0905471
x4	.662171	.1977339	3.35	0.001	.2746197	1.049722
_cons	.3468401	.3020066	1.15	0.251	-.2450819	.9387621

5 . probit y3 x*, nolog

```

Probit regression                               Number of obs   =       550
                                                LR chi2(4)      =       12.45
                                                Prob > chi2     =       0.0143
Log likelihood = -328.03773                    Pseudo R2       =       0.0186
    
```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
y3						
x1	-.6051699	.3913541	-1.55	0.122	-1.37221	.16187
x2	.8380939	.3893332	2.15	0.031	.0750148	1.601173
x3	-.3852996	.1973581	-1.95	0.051	-.7721143	.0015152
x4	-.3176261	.18829	-1.69	0.092	-.6866677	.0514156
_cons	-.4550888	.3159481	-1.44	0.150	-1.074336	.1641582

We should not use separate model, because the correlation among disturbance terms is not zero.

1.d)

6 . mvprobit (y1 x*) (y2 x*) (y3 x*), nolog

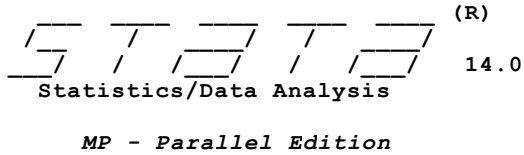
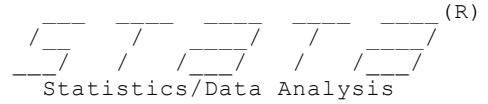
```

Multivariate probit (SML, # draws = 5)        Number of obs   =       550
                                                Wald chi2(12)   =       42.27
Log likelihood = -930.7114                    Prob > chi2     =       0.0000
    
```

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
y1						
x1	1.218133	.3889532	3.13	0.002	.4557985	1.980467
x2	-.6329318	.3792885	-1.67	0.095	-1.376324	.1104601
x3	.6067082	.1780039	3.41	0.001	.257827	.9555894
x4	.2100416	.1887845	1.11	0.266	-.1599691	.5800524
_cons	-.7562663	.304764	-2.48	0.013	-1.353593	-.1589398
y2						
x1	-.6825126	.3755425	-1.82	0.069	-1.418562	.0535372
x2	-.629634	.3747173	-1.68	0.093	-1.364066	.1047984
x3	-.2690646	.1775899	-1.52	0.130	-.6171344	.0790052
x4	.6206782	.1970056	3.15	0.002	.2345544	1.006802
_cons	.3698282	.2999573	1.23	0.218	-.2180773	.9577338
y3						
x1	-.5310234	.3848817	-1.38	0.168	-1.285378	.2233308
x2	.6950041	.3842325	1.81	0.070	-.0580778	1.448086
x3	-.270319	.1866934	-1.45	0.148	-.6362313	.0955933
x4	-.2919389	.1915545	-1.52	0.127	-.6673789	.0835011
_cons	-.4305149	.3184638	-1.35	0.176	-1.054692	.1936626
/atrho21	-.6173183	.0747577	-8.26	0.000	-.7638407	-.4707959
/atrho31	-.4133304	.0738358	-5.60	0.000	-.5580458	-.2686149
/atrho32	-.3203855	.0711927	-4.50	0.000	-.4599206	-.1808504
rho21	-.5492581	.0522045	-10.52	0.000	-.6433337	-.4388421
rho31	-.3912968	.0625305	-6.26	0.000	-.5065261	-.2623355
rho32	-.3098555	.0643574	-4.81	0.000	-.4300195	-.1789042

Likelihood ratio test of rho21 = rho31 = rho32 = 0:
 chi2(3) = 242.632 Prob > chi2 = 0.0000 < 0.05

MVprobit is appropriate, because p-value of LR test lower than 0.05 H0 is rejected. Correlation among the disturbance terms are existed. So, MVprobit would be more appropriate.



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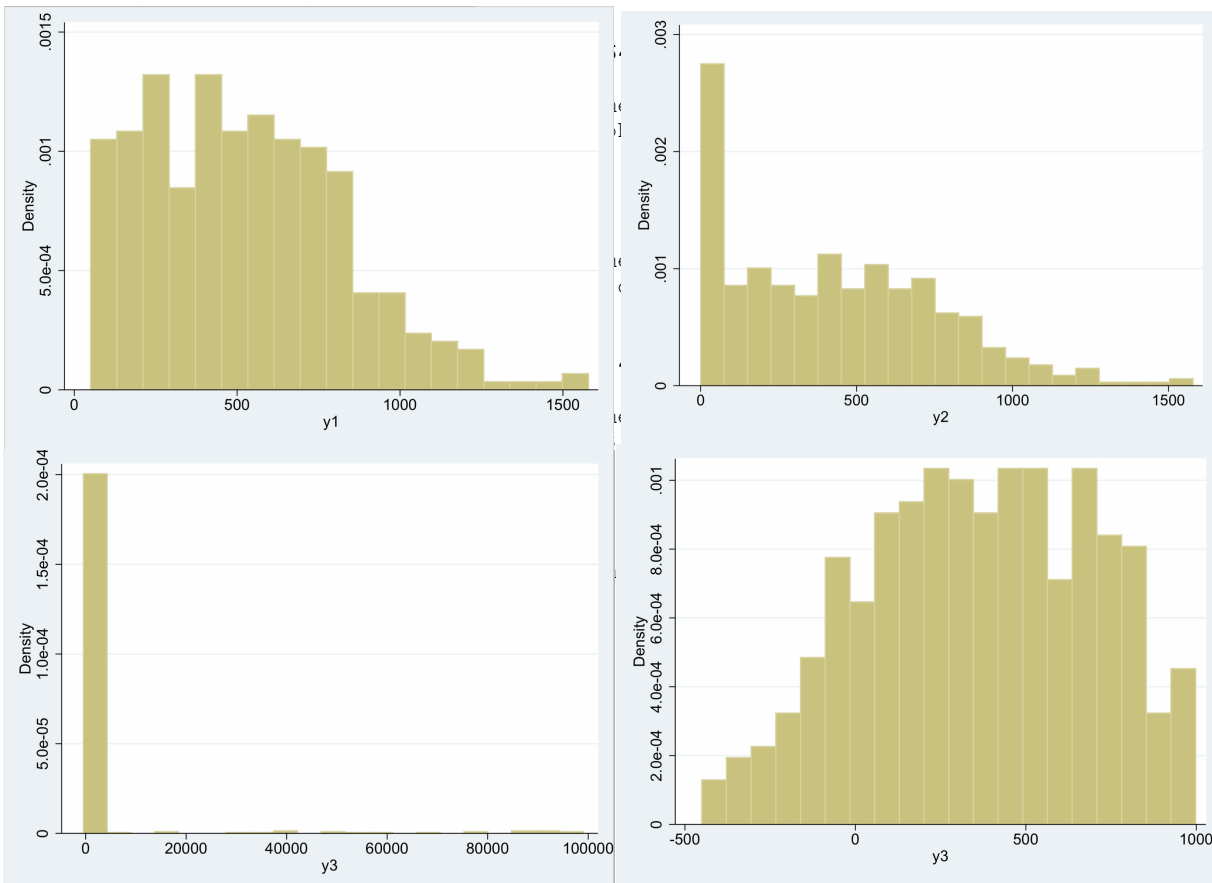
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2. a

```
1 . use "C:\Users\com\Documents\Final_q2_4.dta", clear
2 . sum y1 y2 y3
```

Variable	Obs	Mean	Std. Dev.	Min	Max
y1	367	522.7565	302.0977	50.21759	1578.51
y2	450	427.3414	338.7711	0	1578.51
y3	450	3430.027	14734.15	-450.6205	98951.63



According to data summarize and histogram, y1 has truncated pattern, y2 centered pattern, and y3 outlier.

2.6 11 . reg y1 x

Source	SS	df	MS	Number of obs	=	367
Model	9288132.05	1	9288132.05	F(1, 365)	=	140.59
Residual	24114127.8	365	66066.1036	Prob > F	=	0.0000
				R-squared	=	0.2781
				Adj R-squared	=	0.2761
Total	33402259.9	366	91263.0051	Root MSE	=	257.03

y1	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
x	166.5206	14.04407	11.86	0.000	138.9031 194.138
_cons	-13.50185	47.17533	-0.29	0.775	-106.2714 79.26772

12 . est store olsyl

13 . sum y1

Variable	Obs	Mean	Std. Dev.	Min	Max
y1	367	522.7565	302.0977	50.21759	1578.51

14 . scalar miny=round(r(min))

15 . scalar list miny
miny = 50

16 . truncreg y1 x, ll(miny) nolog
option ll() not allowed
r(198);

17 . truncreg y1 x, ll(miny) nolog
(note: 0 obs. truncated)

Truncated regression

Limit: lower =	50	Number of obs	=	367
upper =	+inf	Wald chi2(1)	=	105.99
Log likelihood =	-2520.8709	Prob > chi2	=	0.0000

y1	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
x	234.1242	22.74121	10.30	0.000	189.5522 278.6961
_cons	-312.1919	86.93118	-3.59	0.000	-482.5739 -141.8099
/sigma	306.1305	16.93546	18.08	0.000	272.9376 339.3234

18 . predict truncated, e(50,.)

19 . est store tyl

21 . lrtest olsy1 tyl, force

Likelihood-ratio test (Assumption: olsy1 nested in tyl) LR chi2(1) = 70.87 Prob > chi2 = 0.0000

2.C

22 . reg y2 x

H₀ is rejected, truncated model is more appropriate

Source	SS	df	MS	Number of obs	=	450
Model	19139065	1	19139065	F(1, 448)	=	264.71
Residual	32390794.3	448	72300.88	Prob > F	=	0.0000
Total	51529859.3	449	114765.834	R-squared	=	0.3714
				Adj R-squared	=	0.3700
				Root MSE	=	268.89

major problem caused by sample is biased only on the y which is ignore OLS will be bias.

y2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
x	199.4128	12.25644	16.27	0.000	175.3255 223.5001
_cons	-172.8354	39.00548	-4.43	0.000	-249.4918 -96.17896

23 . est store olsy2

24 . sum y2

Variable	Obs	Mean	Std. Dev.	Min	Max
y2	450	427.3414	338.7711	0	1578.51

25 . tobit y2 x, ll(0)

Tobit regression Number of obs = 450 LR chi2(1) = 219.07 Prob > chi2 = 0.0000 Pseudo R2 = 0.0378
Log likelihood = -2788.6607

y2	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
x	236.1191	14.62543	16.14	0.000	207.3763 264.8619
_cons	-313.7424	47.36363	-6.62	0.000	-406.8243 -220.6605
/sigma	301.0855	11.15147			279.17 323.0011

67 left-censored observations at y2 <= 0
383 uncensored observations
0 right-censored observations

26 . est store tby2

27 . lrtest olsy2 tby2, force

Likelihood-ratio test (Assumption: olsy2 nested in tby2) LR chi2(1) = 732.59 Prob > chi2 = 0.0000

H₀ is rejected, tobit model is more appropriate

This problem causes by the sample being censored based on y which will make OLS bias.

2.1. 28 . reg y3 x

Source	SS	df	MS	Number of obs	=	450
Model	7.9378e+09	1	7.9378e+09	F(1, 448)	=	39.72
Residual	8.9538e+10	448	199861449	Prob > F	=	0.0000
				R-squared	=	0.0814
				Adj R-squared	=	0.0794
Total	9.7476e+10	449	217095187	Root MSE	=	14137

y3	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
x	4061.094	644.4025	6.30	0.000	2794.667	5327.521
_cons	-8792.729	2050.777	-4.29	0.000	-12823.07	-4762.393

29 . reg y3 x if y3<1000

Source	SS	df	MS	Number of obs	=	427
Model	15200085	1	15200085	F(1, 425)	=	201.57
Residual	32048853.8	425	75409.0679	Prob > F	=	0.0000
				R-squared	=	0.3217
				Adj R-squared	=	0.3201
Total	47248938.8	426	110913.002	Root MSE	=	274.61

y3	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
x	191.8021	13.50959	14.20	0.000	165.2482	218.3561
_cons	-201.0688	41.74988	-4.82	0.000	-283.1308	-119.0069

30 . reg y3 x

Source	SS	df	MS	Number of obs	=	450
Model	7.9378e+09	1	7.9378e+09	F(1, 448)	=	39.72
Residual	8.9538e+10	448	199861449	Prob > F	=	0.0000
				R-squared	=	0.0814
				Adj R-squared	=	0.0794
Total	9.7476e+10	449	217095187	Root MSE	=	14137

y3	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
x	4061.094	644.4025	6.30	0.000	2794.667	5327.521
_cons	-8792.729	2050.777	-4.29	0.000	-12823.07	-4762.393

31 . est store olsy3

32 . sum y3

Variable	Obs	Mean	Std. Dev.	Min	Max
y3	450	3430.027	14734.15	-450.6205	98951.63

33 . tobit y3 x, ul(1000) nolog

```
Tobit regression                               Number of obs   =       450
                                                LR chi2(1)      =       219.04
                                                Prob > chi2     =       0.0000
Log likelihood = -3050.6921                    Pseudo R2      =       0.0347
```

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
y3						
x	223.1527	13.49868	16.53	0.000	196.6243	249.6811
_cons	-269.7417	42.61524	-6.33	0.000	-353.4918	-185.9916
/sigma	289.9116	10.01814			270.2234	309.5999

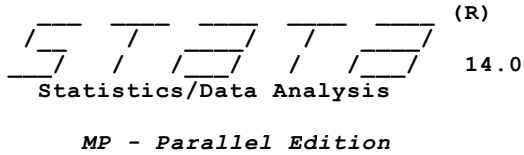
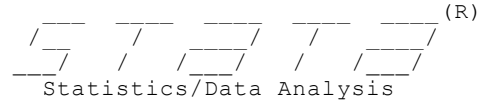
```
0 left-censored observations
427 uncensored observations
23 right-censored observations at y3 >= 1000
```

34 . est store tby3

35 . lrtest olsy3 tby3, force

```
Likelihood-ratio test                               LR chi2(1) =   3774.57
(Assumption: olsy3 nested in tby3)                Prob > chi2 =    0.0000
```

36 . *H₀ is rejected, in this case tobit model is more appropriated, problem caused by outlier which will make OLS bias.*



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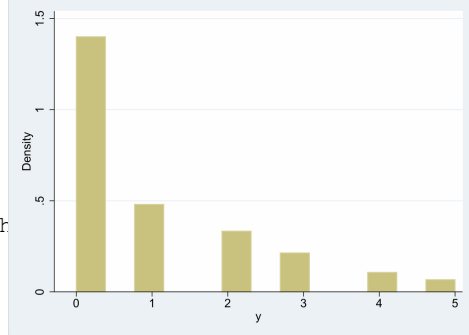
Notes:

1. Unicode is supported; see [help unicode advice](#).
2. More than 2 billion observations are allowed; see [help obs advice](#).
3. Maximum number of variables is set to 5000; see [help set maxvar](#).

```
1 . use "C:\Users\com\Documents\Final_q3_4.dta", clear
2 . log using "C:\Users\com\Documents\q1-3.smcl"
```

3.a.)

```
name: <unnamed>
log: C:\Users\com\Documents\q1-3.smcl
log type: smcl
opened on: 28 May 2021, 11:27:01
```



Dependent variable has poisson distribution due to the value being non-negative and also discrete

```
3 . histogram y
(bin=13, start=0, width=.38461538)
4 . graph save Graph "C:\Users\com\Documents\Graph3.gph"
(file C:\Users\com\Documents\Graph3.gph saved)
5 . reg y x1 x2 x3 x4
```

3.b.)

Source	SS	df	MS			
Model	34.1977239	4	8.54943099	Number of obs	=	195
Residual	311.720225	190	1.64063276	F(4, 190)	=	5.21
Total	345.917949	194	1.78308221	Prob > F	=	0.0005
				R-squared	=	0.0989
				Adj R-squared	=	0.0799
				Root MSE	=	1.2809

y	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
x1	.0789102	.0440378	1.79	0.075	-.0079555 .1657759
x2	.1296332	.0472771	2.74	0.007	.0363778 .2228885
x3	.1965848	.0681721	2.88	0.004	.0621134 .3310561
x4	-.0441712	.0479487	-0.92	0.358	-.1387514 .050409
_cons	.9212025	.1089047	8.46	0.000	.706385 1.13602

```
6 . est store olsy
7 . poisson y x1 x2 x3 x4, nolog
  command poisson is unrecognized
  r(199);
8 . poisson y x1 x2 x3 x4, nolog
```

```
Poisson regression      Number of obs      =      195
                        LR chi2(4)                    =      35.35
                        Prob > chi2                    =      0.0000
Log likelihood = -272.64128  Pseudo R2            =      0.0609
```

y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
x1	.080652	.0341567	2.36	0.018	.0137061 .147598
x2	.1318805	.0367519	3.59	0.000	.0598481 .2039128
x3	.2115507	.0556013	3.80	0.000	.1025743 .3205272
x4	-.0449328	.0375956	-1.20	0.232	-.1186188 .0287531
_cons	-.1705503	.0940062	-1.81	0.070	-.3547991 .0136984

```
9 . estat gof
```

```
Deviance goodness-of-fit = 316.5414
Prob > chi2(190)         = 0.0000

Pearson goodness-of-fit  = 331.5704
Prob > chi2(190)         = 0.0000
```

According to GOF test, H_0 is rejected
Poisson model is inappropriate.

```
10 . poisson y x1 x2 x3 x4, irr nolog
```

```
Poisson regression      Number of obs      =      195
                        LR chi2(4)                    =      35.35
                        Prob > chi2                    =      0.0000
Log likelihood = -272.64128  Pseudo R2            =      0.0609
```

y	IRR	Std. Err.	z	P> z	[95% Conf. Interval]
x1	1.083994	.0370257	2.36	0.018	1.0138 1.159047
x2	1.140972	.0419329	3.59	0.000	1.061675 1.226191
x3	1.235593	.0687005	3.80	0.000	1.10802 1.377854
x4	.9560617	.0359437	-1.20	0.232	.8881463 1.02917
_cons	.8432006	.0792661	-1.81	0.070	.7013143 1.013793

```
11 . est store psy
```

```
12 . mfx
```

```
Marginal effects after poisson
y = Predicted number of events (predict)
  = .8913178
```

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
x1	.0718866	.03007	2.39	0.017	.012952 .130822	-.286065
x2	.1175474	.03186	3.69	0.000	.055098 .179997	.839416
x3	.1885589	.04774	3.95	0.000	.094995 .282123	-.319158
x4	-.0400494	.0334	-1.20	0.230	-.105505 .025407	-.787473

According to the above estimated results, sign and meaning of the estimated coefficients - positive sign and irr > 1 for x_1, x_2, x_3 and negative and irr < 1 for x_4

13 . nbreg y x1 x2 x3 x4, nolog

3.6)

```
Negative binomial regression          Number of obs   =          195
LR chi2(4)                            =          18.83
Dispersion = mean                      Prob > chi2     =          0.0008
Log likelihood = -257.9451              Pseudo R2      =          0.0352
```

*H₀ rejected
Negative binomial model
is more appropriate*

y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
x1	.1071173	.0525476	2.04	0.042	.0041258	.2101087
x2	.1487954	.0525975	2.83	0.005	.0457062	.2518846
x3	.2002722	.0714031	2.80	0.005	.0603247	.3402197
x4	-.0475476	.0503801	-0.94	0.345	-.1462908	.0511957
_cons	-.1889558	.1238346	-1.53	0.127	-.4316672	.0537556
/lnalpha	-.1593017	.2928787			-.7333334	.4147301
alpha	.8527391	.2497492			.4803052	1.513962

Likelihood-ratio test of alpha=0: chibar2(01) = 29.39 Prob>=chibar2 = 0.000

14 . nbreg y x1 x2 x3 x4, ir nolog

```
Negative binomial regression          Number of obs   =          195
LR chi2(4)                            =          18.83
Dispersion = mean                      Prob > chi2     =          0.0008
Log likelihood = -257.9451              Pseudo R2      =          0.0352
```

y	IRR	Std. Err.	z	P> z	[95% Conf. Interval]	
x1	1.113065	.0584889	2.04	0.042	1.004134	1.233812
x2	1.160436	.061036	2.83	0.005	1.046767	1.286448
x3	1.221735	.0872357	2.80	0.005	1.062181	1.405256
x4	.9535651	.0480407	-0.94	0.345	.8639064	1.052529
_cons	.8278231	.1025132	-1.53	0.127	.6494255	1.055227
/lnalpha	-.1593017	.2928787			-.7333334	.4147301
alpha	.8527391	.2497492			.4803052	1.513962

Likelihood-ratio test of alpha=0: chibar2(01) = 29.39 Prob>=chibar2 = 0.000

15 . est store nby

16 . mfx

```
Marginal effects after nbreg
y = Predicted number of events (predict)
= .88588056
```

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]		X
x1	.0948931	.04642	2.04	0.041	.003909	.185877	-.286065
x2	.131815	.04643	2.84	0.005	.040811	.222819	.839416
x3	.1774173	.06299	2.82	0.005	.053956	.300878	-.319158
x4	-.0421215	.04462	-0.94	0.345	-.129581	.045338	-.787473

17 . zip y x1 x2 x3, inflate(x4) vuong nolog

3.17

```
Zero-inflated Poisson regression      Number of obs      =      195
                                       Nonzero obs        =       90
                                       Zero obs           =      105

Inflation model = logit              LR chi2(3)         =      14.04
Log likelihood = -255.9144           Prob > chi2        =      0.0029
```

	y	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
y						
	x1	.0904702	.043557	2.08	0.038	.0051 .1758405
	x2	.1161866	.0408434	2.84	0.004	.0361349 .1962382
	x3	.1530321	.0563315	2.72	0.007	.0426244 .2634397
	_cons	.343263	.1163479	2.95	0.003	.1152254 .5713007
inflate						
	x4	.0593905	.0990726	0.60	0.549	-.1347883 .2535693
	_cons	-.4552474	.2534879	-1.80	0.073	-.9520745 .0415798

Vuong test of zip vs. standard Poisson: z = 2.63 Pr>z = 0.0043

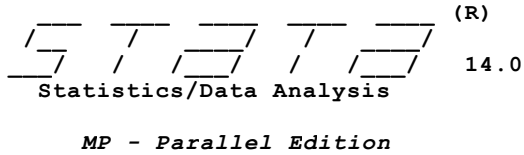
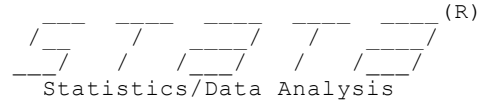
18 . mfx *H₀ is rejected, zip model is more appropriate than poisson distribution*

Marginal effects after zip
y = Predicted number of events (predict)
= .89830433

variable	dy/dx	Std. Err.	z	P> z	[95% C.I.]	X
x1	.0812698	.03885	2.09	0.036	.005116 .157424	-.286065
x2	.1043709	.036	2.90	0.004	.033821 .174921	.839416
x3	.1374694	.04955	2.77	0.006	.040345 .234594	-.319158
x4	-.0201168	.03383	-0.59	0.552	-.086421 .046187	-.787473

19 . log close
name: <unnamed>
log: C:\Users\com\Documents\q1-3.smcl
log type: smcl
closed on: 28 May 2021, 11:32:45

- 20 . *- According to GOF, H₀ is rejected, poisson regression model is more appropriate than OLS*
- According to LR test at Alpha, H₀ is rejected, distribution of dependent variable follow negative binomial regression model is more appropriate than poisson.
- According to Vuong test, H₀ is rejected, zero inflated poisson model is more appropriate than poisson.
- From histogram, it illustrates zero inflated distribution at dependent variable, therefore it is the most appropriate.



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1. Unicode is supported; see [help unicode advice](#).
2. More than 2 billion observations are allowed; see [help obs advice](#).
3. Maximum number of variables is set to 5000; see [help set maxvar](#).

4. a.)

```
1 . use "C:\Users\com\Documents\Final_q4_4.dta", clear
2 . log using "C:\Users\com\Documents\q444.smcl"
```

```
name: <unnamed>
log: C:\Users\com\Documents\q444.smcl
log type: smcl
opened on: 28 May 2021, 13:20:42
```

```
3 . tsset t
    time variable: t, 1 to 500
    delta: 1 unit
```

```
4 . dfuller y, trend lag(1) regress
```

Augmented Dickey-Fuller test for unit root Number of obs = **498**

Test Statistic	Interpolated Dickey-Fuller			
	1% Critical Value	5% Critical Value	10% Critical Value	
Z(t)	-15.043	-3.980	-3.420	-3.130

MacKinnon approximate p-value for Z(t) = **0.0000**

D.y	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Y						
L1.	-.9742616	.0647646	-15.04	0.000	-1.10151	-.8470135
LD.	-.0595457	.0449899	-1.32	0.186	-.1479408	.0288494
_trend	.0015608	.0021098	0.74	0.460	-.0025844	.005706
_cons	.8631999	.6116907	1.41	0.159	-.3386363	2.065036

5 . dfuller x, trend lag(1) regress

Augmented Dickey-Fuller test for unit root Number of obs = **498**

	Test Statistic	Interpolated Dickey-Fuller		
		1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-15.197	-3.980	-3.420	-3.130

MacKinnon approximate p-value for Z(t) = **0.0000**

D.x	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
x						
L1.	-.9858834	.0648736	-15.20	0.000	-1.113345	-.8584212
LD.	-.0505854	.0449959	-1.12	0.261	-.1389924	.0378216
_trend	.0025283	.0030127	0.84	0.402	-.0033909	.0084475
_cons	.4548693	.8696853	0.52	0.601	-1.253869	2.163608

4.6)

```

6 . qui arima y, arima(1,0,1) nolog
7 . est store arima101
8 . qui arima y, arima(1,0,2) nolog
9 . est store arima102
10 . qui arima y, arima(1,0,3) nolog
11 . est store arima103
12 . qui arima y, arima(1,0,4) nolog
13 . est store arima104
14 . qui arima y, arima(2,0,1) nolog
15 . est store arima201
16 . qui arima y, arima(2,0,2) nolog
17 . est store arima202
18 . qui arima y, arima(2,0,3) nolog
19 . est store arima203
20 . qui arima y, arima(2,0,4) nolog
21 . est store arima204
22 . est store arima20
    
```

*X and Y are stationary at I(0)
 Unit root test whether the variable is stationary or not.
 If it is stationary, OLS can be use. But if it's nonstationary, OLS will be biased.
 It's important because, in time series data is high frequency and nonstationary which
 leads to OLS being biased.*

```

23 . drop _est_arima20
24 . qui arima y, arima(3,0,1) nolog
25 . est store arima301
26 . qui arima y, arima(3,0,2) nolog
27 . est store arima302
28 . qui arima y, arima(3,0,3) nolog
29 . est store arima303
30 . qui arima y, arima(3,0,4) nolog
31 . est store arima304
32 . qui arima y, arima(4,0,1) nolog
33 . est store arima401
34 . qui arima y, arima(4,0,2) nolog
35 . est store arima402
36 . qui arima y, arima(4,0,3) nolog
37 . est store arima403
38 . qui arima y, arima(4,0,4) nolog
39 . est store arima404
40 . est table arima10*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
    
```

Variable	arima101	arima102	arima103	arima104
y				
_cons	1.2914044***	1.2947915***	1.2922192***	1.2928823***
ARMA				
ar				
L1.	-.85640789***	.81155755***	-.85856118***	-.81969465***
ma				
L1.	.81391146***	-.8489405***	.82558303***	.78723996***
L2.		.07224584	.02794479	.02698579
L3.			.01984658	.05176941
L4.				.04921138
sigma				
_cons	6.7337275***	6.7337208***	6.7318342***	6.724375***
Statistics				
N	500	500	500	500
ll	-1663.0496	-1663.0373	-1662.9055	-1662.3522
chi2	52.036386	21.452965	52.490033	44.127075
aic	3334.0992	3336.0745	3337.811	3338.7045
bic	3350.9576	3357.1476	3363.0987	3368.2068

legend: * p<.1; ** p<.05; *** p<.01

41 . est table arima20*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

Variable	arima201	arima202	arima203	arima204	arima20
Y					
_cons	1.2948801***	1.294957***	1.2948366***	1.295211***	1.295211***
ARMA					
ar					
L1.	.72238185***	.0241448	-.01889884	-.03422991	-.03422991
L2.	.0767891	.72468411***	.72224755***	.68235388**	.68235388**
ma					
L1.	-.76204883***	-.0455005	-.01659647	-.00023936	-.00023936
L2.		-.65708376**	-.65596752**	-.62985126*	-.62985126*
L3.			.02534626	.02476544	.02476544
L4.				.02420195	.02420195
sigma					
_cons	6.7327733***	6.7225608***	6.7209282***	6.7192909***	6.7192909***
Statistics					
N	500	500	500	500	500
ll	-1662.9796	-1662.2205	-1662.0943	-1661.9821	-1661.9821
chi2	18.506341	20.472762	21.659332	20.47998	20.47998
aic	3335.9593	3336.441	3338.1887	3339.9642	3339.9642
bic	3357.0323	3361.7286	3367.6909	3373.6811	3373.6811

legend: * p<.1; ** p<.05; *** p<.01

42 . est table arima30*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

Variable	arima301	arima302	arima303	arima304
Y				
_cons	1.2923557***	1.2948994***	1.3106553***	1.310671***
ARMA				
ar				
L1.	-.8506904***	-.05135527	1.0676286***	1.0667148***
L2.	.03116454	.72356439***	.65150007**	.65336919*
L3.	.02176893	.02596813	-.83506644***	-.83607105***
ma				
L1.	.81944808***	.01686461	-1.1244915	-1.1244017
L2.		-.65801353**	-.5549227	-.55627031
L3.			.80561492	.80794604
L4.				-.00115815
sigma				
_cons	6.7316549***	6.7209478***	6.6393499	6.6392922
Statistics				
N	500	500	500	500
ll	-1662.8927	-1662.1029	-1658.0636	-1658.0633
chi2	54.165847	22.324573	36395.507	53055.527
aic	3337.7853	3338.2059	3330.1272	3332.1267
bic	3363.073	3367.7081	3359.6295	3365.8435

legend: * p<.1; ** p<.05; *** p<.01

43 . est table arima40*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

Variable	arima401	arima402	arima403	arima404
y				
_cons	1.2934358***	1.2950883***	1.3105705***	1.2959396***
ARMA				
ar				
L1.	-.78010467**	-.07279565	1.0653941***	.07145613
L2.	.03163708	.6468881*	.65471052	-.23262977
L3.	.05438503	.02737472	-.83508037***	-.05411865
L4.	.05046707	.0263793	-.00117021	.70134348***
ma				
L1.	.7477384**	.03787744	-1.123048	-.10749025
L2.		-.59508277	-.55772503	.31613773
L3.			.80706456	.05523027
L4.				-.65137805**
sigma				
_cons	6.7239162***	6.719281***	6.6393476	6.6791682***
Statistics				
N	500	500	500	500
ll	-1662.3324	-1661.9829	-1658.0633	-1659.2463
chi2	37.470199	19.897415	36410.856	1305.9497
aic	3338.6647	3339.9658	3332.1267	3338.4926
bic	3368.167	3373.6827	3365.8435	3380.6386

legend: * p<.1; ** p<.05; *** p<.01

44 . qui arima x, arima(1,0,1) nolog
45 . est store arima101
46 . qui arima x, arima(1,0,2) nolog
47 . est store arima102
48 . qui arima x, arima(1,0,3) nolog
49 . est store arima103
50 . qui arima x, arima(1,0,4) nolog
51 . est store arima104
52 . qui arima x, arima(2,0,1) nolog
53 . est store arima201
54 . qui arima x, arima(2,0,2) nolog

```

55 . est store arima202
56 . qui arima x, arima(2,0,3) nolog
57 . est store arima203
58 . qui arima x, arima(2,0,4) nolog
59 . est store arima204
60 . qui arima x, arima(3,0,1) nolog
61 . est store arima301
62 . qui arima x, arima(3,0,2) nolog
63 . est store arima302
64 . qui arima x, arima(3,0,3) nolog
65 . est store arima303
66 . qui arima x, arima(3,0,4) nolog
67 . est store arima304
68 . qui arima x, arima(4,0,1) nolog
69 . est store arima401
70 . qui arima x, arima(4,0,2) nolog
71 . est store arima402
72 . qui arima x, arima(4,0,3) nolog
73 . est store arima403
74 . qui arima x, arima(4,0,4) nolog
75 . est store arima404
76 . est table arimal0*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

```

Variable	arimal01	arimal02	arimal03	arimal04
x				
_cons	1.1074551***	1.1129997**	1.1077286**	1.1093869**
ARMA				
ar				
L1.	-.87056158***	.82530308***	-.86989874***	-.82631072***
ma				
L1.	.82900678***	-.86560771***	.83576585***	.79202462***
L2.		.07264592	.01754331	.01560246
L3.			.010137	.05057168
L4.				.06049141
sigma				
_cons	9.6082446***	9.6103922***	9.6076013***	9.5913365***
Statistics				
N	500	500	500	500
ll	-1840.7919	-1840.8955	-1840.7394	-1839.9157
chi2	64.625506	24.191636	64.496143	51.651992

aic	3689.5837	3691.791	3693.4788	3693.8313
bic	3706.4422	3712.8641	3718.7664	3723.3336

legend: * p<.1; ** p<.05; *** p<.01

77 . est table arima20*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

Variable	arima201	arima202	arima203	arima204	arima20
x					
_cons	1.1130583**	1.1131009**	1.1129891**	1.1133166**	
ARMA					
ar					
L1.	.74235645***	.02034078	-.02011682	-.0542499	-.03422991
L2.	.07558091	.75473157***	.74792111***	.68493964**	.68235388**
ma					
L1.	-.7840013***	-.04202115	-.01753482	.01871216	-.00023936
L2.		-.69068301***	-.68481529***	-.6419886**	-.62985126*
L3.			.02668621	.02629648	.02476544
L4.				.03465012	.02420195
sigma					
_cons	9.6095249***	9.5935032***	9.5908685***	9.5866293***	6.7192909***
y					
_cons					1.295211***
Statistics					
N	500	500	500	500	500
ll	-1840.863	-1840.0381	-1839.8982	-1839.671	-1661.9821
chi2	21.486252	24.747612	25.866319	23.542158	20.47998
aic	3691.726	3692.0762	3693.7965	3695.342	3339.9642
bic	3712.799	3717.3638	3723.2988	3729.0589	3373.6811

legend: * p<.1; ** p<.05; *** p<.01

78 . est table arima30*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)

Variable	arima301	arima302	arima303	arima304
x				
_cons	1.10841**	1.1127736**	1.1396421**	1.1141422**
ARMA				
ar				
L1.	-1.0290956***	-.05095179	1.0486509***	-1.0749652***
L2.	.01484209	.74990452***	.68271767**	.64984264
L3.	.04725891	.02651813	-.84835494***	.79833364***
ma				
L1.	.99332182***	.01470037	-1.1061222	1.0438769***
L2.		-.68749961***	-.58902275	-.63999994
L3.			.82349234	-.71428105***
L4.				.05894209
sigma				
_cons	9.6155371***	9.591336***	9.4731437	9.560832***
Statistics				
N	500	500	500	500
ll	-1841.2103	-1839.9109	-1835.8176	-1838.4298
chi2	5121.3676	26.755722	30740.94	6383.1042
aic	3694.4206	3693.8218	3685.6352	3694.8596


```

82 . set obs 505
    number of observations (_N) was 500, now 505

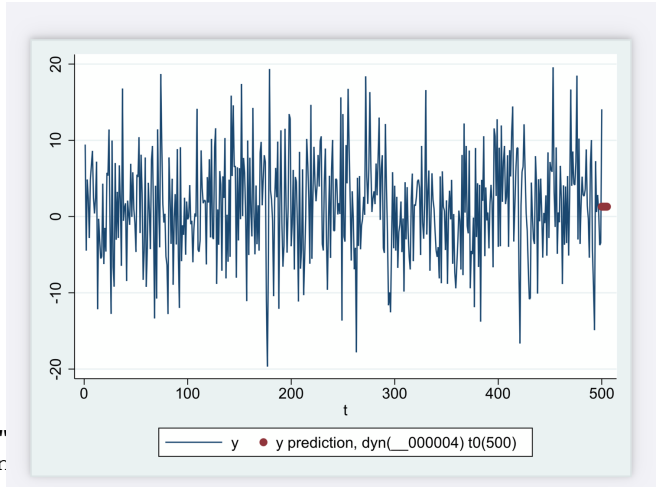
83 . replace t=_n
    (5 real changes made)

84 . predict yhat, y dynamic(.) t0(500)
    Note: beginning dynamic predictions in period
    (499 missing values generated)

85 . twoway (line y t, sort) (scatter yhat t, sort)

86 . graph export "C:\Users\com\Documents\Graph4.pdf"
    (file C:\Users\com\Documents\Graph4.pdf written in

87 . arima x, arima(2,0,1) nolog
  
```



ARIMA regression

Sample: 1 - 500 Number of obs = 500
 Wald chi2(3) = 21.49
 Log likelihood = -1840.863 Prob > chi2 = 0.0001

	Coef.	OPG Std. Err.	z	P> z	[95% Conf. Interval]	
x						
_cons	1.113058	.5193501	2.14	0.032	.0951507	2.130966
ARMA						
ar						
L1.	.7423564	.2396193	3.10	0.002	.2727112	1.212002
L2.	.0755809	.0483223	1.56	0.118	-.0191291	.1702909
ma						
L1.	-.7840013	.2328044	-3.37	0.001	-1.24029	-.3277131
/sigma	9.609525	.3114586	30.85	0.000	8.999077	10.21997

Note: The test of the variance against zero is one sided, and the two-sided confidence interval is truncated at zero.

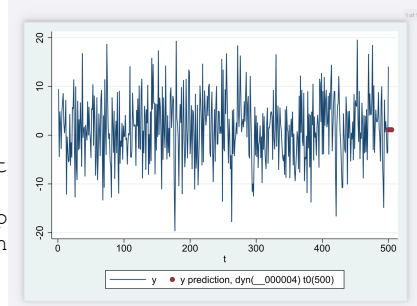
```

88 . predict yhat2, y dynamic(.) t0(500)
    Note: beginning dynamic predictions in period
    (499 missing values generated)

89 . twoway (line y t, sort) (scatter yhat2 t, sort)

90 . graph export "C:\Users\com\Documents\Graph42.p
    (file C:\Users\com\Documents\Graph42.pdf written

91 . reg y x
  
```



Source	SS	df	MS
Model	22628.5824	1	22628.5824
Residual	196.50059	498	.394579499
Total	22825.083	499	45.7416493

Number of obs = 500
 F(1, 498) = 57348.60
 Prob > F = 0.0000
 R-squared = 0.9914
 Adj R-squared = 0.9914
 Root MSE = .62816

4. C.7

	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
y						
x	.6976923	.0029134	239.48	0.000	.6919682	.7034164
_cons	.5187331	.0282773	18.34	0.000	.4631756	.5742905

92 . estat archlm
LM test for autoregressive conditional heteroskedasticity (ARCH)

lags(p)	chi2	df	Prob > chi2
1	38.506	1	0.0000

H0: no ARCH effects vs. H1: ARCH(p) disturbance

Significant ARCH effects exist, since p-value of ARCHLM-test is less than 0.05. H0 is rejected all alpha = 0. The test classifies as LM test because it is based on restricted model.

4.d.)

```

94 . est store garch11
95 . est store garch11
96 . qui arch y, arch(1) garch(2) nolog
97 . est store garch12
98 . qui arch y, arch(2) garch(1) nolog
99 . est store garch21
100 . qui arch y, arch(2) garch(2) nolog
101 . est store garch22
102 . est store garch1*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
    option star() not allowed
    r(198);
103 . est store garch11, stat(N ll chi2 aic bic)
    option stat() not allowed
    r(198);
104 . est table garch1*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
    
```

Variable	garch11	garch12

__000003 L1.	-.05353297	
__000004 L1.	.05173741	
_cons	48.423207***	
Y		
_cons		1.4314151***
ARCH		
arch L1.		.07453436
garch L2.		-.74109659***

_cons	76.75365***	
Statistics		
N	468	500
ll	-2614.2873	-1663.7719
chi2	.	.
aic	5234.5746	3335.5438
bic	5247.02	3352.4023

legend: * p<.1; ** p<.05; *** p<.01

```
105 . est table garch2*, star(0.1 0.05 0.01) stat(N ll chi2 aic bic)
```

Variable	garch21	garch22
y		
_cons	1.3335124***	1.2910929***
ARCH		
arch		
L2.	.05992349	.00819521
garch		
L1.	-.70832901***	
L2.		.47561959
_cons	75.547661***	23.589124
Statistics		
N	500	500
ll	-1663.5794	-1664.6988
chi2	.	.
aic	3335.1589	3337.3975
bic	3352.0173	3354.256

legend: * p<.1; ** p<.05; *** p<.01

```
106 . arch y x, garch(1/2) arch(1/1) nolog
```

ARCH family regression

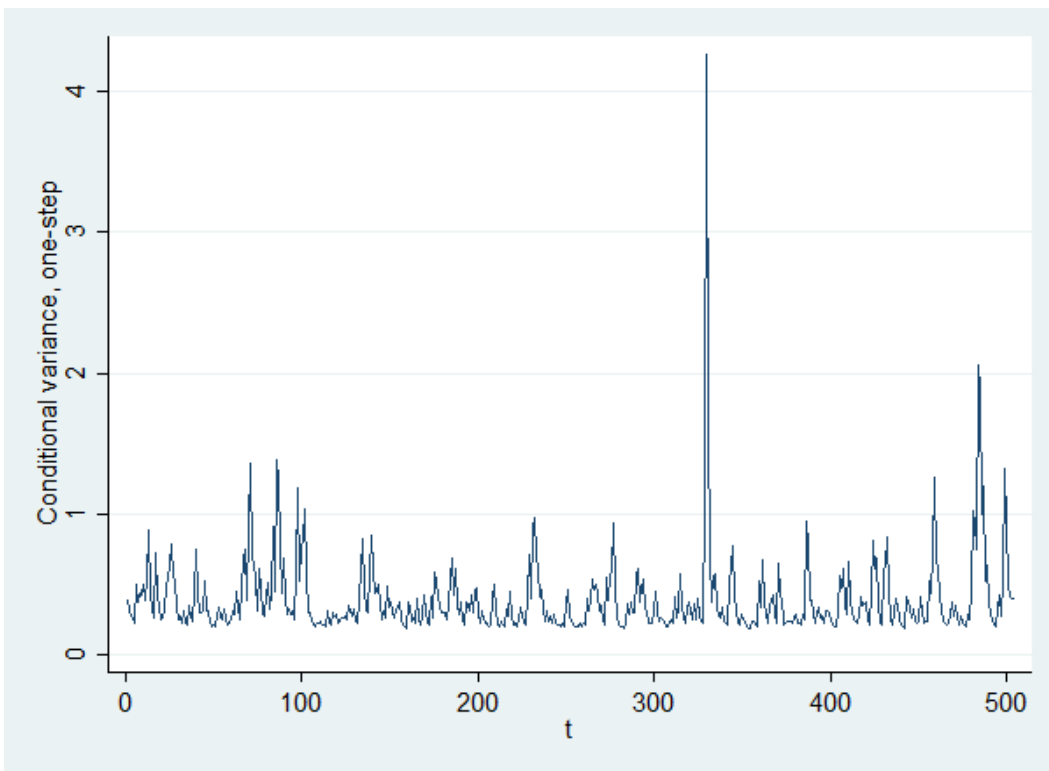
Sample: 1 - 500
 Distribution: Gaussian
 Log likelihood = -444.3627

Number of obs = 500
 Wald chi2(1) = 72765.33
 Prob > chi2 = 0.0000

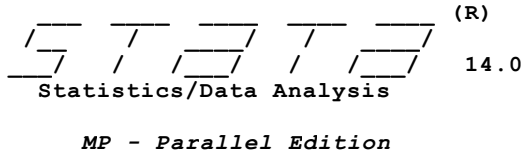
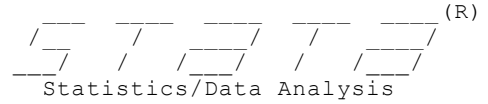
y	Coef.	OPG		z	P> z	[95% Conf. Interval]	
		Std. Err.					
y							
x	.6977952	.0025868		269.75	0.000	.6927251	.7028652
_cons	.5189555	.0239729		21.65	0.000	.4719695	.5659416
ARCH							
arch							
L1.	.361282	.0751005		4.81	0.000	.2140877	.5084762
garch							
L1.	.327653	.1703144		1.92	0.054	-.006157	.6614631
L2.	-.0098963	.1361589		-0.07	0.942	-.2767629	.2569702
_cons	.128758	.0381384		3.38	0.001	.0540081	.2035078

According to BIC the most appropriate lag order is GARCH(1,1)

```
107 . predict sigma_hat, v
108 . line sigma_hat t
109 . graph save Graph "C:\Users\com\Documents\Graph43.gph"
    (file C:\Users\com\Documents\Graph43.gph saved)
110 .
```



(i.e.) The more appropriate case is GARCH. GARCH is an extension form of ARCH and EGARCH, we need to shock asymmetrically.



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Notes:

1. Unicode is supported; see [help unicode advice](#).
2. More than 2 billion observations are allowed; see [help obs advice](#).
3. Maximum number of variables is set to 5000; see [help set maxvar](#).

```
1 . use "C:\Users\com\Documents\Final_q5_4.dta", clear
2 . log using "C:\Users\com\Documents\q5.smcl"
```

name: <unnamed>
 log: C:\Users\com\Documents\q5.smcl
 log type: smcl
 opened on: 28 May 2021, 13:39:05

5.a.)

```
3 . tsset t
    time variable: t, 1 to 500
    delta: 1 unit
4 . varsoc y x, maxlag(5)
```

Selection-order criteria
 Sample: 6 - 500

Number of obs = 495

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-1363.76				.854259	5.51823	5.5249	5.53522
1	-1316.78	93.956*	4	0.000	.718084*	5.34458*	5.36459*	5.39555*
2	-1316.03	1.5085	4	0.825	.727564	5.3577	5.39104	5.44264
3	-1315.09	1.8798	4	0.758	.736617	5.37006	5.41675	5.48898
4	-1312.98	4.2227	4	0.377	.742263	5.37769	5.43771	5.53059
5	-1311.48	3.0074	4	0.557	.749792	5.38778	5.46114	5.57465

Endogenous: y x
 Exogenous: _cons

According to SBIC, the most appropriate lag order is 1.

5.b.) 5 . var y x, lag(1/1)

Vector autoregression

Sample: 2 - 500
 Log likelihood = -1328.14
 FPE = .720002
 Det(Sigma_ml) = .7028937

Number of obs = 499
 AIC = 5.347253
 HQIC = 5.36713
 SBIC = 5.397905

Equation	Parms	RMSE	R-sq	chi2	P>chi2
y	3	.991934	0.0155	7.831204	0.0199
x	3	.998182	0.0882	48.24373	0.0000

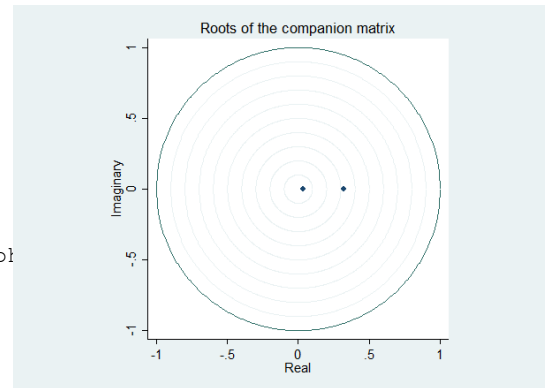
		Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
y	Y					
	L1.	.1393618	.0501099	2.78	0.005	.0411482 .2375754
	x					
	L1.	.0482738	.0478845	1.01	0.313	-.0455781 .1421256
	_cons	.3359734	.0543027	6.19	0.000	.2295421 .4424047
x	Y					
	L1.	.3428235	.0504255	6.80	0.000	.2439913 .4416558
	x					
	L1.	.2120121	.0481861	4.40	0.000	.117569 .3064551
	_cons	.1239039	.0546447	2.27	0.023	.0168021 .2310056

6 . varstable, graph

Eigenvalue stability condition

Eigenvalue	Modulus
.3093615	.309362
.04201236	.042012

All the eigenvalues lie inside the unit circle. VAR satisfies stability condition.



7 . graph save Graph "C:\Users\com\Documents\Graph5.gph" (file C:\Users\com\Documents\Graph5.gph saved)

8 . vargranger

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
y	x	1.0163	1	0.313
y	ALL	1.0163	1	0.313
x	y	46.221	1	0.000
x	ALL	46.221	1	0.000

5 C.) 10 . irf create order1, order(y x) step(5) set(irf0001) (file irf0001.irf created) (file irf0001.irf now active) (file irf0001.irf updated)

- According to stability test, the system is stable since all of the eigenvalues lie inside the unit circle
 - According to Granger exogeneity, x is endogenous since the test is significant, while y is not endogenous
 - I stability assumption is unrealistic, IRF won't get back to the equilibrium.

11 . irf table irf, impulse(y x) response(y x)

Results from order1

step	(1) irf	(1) Lower	(1) Upper	(2) irf	(2) Lower	(2) Upper
0	1	1	1	0	0	0
1	.139362	.041148	.237575	.342824	.243991	.441656
2	.035971	-.013115	.085057	.120459	.068749	.17217
3	.010828	-.009157	.030813	.037871	.012892	.062849
4	.003337	-.004115	.010789	.011741	.000354	.023128
5	.001032	-.001657	.00372	.003633	-.001163	.008429

step	(3) irf	(3) Lower	(3) Upper	(4) irf	(4) Lower	(4) Upper
0	0	0	0	1	1	1
1	.048274	-.045578	.142126	.212012	.117569	.306455
2	.016962	-.016312	.050236	.061499	.023894	.099103
3	.005333	-.006645	.01731	.018853	.001111	.036596
4	.001653	-.002645	.005951	.005825	-.001756	.013407
5	.000512	-.001008	.002031	.001802	-.001211	.004815

95% lower and upper bounds reported

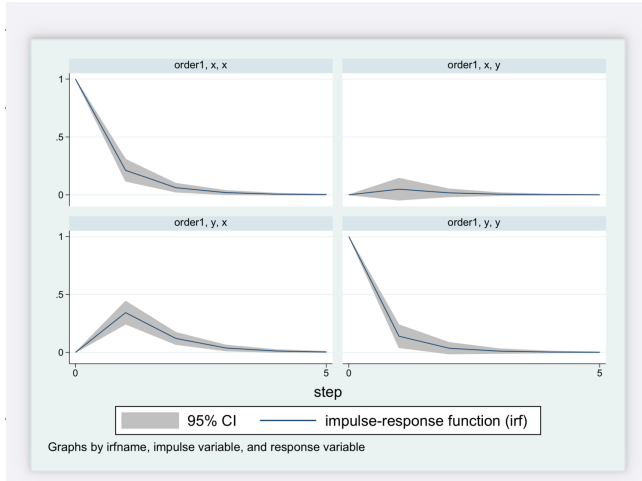
- (1) irfname = order1, impulse = y, and response = y
- (2) irfname = order1, impulse = y, and response = x
- (3) irfname = order1, impulse = x, and response = y
- (4) irfname = order1, impulse = x, and response = x

12 . irf graph irf, impulse(y x) response(y x)

13

51.pdf", as(pdf) replace
tten in PDF format)

14



15

16 . irf table oirf, impulse(y x) response(y x)

Results from order1

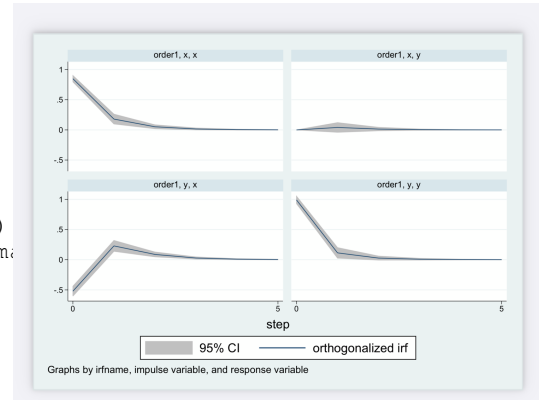
step	(1) oirf	(1) Lower	(1) Upper	(2) oirf	(2) Lower	(2) Upper
0	.988948	.927592	1.0503	-.521234	-.602341	-.440126
1	.11266	.026045	.199275	.228527	.139173	.317881
2	.026732	-.006179	.059643	.087073	.04764	.126506
3	.007929	-.005814	.021671	.027625	.010034	.045216
4	.002439	-.00274	.007617	.008575	.000831	.016319
5	.000754	-.001125	.002633	.002654	-.000611	.005919

step	(3) oirf	(3) Lower	(3) Upper	(4) oirf	(4) Lower	(4) Upper
0	0	0	0	.847757	.795161	.900354
1	.040924	-.03868	.120529	.179735	.098897	.260572
2	.01438	-.013843	.042602	.052136	.020092	.084179
3	.004521	-.005637	.014679	.015983	.000909	.031057
4	.001402	-.002243	.005046	.004938	-.001496	.011373
5	.000434	-.000855	.001722	.001528	-.001029	.004084

95% lower and upper bounds reported

- (1) irfname = order1, impulse = y, and response = y
- (2) irfname = order1, impulse = y, and response = x
- (3) irfname = order1, impulse = x, and response = y
- (4) irfname = order1, impulse = x, and response = x

```
17 . irf graph oirf, impulse(y x) response(y x)
18 . graph export "C:\Users\com\Documents\Graph53.pdf", as(pdf)
    (file C:\Users\com\Documents\Graph53.pdf written in PDF format)
19 . irf table coirf, impulse(y x) response(y x)
```



Results from order1

step	(1) coirf	(1) Lower	(1) Upper	(2) coirf	(2) Lower	(2) Upper
0	.988948	.927592	1.0503	-.521234	-.602341	-.440126
1	1.10161	.991496	1.21172	-.292707	-.419165	-.166249
2	1.12834	.999448	1.25723	-.205634	-.34767	-.063598
3	1.13627	.999705	1.27283	-.178009	-.327187	-.028831
4	1.13871	.999221	1.27819	-.169434	-.321536	-.017333
5	1.13946	.998924	1.28	-.16678	-.319996	-.013565

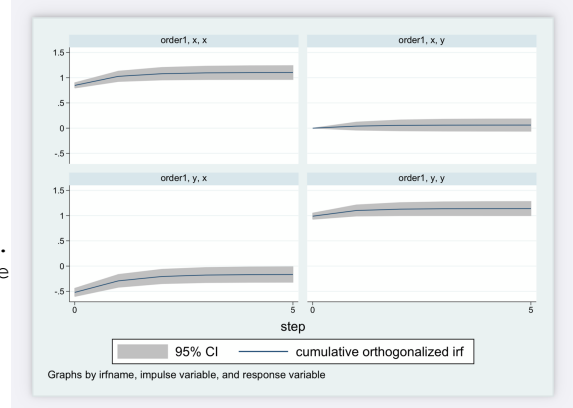
step	(3) coirf	(3) Lower	(3) Upper	(4) coirf	(4) Lower	(4) Upper
0	0	0	0	.847757	.795161	.900354
1	.040924	-.03868	.120529	1.02749	.925149	1.12984
2	.055304	-.052211	.16282	1.07963	.955689	1.20357
3	.059825	-.057646	.177296	1.09561	.962919	1.2283
4	.061227	-.059789	.182242	1.10055	.9644	1.2367
5	.06166	-.0606	.18392	1.10208	.964637	1.23952

95% lower and upper bounds reported

- (1) irfname = order1, impulse = y, and response = y
- (2) irfname = order1, impulse = y, and response = x
- (3) irfname = order1, impulse = x, and response = y
- (4) irfname = order1, impulse = x, and response = x

```

20 . irf graph coirf, impulse(y x) response(y x)
21 . graph export "C:\Users\com\Documents\Graph54.
    (file C:\Users\com\Documents\Graph54.pdf writte
22 . irf graph fevd, impulse(y x) response(y x)
5.67 23 . irf table fevd, impulse(y x) response(y x)
    
```



-According to IRF analysis, y has more impact on x

Results from order1

step	(1) fevd	(1) Lower	(1) Upper	(2) fevd	(2) Lower	(2) Upper
0	0	0	0	0	0	0
1	1	1	1	.274324	.207628	.341021
2	.998312	.991753	1.00487	.301337	.236495	.366179
3	.998106	.990752	1.00546	.305463	.241154	.369773
4	.998085	.990643	1.00553	.305879	.241635	.370124
5	.998083	.990631	1.00554	.30592	.241681	.370158

step	(3) fevd	(3) Lower	(3) Upper	(4) fevd	(4) Lower	(4) Upper
0	0	0	0	0	0	0
1	0	0	0	.725676	.658979	.792372
2	.001688	-.004872	.008247	.698663	.633821	.763505
3	.001894	-.00546	.009248	.694537	.630227	.758846
4	.001915	-.005528	.009357	.694121	.629876	.758365
5	.001917	-.005536	.009369	.69408	.629842	.758319

95% lower and upper bounds reported

- (1) irfname = order1, impulse = y, and response = y
- (2) irfname = order1, impulse = y, and response = x
- (3) irfname = order1, impulse = x, and response = y
- (4) irfname = order1, impulse = x, and response = x

- According to forecast error variance decomposition, y has more impact on x

e. Yes, the change in order will reflect the change in matrix.