FINAL EXAMINATION – INDEX 1

FINANCIAL ECONOMETRICS			Duration: 100 min
Head of Department of Mathematics Prof. Pham Huu Anh Ngoc	Lecturer:  Dr. Nguyen Phuong Anh	**Student ID:** **Name:**	Date: June 2021

INSTRUCTIONS:

1. This is an open book examination.
2. Internet search is **not** allowed.
3. The use of calculators is allowed.
4. Discussion and material transfer are strictly prohibited.

Total pages: **03** (including this page)

Question 1.

You have estimated the following **ARMA(1,1)** model for some time series data:

$$y_t = 0.1 + 0.8y_{t-1} + 0.5u_{t-1} + u_t$$

1. Is this series stationary?
2. Is this series invertible?
3. Calculate the expectation, variance, autocorrelation coefficients order 1 and 2.
4. Suppose that you have data: $y_{t-1} = 3$, $\hat{u}_{t-1} = 0.2$. Obtain forecasts for the series *y* for times *t* and *t+1* using this ARMA model.

Question 2.

You obtain the following sample autocorrelations and partial auto-correlations for a sample of 100 observations from actual data:

Lag	1	2	3	4	5	6	7	8
acf	0.420	0.104	0.032	−0.206	−0.138	0.042	−0.018	0.074
pacf	0.632	0.381	0.268	0.199	0.205	0.101	0.096	0.082

Can you identify the most appropriate time series process for this data?

Question 3.

From the U.K. *private sector housing starts* (X) for the period 1948 to 1984, Terence Mills obtained the following regression results:

$$
\begin{aligned}
&\Delta X_t = 31.03 - 0.18 X_{t-1} + u_t \\
&\text{SE} = (12.5) \qquad (0.08) \\
&(\text{TS} =) \qquad\qquad (-2.25)
\end{aligned}
$$

On the basis of these results, is the *housing starts time series* stationary or nonstationary? Alternatively, is there a unit root in this time series?

Note: The 5% critical τ value is -2.95 and the 10 percent critical τ value is -2.60 for **Dickey-Fuller Test**.

Question 4.

An economics department at a large state university keeps track of its majors' starting salaries. The main question is: does taking econometrics affect starting salary?

Let SAL = salary in dollars, GPA = grade point average on a 4.0 scale, $METRICS$ = 1 if student took econometrics, and $METRICS$ = 0 otherwise.

The estimated regression from a sample of 50 recent graduates is as follows:

$$
\begin{array}{lllll}
\widehat{SAL} & = 24200 & + 1643GPA & + 5033METRICS & R^2 = 0.74 \\
(\text{se}) & (1078) & (352) & (456) &
\end{array}
$$

a) Use hypothesis testing to answer the research question whether METRICS affects SAL?
b) How would you modify the equation to see whether women had lower starting salary than men? (***Hint***: define and use the dummy variable FEMALE = 1 if female, zero otherwise)
c) How would you modify the equation to see if the parameter of the variable METRICS was the same for men and women?

Question 5.

Which are the 3 most important diagnostic tests regarding a multiple linear regression model for a time series?

How to detect them? What are the consequences? Which is (potentially) the best solution to deal with them?

Table A2.2 Critical values of Student's *t*-distribution for different probability levels, α and degrees of freedom, ν

α	0.4	0.25	0.15	0.1	0.05	0.025	0.01	0.005	0.001	0.0005
ν										
1	0.3249	1.0000	1.9626	3.0777	6.3138	12.7062	31.8205	63.6567	318.3087	636.6189
2	0.2887	0.8165	1.3862	1.8856	2.9200	4.3027	6.9646	9.9248	22.3271	31.5991
3	0.2767	0.7649	1.2498	1.6377	2.3534	3.1824	4.5407	5.8409	10.2145	12.9240
4	0.2707	0.7407	1.1896	1.5332	2.1318	2.7764	3.7469	4.6041	7.1732	8.6103
5	0.2672	0.7267	1.1558	1.4759	2.0150	2.5706	3.3649	4.0321	5.8934	6.8688
6	0.2648	0.7176	1.1342	1.4398	1.9432	2.4469	3.1427	3.7074	5.2076	5.9588
7	0.2632	0.7111	1.1192	1.4149	1.8946	2.3646	2.9980	3.4995	4.7853	5.4079
8	0.2619	0.7064	1.1081	1.3968	1.8595	2.3060	2.8965	3.3554	4.5008	5.0413
9	0.2610	0.7027	1.0997	1.3830	1.8331	2.2622	2.8214	3.2498	4.2968	4.7809
10	0.2602	0.6998	1.0931	1.3722	1.8125	2.2281	2.7638	3.1693	4.1437	4.5869
11	0.2596	0.6974	1.0877	1.3634	1.7959	2.2010	2.7181	3.1058	4.0247	4.4370
12	0.2590	0.6955	1.0832	1.3562	1.7823	2.1788	2.6810	3.0545	3.9296	4.3178
13	0.2586	0.6938	1.0795	1.3502	1.7709	2.1604	2.6503	3.0123	3.8520	4.2208
14	0.2582	0.6924	1.0763	1.3450	1.7613	2.1448	2.6245	2.9768	3.7874	4.1405
15	0.2579	0.6912	1.0735	1.3406	1.7531	2.1314	2.6025	2.9467	3.7328	4.0728
16	0.2576	0.6901	1.0711	1.3368	1.7459	2.1199	2.5835	2.9208	3.6862	4.0150
17	0.2573	0.6892	1.0690	1.3334	1.7396	2.1098	2.5669	2.8982	3.6458	3.9651
18	0.2571	0.6884	1.0672	1.3304	1.7341	2.1009	2.5524	2.8784	3.6105	3.9216
19	0.2569	0.6876	1.0655	1.3277	1.7291	2.0930	2.5395	2.8609	3.5794	3.8834
20	0.2567	0.6870	1.0640	1.3253	1.7247	2.0860	2.5280	2.8453	3.5518	3.8495
21	0.2566	0.6864	1.0627	1.3232	1.7207	2.0796	2.5176	2.8314	3.5272	3.8193
22	0.2564	0.6858	1.0614	1.3212	1.7171	2.0739	2.5083	2.8188	3.5050	3.7921
23	0.2563	0.6853	1.0603	1.3195	1.7139	2.0687	2.4999	2.8073	3.4850	3.7676
24	0.2562	0.6848	1.0593	1.3178	1.7109	2.0639	2.4922	2.7969	3.4668	3.7454
25	0.2561	0.6844	1.0584	1.3163	1.7081	2.0595	2.4851	2.7874	3.4502	3.7251
26	0.2560	0.6840	1.0575	1.3150	1.7056	2.0555	2.4786	2.7787	3.4350	3.7066
27	0.2559	0.6837	1.0567	1.3137	1.7033	2.0518	2.4727	2.7707	3.4210	3.6896
28	0.2558	0.6834	1.0560	1.3125	1.7011	2.0484	2.4671	2.7633	3.4082	3.6739
29	0.2557	0.6830	1.0553	1.3114	1.6991	2.0452	2.4620	2.7564	3.3962	3.6594
30	0.2556	0.6828	1.0547	1.3104	1.6973	2.0423	2.4573	2.7500	3.3852	3.6460
35	0.2553	0.6816	1.0520	1.3062	1.6896	2.0301	2.4377	2.7238	3.3400	3.5911
40	0.2550	0.6807	1.0500	1.3031	1.6839	2.0211	2.4233	2.7045	3.3069	3.5510
45	0.2549	0.6800	1.0485	1.3006	1.6794	2.0141	2.4121	2.6896	3.2815	3.5203
50	0.2547	0.6794	1.0473	1.2987	1.6759	2.0086	2.4033	2.6778	3.2614	3.4960
60	0.2545	0.6786	1.0455	1.2958	1.6706	2.0003	2.3901	2.6603	3.2317	3.4602
70	0.2543	0.6780	1.0442	1.2938	1.6669	1.9944	2.3808	2.6479	3.2108	3.4350
80	0.2542	0.6776	1.0432	1.2922	1.6641	1.9901	2.3739	2.6387	3.1953	3.4163
90	0.2541	0.6772	1.0424	1.2910	1.6620	1.9867	2.3685	2.6316	3.1833	3.4019
100	0.2540	0.6770	1.0418	1.2901	1.6602	1.9840	2.3642	2.6259	3.1737	3.3905
120	0.2539	0.6765	1.0409	1.2886	1.6577	1.9799	2.3578	2.6174	3.1595	3.3735
150	0.2538	0.6761	1.0400	1.2872	1.6551	1.9759	2.3515	2.6090	3.1455	3.3566
200	0.2537	0.6757	1.0391	1.2858	1.6525	1.9719	2.3451	2.6006	3.1315	3.3398
300	0.2536	0.6753	1.0382	1.2844	1.6499	1.9679	2.3388	2.5923	3.1176	3.3233
∞	0.2533	0.6745	1.0364	1.2816	1.6449	1.9600	2.3263	2.5758	3.0902	3.2905

Source: Biometrika Tables for Statisticians (1966), volume 1, 3rd edn. Reprinted with permission of Oxford University Press.