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# Financial Econometrics

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## EC5609: Problem Set 1

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- 1(a). The table below provides Stata output based on the variable MktRF, a measure of weekly excess US stock market returns (%) from March 2000 to May 2021 ( $T = 255$ ). Using the information provided comment on the statistical properties of MktRF.

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. summarize MktRF, detail
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Mkt-RF				
	Percentiles	Smallest		
1%	-10.72	-17.23		
5%	-8.12	-13.38		
10%	-5.99	-10.72	Obs	255
25%	-1.96	-10.35	Sum of wgt.	255
50%	1.17		Mean	.5940392
		Largest	Std. dev.	4.543082
75%	3.33	10.18		
90%	5.65	11.35	Variance	20.63959
95%	7.63	12.47	Skewness	-.5298389
99%	11.35	13.65	Kurtosis	4.035121

- 1(b). Using the Stata output below, perform a two sided hypothesis test at the 99% significance level that weekly excess US stock market returns (MktRF) has zero autocorrelation at lag 2. [We will cover how to generate such tables in the Stata labs. Note that AC refers to a column with the sample autocorrelations at the corresponding lag. We will not cover the PAC stat in this module. The Q and Prob>Q columns we will discuss in a later lecture.]

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. corrgram MktRF
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LAG	AC	PAC	Q	Prob>Q
1	0.0854	0.0854	1.8799	0.1704
2	-0.0649	-0.0735	2.9697	0.2265
3	0.0591	0.0722	3.8788	0.2749

2. The weekly returns of the Apple stock for 1/1/01 to 12/2/01 are (0.101,0.050, 0.135, 0.003,0.0543,-0.072, -0.007, -0.007,-0.009). Using this data set of size  $T = 9$  answer the following (all the below can be done on a calculator, and I would advise you use a calculator in this example).
- Calculate the sample mean and variance. Using these results calculate the sample skewness and kurtosis.
  - What can we infer from the estimated moments in (a) about the properties of the distribution of the sample data.
  - Perform a test that the true mean of apple returns is zero, against the alternative the true mean is non zero at the 95% significance level. [ See the my Youtube video on Sampling and Hypothesis testing for more background on this.]
  - Calculate the sample autocorrelation at lag 1 and 2.
  - Perform a 95% two sided hypothesis test that the population correlation at lag 1 is zero (state all the steps, the test statistic and distribution and any assumptions made).
  - Why may we be sceptical of inference from the hypothesis tests in (c),(e).
3. Below is the joint distribution of returns  $R_t$  for  $t = 1$  and  $t = 2$  that take 3 values, 0,1 or 2 percent.

		$R_2$		
		0	1	2
$R_1$	0	0.05	0.1	0.03
	1	0.21	0.11	0.19
	2	0.08	0.15	0.08

- Derive the marginal distributions of  $R_1$  and  $R_2$ .
- Derive the mean and variance of  $R_1, R_2$ .
- Find  $Cov(R_1, R_2)$  and  $Cov(R_1^2, R_2^2)$ .
- Find the conditional distribution of  $R_1$  given  $R_2 = 0, 1$  or  $2$  respectively. .
- Derive the conditional mean and variance of  $R_1$  given each possible value of  $R_2$ .
- Are the variables  $R_1$  and  $R_2$  statistically independent? Provide a verification for your answer.