**Boston University Questrom School of Business**

**MF840 – Spring 2019**

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**Problem Set 2**

**Due Thursday February 28th in class**

Problems turned in after the beginning of student section have a notch deduction.

**Teams “*across sections*” turn in their homework at the beginning the morning class**

Problems turned in after class get a zero.

* Do the Problem Set in groups of two
* Turn in one paper copy in class with two names, no electronic submission accepted.
* **To get a check, you need to answer all the questions.**
* **You can type in discussion answers directly in this file**.

You can do this quickly if you use the R help given !

The xx-indus-mon.csv files in the DATA directory contain the monthly returns on xx industries. Go to Ken French’s web site to understand what the variables are. I cleaned up the files for you and added XRM = RM – RF and RF for you in the last two columns of each file.

Use the Risk free rate in the last column to compute excess returns for the industries. It’s OK to leave all returns in % ala KF. You can now run the excess-returns regressions:

XRit = Rit-RFt = αI + βI XRMt

For this entire problem, you can assume that the OLS assumption applies to each regression alone.

**Problem 1: Bonferroni and Hotelling corrections:**

Use 16indus to fill in Table 1. Use the 60 monthly returns from 200901 to 201312. For each industry, write the slope estimate, the t-statistic for a test of H0: β=1, the excess average return α (aka Jensen’s α aka abnormal return).

Consider two-sided 5% tests. ANSWER HERE

What is the cut-off for the absolute value of t? ?

Flag every t exceeding the cutoff with a \* on its left.

Bonferroni: What is the Bonferroni cutoff. ?

Put a \* in the Bonferroni column if it exceeds it.

Hotelling: What is the exact Hotelling cut-off, ?

What is the asymptotic cut-off? ?

Use the exact cut-off to put a \* in the Hot. Column

Questions:

* Does it look like we can reject the null H0 that the βs are all 1?
* Does it look like we can reject the null H0 that theses industries have no abnormal return

Table 1: OLS estimates, monthly excess returns on 16 US industries

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Industry |  | tβ | Bonf. | Hot. | α x 12 | tα | Bonf. | Hot. |
|  | .xx | .xx | \* if reject | \* if reject | .xx | .xx |  |  |
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**Problem 2: SUR and Wald Tests:**

This is interesting but not quite satisfactory. You want a YES/NO answer to each question. You know that as thes are tests of βs and αs across equations, you need the SUR framework. Let’s move to more industries. For Problem 2, use 30indus-mon, same period 2009-2014

While doing your SUR answer these questions

* Are the OLS βs “correct” or we need to use SUR to compute a different βGLS?
* What are the typical (average over the 30) R2 and stdev() for theses regressions.

Be sure to not count the 30 correlations of 1 when answering these questions!

ANSWER HERE

* What is the average correlation of the 30 industries? ?
* What is the average correlation of the 30 residuals? ?
* Consider these 435 paiwise residual correlations you just estimated, what is their standard deviation:

?

* The asymptotic standard deviation of a correlation estimate is – you won’t believe ‼ 1/) Compare this with your “realized” correlation of the 435 estimates. With lots of ifs – e.g., if the 120 correlations are independently estimated, answer qualitatively.

Does it look like all these non-zero correlations could be just due to estimation error?

a) You wonder if all these industries have the same systematic risk. Do a Hotelling T2 test of H0 that

the **30 βs** are equal. You know to write your test under H0 as R β =r.

* What are the dimensions of the matrix R and what elements does it contain?
* What is in the vector r
* Write the formula for the Wald Test:

* What Wald test statistic do you find: ?
* What are the asymptotic distribution and 5% level cutoff for the test.
* Reject or Accept (use the asymptotic cutoff)? YES / NO
* Given what you know of the distribution of the Hotelling T2 statistic in exact sample, does the asymptotic cutoff for the Wald test look appropriate?

b) This multivariate regressions is well-known as the **1-pass method** to test and Asset Pricing Model: take a bunch of portfolios, estimate their βs and αs simultaneously.

CAPM says the αs should be zero. Accept or Reject, done!

You want to do this for these 30 industries. Do a Hotelling T2 that all the αs are zero.

T2 = ?

Accept /Reject:

**Problem 3: Sorting on Estimates**

You are interested in the 2-pass approach because it has a predictive content and is used both for testing the models and by practitioners to control risk while attempting to forecast returns . This is why you are really excited about the upcoming lecture on Thursday Feb. 28th, where you will learn more about it. You heard a lot has to do with estimating risk from one period and using it for the next … or something like that.

You wonder if βs are stable from period to period. There are two issues, estimates are noisy but maybe true βs move around. You know one thing: Since ϵ ∼ N(0,σ2 I), the βs are estimated with no bias. So there should not be a bias from one period to the next …. unless true βs vary with time in a systematic manner.

You are going to use **47indus** for this experiment.

a) Consider for period 1: 200901-201312 and period 2: 201401-201812. Estimate the β vector for each period. In Figure 1 plot β2 vs β1. Regress the 48 β2s against their first period counterparts. Write the estimates below:

2 = ?? + ?? 1

Add the regression line to your Figure 1, as well as the 45 degree line.

* Using the regression. For 1s = (0.5, 1, 1.5) what 2 do you forecast in the next 60-month period?
* Is there a bias here, which way, for what ranges of values of 1?
* What could be the reason?

b) This is puzzling! You wonder if it is specific to 2009-13, 2013-18. So you repeat the whole thing starting in 197401. This allows you to have exactly 9 periods of 5 years. Estimate the βs for each 5-year period. Then create two vectors: Oldbet and Newbet. Oldbet will have the βs estimated during the first 8 periods, Newbet the β estimates from periods 2 to 9. Each has 47x8 estimates to be sure. Then just redo the plot in Figure 2 and the regression.

2 = ?? + ?? 1

Any change?

* What could be the reason for this?

A R help file will be posted with tips on fast ways to do some of the questions.