UNIVERSITY OF Southampton

SEMESTER 2 2022/23

GROUP COURSEWORK BRIEF:

Module Code:	MATH 6008	**Assessment:**	Group Coursework	**Weighting:**	20%
Module Title:	Quantitative Research in Finance				
Module Leader:	Dr				
Submission Due Date:		2023	**Word Count/Duration:**		2000
Method of Submission:	Electr		nitin **ONLY (You are not required to submit a hard copy)**		
	(Please		es not appear on any part of your work)		

Any work submitted afte *date will be subject to the standard University late penalties (see below), unless an extension has been granted, in writing by the Senior Tutor, in advance of the deadline.*

University Working Days Late:	Mark:
1	(final agreed mark) * 0.9
2	(final agreed mark) * 0.8
3	(final agreed mark) * 0.7
4	(final agreed mark) * 0.6
5	(final agreed mark) * 0.5
More than 5	0

This assessment relates to the following module learning outcomes:

A. Knowledge and Understanding	A1. Demonstrate a critical understanding of the basic theory of financial econometrics; A2. Demonstrate a critical understanding of some specific applications of such theory; A3. Apply such understanding to a specific empirical project; A4. Demonstrate competence in using a basic econometrics software package.
B. Subject Specific Intellectual and Research Skills	B1. Demonstrate quantitative skills in evaluating numerical data.
C. Transferable and Generic Skills	C1. Demonstrate skills in utilizing analysis software.

Group Coursework Brief:

You should be aware that all members of your group share responsibility for any academic integrity breaches or other issues that may arise from your group's coursework submission. ***The awarded mark to a group implies that each member of that GROUP receives the same mark as others in the same group. Use STATA for estimations and tests. Assume, where relevant the significance level of 5%.*** **PLEASE NOTE THAT ONLY ONE MEMBER OF THE GROUP SHOULD SUBMIT THE ASSIGNMENT TO BLACKBOARD TURNITIN.**

Answer ALL Questions in Full

Question ONE

Question ONE requires using the data from the module page on Blackboard. The data file **Q1.XLS** contains the short-term interest rates for selected OECD countries, the US policy interest rate (i.e., effective federal funds rate) (**USinterest**), the US VIX volatility index (**VIX**), and the US economic policy uncertainty index (**EPU**). These data are obtained from the OECD database and the Federal Reserve Bank St Louis' database.

Suppose that you want to study the (spillover) effect of US monetary policy on the short-term interest rates in the OECD countries. To this end, consider the following regression model:

$$R_{i,t} = \alpha + \beta_1 R_t^{US} + u_{i,t} \quad , \qquad (1)$$

where $R_{i,t}$ is the short-term interest rate for an OECD country i (each group will be allocated a country), R_t^{US} is the US policy interest rate, and $u_{i,t}$ is the random disturbance term.

IMPORTANT NOTE: You MUST answer each part of the question separately and clearly.

Required for Questio

a) What assumptions ... e random disturbance term and/or the explanatory variable so that the estimated co... you expect these assumptions to hold for the model outlined in Equation (1)? Discuss.

b) Estimate Equation 1 using OLS. Summarise the goodness of fit of the model and test the hypothesis that the short-term interest rate in the selected country responds positively to the US policy interest rate. Outline the null and alternative hypotheses for this test. Perform the test and comment on the result.

c) Perform a test for heteroscedasticity in the residuals from Equation (1). Comment on the result. What inferences would you make in the presence of heteroscedasticity? What methods would you employ to remedy the presence of heteroscedasticity?

d) Perform a test for serial correlation in the residuals from Equation (1). Comment on the result. What inferences would you make in the presence of serial correlation? What methods would you employ to remedy the presence of serial correlation?

e) In addition to the monetary policy, it is believed that uncertainty is another important factor in explaining the short-term interest rate. Suppose that there are two types of uncertainty under your consideration, economic policy uncertainty (EPU) (measured by the US economic policy uncertainty index) and financial uncertainty (VIX) (measured by the VIX volatility index). Consider the following regression model:

$$R_{i,t} = \alpha + \beta_1 R_t^{US} + \beta_2 U_t^{US} + u_{i,t}, \quad (2A,B)$$

where U_t^{US} is the uncertainty index measured by either VIX or EPU. Perform OLS estimations of Equation (2A,B) twice. Use VIX to measure U_t^{US} in Equation 2A and use EPU in in Equation 2B. Compare your results across the three specifications (Equations 1, 2A and 2B). Which regression specification should be employed? Which uncertainty measure (VIX or EPU) should be included in the regression model?

[50 marks]
[Maximum 1000 words]

Question TWO

Question TWO requires to use the same data file as for **Question ONE**. **Required for Question TWO**

a) Depict the short-term interest rate, $R_{i,t}$, on a time series graph. Comment on the result.

b) Perform a unit root test on the interest rate. Is the variable I(0) or I(1)? Carefully outline the test equation, as well as the null and alternative hypotheses for this test. Discuss if an intercept and/or linear trend need to be included in the test equation.

If the interest rate is I(1), for the remainder of this question transform it into FIRST DIFFERENCES. If the interest rate is found I(0) no transformation is necessary; continue using the variable in LEVELS.

c) Estimate the autocorrelation and partial autocorrelation functions for the interest rate (in LEVELS or DIFFERENCES, depend[illegible]nt on the estimation output.

d) Estimate AR(p) moc[illegible]ARMA(p,q) models with p=1,2,3 and q=1,2,3. Summarise in tables the coefficient estima[illegible]ndard errors, the information criteria AIC and BIC, as well as the Ljung-Box Q test for th[illegible]ions in the residual series. Comment on the results.

e) Based on the estim[illegible]ct the optimal time-series model. Justify your choice.

[25 marks]
[Maximum 500 words]

Question THREE

Question THREE requires to use the same data file as for **Question ONE**. **Required for Question THREE**

If the interest rate is I(1), for the remainder of this question transform it into FIRST DIFFERENCES. If the interest rate is found I(0) no transformation is necessary; continue using the variable in LEVELS.

a) Depict $R_{i,t}$ on a time series graph and discuss if there is evidence of volatility clustering in the data. Comment on the result. Calculate the squared $R_{i,t}$ and depict graphically the correlation and partial correlation functions of the squared $R_{i,t}$. Comment on the result.

b) With respect to the series $R_{i,t}$, test for the presence of conditional heteroscedasticity in the residuals of the conditional mean model, formulated as in Equation (1). Perform the LM-ARCH test for lag orders 1 and 6. Comment on the results. Is there evidence of conditional heteroscedasticity in the residuals? *Please use the same conditional mean model in c) and d) below.*

c) Proceed to estimate ARCH(p) models with p=1,…,6. Summarise the estimated models in a table. Discuss the results. Which of the estimated models provides the best fit? *The conditional mean model is as in b).*

d) Now estimate the conditional variance using GARCH(1,1) and TGARCH(1,1) models. Discuss the results. Which of the two models provides the best fit? *The conditional mean model is as in b).*

e) Now estimate a GARCH(1,1)-M model, in which the conditional mean model is formulated as $R_{i,t} = \alpha + \beta_1 R_t^{US} + \Lambda\sigma_{i,t-1}^2 + u_{i,t}$. Comment on the results.

[25 marks]
[Maximum 500 words]

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Nature of Assessment: This is a SUMMATIVE ASSESSMENT. See 'Weighting' section above for the percentage that this assignment counts towards your final module mark.

Word Limit: +/-10% ei unt (see above) is deemed to be acceptable. Any text that exceeds an additional 10% will nc e relevant word count *includes* items such as cover page, executive summary, title page, ta gures, in-text citations and section headings, if used. The relevant word count *excludes* your lis ppendices at the end of your coursework submission.
You should always in from Microsoft Word, not Turnitin), at the end of your coursework submission, before you

Title/Cover Page: You must include a title/ cover page that includes: your Student ID, Module Code, Assignment Title, Word Count. This assignment will be marked anonymously, please ensure that your name does not appear on any part of your assignment.

References: You should use the Harvard style to reference your assignment. The library provide guidance on how to reference in the Harvard style and this is available from: http://library.soton.ac.uk/sash/referencing

Submission Deadline: Please note that the submission deadline for Southampton Business School is **16.00 for ALL assessments.**

Turnitin Submission: The assignment MUST be submitted electronically via Turnitin, which is accessed via the individual module on Blackboard. Further guidance on submitting assignments is available on the Blackboard support pages.

It is important that you allow enough time prior to the submission deadline to ensure your submission is processed on time as **all** late submissions are subject to a late penalty. We would recommend you allow 30 minutes to upload your work and check the submission has been processed and is correct. Please make sure you submit to the correct assignment link.

Email submission receipts are not currently supported with Turnitin Feedback Studio LTI integrations, however following a submission, students are presented with a banner within their assignment dashboard that provides a link to download a submission receipt. You can also access your assignment dashboard at any time to download a copy of the submission receipt using the receipt icon. It is vital that you make a note of your **Submission ID (Digital Receipt Number)**. This is a unique receipt number for your submission, and is proof of successful submission. You may be required to provide this number at a later date. We recommend that you take a screenshot of this page, or note the number down on a piece of paper.

The last submission prior to the deadline will be treated as the final submission and will be the copy that is assessed by the marker.

It is your responsibility to ensure that the version received by the deadline is the final version, resubmissions after the deadline will not be accepted in any circumstances.

Important: If you have any problems during the submission process you should contact ServiceLine immediately by email at Serviceline@soton.ac.uk or by phone on +44 (0)23 8059 5656.

Late Penalties: Further information on penalties for work submitted after the deadline can be found here.

Special Considerations: If you believe that illness or other circumstances have adversely affected your academic performance, information regarding the regulations governing Special Considerations can be accessed via the Calendar: http://www.calendar.soton.ac.uk/sectionIV/special-considerations.html

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Extension Requests: : Extension requests along with supporting evidence should be submitted to the Student Office as soon as possible before the submission date. Information regarding the regulations governing extension requests can be accessed via the Calendar: http://www.calendar.soton.ac.uk/sectionIV/special-considerations.html

Academic Integrity Pou can access Academic Integrity Guidance for Students via the Quality Handbook: http://w quality/assessment/academic_integrity.page?. Please note any suspected cases of Aca otified to the Academic Integrity Officer for investigation.

Feedback: Southampt mitted to providing feedback within 4 weeks (University working days). Once the marks are re eived your feedback, you can meet with your Module Leader / Module Lecturer / Personal A s the feedback within 4 weeks from the release of marks date. Any additional arrangemer in the Module Profile.

Student Support: Study skills and language support for Southampton Business School students is available at: http://www.sbsaob.soton.ac.uk/study-skills-and-language-support/.

External Examiner:	
External Examiner Comments:	
Final Approval by External Examiner Date:	
Module Leader Response to External Examiner: (Please note these comments are REQUIRED and will be sent to the External Examiner)	