

IP309-15 Quantitative Research Methods: Understanding relationships in data

20/21

Department

Liberal Arts

Level

Undergraduate Level 2

Module leader

Tim Burnett

Credit value

15

Module duration

11 weeks

Assessment

100% coursework

Study location

University of Warwick main campus, Coventry

Description

Introductory description

As individuals and scholars we are frequently confronted with the claim that A causes B, or the requirement to verify whether a relationship between A and B exists. While anecdotal accounts can help inform our opinion, it is dangerous to rely on one-off observations to verify more general relationships. Equally, even where we believe there may be a relationship, we can be misled by confounding influences which obscure or mislead us.

This is where quantitative approaches can help us untangle the relationships we observe around us, and help us answer question of whether these relationships hold in the wider population. The skills acquired on this module will be invaluable for any student wishing to pursue research which involves large numbers of participants, or which involves the analysis of datasets from official sources.

[Module web page](#)

Module aims

This module utilises an innovative Problem-Based Learning approach to teaching intermediate quantitative concepts which promotes self-directed and reflective learning. Through tackling multifaceted and complex social issues, students will begin to generate, appreciate and understand broader, underlying, conceptual problems around why quantitative approaches are relevant, and to uncover the appropriate methodologies. In addition to improved learning outcomes, this approach also aligns learning activities with the processes of independent research — effectively preparing students for independent project work or modules which encourage individual enquiry.

Through group discussion and research around the provided cases, students will begin building their knowledge and confidence in plotting and estimating bivariate relationships, uncover the core technical approaches we use for this, and the conditions under which these approaches are appropriate. They will build on existing knowledge of distributions to study the principles of hypothesis testing to understand how we can use results based on a sample to make inferences about the wider population.

As the course develops, problems will move toward the requirement to understand more complex multivariate relationships, the importance of control variables in reducing 'noise' in our models, and finally extensions which allow us to use our frameworks to plot non-linear relationships.

The combination of PBL discussion classes, and practical workshops will build students' confidence at using statistical computer packages to put into practice the concepts they uncover through their research, and to take their first steps in statistically modelling the relationship between two or more variables.

This module builds on the introductory understanding students acquired in IP110 Quantitative Methods for Undergraduate Research and serves as a pre-requisite for the specialised techniques studied in IP306. Students will also find the concepts in this module complementary to the approaches taken in IP201 (Sustainability).

Outline syllabus

This is an indicative module outline only to give an indication of the sort of topics that may be covered. Actual sessions held may differ.

The following outline represents the core knowledge and competency gain associated with the course activities.

In order to facilitate the acquisition of knowledge and competency, the course is delivered via Problem-Based Learning which emphasises student knowledge acquisition via efforts to understand the parameters of, and solutions to, complex real-world situations. Such case studies will involve engaging and contemporary challenges around the identification of patterns and relationships across themes such as education, deprivation and social exclusion, social justice, climate and environment, and health and wellbeing.

In practical accounts of PBL approaches to quantitative methods, complex case studies are presented, accompanied by data, which encourage students to engage with deeper conceptual problems around the use and method of quantitative enquiry when studying relationships. For each study students will need to engage with the data, potentially identifying and learning techniques for statistical or quantitative which will allow them to understand and address the case study and the deeper underlying problem. As such it is customary for students to be expected to consult a well-chosen and accessible text relating to statistical methods as a source for technical background material.

This approach, when applied to the teaching of quantitative research methods is very innovative,

though earlier studies (e.g. Karpiak (2011)) suggest that learning outcomes are improved for students who study the subject in this fashion. Moreover, the PBL approach more closely aligns the mode of learning with the research process such that students will first encounter the scenario, generate the problem, before working to acquire the skills and knowledge required to address said problem.

The use of complex and involved case studies allows multiple learning outcomes to be associated with a single problem; as students develop their knowledge they are able to iteratively explore the problem in greater depth over several weeks. The course will be based around case studies which address four key conceptual problems around the use of quantitative research to elicit relationships:

1. Why employ quantitative approaches to relationships, and why not? Which will allow students to develop knowledge and understanding around:

- Core statistical concepts used to describe relationships
- Differences between quantitative and qualitative approaches and their respective strengths
- Why correlation isn't causality

1. How can we model the strength of a relationship?

Which will allow students to develop knowledge and understanding around:

- Core principles of linear regression modelling
- Estimating straight line relationships using ordinary least squared (OLS) approaches
- The required assumptions of ordinary least squared modelling and what happens when we ignore them
- Using regression analysis of data samples to make inferences about the population

1. How can we deal with complex multifaceted relationships?

Which will allow students to develop knowledge and understanding around:

- Control variables, confounding influences, and the usefulness (and shortcomings) of multivariate modelling
- Estimating linear relationships using OLS when we have many variables
- The required assumptions of multivariate ordinary least squared modelling and what happens when we ignore them
- Using multivariate regression analysis of data samples to make inferences about the population

1. What happens when we don't have a linear relationship?

Which will allow students to develop knowledge and understanding around:

- The role of interactions in data
- Inclusion of data transformations in regression models and what they mean
- Interpreting binary variables in the context of statistical models

The methods of teaching, and the emphasis on student understanding through self-directed inquiry, differentiates this module from other thematically similar modules at this level taught at the university (and more widely).

References:

Karpiak, C.P. (2011) Assessment of Problem-Based Learning in the Undergraduate

Learning outcomes

By the end of the module, students should be able to:

- Demonstrate an understanding and usefulness of the key concepts in describing relationships in data, the meaning and of descriptive statistics used to describe such relationships, and the generation and application of such statistics using real-world data.
- Use regression analysis to evaluate linear bivariate relationships in real-world data, understand issues in data and its collection

Research element

This is an optional module on the Liberal Arts course which aims to facilitate the acquisition by students of a range of methods of enquiry from various disciplines and equip them to deploy those skills in research. Research skills are embedded into the teaching strategy of all of the course's modules which, collaboratively, seek to develop and enhance students' capacity to conduct independently original research into a current problem. Specifically, the approach used in this module serves to align learning activities with the processes of independent research – effectively preparing students for independent project work or modules which encourage individual enquiry.

Interdisciplinary

This is an optional module on the Liberal Arts course which adopts an interdisciplinary approach spanning the arts, humanities, social and natural sciences fields in order to engage with debates on topical, local national and international issues

International

This is an optional module on the BA in Liberal Arts course which offers a unique transdisciplinary learning experience allowing students to achieve breadth and depth of knowledge

Subject specific skills

Skills in data analysis using a range of methods

Transferable skills

Skills in using statistical computer software packages to manage data and perform data analysis tasks

Problem solving

Information technology

Numeracy

Oral and written communication

Digital literacy

Study

Study time

Type	Required
Lectures	(0%)
Seminars	10 sessions of 2 hours (13%)
Practical classes	9 sessions of 2 hours (12%)
Private study	112 hours (75%)
Total	150 hours

Private study description

Research and preparation for classes and assessments

Costs

No further costs have been identified for this module.

Assessment

You do not need to pass all assessment components to pass the module.

Assessment group A1

	Weighting	Study time
Technical Report	30%	
1 x 1,250-word technical report (30%)		
In-class group presentation	15%	
Group technical report	15%	
Group technical report		
Computer-based exam	40%	
Questions seen 7 days before the test.		

Feedback on assessment

- Written feedback for written assignments (individual and group) will be provided via Tabula
Written feedback will be provided for presentations via Tabula in addition to feedback and discussion in class at time of presentation
Feedback on the exam will be

provided individually with written comments via Tabula.

Availability

Courses

This module is Optional for:

- UIPA-L1L8 Undergraduate Economic Studies and Global Sustainable Development
 - Year 2 of L1L8 Economic Studies and Global Sustainable Development
 - Year 3 of L1L8 Economic Studies and Global Sustainable Development
- Year 4 of UIPA-L1L9 Undergraduate Economic Studies and Global Sustainable Development (with Intercalated Year)
- UIPA-XL38 Undergraduate Education Studies and Global Sustainable Development
 - Year 2 of XL38 Education Studies and Global Sustainable Development
 - Year 3 of XL38 Education Studies and Global Sustainable Development
- Year 4 of UIPA-XL39 Undergraduate Education Studies and Global Sustainable Development (with Intercalated Year)
- UIPA-L8A1 Undergraduate Global Sustainable Development
 - Year 2 of L8A1 Global Sustainable Development
 - Year 3 of L8A1 Global Sustainable Development
- Year 4 of UIPA-L8A2 Undergraduate Global Sustainable Development (with Intercalated Year)
- UIPA-L8N1 Undergraduate Global Sustainable Development and Business
 - Year 2 of L8N1 Global Sustainable Development and Business Studies
 - Year 3 of L8N1 Global Sustainable Development and Business Studies
- Year 4 of UIPA-L8N2 Undergraduate Global Sustainable Development and Business Studies (with Intercalated Year)
- UIPA-R4L8 Undergraduate Hispanic Studies and Global Sustainable Development
 - Year 2 of R4L8 Hispanic Studies and Global Sustainable Development
 - Year 3 of R4L8 Hispanic Studies and Global Sustainable Development
- Year 4 of UIPA-R4L9 Undergraduate Hispanic Studies and Global Sustainable Development (with Intercalated Year)
- UIPA-V1L8 Undergraduate History and Global Sustainable Development
 - Year 2 of V1L8 History and Global Sustainable Development
 - Year 3 of V1L8 History and Global Sustainable Development
- Year 4 of UIPA-V1L9 Undergraduate History and Global Sustainable Development (with Intercalated Year)
- UVCA-LA99 Undergraduate Liberal Arts
 - Year 3 of LA99 Liberal Arts
 - Year 3 of LA92 Liberal Arts with Classics
 - Year 3 of LA73 Liberal Arts with Design Studies
 - Year 3 of LA83 Liberal Arts with Economics
 - Year 3 of LA82 Liberal Arts with Education

- Year 3 of LA95 Liberal Arts with English
- Year 3 of LA81 Liberal Arts with Film and Television Studies
- Year 3 of LA80 Liberal Arts with Global Sustainable Development
- Year 3 of LA93 Liberal Arts with Global Sustainable Development
- Year 3 of LA97 Liberal Arts with History
- Year 3 of LA91 Liberal Arts with Life Sciences
- Year 3 of LA75 Liberal Arts with Modern Languages and Cultures
- Year 3 of LA96 Liberal Arts with Philosophy
- Year 3 of LA94 Liberal Arts with Theatre and Performance Studies
- UIPA-C1L8 Undergraduate Life Sciences and Global Sustainable Development
 - Year 2 of C1L8 Life Sciences and Global Sustainable Development
 - Year 3 of C1L8 Life Sciences and Global Sustainable Development
 - Year 3 of C1LA Life Sciences and Global Sustainable Development: Biological Sciences
 - Year 3 of C1LB Life Sciences and Global Sustainable Development: Ecology
- UIPA-C1L9 Undergraduate Life Sciences and Global Sustainable Development (with Intercalated Year)
 - Year 4 of C1L9 Life Sciences and Global Sustainable Development (with Intercalated Year)
 - Year 4 of C1L9 Life Sciences and Global Sustainable Development (with Intercalated Year)
 - Year 4 of C1LC Life Sciences and Global Sustainable Development: Biological Sciences (with Intercalated Year)
 - Year 4 of C1LC Life Sciences and Global Sustainable Development: Biological Sciences (with Intercalated Year)
 - Year 4 of C1LD Life Sciences and Global Sustainable Development: Ecology (with Intercalated Year)
 - Year 4 of C1LD Life Sciences and Global Sustainable Development: Ecology (with Intercalated Year)
- UIPA-V5L8 Undergraduate Philosophy and Global Sustainable Development
 - Year 2 of V5L8 Philosophy and Global Sustainable Development
 - Year 2 of V5L8 Philosophy and Global Sustainable Development
 - Year 3 of V5L8 Philosophy and Global Sustainable Development
 - Year 3 of V5L8 Philosophy and Global Sustainable Development
- Year 4 of UIPA-V5L9 Undergraduate Philosophy and Global Sustainable Development (with Intercalated Year)
- UIPA-L2L8 Undergraduate Politics, International Studies and Global Sustainable Development
 - Year 2 of L2L8 Politics, International Studies and Global Sustainable Development
 - Year 3 of L2L8 Politics, International Studies and Global Sustainable Development
- Year 4 of UIPA-L2L9 Undergraduate Politics, International Studies and Global Sustainable Development (with Intercalated Year)
- Year 3 of UIPA-C8L8 Undergraduate Psychology and Global Sustainable Development
- Year 4 of UIPA-C8L9 Undergraduate Psychology and Global Sustainable Development (with Intercalated Year)
- UIPA-L3L8 Undergraduate Sociology and Global Sustainable Development

- Year 2 of L3L8 Sociology and Global Sustainable Development
- Year 3 of L3L8 Sociology and Global Sustainable Development
- Year 4 of UIPA-L3L9 Undergraduate Sociology and Global Sustainable Development (with Intercalated Year)
- Year 3 of UIPA-W4L8 Undergraduate Theatre and Performance Studies and Global Sustainable Development
- Year 4 of UIPA-W4L9 Undergraduate Theatre and Performance Studies and Global Sustainable Development (with Intercalated Year)
- Any other undergraduate course provided that pre-requisite knowledge is in place
- Any other undergraduate course provided that pre-requisite knowledge is in place
- C818 BAsc Psychology and GSD
- LA 98 BA Liberal Arts with Intercalated year
- LA 99 BA Liberal Arts
- W418 BAsc Theatre Studies and GSD