ECO220Y1Y, Introduction to Data Analysis and Applied Econometrics

Economics Department, University of Toronto, 2023/24

Sept to Dec: Prof. Murdock // **Jan to Apr:** Dina O'Brien, Kathleen Dobson, and Quinlan Lee

1 Welcome and Intro to ECO220Y1Y

Welcome to my favorite course! You have the chance to gain essential analysis and exposition skills – ours is a practical course – and learn about what many economists really do. If you're curious about how to analyze data, research questions in a variety of economic fields, and how to present and interpret results, then this is the course for you. You'll need to hone your preexisting reading, writing, and quantitative analysis skills. While some of the new skills are challenging and require substantial practice, your classmates, TAs and instructors are your allies. Make an extra effort to socialize and form new connections.

Sections LEC0101, LEC0201, LEC0301, and LEC0401 share this syllabus. Prof. Murdock teaches in the Fall term and runs DACM. Dina O'Brien (LEC0101/LEC0201), Kathleen Dobson (LEC0301), and Quinlan Lee (LEC0401) teach in the Winter term. All seven sections do the Data Analysis Course Module (DACM) – spaced over both terms – where you dive into real data and research and replicate key findings.

2 Learning Objectives: Expected Depth of Understanding

(1) Translate between plain English and statistical terms and concepts: identify key information regardless of wording and distinguish incorrect statements from correct ones

(2) Select and apply a suitable quantitative approach to a new situation while making your reasoning clear: may require sentences, hypotheses, equations, calculations, fully-labeled graphs, diagrams

(3) Proficiently read output from various statistical software packages including Stata

(4) Use Excel to analyze data and replicate published results

(5) Correctly interpret quantitative results for a non-technical or technical audience

(6) Draw valid statistical conclusions and steer clear of common pitfalls

(7) Explain what would change if a researcher made different choices or the data changed

(8) Identify the underlying assumptions in quantitative analyses and figure out how violations affect conclusions and interpretations

(9) Read and critically evaluate analyses without being dazzled by data, methods or jargon

(10) Effectively apply course concepts to a wide range of contexts from popular press articles to papers in peer-reviewed academic journals

(11) Assess available data or propose a data collection plan to address a research question

(12) Craft compelling, concise, precise, clear, and coherent written arguments

3 For Everyone: Accessibility, Absences, and Help

If you require accessibility accommodations, register with both Accessibility Services https://studentlife.utoronto.ca/department/accessibility-services/ and Accommodated Testing Services (ATS): https://lsm.utoronto.ca/ats/. Everyone may use the Academic Success Centre. Contact The Information Commons Help Desk with any technical issues around Quercus, your devices, software, or technology.

For complex/challenging situations, you must ***work with your College Registrar***. They give guidance and, when appropriate, contact your professors while guarding your privacy. This requires *working closely with* your College Registrar, and not merely having them restate your requests to your professors. However, there are limits to what we can accommodate and sometimes the only viable option is dropping our course.

4 Academic Integrity

Please do not create a horrible situation for yourself, your classmates, our TAs, and me. Even if you are suffering stress, under extreme pressure, far behind, facing failure, and/or lacking self-confidence, cheating is not worth it. Infractions can take many, many agonizing months to resolve and sanctions can be severe. We must all work together supporting the integrity of our course and U of T. Read this link and sublinks https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity.

5 Required Readings and Textbook

Section 14 lists the readings and Quercus gives each unit's assignment. For our required textbook – *2020 Business Statistics, Fourth Canadian Edition* by Sharpe, De Veaux, Velleman, and Wright – you may buy:

- the eText directly from Pearson for $64.99 (ISBN 9780136964032),
- the print textbook from Pearson with an access code for the eText for $217.99 (ISBN 9780136726548),
- a used copy of the *Fourth Canadian Edition*. Older editions or the US / international editions are poor substitutes. However, the *Third Canadian Edition* is an acceptable substitute.

Note that MyLab Statistics is *neither* required nor recommended: we do not use it. Also, be advised that our textbook highlights important points with boxes (sometimes in the margins): take the boxes seriously, including "Just Checking." Similarly, don't skip "What Can Go Wrong?"

6 Prerequisites and Workload

An administrator will remove anyone missing prerequisites. Note that I cannot waive prerequisites. You should expect to work about 8 hours per week on our course. Here's a direct quote from course evaluations: "Practice, practice, practice. Swimming in the ocean of problems really helps."

7 Fall Term: Required Lecture Videos and Lecture Slides

For each unit, required lecture videos (Microsoft or YouTube) and lecture slides (pdf) are on Quercus. Complete readings and lecture videos ***before*** the workshop on each unit.

8 Fall Term: Workshops

On Tuesdays (LEC0101 and LEC0201) or Wednesdays (LEC0301 and LEC0401) we meet for required workshops led by Prof. Murdock. You practice skills, collaborate with others, and work with mini case studies. Some Fridays are required TA led workshops to give you extra practice with the most challenging topics. Complete the unit's reading and lecture videos ***before*** your workshop. Expect to solve questions, write, and interact with your classmates and the instructional team. Bring pencils, erasers, your TCard, and the course aid sheets. ***You must attend with your ACORN section.*** (If you attend with the wrong section you *cannot* get credit for submitted work.) See the Workshops page on Quercus.

9 Both Terms: DACM Practicums

Ten Fridays have required DACM practicums. You learn data analysis skills, reinforce your understanding of core course curriculum, and practice effective writing skills. Bring your laptop with an up-to-date installation of Microsoft 365 ProPlus. Also, bring pencils, erasers, your TCard, and the course aid sheets. Be prepared to actively work with others, do analyses, and write. Complete the assigned readings in the DACM Handbook ahead of time. ***You must attend with your ACORN section.*** (If you attend with the wrong section you *cannot* get credit for submitted work.) Accept your invitation to join the DACM Quercus site https://q.utoronto.ca/courses/326257: you will receive your invitation on September 15.

10 Ungraded Homework

Each unit has ungraded homework – end-of-chapter textbook exercises and required problems – and solutions on Quercus. For more on solutions to textbook exercises, see Quercus.

11 Communication: Class Meetings, Student Hours, and MS Forms

For any questions or topics of discussion, weekly class meetings are a great opportunity. These include opportunities for quick conversations at the beginning, middle, and end. Outside of class meetings, you are encouraged to use student hours. TA hours focus on questions about course curriculum and skills. Instructor hours are also for questions about course curriculum and skills, personal matters, and other topics of interest. See the Student Hours page on Quercus for the latest schedule. Note that Prof. Murdock's student hours are on Zoom and *do* allow for a private conversation whenever needed.

Prof. Murdock does ***not*** use e-mail nor other two-way electronic modes of communication like Quercus for conversations with with students regarding our course (e.g. concerns with grades, questions about content or upcoming tests/exams, excuses for missing work, an so on). ***Please do not expect replies to e-mails or to message sent via Quercus.*** If you write to alert me about a problem in the course (e.g. a broken link), we will address it and, if needed, post an announcement. For two-way communication, please speak to the instructional team during class meetings and/or use student hours.

For any remark requests, see Section 12.4. For any missed work, see Section 12.5. For remarks, missed work, and conflicts – which are situations not resolved via a conversation – you must complete the appropriate MS Form.

12 Course Grades and Marking

Assessment	Weight	Estimated Date(s), Time
Term Test #1	16 %	Friday, Oct 27, 9:10am-11am
Term Test #2	16 %	Thursday, Dec 7, 6:30pm-8:20pm (for ACORN conflicts, see footnote 1)
Term Test #3	14 %	Friday, Feb 9, 9:10am-11am
Term Test #4	14 %	Friday, Apr 5, 9:10am-11am
Fall Term Participation	8 %	Workshops during most class meeting times where the *quality* of your participation matters. You *must* attend with your ACORN section.
DACM Practicums	8 %	Sep 22, Oct 13, Oct 20, Nov 24, Dec 1, Jan 26, Feb 16, Mar 8, Mar 22, Apr 8. *Quality* matters. You *must* attend with your ACORN section.
Final Exam	24 %	Three hours and cumulative TBA by A&S: April 10 to 30

12.1 Term Tests and the Final Exam

We post announcements on Quercus with information before each test and the final exam. We give you the aid sheets at each test/exam. For a missed test, see Section 12.5.1. Note the **special day and time of Term Test #2**: see footnote for ACORN conflicts.[1] The final exam is cumulative[2] and includes DACM.

12.2 Workshops and DACM Practicums

Quality matters for marks in workshops and DACM practicums. Arrive on time, well prepared, and actively engage throughout. For more, see Sections 8 and 9. For workshops and practicums, we return work via Crowdmark: check your U of T e-mail. For a missed workshop or practicum, see Section 12.5.2.

12.3 Grading of Term Tests and the Final Exam

Marks reflect any adjustments to raw scores such as adding points or not counting an unduly difficult/confusing question. Marks, not raw scores, measure your performance. For partial credit, part of your answer must be correct, directly relevant to the question, and not contradicted elsewhere in your answer.

12.4 Remark Requests

For term tests, remark requests must: (1) Be submitted to Remark Test, which is an MS form, (2) Explain WHY more points are justified, (3) Be submitted within TWO WEEKS of the test's return to the class. Your mark may remain unchanged, go up, or go down. These are given a fair look: TAs are *not* seeking to penalize those with genuine marking concerns. Requests are reviewed *after* the two-week deadline, not immediately. We will *not* consider any remark requests after the deadline. Note that there is no "reply" to remark requests: after they are processed, any changes will automatically appear on your Crowdmark paper. (The most common result is no change.) Note that we do **not** accept remark requests for workshops or DACM practicums: see Section 12.5.2 if you are unhappy with a mark.

[1] December 7 is an optional make-up for Monday classes. For a *direct* ACORN conflict for Test #2, you must complete ACORN Conflict for Test #2 (an MS form) after 9am on Nov 7 and before 9am on Nov 30. A conflict is a regularly scheduled required course activity that must be completed at exactly the same time. We address valid conflicts with a *minimal* time shift, but everyone writes Test #2. Those with valid conflicts will get an e-mail to their U of T account on Dec 1 with details.

[2] Why have a *cumulative* final exam? Pedagogically, revisiting earlier material aids learning and long-term retention of skills. Practically, it allows the final to have a higher weight and be an opportunity to rebound.

12.5 Missed Work and Accommodations

Complete work as scheduled in Section 12. Any missed work earns a mark of zero. This section explains accommodations for: illness, injury, personal/family problems, religious reasons, extracurricular conflicts, late enrollment in the course, travel issues, accessibility concerns, and/or other challenging situations beyond your control. ***For significant challenges, work with your College Registrar immediately.***

12.5.1 Missing a Term Test

For a missed term test, complete BOTH of these steps. (If you are just late, show up late to the test.)

First Step: Complete Missed Term Test, which is an MS form. Submit it ***as soon as you know that you will miss a test***. The ***absolute minimum is 12 hours*** in advance. We do NOT wish to see documents from doctors or others. All questions in the MS form are *required*, including your current ACORN timetable.

Second Step (if miss Test #1, #2, or #3): Write *all* other tests as scheduled. Write a *cumulative* make-up test. Within three business days after the date of the missed test, we write to your U of T e-mail. Subsequent e-mails may clarify the date, time, and location of the make-up. Students are expected to be available both during the term and during the exam periods and to be ready to write the make-up test. We do not accommodate a missed make-up test nor do we schedule individual writing times given travel plans, work schedules, or other issues. (Also, note that make-up tests are restricted, which means that you will not see it in Crowdmark. If you wish to practice and get feedback, see the posted regular test and mark yourself against the posted solutions.)

Second Step (if miss Test #4): Write the final exam. The weight of Term Test #4 shifts to the final exam and the weights of Term Tests #1, #2, and #3 are as stated in the table in Section 12.

We will *not* accommodate more than one missed test in a term. If your situation is such that you are unable to complete more than one test, you should consult your College Registrar for advice on dropping the course and retaking it when you are in a better position to complete the required work.

12.5.2 Automatic Accommodations for Workshops and DACM Practicums

To accommodate people who miss, arrive late, or have any problems for a workshop for reasons beyond their control, we automatically drop the lowest three workshops. For DACM practicums, we automatically drop the lowest two. These are for situations entirely outside your control: do not miss for any potentially avoidable reasons. These are *automatic*: please do *not* contact us about missing a workshop or practicum.

12.6 Automatic Adjusted Weights for Relatively Poor Test Performance

Automatic adjusted weights may help if your performance is relatively poor for one test because of any kind of problem or challenge. If you write all four term tests, and if it helps your course grade, we automatically lower the weight on your lowest test by 8 percentage points and increase the weight of the final exam by 8 percentage points. Any questions around your academic integrity for *any* work disqualify you from automatic adjusted weights. Note that if you miss Term Test #4 there are *no* automatic adjusted weights because the final exam weight is already substantially increased according to the steps in Section 12.5.1.

12.7 Rebounding from Failures & Handling Ambiguity: Message from Prof. Murdock

Even though none of us enjoy them, failures are normal for learning and growth. We do *not* mark you as a person/student: we mark your submitted work. How do you react to a poor mark? Instead of feeling discouraged or frustrated, try reflecting on how that poor mark came to be and what is within your control to change going forward. If you're unsure of the causes, speak with your instructors or your TAs for advice.

Let me share a true story. In my first term in the College of Agriculture and Life Sciences at Cornell, I enrolled in Calc II using my AP credit for Calc I from high school. I found the course challenging and studied many hours. My only activities were studying, working in the dining hall, and the necessities of life (eating, sleeping, etc.). I thought the first test went ok and then I got my mark. At Cornell, numeric marks had no meaning: everything was curved. I waited for the professor to write the letter grades for each range of marks on the board. He never it made it as low as my mark: I wasn't even close to a D-. I remember walking around campus in tears. But then I asked for help. The registrar helped me to switch me into Calc I. I ended up with top marks, became a math major, and transferred to a new school. So what is the point of this story? It's not that everything we fail at will ultimately become a great success. Sometimes we need to ask for help and adjust our approach. Sometimes we will ultimately find some measure of success, just not yet.

Practicing economists often fail and there are few "right answers." Many research endeavors have false starts, dead ends, and months of wasted work. There are also well-publicized examples of economists making a small coding error that means their headline empirical results are wrong. Further, people entering their second year of university often think in dualistic terms. Dual means two and symptoms are thinking in terms of black/white or right/wrong. Almost all empirical results in economics are subject to some debate: there is no one correct answer (even if many answers are definitely incorrect). While our course will often be on firm ground, we do venture into real research where we have to deal with shades of grey and ambiguity.

We cannot offer individual opportunities to rebound. This means we cannot change the marking scheme or offer bonus assignments upon request. While some may see this as "strict," our goal is to be fair and kind. It is not fair to make exceptions only for those who contact us: many are not comfortable asking. Further, in many cases where extraordinary accommodations would be needed, the ultimate outcome is failing or dropping the course. It is not kind to carry on without a realistic chance of an acceptable outcome.

13 Advice for Your Success

Take advantage of our course supports: our TAs, your instructors, and Quercus. For additional supports outside of our class times and student hours, visit the Economics Study Centre. On Quercus we alert you to the Learning Assistants who have taken ECO220Y1Y themselves last year or two years ago. Also, check out Recognized Study Groups to connect with classmates and stay on track with your study plans.

Be careful with paid services with marketing approaches that may prey on your worst fears or may promise top marks with less work: real learning is hard and requires a sustained effort. Also, outside services have contributed to students being sanctioned for academic infractions. Also note that in May of 2022 U of T sued Easy EDU. In contrast, services provided by U of T are safe for you to use.

Use posted solutions with care. Construct your own *full* replies for homework. Work with old tests and exams in test-like conditions. If you cannot solve a question, turn to your notes and course materials. Only as a *last resort*, ask a person or look at the solutions. Use solutions to *grade* your own answers.

14 Topics and Required Readings

Required readings include our textbook and supplements created for our course (marked in boldface below and available on Quercus). Chapter numbers reference our textbook and any exclusions are noted. We finish through Chapter 11 in the Fall term and the rest in the Winter term.

- ***Prerequisite Review for ECO220Y1Y, 2023/24*** pages 1 - 42
- ***The DACM Handbook for ECO220Y1Y, 2023/24*** pages 1 - 182
- Chapter 1: *An Introduction to Statistics*
- Chapter 2: *Data*
- Chapter 3: *Surveys and Sampling*
- Chapter 4: *Displaying and Describing Categorical Data*
- Chapter 5: *Displaying and Describing Quantitative Data*
- Chapter 6: *Scatterplots, Association, and Correlation*
- SW11: Chapter 1, *Economic Questions and Data* pp. 1 - 13 from *Introduction to Econometrics, Third Ed.*, 2011, by James H. Stock and Mark W. Watson
- Chapter 7: *Introduction to Linear Regression*
- ***Logarithms in Regression Analysis with Asiaphoria for ECO220Y1Y, 2023/24*** pages 1 - 27
- Chapter 8: *Randomness and Probability*
- Chapter 9: *Random Variables and Probability Distributions* (Excluding Sections 9.7 *The Poisson Distribution*, 9.12 *The Exponential Distribution*, and "Normal Probability Plots" pp. 280-2)
- ***Normal Table: Read it, Use it for ECO220Y1Y, 2023/24*** pages 1 - 14
- Chapter 10: *Sampling Distributions*
- Chapter 11: *Confidence Intervals for Proportions*
- Chapter 12: *Testing Hypotheses About Proportions*
- Chapter 13: *Confidence Intervals and Hypothesis Tests for Means*
- Chapter 14: *Comparing Two Means*
- Chapter 18: *Inference for Regression* (Excluding "How does the Normal probability plot work?" pp. 607-8)
- Chapter 19: *Understanding Regression Residuals*
- Chapter 20: *Multiple Regression*
- Chapter 21: *Building Multiple Regression Models* emphasizing Sections 21.1 *Indicator (or Dummy) Variables*, 21.2 *Adjusting for Different Slopes – Interaction Terms*, and *Quadratics* (online) (Excluding "Residuals and Standardized Residuals" and "Influence Measures" pp. 737-9)

Also, an optional (and recommended) reading, is "Belief in the Law of Small Numbers" by Amos Tversky and Daniel Kahneman published in 1971 in *Psychological Bulletin* (**TK71**).[3]

[3]This is an academic journal article co-authored by a winner of the Nobel prize in economics.