

ECO220Y1Y, Test #1, Prof. Murdock

October 28, 2022, 9:10 – 11:00 am

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Instructions:

- You have 110 minutes. Keep these test papers and the *Supplement* closed and face up on your desk until the start of the test is announced. You must stay for a minimum of 60 minutes.
- You may use a **non-programmable calculator**.
- There are 8 questions (some with multiple parts) with varying point values worth a total of 95 points.
- This test includes these 8 pages plus the *Supplement*. The *Supplement* contains the aid sheets, readings, figures, tables, and other materials for the test questions. For each question referencing the *Supplement*, carefully review *all* materials. **The *Supplement* will NOT be collected:** write your answers on these test papers. When we announce the end of the test, hand these test papers to us (you keep the *Supplement*).
- Write your answers clearly, completely, and concisely in the designated space provided immediately after each question. An answer guide ends each question to let you know what is expected. For example, a quantitative analysis, a fully labelled graph, and/or sentences. Any answer guide asking for a quantitative analysis *always* automatically means that you must show your work and make your reasoning clear.
 - Anything requested by the question and/or the answer guide is required. Similarly, limit yourself to the answer guide. For example, if the answer guide does not request sentences, provide only what is requested (e.g. quantitative analysis).
 - Marking TAs are instructed to accept all reasonable rounding.
- **Your entire answer must fit in the designated space provided immediately after each question.** No extra space/pages are possible. You *cannot* use blank space for other questions, nor can you write answers on the *Supplement*. **Write in PENCIL and use an ERASER as needed** so that you can fit your final answer (including work and reasoning) in the appropriate space. Questions give more blank space than is needed for an answer (with typical handwriting) worth full marks. **Follow the answer guides and avoid excessively long answers.**

(1) See *Supplement for Question (1): Self-Reported Competitiveness in ECO220Y in September 2022*.

(a) [3 pts] Given the histogram of the sample, circle all phrases that offer a reasonable and convincing inference about the shape of the distribution for all ECO220Y students. Answer by circling applicable phrases among the nine given.

- | | | |
|----------------------|-------------------------|------------------------|
| Normal (Bell Shaped) | Positive (right) skewed | Negative (left) skewed |
| Symmetric | Uniform | Weak correlation |
| Unimodal | Bimodal | Multimodal |

(b) [7 pts] Complete the Stata summary below. Answer by writing 17 numbers on the lines in the output below.

competitiveness				

	Percentiles	Smallest		
1%	_____	_____		
5%	_____	_____		
10%	_____	_____	Obs	489
25%	_____	_____	Sum of Wgt.	489
50%	_____		Mean	6.985685
		Largest	Std. Dev.	2.073891
75%	_____	_____		
90%	_____	_____	Variance	4.301024
95%	_____	_____	Skewness	-.9508847
99%	_____	_____	Kurtosis	4.003977

(2) [5 pts] See *Supplement for Question (2): The Programme for International Student Assessment (PISA)*. What is the coefficient of correlation between the math scores and the science scores? Answer with a quantitative analysis.

(3) See *Supplement for Question (3): Penn World Tables 10.0 (PWT 10.0)*.

(a) [9 pts] For `r_2000_10_round`, draw the box plot. Descriptively label and title it. Answer with a fully labelled graph.

(b) [8 pts] How does the variable named `r_2000_10` relate to the publicly posted PWT 10.0 data, which has a format like `asiap_pwt_100_all.xlsx`? *Explain*, including how `r_2000_10` is created. Answer with 2 – 4 sentences.

(4) See *Supplement for Question (4): Survey in ECO220Y in September 2022*.

(a) [9 pts] A researcher creates a dummy variable for each quality to add to the raw data and ready it for analysis. Sketch the data, with the dummies, and use “...” to skip the middle parts. (Remember that data look like a spreadsheet and are comprised of variables and observations.) Next, explain whether these are cross-sectional, time series, or panel data and state the number of observations and variables. Answer with a sketch of the data & 1 – 2 sentences.

(b) [4 pts] The mean of the dummy variable for “Tolerance and respect for other people” is 0.6585. What is the approximate standard deviation of this dummy variable? Show your work. Answer with a quantitative analysis.

(5) See *Supplement for Question (5): Fictional Money, Real Costs*.

(a) [5 pts] For “a 10 percentage point increase in the share of monetary themed questions,” create a *specific numeric example* of such a change *in this context*. Specify the total number of questions on your imagined exam. Further, for your specific numeric example, also give the relevant *percent* increase. Answer with 1 – 2 sentences.

(b) [7 pts] Given the excerpts, which kind of data do the researchers use: observational or experimental? *Explain* and state the relevant y (dependent) variable and the relevant x (explanatory) variable. Answer with 2 – 3 sentences.

(6) [12 pts] See **Supplement for Question (6): PISA: Australia and Portugal**. On one pair of axes, graph the OLS results for Australia and Portugal, creating one useful figure to summarize the results. Next, *interpret* the *slope coefficients* for both regressions, including a *comparison*. Answer with a fully labelled graph, a quantitative analysis & 2 – 3 sentences.

(7) [12 pts] See *Supplement for Question (7): WFH (Working from Home) Around the World*. Given **Figure 9** and the excerpts, what is the **approximate mean percent difference in productivity relative to expectations**? Next, what is the *interpretation* of that value? Answer with a quantitative analysis & 2 – 3 sentences.

(8) See *Supplement for Question (8): Consumer Demand with Social Influences: Evidence from an E-Commerce Platform*.

(a) [8 pts] In **Column (1)** of Table 1, what is the *interpretation* of 0.039? Answer with 2 – 3 sentences.

(b) [6 pts] Continuing, in **Column (2)** of Table 1, what is the *interpretation* of -0.048? Answer with 1 – 2 sentences.

This *Supplement* will NOT be collected or graded: write your answers on the test papers. **Supplement: Page 1 of 4**

This *Supplement* contains the aid sheets, readings, figures, tables, and other materials for some test questions. For each question referencing this *Supplement*, carefully review *all* materials.

Sample mean: $\bar{X} = \frac{\sum_{i=1}^n x_i}{n}$ **Sample variance:** $s^2 = \frac{\sum_{i=1}^n (x_i - \bar{X})^2}{n-1} = \frac{\sum_{i=1}^n x_i^2}{n-1} - \frac{(\sum_{i=1}^n x_i)^2}{n(n-1)}$ **Sample s.d.:** $s = \sqrt{s^2}$

Sample coefficient of variation: $CV = \frac{s}{\bar{X}}$ **Sample covariance:** $s_{xy} = \frac{\sum_{i=1}^n (x_i - \bar{X})(y_i - \bar{Y})}{n-1} = \frac{\sum_{i=1}^n x_i y_i}{n-1} - \frac{(\sum_{i=1}^n x_i)(\sum_{i=1}^n y_i)}{n(n-1)}$

Sample interquartile range: $IQR = Q3 - Q1$ **Sample coefficient of correlation:** $r = \frac{s_{xy}}{s_x s_y} = \frac{\sum_{i=1}^n z_{x_i} z_{y_i}}{n-1}$

SIMPLE REGRESSION:

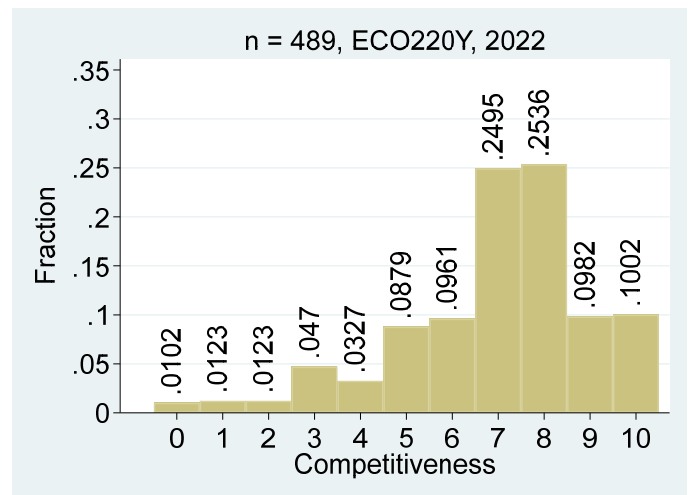
OLS line: $\hat{y}_i = b_0 + b_1 x_i$ $b_1 = \frac{s_{xy}}{s_x^2} = r \frac{s_y}{s_x}$ $b_0 = \bar{Y} - b_1 \bar{X}$

Residuals: $e_i = y_i - \hat{y}_i$ **Standard deviation of residuals:** $s_e = \text{Root MSE} = \sqrt{\frac{SSE}{n-2}} = \sqrt{\frac{\sum_{i=1}^n (e_i - 0)^2}{n-2}}$

$SST = \sum_{i=1}^n (y_i - \bar{Y})^2 = SSR + SSE$ $SSR = \sum_{i=1}^n (\hat{y}_i - \bar{Y})^2$ $SSE = \sum_{i=1}^n e_i^2 = \sum_{i=1}^n (y_i - \hat{y}_i)^2$

$s_y^2 = \frac{SST}{n-1}$ **Coefficient of determination:** $R^2 = (r)^2 = \frac{SSR}{SST} = 1 - \frac{SSE}{SST}$

Supplement for Question (1): During the second workshop, recall the survey question asking students to self assess how competitive they are on an integer scale from 0 (least competitive) to 10 (most competitive). The relative frequency histogram to the right summarizes results for the students participating in Prof. Murdock’s sections of ECO220Y in September of 2022. There are three other sections of ECO220Y, with similar students, taught by a different professor. The number above each bar tells its height.



Supplement for Question (2): Recall the Programme for International Student Assessment (PISA). Roughly every three years, it administers standardized tests in the subjects of reading, math, and science in many countries. Using 2018 data from the OECD website for 40 countries, consider the variance-covariance matrix below.

	reading	math	science
reading	1130.66		
math	1234.93	1610.49	
science	1099.72	1299.42	1152.55

This *Supplement* will *NOT* be collected or graded: write your answers on the test papers. **Supplement: Page 2 of 4**

Supplement for Question (3): Recall the Penn World Tables (PWT), Version 10.0. DACM gives two datasets related to it: `asiap_pwt_100_all.xlsx` and `asiap_rates_pwt_100.xlsx`. The tabulation below is for a variable that rounds the variable named `r_2000_10` in `asiap_rates_pwt_100.xlsx` to the nearest second decimal place. In the readme tab, `r_2000_10` is labelled as the “Estimated annual growth rate of GDP per capita from 2000 to 2010.”

r_2000_10_round	Freq.	Percent	Cum.
-.02	2	1.41	1.41
-.01	4	2.82	4.23
0	12	8.45	12.68
.01	28	19.72	32.39
.02	23	16.20	48.59
.03	30	21.13	69.72
.04	20	14.08	83.80
.05	9	6.34	90.14
.06	9	6.34	96.48
.07	3	2.11	98.59
.08	1	0.70	99.30
.09	1	0.70	100.00
Total	142	100.00	

Supplement for Question (4): In a workshop, 489 people answered two questions in an anonymous survey. The first asked for self-assessed competitiveness on a scale from 0 to 10 and the second asked about eleven possible qualities:

Here is a list of qualities that children can be encouraged to learn at home. Which, if any, do you consider to be especially important? Please choose up to five!

- Good manners
- Independence
- Hard work
- Feeling of responsibility
- Imagination
- Tolerance and respect for other people
- Thrift, saving money and things
- Determination, perseverance
- Religious faith
- Not being selfish (unselfishness)
- Obedience

In the raw data, the answer is coded as one variable with each choice separated with “;”. For example, its value for one specific student is “Independence;Hard work;Determination, perseverance;Imagination;Feeling of responsibility;”.

Supplement for Question (5): In a 2022 article “Fictional Money, Real Costs: Impacts of Financial Salience on Disadvantaged Students,” the authors study how students from disadvantaged backgrounds perform on math questions with a monetary theme versus another theme. For example, “What is the mean of \$242, \$634, and \$421 for three charitable donations?” is a question with financial salience – a noticeable theme related to money – whereas “What is the mean of 242, 634, and 421 cars for three parking lots?” does not. Below are select excerpts.

Excerpts: Disadvantaged students perform differentially worse when randomly given a more financially salient mathematics exam with higher shares of monetary themed questions. I exploit the random assignment of exam booklets to students as there is variation in the proportion of monetary questions across booklets. For students with socioeconomic indicators below the national median, a 10 percentage point increase in the share of monetary themed questions depresses exam performance by 0.026 standard deviations.

Supplement for Question (6): For the Programme for International Student Assessment (PISA), focus on reading and the countries of Australia and Portugal. For each of these two countries the mean reading score is recorded for the years of 2000, 2003, 2006, 2009, 2012, 2015, and 2018. A variable named reading is the mean reading score in each year for each country. A variable named year takes the values 2000, 2003, 2006, ..., 2018. Consider the two OLS regressions below.

Australia: $\text{reading-hat} = 3384.143 - 1.428571 \cdot \text{year}$, $n = 7$, $R\text{-squared} = 0.9105$

Portugal: $\text{reading-hat} = -2433.976 + 1.452381 \cdot \text{year}$, $n = 7$, $R\text{-squared} = 0.7854$

Supplement for Question (7): A 2022 NBER Working Paper is titled “Working from Home Around the World.” Consider the excerpts and Figure 9 below. The authors abbreviate “working from home” as WFH.

Excerpt, p. 1: We field a new *Global Survey of Working Arrangements* (G-SWA) in 27 countries. The survey yields individual-level data on demographics, earnings, current WFH levels, employer plans and worker desires regarding WFH after the pandemic, perceptions related to WFH, and more. Thus far, we have fielded the survey online in two waves, one in late July/early August 2021 and one in late January/early February 2022.

Excerpt, p. 15: We put the following question to G-SWA participants who mainly worked from home at some point during the pandemic: “Compared to your expectations **before COVID (in 2019)** how has working from home turned out for you?” Response options are as follows:

- Hugely better – I am 20%+ more productive than I expected
- Substantially better – I am to 10% to 19% more productive than I expected
- Better – I am 1% to 9% more productive than I expected
- About the same
- Worse – I am 1% to 9% less productive than I expected
- Substantially worse – I am to 10% to 19% less productive than I expected
- Hugely worse – I am 20%+ less productive than I expected

Excerpt, p. 46: Figure 9 [below] summarizes a sample of 19,027 G-SWA respondents in mid 2021 and early 2022 who worked mainly from home at some point during the COVID-19 pandemic.

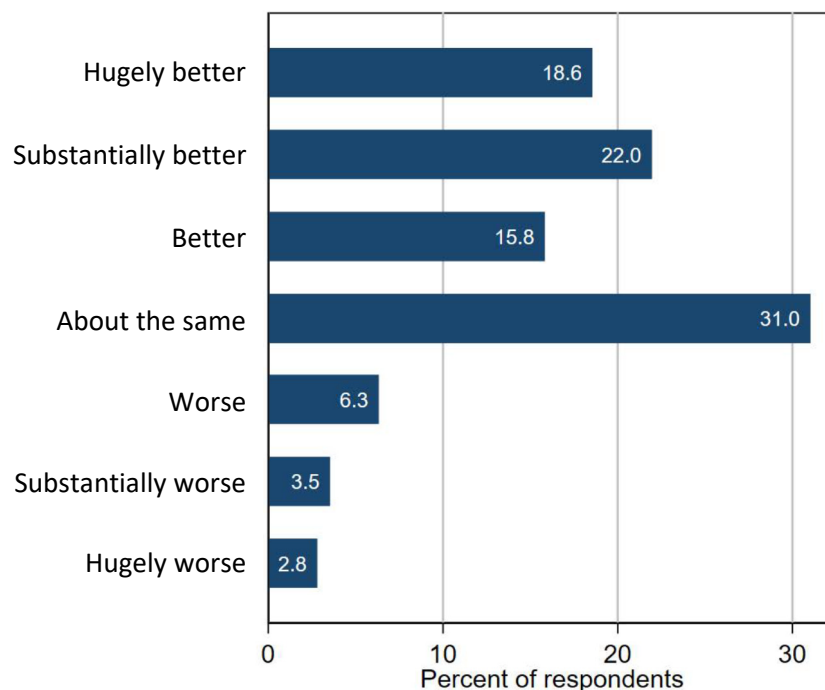


Figure 9. The Distribution of WFH Productivity Relative to Expectations

Supplement for Question (8): Consider a 2022 NBER Working Paper titled “Consumer Demand with Social Influences: Evidence from an E-Commerce Platform.” See the excerpt below. Also, read a brief explanation of how quantity is measured. Finally, see Table 1, making sure to read the notes below Table 1.

Excerpt, p. 2: We exploit a sale of outdoor slippers, or “slides,” shown to the right. These were customized by Ben Baller, a celebrity jeweler popular in the hip hop community. The slides had the expression “Ben Baller did the chain” printed on them. This expression is a lyric from the rapper A\$AP Ferg, who rapped “Ferg is the name, Ben Baller did the chain” on the track “Plain Jane.” In the song, the expression carries a meaning of exclusivity.



The product was offered in two colors – red and black – and in nine different adult sizes, creating nine distinct markets. To sell the slides, Mr. Baller partnered with StockX, an e-commerce platform for branded shoes, handbags, and watches. The slides were sold directly to customers in an auction with a \$50 reserve price. Total quantities for each color and size combination were announced ex ante [which means before the auctions began], and the auctions for each color-size product were run independently. Customers could submit at most one bid for each color-size combination.

The red slide was considerably rarer than the black slide. The rareness of the red slide was not due to any anticipated difference in demand or difference in production cost for red versus black, which both cost \$30 to manufacture. In fact, Mr. Baller reportedly did not know beforehand which color would prove more popular. The product had never been sold before making it unlikely that inventory levels by shoe size and color were optimized.

The quantity of slides offered for each color and size combination is known. For example, there were 100 pairs of black slides in size 10 offered. For another example, there were 50 pairs of red slides in size 10 offered.

Table 1: Effect of Rarity on Bids

	<i>Dependent variable: Bid (log)</i>			
	(1)	(2)	(3)	(4)
Constant	4.577 (0.008)	4.785 (0.047)	4.744 (0.068)	
Red (indicator)	0.039 (0.011)		0.013 (0.016)	0.011 (0.018)
Quantity (log)		-0.048 (0.012)	-0.039 (0.016)	-0.042 (0.022)
Shoe size FE	No	No	No	Yes
Observations	6,467	6,467	6,467	6,467

Notes: Standard errors are in parenthesis. Shoe size FE (fixed effects) are dummies for three size categories: small (5-7), medium (8-10), large (11-13).

Notes from Prof. Murdock: Columns (1) and (2) each report a simple regression (OLS) and a blank cell in a column means that the variable in that row is not included in the regression. You have not yet studied standard errors: those are in grey font, and you may ignore them. Columns (3) and (4) each report a multiple regression (OLS) and you are not asked about those because we have not yet studied multiple regression.