ECO220Y1Y, Test #1, Prof. Murdock

October 5, 2018, 9:10 – 11:00 am

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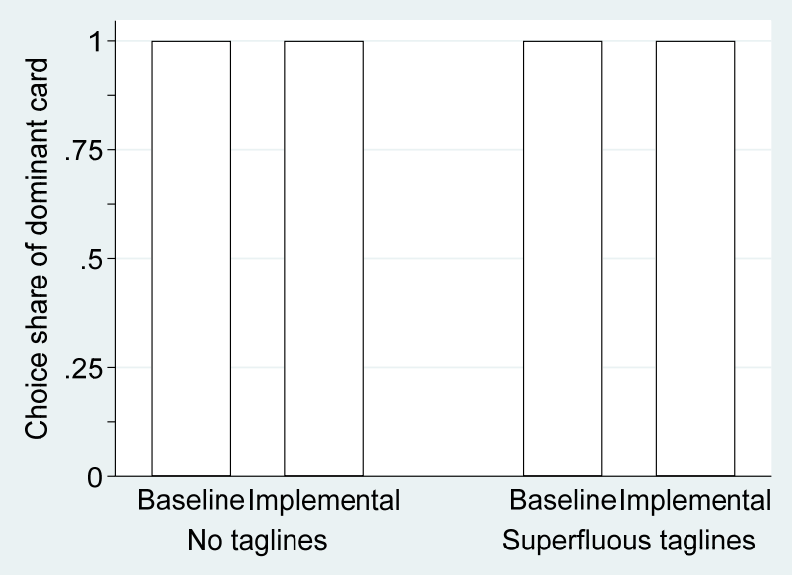
Instructions:

- 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 (most with multiple parts) with varying point values worth a total of 100 points.
- This test includes these 8 pages plus the *Supplement*. The *Supplement* contains the aid sheets (formulas) and readings, figures, tables, and other materials required for some test questions. For each question referencing the *Supplement*, review *all* materials. ***The Supplement will NOT be graded:*** 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 (which shows your work), a fully-labelled graph, and/or sentences.
    - 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). Leave yourself time to complete all questions rather than overdoing some questions and running out of time.
    - What is ***acceptable rounding***? Unlike online quizzes, written tests and exams do not specify high-precision rounding requirements. Marking TAs are instructed to accept all reasonable rounding.
    - For questions with multiple parts (e.g. (a) – (c)), ***attempt each part***.
- ***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)***: *Choosing a Credit Card.*

(a) [6 pts] In the same style as Figure 6, complete the figure below to summarize the results of the **new study**. *Be careful* that your results correspond to the vertical and horizontal axis labels in the figure below. Show your work to the right of the figure. Answer by finishing the figure & showing your calculations.



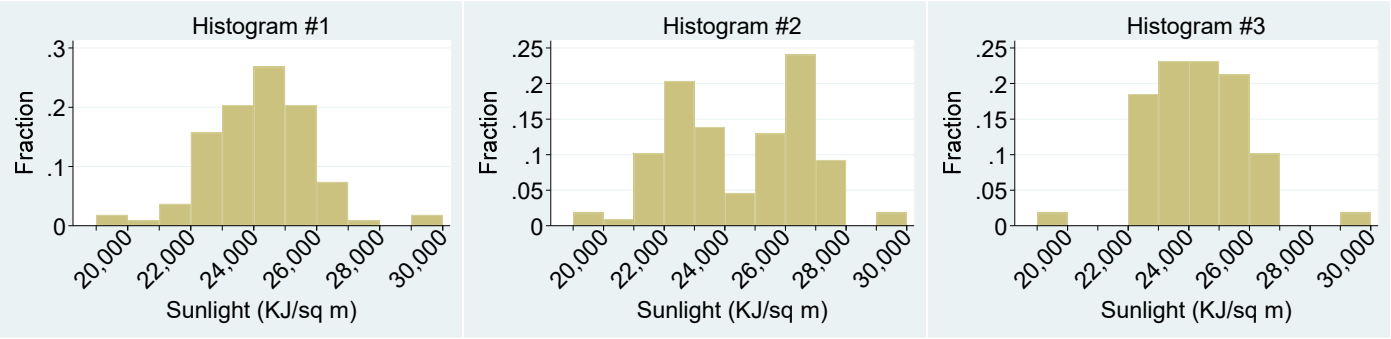
(b) [8 pts] From your Part **(a)** answer, consider the numbers displayed in the bars for superfluous taglines (i.e. the two bars on the right half of the figure). Are those two numbers equally affected by *sampling error*? Explain. Reference the most relevant evidence from the *Supplement*. Answer with 2 – 3 sentences.

(2) [7 pts] A very large survey asks how many siblings (brothers and sisters) each respondent has: 33.52% answer 0, 50.34% answer 1, 14.28% answer 2, 1.80% answer 3, and 0.06% answer 4 siblings. For the variable recording the number of siblings, the mean is 0.8454. What is the *standard deviation*? Answer with a quantitative analysis.

(3) See ***Supplement for Question (3)***: *Sunlight and Protection Against Influenza.*

(a) [8 pts] Recall that the data are panel data with 1,404 observations. Give *one specific example* of a subset of these data where the subset is cross-sectional data. Next, give *one specific example* of a subset of these data where the subset is time series data. For each, use a big subset (i.e. not something with only a few observations) and specify the number of observations and the unit of observation in each of your examples. Answer with 2 precise sentences.

(b) [7 pts] For sunlight in July, use the **close up** boxplot in the *Supplement.* Which *one* of these three histograms is *consistent* with that boxplot? (One is consistent and two can be ruled out.) Explain why you can definitively rule out the other two. Answer by filling in the blank & with 2 sentences explaining why you can rule out the other two.



The histogram that is consistent with the boxplot is _____. We can rule out the other two because:

(c) [6 pts] For June (month 6), consider a histogram of the flu index with 10 bins where the first bin starts at 1 and the first bin ends at 1.9. For a *relative frequency histogram*, what would be the height of the first bar? Use reasonable approximation as needed. Answer with a quantitative analysis & 1 – 2 sentences explaining your rationale.

(4) [7 pts] See ***Supplement for Question (4)***: *Alumni Impact Survey.* Construct a good approximation of the mean age of *all* of U of T's alumni. Is this value $\bar{X}$ or μ? Answer with a quantitative analysis & specify $\bar{X}$ or μ.

(5) See ***Supplement for Question (5)***: *Changes in German Local Business Tax Rates.*

(a) [4 pts] What percent of the sample has a tax rate change ranging from 0 to an increase of 0.5 percentage points? Use reasonable approximation as needed and show your work. Answer with a quantitative analysis.

(b) [4 pts] The **excerpt** (from pages 399 – 400) discusses the size of the tax rate *increases*. What is the corresponding starting tax rate that the authors used? (The starting tax rate is a typical local business tax rate prior to the increase.) Show your work. Answer with a quantitative analysis.

(6) See ***Supplement for Question (6)***: *Growth in real GDP per capita in Mexico.*

(a) [5 pts] What is the equation of the line in the graph titled "Mexico, 2010 and 2012 (PWT 9.0)"? Give clear names to your y and x variables (*not* x and y, but something descriptive) and use reasonable approximation where necessary. Answer with a quantitative analysis & the equation of the line using descriptive variable names.

(b) [8 pts] Find the *slope* of the line in the graph titled "Mexico, 1960 and 1970 (PWT 9.0)." *Interpret* that slope. Next, how do the slopes compare between the two graphs? Carefully taking into account the context, explain what the difference in slopes means. Answer with a quantitative analysis & 2 – 3 sentences.

(7) See ***Supplement for Question (7)***: *Air Pollution in China: PM10.*

(a) [6 pts] What are the values of the summary statistics requested below? *Include the units of measurement of each.* Briefly show your work next to each. Answer with a quantitative analysis, values & units of measurement for each.

Range: _____

Interquartile Range: _____

Coefficient of Variation: _____

(b) [6 pts] State what the Empirical Rule says if the shape of the PM10 distribution were Normal (Bell). Use the relevant numbers from the STATA output *and the context of these data* to state *specifically* what the Empirical Rule would say. (In Part **(c)**, ***NOT*** here, you assess if the rule holds for these data.) Answer with **three** precise statements.

(c) [6 pts] Given the STATA summary of PM10, how well does the Empirical Rule hold? Include specific evidence to support your claim for each of the three parts of the Empirical Rule. Answer with 2 – 3 sentences.

(8) See ***Supplement for Question (8)***: *Jobs for PhD Economists.*

(a) [6 pts] What is the *interpretation* of -9.9409, which is computed as $100 * \left(\frac{194}{21+34+162+194} - \frac{232}{15+26+133+232}\right)$? Answer with 1 sentence.

(b) [6 pts] What is the *interpretation* of 5.1095, which is computed as $100 * \frac{21}{21+34+162+194}$? Why may that number be potentially misleading? Does it overestimate or underestimate what is happening? Answer with 2 sentences.

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

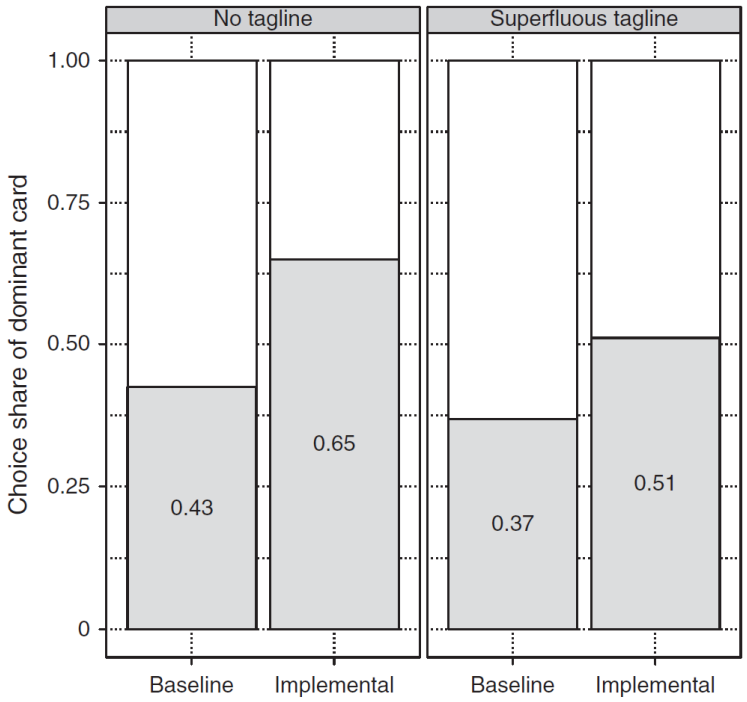
Sample mean: $\bar{X} = \frac{\sum_{i=1}^{n} x_i}{n}$ **Sample variance:** $s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{X})^2}{n-1} = \frac{\sum_{i=1}^{n} x_i^2}{n-1} - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n(n-1)}$ **Sample s.d.:** $s = \sqrt{s^2}$

Sample coefficient of variation: $CV = \frac{s}{\bar{X}}$ **Sample interquartile range:** $IQR = Q3 - Q1$

Supplement for Question (1): Recall Carlin et al. (2017) "Millennial-Style Learning: Search Intensity, Decision Making, and Information Sharing" and **Figure 6** (right). (https://doi.org/10.1287/mnsc.2016.2689) The researchers study peoples' ability to choose the best credit card (*dominant card*) from among four offers. They show a short video (*baseline)* to some participants and a longer video (*implemental*) to others. Additionally, they show the four credit card offers either with misleading ads (*superfluous taglines*) or without misleading ads (*no taglines*).

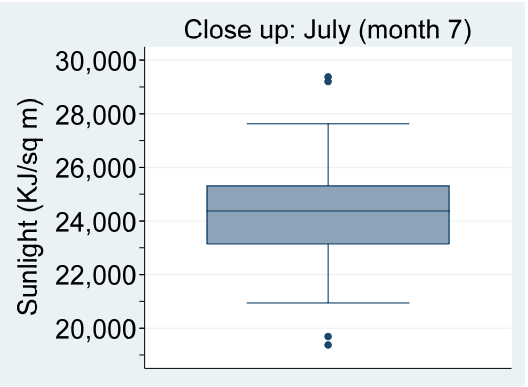
Suppose a student-led research team does a similar study with a sample of 329 participants from Canada. Two cross-tabulations from the **new study** are below. The variable `chosedom` is a dummy variable (=1 if chose the dominant card, =0 otherwise). The variable `video` records which video the participant is shown and `tagline` records whether the participant is shown misleading ads or not.

Figure 6. Choice Proportion of the Dominant Card in Each of the Four Experimental Treatments

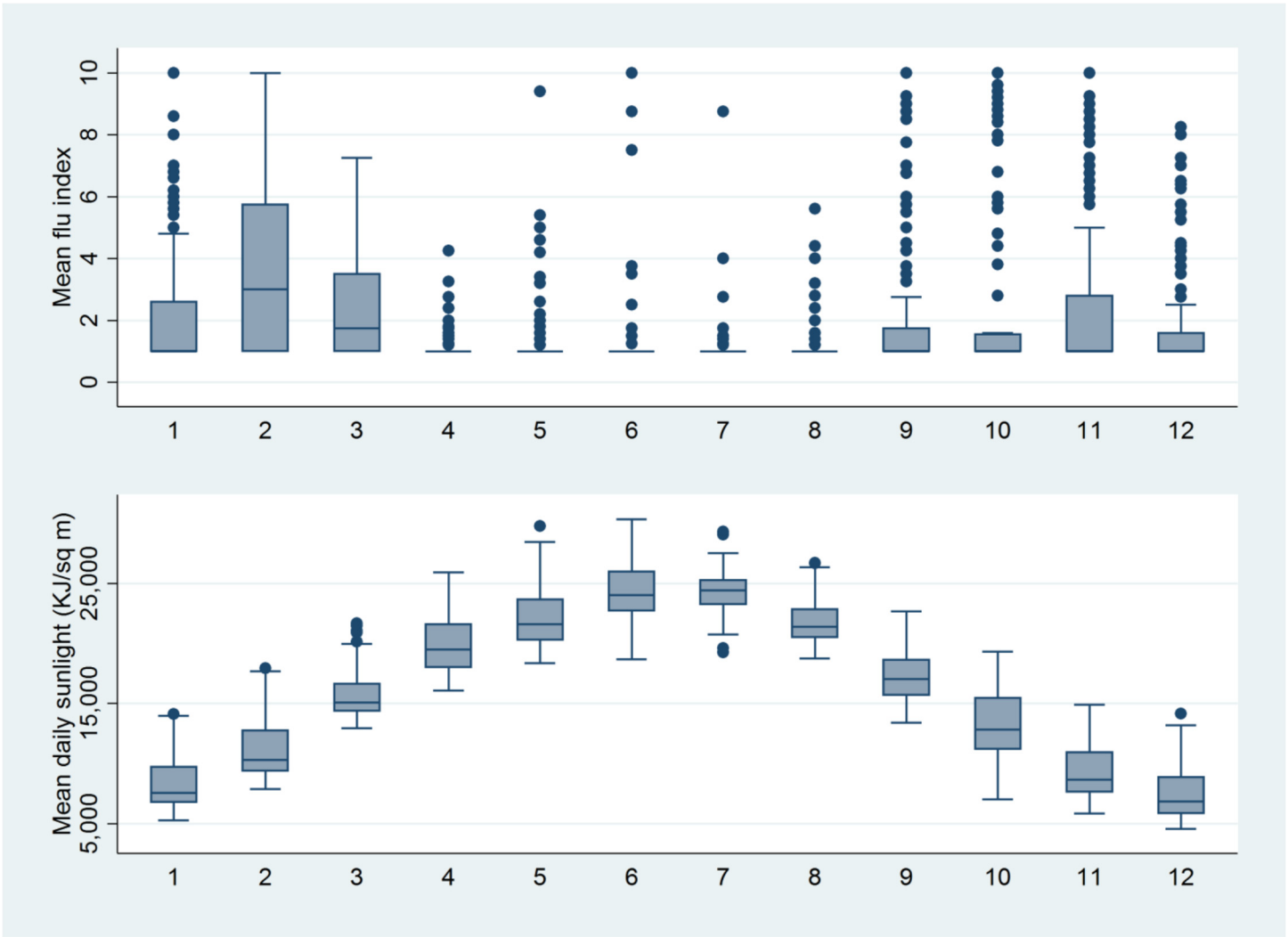



```
-> tagline = No taglines

           |         video
  chosedom |  Baseline    Implemental |     Total
-----------+--------------------------+----------
         0 |        20             46 |        66
         1 |        13             77 |        90
-----------+--------------------------+----------
     Total |        33            123 |       156

-> tagline = Superfluous taglines

           |         video
  chosedom |  Baseline    Implemental |     Total
-----------+--------------------------+----------
         0 |        18             77 |        95
         1 |        15             63 |        78
-----------+--------------------------+----------
     Total |        33            140 |       173
```

Supplement for Question (3): Recall "Sunlight and Protection Against Influenza," a 2018 *NBER Working Paper*, http://www.nber.org/papers/w24340. The authors analyze panel data that covers 36 U.S. states[1] over each of 39 months, starting October 2008 through December 2011, for a total of 1,404 observations (=36*39). Hence, there are 108 observations each for January (month 1), February (month 2), …, September (month 9) and 144 observations each for October (month 10), November (month 11), and December (month 12), which totals 1,404 observations (=9*108 + 3*144). A figure on page 11, reproduced below, summarizes, by month, two key variables in the data: the flu index and daily sunlight. The flu index ranges from 1 to 10 (with 10 being the most severe). Sunlight is mean daily solar radiation (in kilojoules per square meter) in each state and each month. [The vertical axes say mean because, for each month and state, the authors average more finely recorded data, which is at the daily or weekly level and at the county or small geographic grid level.]



NOTE: For July, a **close up** view of the boxplot for sunlight is to the right.



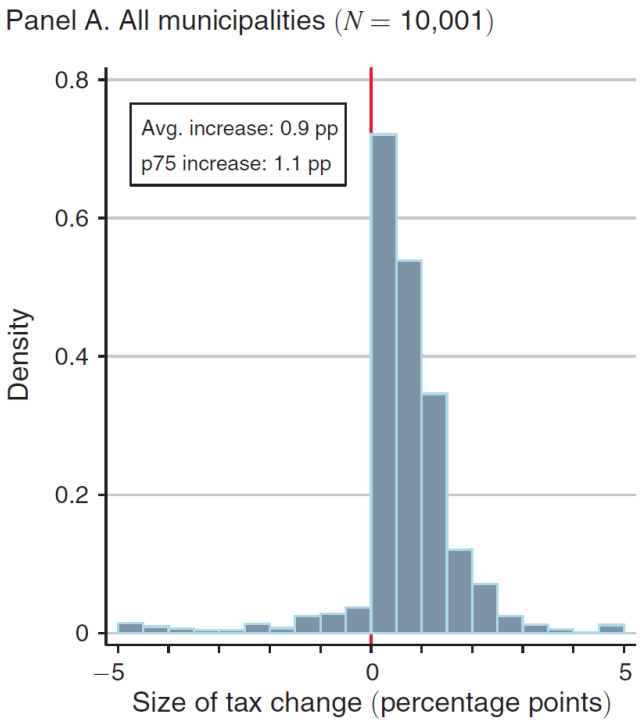
[1] The 36 states are: Alabama, Arizona, California, Colorado, Florida, Georgia, Illinois, Indiana, Kansas, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, West Virginia, Wisconsin, and Wyoming.

Supplement for Question (4): Recall the U of T 2017 Alumni Impact Survey and the "Background & Methodology" section (https://alumni.utoronto.ca/alumni-impact-survey). "The total living U of T alumni population is about 545,000." "The overall response rate was approximately 8% or just over 21,000 respondents." Some tables are given under the heading "Survey Respondents Compared to Alumni Population." One table, investigating the age distribution, is below.

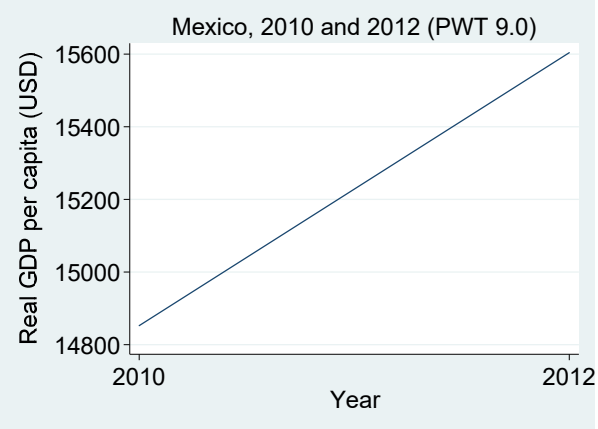
SEGMENT	# COMPLETES	% COMPLETES	% OF ALUMNI POPULATION
20-29	3,243	16.8	14.2
30-39	3,910	20.2	20.3
40-49	3,268	16.9	17.7
50-59	3,132	16.2	16.7
60-69	2,722	14.1	14.7
70+	3,068	15.9	16.1

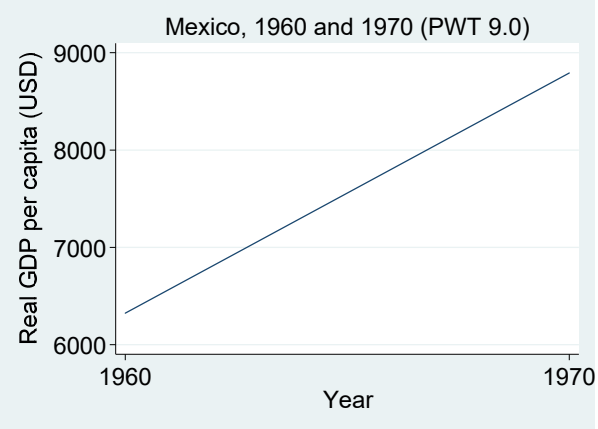
Supplement for Question (5): Consider a 2018 academic journal article "Do Higher Corporate Taxes Reduce Wages? Micro Evidence from Germany" (https://doi.org/10.1257/aer.20130570). An excerpt from Figure 2 "Distribution of Local Business Tax Changes" is to the right. This histogram shows how the German local business tax rate changed from 1993 to 2012 across a sample of municipalities.

> **Excerpt discussing Figure 2 (histogram), pp. 399-400:** [In this sample,] 93 percent of the tax changes are increases. The mean increase is 0.9 percentage points (or 5 percent) and the seventy-fifth percentile of the tax increase distribution is equal to 1.1 percentage points (6 percent).



Supplement for Question (6): The Penn World Tables (PWT) are a major database with some key economic indicators for many countries over many years. The graphs below use PWT 9.0 (released June 9, 2016, DOI: 10.15141/S5J01T). They show real GDP per capita (at constant 2011 national prices in 2011 US dollars) for two pairs of years for Mexico.





Supplement for Question (7): Recall Zheng and Kahn (2017) "A New Era of Pollution Progress in Urban China?" (https://www.aeaweb.org/articles?id=10.1257/jep.31.1.71) and the PM10 measure of air pollution, which is measured in micrograms per cubic meter of air ($\mu g/m^3$). The STATA summary below is for the 85 Chinese cities with PM10 recorded for the year 2010.

```
. summarize pm10 if year==2010, detail;

      Particulate matter conc. (micrograms/cubic meter
                air; diameter<=10 micrometers)
-------------------------------------------------------------
      Percentiles      Smallest
 1%           40             40
 5%           57             45
10%           61             49       Obs                  85
25%           72             51       Sum of Wgt.          85

50%           88                      Mean           87.31765
                        Largest       Std. Dev.      20.86533
75%           99            124
90%          114            126       Variance       435.3622
95%          121            133       Skewness       .2811682
99%          155            155       Kurtosis       3.364796
```

Supplement for Question (8): Consider a September *2018 NBER Working Paper* "Economists (and Economics) in Tech Companies" by Susan Athey and Michael Luca (http://www.nber.org/papers/w25064.pdf). Some excerpts are below.

> **Excerpt, p. 3:** PhD economists have started to play an increasingly central role in tech companies, tackling problems such as platform design, pricing, and policy. Major companies, including Amazon, eBay, Google, Microsoft, Facebook, Airbnb, and Uber, have large teams of PhD economists working to engineer better design choices. For example, led by Pat Bajari, Amazon has hired more than 150 Ph.D. economists in the past five years, making them the largest employer of tech economists. In fact, Amazon now has several times more full time economists than the largest academic economics department, and continues to grow at a rapid pace.
>
> Many tech companies now recruit directly through the American Economic Association's Job Openings for Economists platform, which is where much of the recruiting for PhD economists begins. During the 2017-18 academic year, 21 tech companies were hiring through the JOE website. To put this into context, there are roughly two-thirds as many tech companies hiring through JOE as there are policy schools. Taking into account the fact that many of these companies had multiple positions, the number of positions available for economists in tech companies exceeded those at policy schools. Moreover, [the table below] shows that the number of tech companies with job postings has consistently risen in recent years, in contrast to policy schools (which have gone up and down) and economics departments (which have gone down).

Number of Employers Hiring, By Recruiting Year and By Employer Type				
	Tech companies	Policy schools	Business schools	Economics departments
Feb. 2017 – Jan. 2018	21	34	162	194
Feb. 2016 – Jan. 2017	20	23	149	199
Feb. 2015 – Jan. 2016	18	31	150	218
Feb. 2014 – Jan. 2015	15	26	133	232