Use of Evidence: Explanation of Outcome (c)

(Slide 1) This lecture provides a single, detailed example to illustrate learning outcome (2c), or how to draw inferences from charts and tables. The example by itself is reasonably straightforward, but it will be worthwhile to take the time to work through thoroughly.

(Slide 2) On July 29, 2011, David Faber interviewed Tad Rivelle, the CIO of Fixed Securities at TCW, an investment management firm, on the program Strategy Session, which airs on the cable network CNBC. To provide some context for this interview, 2011 was deep into the Great Recession that had been brought about by the bubble in real estate prices. Republicans in Congress, led by the recently elected Tea Party supporters, had grown worried by the growth in US Federal debt, and had threatened not to raise the cap on federal borrowing; if the cap was not raised, then the US government risked defaulting on its public debt, something that never before happened. The bond ratings agency Standard and Poor's had then warned that a default would likely result in the government losing its top-level bond rating, known as a Triple-A rating, which would in turn make it more expensive for the government to borrow more money and service its existing debt.

Rivelle had been asked whether a downgrade in US credit-worthiness was more likely that a default on federal debt obligations, and what the results of such a default would be. He answered that a downgrade may not of itself be of much significance to market participants, because it simply reflected the underlying economic fundamentals of federal finance. To support his point, he provided an argument that hinged upon a particular piece of evidence, which he quoted in the form of the ratio public-debt-to-GDP, or gross domestic product. He said that this ratio was no longer favorable for the US as compared to other Triple-A-rated countries such as Germany, and added that this ratio was no longer consistent with a Triple-A rating. Put differently, America no longer deserved to have a Triple-A rating, so having Standard and Poor's downgrade the US to Double-A would simply be an admission of facts that the market already knew, and consequently wouldn't be terribly significant in itself.

(Slide 3) Let's now look at one of the charts that CNBC displayed on screen during this segment of the interview. The chart wasn't discussed specifically, and viewers were expected to be able to read and interpret the chart while listening to Rivelle make his argument. Viewers would have to be rather adept at reading charts to do this, much like a driver must be able to read street signs while negotiating heavy traffic: someone who is barely literate will have trouble doing this, but someone who can glance at a sign and immediately get its meaning may not even realize that he is reading at all. It's just second nature. Similarly, someone who wants to understand current business news should be able to read a chart like this by simply glancing at it.

This particular chart is somewhat complex in several ways. Here's how the quantitatively literate person would read it. The graphic charts two different quantities. The horizontal axis is the same for both, so you can read the value of both quantities for any given date by picking a year and moving your eyes upward from the horizontal axis. However, the two quantities are measured in different units, so a secondary vertical axis is required. If you want to know the value of federal surplus or deficit, you find the red line for the year in question and look to the left axis to read the value of the line at that point in time. On the other hand, if you want this quantity divided by GDP, you need to read the value of the blue line on the right axis. Since the former quantity is measured in billions of dollars and the latter as a percent, this chart is really two charts overlaid on one another in such a way as to make comparisons of the two lines easier. This is the first challenge for the viewer, to identify the type of chart that is being presented, and the best way to do this is to be familiar with common ways that evidence is represented graphically.

(Slide 4) Once you recognize the chart type, the next challenge is to make sense of the quantities themselves. Federal surplus or deficit is represented in the legend with a slash mark, which may seem ambiguous since slash marks are also used to indicate division. But here the meaning is that positive values of this quantity indicate surpluses, and negative values deficits. To recognize this, you need to understand the meaning of the words "deficit" and "surplus," in particular that a deficit is the same thing as a negative surplus. This is discipline-specific knowledge, and not something that a person who is a good critical thinker could be expected to know if they knew nothing about finance.

The other quantity, in contrast, actually is a ratio, or a quantity that results from the process of division, but the way you know this from the legend is by the phrase "as a percentage of." A percent is a way of representing a ratio. This is mathematical knowledge, in particular basic arithmetic. Some charts will presume sophisticated mathematical knowledge, but most won't.

(Slide 5) It's important when you're studying examples to think about what kind of knowledge is being called upon at different points, because when you're having trouble solving a problem on your own, you often need to explicitly ask yourself where you're having trouble. The last slide illustrated three common types of knowledge: general purpose skills (such as critical thinking skills), background knowledge (such as mathematical tools), and discipline-specific knowledge. If you don't know enough about the discipline you're studying, then your strategy should be very different than if you're having trouble thinking in the discipline (which may result from poor critical thinking skills). Often students assume that when they hit a road block, they just need to look up the answer, but if you're having trouble reasoning to an answer, then trying to simply look it up won't work. Easy access to the internet, with its wealth of occasionally reliable information, just makes this common tendency among students worse.

(Slide 6) Getting back to our example, the interesting thing about this ratio is that its numerator is the surplus or deficit, that is, the quantity that is charted by the other line. (Recall the terminology given in the lower right-hand corner: in a ratio, the top number is the numerator and the bottom number is the denominator.) So the two lines represent <u>deficit</u> and <u>deficit over GDP</u>.

(Slide 7) It would be possible from this information to add another line that gave the value of the national GDP (it would be easier if you could draw a third axis on the page). The table shown here illustrates how this would be done. It uses made-up numbers, but ones that are of the same general magnitude as the real numbers during the two decades shown on the CNBC chart. More important than the numbers, which are merely for illustration, are the equations at the bottom of the screen. If the ratio of deficit to GDP is called simply "ratio," then GDP can be calculated from this number and the deficit as shown. Since the GDP is always positive, the ratio is negative when its numerator, the federal surplus, is negative (that is, when the government is operating at a deficit), and positive otherwise. Feel free to pause the lecture here if you want to take notes.

(Slide 8) On the original CNBC chart, the first thing to observe is that the ratio tracked the surplus very closely from 1990 until the financial crisis hit around 2007; there had been some increase in the spread (or distance between the lines) around 2002, but after about five years this spread increased substantially. For purposes of understanding Rivelle's argument, all the viewer needs to notice is that when the crisis hit, the deficit increased faster than the ratio.

From a financial perspective, the ratio of federal debt to GDP is a measure the government's ability to pay its obligations. GDP represents the total productivity of the US economy, and since the government can increase taxation if it wants to, the GDP is an approximate measure of the possible revenue that the government can earn. Of course, if the government could collect everything made in the country, no one would bother making anything, but very approximately we could think of this ratio as being similar to the ratio of indebtedness to income for n individual. The lower this ratio, the more credit-worthy the person is: that is, the more likely the person will be able to repay his debts. Looked at the other way, the greater a person's indebtedness, the greater the portion of his income that goes to paying off existing debt, and if his earnings decrease, the greater his indebtedness, the greater the chance that he won't be able to pay his debt. When the government runs a deficit, this means it is spending more than it is earning. Deficits are funded by debt – that's the relation between these two concepts.

(Slide 9) The last slide addressed two issues. The second was disciplinary background: it explained what GDP is, and the significance of the deficit-to-GDP ratio. Before that, however, the shape of the chart was discussed, and the language used was carefully chosen. The reason for this is as follows. Whenever you look at a chart, you need to think about three things: the underlying content that's being charted (in this case what "deficit" and "GDP" mean), how the method of charting reflects the relations that the chart displays, and the underlying relationship between the various elements of content. We said that the spread between the two lines increased around 2002, but grew much more pronounced five years later. These both reflect relationships between the content elements. But we specifically didn't say either that the two lines were essentially overlapping before 2002, or that the deficit was greater than the ratio after 2007, because neither of those claims would be true. Both would simply be a result of how the chart was drawn. That the spread increased would be true however the chart was drawn, but whether one line is above or below the other, or by how much, is just a function of the presentation of the data, not the data themselves.

(Slide 10) To see how this is the case, we have redrawn the CNBC chart as accurately as we could, in the chart at the top of the slide, and again in the chart below, but with different minimum and maximum values on the left, vertical axis. In the original chart, the maximum value was $600 billion and the minimum was -$1.8 trillion, so the distance between them was $2.4 trillion (subtracting the minimum from the maximum). In the second chart, the values of each data point are the same, but the distance between minimum and maximum is only $1.8 trillion. The result of this is to pull the solid, red line up on the chart relative to the dotted, blue line which stays in the same place. Thus points at which the two lines overlapped on the upper chart no longer do on the lower chart, but, as you can see by identifying the values for a given year, both charts use exactly the same data.

(Slide 11) The same point could be made by narrowing the distance between minimum and maximum on the right-hand axis, which goes from 10% to -30% on the original chart (given above on this slide), but from 5% to -25% (given below on this slide). If you're familiar with how charts get drawn, you could visualize these relationships by raising or lowering one line or the other in your mind, and stretching it out so the distance from a peak to a trough on the line takes up more distance in inches than it did in the original. When you're reading, you could go to a computer program like Excel (which was the program used to produce these charts), redraw the original chart, and then manipulate it, but that would be a lot of work. It's easier to learn how to make these changes in your mind.

(Slide 12) Even weirder is what you see in the lower chart on this page. Here the right axis has been manipulated so that the solid line, which was generally above the dotted line in the original chart, is now below it. Here you can see very clearly that many of the relationships between the lines don't have anything to do with the data, or evidence, that they represent, but only with how that evidence is represented. Note that earlier, when we said that the spread increased after 2007, that was not technically correct, as this chart illustrates.

(Slide 13) Really what we should have said is, if the chart is drawn so that the distance between the lines before 2002 is minimal, then the spread increases dramatically after 2007. The reason we emphasized that point is that it does illustrate a real fact about the underlying evidence, and in fact <u>the</u> point that Rivelle was making. The federal deficit got significantly bigger, as compared to GDP, after the financial crisis began. This could have been demonstrated, as in the present slide, just with one line and not two. But using a chart with two, overlapping data sets had two advantages. First, it allowed the viewer to quantify the size of the deficit: by reading the left-hand axis, you can see in dollar terms how big the deficit has become. And second, by drawing the chart so that the two lines largely overlapped until the crisis began, it emphasized the point that the deficit had grown <u>relative to</u> GDP. If only the ratio is charted, then the eye notices the variations in its value before 2007. If both lines are charted, then the eye is drawn not to the change over time but rather to the spread between the lines after 2007.

(Slide 14) The chart is successful because the critical reader of quantitative evidence immediately sees the point that is being emphasized. Trying to explain how one sees this is a complex endeavor, as this lecture illustrates, but then again, it would take an equally long lecture to explain how traffic signs work, and how the literate driver reads them, even though the literate driver simply looks at the sign and knows its meaning. If you're one of the many people who are not yet comfortable with reading quantitative evidence presented in visual form, you'll find that your life in college (and beyond) gets much easier when you begin to develop your quantitative reasoning skills.