Seasonal Adjustment

Data are smoothed when they exhibit a strong seasonal pattern. Seasonal adjustment enables better comparison by removing the seasonal trend.

Many statistics are routinely seasonally adjusted. We use the unemployment rate an example of what seasonal adjustment does and how it works.

We use a powerful Excel tool called a *PivotTable* (notice that Microsoft does not use a space between the two words). Introduced in 1994 in Excel 5.0, Microsoft's Help says that PivotTables are "an interactive way to quickly summarize large amounts of data."

An Example

We begin by getting seasonally adjusted (SA) and not seasonally adjusted (NSA) versions of the unemployment rate.

$STEP$ In a blank sheet, search FRED for *unemployment rate* and select the two top hits. Click *Add Series ID* and close the search box.

Excel enters UNRATE and UNRATENSA in the top row of your spreadsheet. These are both measures of the unemployment rate, but one is seasonally adjusted and the other is not. How do they compare?

$STEP$ Download data for both series and make two separate charts.

It is easy to see that the UNRATENSA chart is much more jagged than the UNRATE chart. The raw, unadjusted unemployment rate is always higher in the winter and summer and falls quite a bit in the last quarter as retail sales increase.

We can see this seasonal pattern more clearly by looking at the unemployment rate for each month. To do this, we need to prepare the data and then make a PivotTable.

Our strategy is to use Excel's TEXT function to extract the month from each date. Recall from the previous section that Excel stores dates as numbers. You see 1/1/1948, but Excel has 17533 (the number of days since January 1, 1900) in its memory. We can apply many different date formats to display this number as a date, such as just the year (yyyy) or the month-year (mmm-yy).

Excel's TEXT function converts numbers to text and this allows us to display the month in each date value. We use mmm as the format code.

STEP In cell E7 enter the label *Month* and in cell E8 enter the formula =TEXT(A8,"mmm"). Fill it down.

Excel displays the months for each date value in column A. Notice that it does this to cell A8 also, which is in its raw number form.

We use the same strategy to extract the year.

STEP In cell F7 enter the label *Year* and in cell F8 enter the formula =TEXT(A8,"yyyy"). Fill it down.

Similar to the previous step, Excel displays the year for each date value in column A. As before, it does this to the number in cell A8 also.

STEP Change cell B7 to SA and D7 to NSA.

We are now ready to compute the average unemployment rate for each month. We could use formulas to do this, but a PivotTable does it in seconds.

STEP Go to the *Insert* tab in the *Ribbon*. Click the | PivotTable | button in the top left.

Excel displays the Create PivotTable dialog box. It may have pre-populated the Table/Range field, but this is probably wrong.

STEP In the Table/Range field, select the cell range from A7 to column F and the bottom row of your downloaded data. The range should look like this: Sheet1!$A$7:$F$915 (although your bottom row may be bigger).

$STEP$ Click the New Worksheet radio button and click OK.

Excel inserts a new sheet in your workbook. On the right is a context-sensitive area that pops up whenever you are in a PivotTable and an empty PivotTable in columns A, B, and C.

Different versions of Excel have different PivotTable interfaces so you may need to adjust the instructions below. Do not be passive—search the internet or use generative AI (such as ChatGPT) to figure out how to work with PivotTables on your version of Excel.

$STEP$ You may be able to just click the *Month* variable listed on the right of your screen or you may have to click and drag down to the *Rows* area below the listed variables.

Excel adds the *Month* variable to the PivotTable, creating a list of months in column A.

$STEP$ Click *NSA* or click and drag *NSA* into the *Values* area.

Excel adds the *NSA* variable, but we do not want the sum (which is the default). We want the average for each month.

$STEP$ Click on the *Sum of NSA* in the *Values* area (bottom left of your screen) and select *Value Field Settings*. In the dialog box that pops up, select the *Average* (instead of the default *Sum*) and click *OK*.

The average unadjusted unemployment rate (UNRATENSA) for each month is now displayed. This is a one-dimensional cross tabulation (crosstab).

Notice that the values are higher in the winter months, fall, then go up again in June and July, before falling again at the end of the year. This is happening because of seasonality in the unemployment rate.

$STEP$ Repeat this procedure for *SA*. In other words, add *SA* to the table and then change it from *Sum* to *Average* via the *Value Field Settings*.

Notice that the SA column (the seasonally adjusted unemployment rate) is much more stable across the months. It has had the seasonal component removed and the data are smoothed.

A chart will make this crystal clear.

$STEP$ Select the PivotTable data and insert a *Line* chart (since the x axis is text, this is an appropriate chart) to reproduce Figure 5.10.

The nearly horizontal line shows how the unemployment rate has been smoothed. The squiggly line shows the persistent pattern inherent in the raw, unadjusted data. The unemployment rate is usually high in the winter, then falls, then pops up again in the summer before falling again the rest of the year.
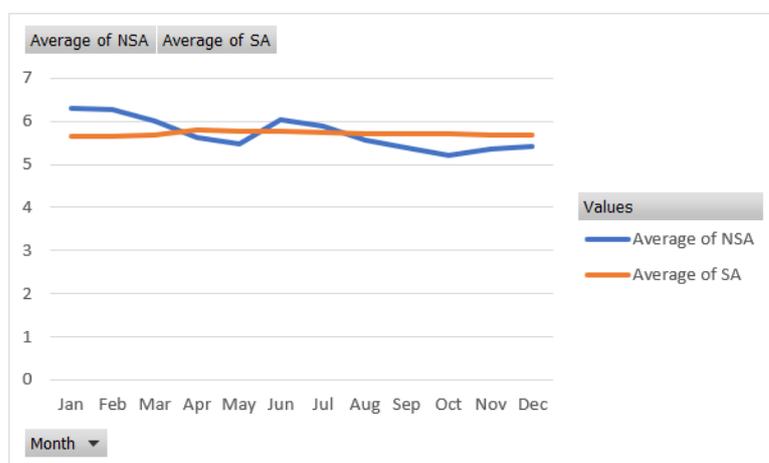
Figure 5.10: Unadjusted and seasonally adjusted monthly average UNRATE.

The Meaning of Seasonal Adjustment

Suppose we used the unadjusted unemployment rate and it was 6.2%, but the month was unknown. We would have a problem correctly interpreting this number. If it was for January, then it seems typical, but if it was for October, we would conclude the economy was struggling because it is higher than usual for October.

Seasonal adjustment solves this problem. If the unemployment rate is seasonally adjusted, we can use it to make a decision for any month. A 6.2% seasonally adjusted rate is not good, no matter the month.

Another way to understand what seasonal adjustment does is to look at the data and compare the two series.

$STEP$ Return to your data sheet and go to row 785. Look at the Oct, Nov, and Dec values in column B versus D.

The BLS has literally inflated (revised upwards) the values in column D to create the values in column B for those months. This is because historically, unemployment is lower in the fall months when retail sales spike and consumer spending increases.

The raw unemployment rate of 7.5% (which is high) in October 2012 is interpreted as actually even worse than that because it is being artificially lowered by the fact that it is October. The BLS corrects for this and bumps it up.

$STEP$ Look a few rows down at Jan 2013.

This time, the BLS lowered the unemployment rate. It was 8.5% unadjusted (which is pretty bad), but the BLS and media report it as 8.0%. This is because January unemployment is always higher than usual so we want to remove that component.

Using adjusted data enables us to make a better comparison of any two months. We do not have to worry about the seasonal pattern baked into the data.

Loose Ends

The overall average unemployment rate for the United States since 1948 is around 7.1% and this is much higher than the 4% to 5% magic number for the unemployment rate. What is going on here?

The answer is that the economy is much more likely to be in recession or even depression with high unemployment than it is to be overheated with extremely low unemployment rates.

It is also true that the few times the unemployment rate is too low, it can only go down a few percentage points below 4%. On the other hand, when the economy crashes, the unemployment rate can and has soared into the double-digit territory.

Another issue that you might be wondering about is exactly how the BLS does the seasonal adjustment. This is an advanced topic beyond the scope of this book. The procedure involves a complicated model. The BLS is transparent about the methodology, which it calls the X-13ARIMA-SEATS Seasonal Adjustment Method, on its website at bls.gov. It would be a challenging and perhaps fun project to replicate the reported adjusted values.

There are many ways to seasonally adjust and different statistical agencies do different things. They are all looking to remove seasonality from data collected at intervals throughout the year.

Discovery

Along with the unemployment rate, labor market experts closely follow the labor force participation rate. Seasonal adjustment is also routinely applied to the LFPR, but do you think it operates the same way? Let's find out.

STEP Your task is to apply the same steps described above to the LFPR to make a chart like Figure 5.10. You will download both the SA and NSA versions of the LFPR, extract the month (using Excel's *TEXT* function), and make a PivotTable of the average LFPR for each month (for both SA and NSA). Finally, you will make a *Line* chart of the two series.

What did you discover—is the seasonal adjustment for LFPR the same or different than the unemployment rate? In what specific ways are they the same or different?

Takeaways

We seasonally adjust variables that vary systematically over the year. For example, construction employment falls in the winter and rises in the summer. Seasonal adjustment would tweak the construction employment numbers higher in the winter and lower in the summer so we can remove the seasonal component and make a better comparison across months.

Seasonal adjustment involves removing the cyclical component of a variable so we get a better reading of what is really going on.

When you hear an unemployment rate in the media, it is almost certainly a seasonally adjusted unemployment rate.

Using seasonally adjusted variables enables better comparison and interpretation.

An Excel PivotTable is a powerful summary tool that enables data exploration and display of relationships in the data.

PivotTables can produce static cross tabs, but they are also a great way to dynamically visualize data. Moving variables around can quickly provide different views of the data.