Diving into Excel's Pivot Tables

Kirsten Rewey, Quantitative Analyst, Minnesota Department of Education

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By the end of this session you should be able to:

- Select data that is appropriate for pivot tables;
- Prepare data for pivot tables;
- Construct a pivot table;
- Edit a pivot table;
- Determine when an additional variable is needed vs. a filter; and
- Construct a pivot chart.

Agenda and Steps

1. Selecting data that is appropriate for pivot tables

a. In order to make a pivot table you need a minimum of 2 columns of data in Excel:
    i. One column of data with limited number of values and there are duplicates
        1. In technical terms, this column contains "nominal" or "ordinal" data
        2. Think of this column as consisting of "buckets" that hold data.
        3. Examples:
            a. Types of furniture: chairs, tables, desks, sofas
            b. Types of fruit: apples, oranges, pineapples
            c. Types of pets: birds, cats, dogs, rabbits
            d. Age groupings: birth to 5, 6 to 14, 15 to 21
            e. Sales groupings: up to $9.99, $10 to $19.99, $20 to $29.99, $30 or more
            f. Credit accrual: 0-29=Freshman; 30-59=Sophomore, 60-89=Junior; 90+=Senior
    ii. One column of data with an unlimited number of values; in fact each cell in the column might have a unique value and no two values may be alike.
        1. In technical terms, this is "interval" or "ratio" data
        2. This would be data that can be added up
        3. Examples
            a. Cost of items
            b. Number of pets in a home
            c. Income

      d.   Personal information like age, height, weight, heart rate, blood pressure, cholesterol, body mass index, etc.

      e.   Credits earned

      f.   Temperature (or a person, the air, water)

      g.   Measures of air or water quality (e.g., pollens, pollutants)

b.   Note: Some types of data can fall into both the "buckets" and "numerical" data types. Why? You can convert numerical data into buckets.

c.   In a pivot table you can have multiple columns of each type of data but – at a minimum – you need at least one column of "buckets" and one column of "numerical" data.

2. Preparing data for pivot tables

a.   Making a pivot table is a two-step process: Identifying the data then constructing the pivot table.

b.   To identify the data:

    i.   Go to the "Insert" ribbon and click on the "Pivot Table" button. It's on the far left of the ribbon.

    ii.   You will get a "Create PivotTable" pop-up menu. In this menu you will need to specify two things: the data you want summarized in the pivot table and where Excel should put the new pivot table.

    iii.   To specify the data:

      1.   Click on the cell selector icon on the top half of the menu; most of the pop-up menu will disappear. (The "cell selector icon" looks like a tiny spreadsheet with a red arrow superimposed on it.)

      2.   Click+Drag on the cells you want included in your pivot table. You should select both the "buckets" and the "numerical" data.

      3.   Click the cell selector icon again and the pop-up menu will re-appear.

    iv.   To specify the location:

      1.   Click one of the radio buttons for a new worksheet or an existing worksheet.

      2.   If you select "Existing Worksheet" you must specify where in the existing worksheet you would like the pivot table to start. The cell you select will be the upper left most corner of the pivot table.

         a.   Click on the cell selector icon on the bottom half of the menu near the "Location" field. Most of the pop-up menu will disappear;

         b.   Click on an empty cell that will be the upper left corner of the pivot table;

         c.   Click on the cell selector icon again and the pop-up menu will re-appear.

    v.   Click the "OK" button and Excel will generate your pivot table.

c.   When you click "OK" Excel will insert a blank pivot table into your Excel file. At the same time, the screen will show two changes:

    i.   You will get a "PivotTable Fields" slide-out window on the right side of your screen; and

    ii.   You will see two "PivotTable Tools" ribbons on the top of your screen, one to Analyze, one to Design.

    iii.   Note that the slide-out window and the ribbons only appear when you have the pivot table selected. If you click somewhere else in the worksheet the ribbon and slide-out windows will disappear.

3. Constructing a pivot table

a. Note: There are two interfaces for building a pivot table: the default interface and the "classic" interface. We will explore both. They are identical in how they *function* but do differ in appearance and somewhat in the way that the pivot table is constructed.
b. The Default Interface
      i.   Overview: You will use the "PivotTable Fields" menu to construct your pivot table.
      ii. Using the tab labeled "1. 3 simple columns" insert a pivot table (if you don't already have one).
            1. In the "PivotTable Fields" slide-out window click on "Type." The check box should now have a check and "Type" should now appear at the bottom of the window in the "Rows" box.
            2. Now click on "Quantity" in the "PivotTable Fields" menu. It should now have a check in the box and appear in the bottom of the window in the "Values" box. And on the left side of your screen you should see your pivot table.
            3. Let's say you want to add "Date" as a filter. Click "Date" in the "PivotTable Fields" window. It should now have a check in the box. But it appears in the "Rows" box, not in the "Filters" box where we want it. We can move it to the "Fields" box by clicking on it and drag+drop to the "Filters" box.
                  a. Note: As of Excel 2016 the software will recognize dates and parse that data into it's component parts. When we constructed the pivot table Excel automatically recognized the different months in the date column and provided a "Months" field.
            4. You can use the downward triangle in the filters area to dig into the data and see what's going on.
                  a. You can select just one or multiple values in the filters.
c. The Classic Interface
      i.   Overview: With this method you can drag-and-drop fields from the "PivotTable Fields" slide-out menu to the pivot table. Before you can construct the pivot table you have to change the default setting to the "Classic" one.
      ii. This is a little weird because you have to build a pivot table first, before you can change from the default to classic settings!
      iii. Select your pivot table (click somewhere in the table). The "Pivottable Tools: Analyze" ribbon should be viewable.
            1. Select it and, in the far left of the ribbon, look for the "Options" button. Click it. You will get a pop-up menu and, in it, select "Options."
            2. You will now get the "PivotTable Options" pop-up menu. It will show you the name of the PivotTable and these tabs:
                  a. Layout & Format
                  b. Totals & Filters
                  c. Display
                  d. Printing
                  e. Data
                  f. Alt Text

iv. Select the "Display" tab at the top of the menu. In the middle of the menu click the check-box next to "Classic PivotTable layout (enables dragging of fields in the grid)." Then click the "OK" button.

v. Your pivot table will change in appearance and you are ready to drag-and-drop fields to construct your pivot table.

vi. Example using tab "2. 3 complex columns":

1. Select a cell that has some contents. Go to the "Insert" ribbon and, on the far left side select "PivotTable." Excel will insert a pivot table.

2. To change from default to "classic" settings:
   a. On the "PivotTable Tools: Analyze" ribbon, under "PivotTable Name" click on "Options" then "Options" again.
   b. Click the "Display" tab. In the middle of the pop-up menu select "Classic PivotTable layout (enables dragging of fields in the grid)." Click "OK."
   c. The appearance of the pivot table will change and you will see blue boxes.

3. To create the pivot table, drag fields (from the "PivotTable Fields" slide out menu on the right) to the blue boxes to construct the pivot table.
   a. In the "PivotTable Fields" slide-out window click on "Bar" and drag+drop the field to the area "Drop Row Fields Here."
   b. Now click on "Type" and drag+drop the field to the area "Drop Column Fields Here."
   c. Last, click on "Quantity" and drag+drop the field to the area "Drop Value Fields Here."

4. Click on "Type" in the "PivotTable Fields" slide-out menu and drag+drop the field to the area "Drop Row Fields Here."

d. Example using tab "3. 4 complex columns"

i. Click somewhere in the data. Insert a pivot table, this time put it in the same workbook in cell G10.

1. Click on the data.
2. Go to the "Insert" ribbon.
3. Click the PivotTable button.
4. In the pop-up menu click the radio button next to "Existing Worksheet."
5. Click on the cell selector icon, select cell G10, click on the cell selector icon a second time. Click the "OK" button.

ii. Now build a pivot table: Put "Bar" on the rows, "Month" on the column, and "Quantity" in the values.

1. Put "Bar" on the rows, "Month" on the column, and "Quantity" in the values.
   a. In which month did the store sell the most chocolate?
   b. The least chocolate?

2. Now add "Type" to the rows.
   a. In which month did the store sell the most 'plain' bars?
   b. The most bars with nuts?

4. Editing a pivot table

a. Change placement of the subtotal row.
   i. Go to the "PivotTable Tools: Design" ribbon. On the far left of the ribbon are four buttons that will customize the appearance of the pivot table.
   ii. Select "Subtotals" and you will get a pop-up menu with three options:
      1. Do not show subtotals
      2. Show subtotals at the bottom of the group
      3. Show subtotals at the top of the group (this is Excel's default)
   iii. Make a selection.
   iv. Note that you can update or revise that selection at any point in time!

b. Change appearance of "Grand Totals."
   i. Go to the "PivotTable Tools: Design" ribbon. On the far left of the ribbon are four buttons that will customize the appearance of the pivot table.
   ii. Select "Grand Totals" and you will get a pop-up menu with four options:
      1. Off for Rows and Columns – no grand totals will be displayed
      2. On for Rows and Columns – all grand totals will be displayed
      3. On for Rows only – only row grand totals will be displayed
      4. On for Columns only – only column grand totals will be displayed
   iii. Make a selection; again, this can be updated at any point in time

c. Change availability of blank rows.
   i. Go to the "PivotTable Tools: Design" ribbon. On the far left of the ribbon are four buttons that will customize the appearance of the pivot table.
   ii. Select "Subtotals" and you will get a pop-up menu with two options:
      1. Insert a Blank Line after Each Item
      2. Remove Blank Line after Each Item
   iii. Once a selection is made it can be changed at any point in time.

d. Change the order of the *fields* in the pivot table.
   i. Drag & Drop Method – In the PivotTable Fields boxes, click+drag a field to a new location.
   ii. Little Triangle Method
      1. In the PivotTable Fields boxes, click on the black triangle for the field you want to move.
      2. In the pop-up menu select the new location for the field: Up, Down, Top, or End.

e. Change the order of the rows in the pivot table.
   i. Select a row of the pivot table.
   ii. Hover over the green border around the selection. Move the cursor around a bit until it to a "plus" sign with arrows on the end of all line segments.
   iii. Click, then drag+drop the row to a new location.
   iv. Example - Change the order of the rows in the pivot table for "3. 4 complex columns" so they appear in this order:
      1. White chocolate
      2. Milk chocolate
      3. Dark chocolate

4. Extra dark chocolate
    v. Note that, when you change the order of the rows under one section (e.g., under "Plain") the order changes throughout the pivot table.
f. Change the order of the columns in the pivot table.
    i. Same process as changing the order of rows.
    ii. Select a column in the pivot table
    iii. Hover over the green border around the selection. Move the cursor around until it changes to a plus sign with arrows on the end of all the line segments.
    iv. Click, then drag+drop the column to a new location.
    v. If there are multiple fields for the columns, changing the order of the columns in one section will change the column order throughout.
g. Change the row or column labels.
    i. Select the cell with the default label. Type the new label.
    ii. NOTE: If you change the default label and then change the order of your fields (or change fields completely) the pivot table label will *not* auto-update. In other words, if you change fields or field order after you have changed the row or column labels you will have to update those labels.
h. *Transition - Build a pivot table using the "5. Voters" tab.*
    i. *Put "Age Group" and "Party" on the rows.*
    ii. *Put "Ballot Status" on the columns.*
    iii. *Put "Voter" under "Values."*
i. Change the values that are shown in the pivot table.
    i. Excel's default of a pivot table is to sum the values in the pivot table. In the examples with quantity or sales that default setting works well. But for other data – like the voter pivot table – that format will not work. In this case, Excel is adding up the voter ID numbers.
    ii. We need to tell Excel to stop adding up those numbers and count them instead. Two ways to do this.
    iii. Method 1: Use the "PivotTable Tools: Analyze" Ribbon
        1. Go to the "PivotTable Tools: Analyze" ribbon.
        2. On the left side of the ribbon is a section called "Active Field." Click on "Field Settings."
        3. You will get the "Value Field Settings" pop-up menu. Click on "Count" then click the "OK" button.
        4. Excel will now count voter ID numbers.
    iv. Method 2: Use the "PivotTable Fields" Window
        1. Every time a field is moved into one of the boxes at the bottom of the PivotTable Fields window a little black triangle shows up to the right of the field name. As always, those triangles mean that you can do stuff.
        2. Click on the black triangle to the right of "Sum of VOTER" and select "Value Field Settings," the last option on the pop-up menu.
        3. The "Value Field Settings" menu will appear. Select "Count" then click "OK."
        4. Excel will now count voter ID numbers.
    v. Some more information on the "Value Field Settings" pop-up menu. Use this menu to:

1. Change the number format (see also below).
2. Give the field a custom name. (Clicking on the black triangle for filters, columns, or row fields will allow you to select the "Field Settings" pop-up menu. Same process as outlined above.)
3. Change the pivot table from sum or count to percents.
   a. On the "Value Field Settings" pop-up menu select the "Show Values As" tab.
   b. Under "Show Values as" use the drop-down menu to select how percentages should be calculated (percent using rows, using columns, or using the grand total).
      i. Be prepared to play with the settings here so that you get percentages calculated the way you intend.
      ii. % of Row Total – the percentages of each cell in the row will total 100%.
      iii. % of Parent Row Total – the percentages of the cells in the rows under the "parent" row (the field that is at the top of the list under "ROWS" are of the "PivotTable Fields" slide-out menu) will total 100%.
      iv. % of Grand Total – the percentages of all the cells in the pivot table will total 100%.
   c. There are no hard-and-fast rules about which percentage calculation method you should select. It will depend on how you have set up your data and constructed your pivot table.

j. Change number format.
   i. Go to the "4. 5 complex columns" tab. Change the "Values" from 'Quantity' to 'Sales.' Note that, although sales is correctly displayed as dollars and cents in the spreadsheet, that formatting doesn't carry over to the pivot table.
   ii. Use the "Value Field Settings" pop-up menu to change number format.
      1. Method 1: Use the "PivotTable Tools: Analyze" Ribbon
         a. Go to the "PivotTable Tools: Analyze" ribbon.
         b. On the left side of the ribbon is a section called "Active Field." Click on "Field Settings."
         c. You will get the "Value Field Settings" pop-up menu. Click on the "Number Format" button on the bottom-left of the menu.
         d. Use the "Formal Cells" pop-up menu to format the numbers. Click "OK."
         e. Click "OK" a second time.
      2. Method 2: Use the "PivotTable Fields" Window
         a. Click on the black triangle to the right of "Sum of Sales" and select "Value Field Settings," the last option on the pop-up menu.
         b. The "Value Field Settings" menu will appear. Click on the "Number Format" button on the bottom-left of the menu.
         c. Use the "Formal Cells" pop-up menu to format the numbers. Click "OK."
         d. Click "OK" a second time.

k. Remove the pivot table.
   i. If the pivot table is in a tab separated from the data, delete the tab.
   ii. If the pivot table is in the same tab as the data, delete the columns with the pivot table.

5. Difference between 0 (zero), a blank cell, and a missing line

    a. Depending on the data you are summarizing you may experience none, some, or all of the above.
        i. Example: tab "4. 5 complex columns"
        ii. Dark and Milk chocolate both have rows for "Caramel," but some of the cells are blank.
        iii. White chocolate has a row for "Nuts" and the value in April is 0 (zero).
    b. There is no functional difference between a 0 (zero), a blank cell, and a missing line. All indicate that there are no values to summarize.
    c. However, a missing line is the hardest to *work with*: Users may need additional supports to remember that a line is missing or what a missing line means.
    d. Suggestion: when sharing the data with other users, "paste values" into a new table. Where needed, add in missing rows or columns and 0s (zeroes).
        i. Select the pivot table.
        ii. Right-click and, in the pop-up menu, select "Paste Special" and then "Paste Values." The pivot table contents will be pasted without formatting or the capability to be filtered, adjusted, etc. The table contents can now be edited prior to sharing.

6. Determining when an additional variable is needed vs. a filter

    a. Additional fields, either as rows or columns, and filters essentially perform the same function: to help you disaggregate or "drill down" into your data. However, fields and filters are not identical.
        i. Additional fields – whether they are rows or columns – show you all the values in the field and allow you to make comparisons across those values. For instance, if you added gender as an additional field the pivot table would show data for both men and women and you could make comparisons across the two genders.
        ii. Filters are often more restrictive and show only specific values and allow you to ignore values you aren't interested in. For example, if you used gender as a filter you could drill down to see data for just men and (temporarily or permanently) ignore the data for women.
    b. The disadvantage of adding lots of additional fields to a pivot table is they take up space and could make your pivot table too large to see and/or use.
    c. Add one or more filters
        i. Using the default pivot table
            1. In the "PivotTable Fields" window click the check box next to the field you would like to use as a filter. By default this will move the field to the "Rows" box.
            2. Click+Drag the filter field from the "Rows" box to the "Filter" box.
            3. Repeat steps 1 and 2 for additional filters.
        ii. Using the classic pivot table
            1. In the "PivotTable Fields" window Click+Drag the filter field to the "Drop Report Filter Fields Here" area of the pivot table.
            2. Repeat step 1 for additional filters.
    d. Change the order of the filters: Only one way to do this!
        i. In the "PivotTable Fields" window Click+Drag a filter field to the new position on a list.
        ii. Repeat as needed.

e. Remove a filter (or filters)
  i. Using the default pivot table
     1. In the "PivotTable Fields" window un-check the box next to the filter name.
     2. Repeat as needed.
  ii. Using the classic pivot table
     1. Click+Drag the filter field name away from the pivot table.
     2. Repeat as needed.
  iii. Option 3: In the "Pivot Table Fields" window "Filter" box, click on the black triangle next to the name of the filter. In the pop-up window select "Remove Filter." Repeat as needed.

7. Constructing a pivot chart

a. Excel can automatically construct a chart of your pivot table data. You can use filters in the chart or in the pivot table to refine and edit the chart.
b. How to make a pivot chart:
  i. Go to "5. Voters" tab.
  ii. Make a pivot table:
     1. Filters: "BALLOTSTATUS"
     2. Rows: "Party"
     3. Columns: "Age Group"
     4. Values: "Voter ID" (make sure to change this from "Sum" to "Count"!)
  iii. Select a cell in the pivot table.
  iv. Make the pivot chart
     1. Method 1: "Insert" Ribbon
        a. Select the "Insert" Ribbon.
        b. Look for the "PivotChart" button. Select the button and, in the pop-up menu, select "PivotChart."
        c. In the "Insert Chart" pop-up window select the chart type (e.g., line, column, histogram) and, if applicable, sub-type (e.g., clustered, stacked N, stacked %).
        d. Click "OK."
     2. Method 2: "PivotTable Tools: Analyze" Ribbon
        a. Select the pivot table. Now select the "PivotTable Tools: Analyze"ribbon.
        b. On the right side of the ribbon select "PivotChart."
        c. In the "Insert Chart" pop-up window select the chart type (e.g., line, column, histogram) and, if applicable, sub-type (e.g., clustered, stacked N, stacked %).
        d. Click "OK."
  v. The pivot chart will be generated but will look slightly different than a typical Excel chart: It will have gray, pill-shaped filters. Those filters can be used to update the chart.
c. Edit the appearance of your chart(e.g., bar or line color, title, legend) as needed.
d. Note that the pivot table and the pivot chart will always be aligned and show the same information. If you make an adjustment to the pivot table the change will be reflected in the chart. The reverse is also true: if you make a change in the chart it will also be reflected in the table.

8. Playtime!

    a. About the data file for "6. Assessment Results."

        i. Individual records from the spring 2018 administration of the MCA-III and MTAS-III for both reading and math.

        ii. One-percent of all the records were sampled and then de-identified: any identifying information (e.g., student name, MARSS number) was removed from the file.

    b. Demographic Questions

        i. How many 3rd grade students who took the Math assessments were eligible for free or reduced-price meals?

        ii. How many 11th grade students who took the Reading assessments were eligible for English learner services?

        iii. How many boys took the Reading assessment? How many 7th graders took the Reading assessment? How many 7th grade boys took the Reading assessment?

        iv. How many Native Hawaiian or Pacific Islander boys took the Reading assessment? The Math assessment?

        v. How many MTAS-III Reading tests were given?

        vi. How many MCA-III Math tests were given?

    c. Assessment Questions

        i. In this district, which test subject (Math or Reading) had a higher proficiency rate?

        ii. Is there at least a 5% difference in the proficiency rates for girls vs. boys on the Math tests? On the Reading tests? If so, what is the actual difference and which group (girls or boys) has the higher proficiency rate?

        iii. Which grade has the highest percentage of students scoring "Exceeds Standards" on the Math assessment? On the Reading assessment? If you look only at MCA-III results are there any changes in the highest percentage of students by grade?