

Lecture Note #16: PivotTables Part #3

BUSI 201: Business Data Analysis

Topic 1. PivotTables: Grouping

When we have a wide range of variables taking up the row or columns, we may gain more insight about the data when we gather them into larger groups. For instance, you may want to analyze individuals by groups of age, daily sales data in terms of weeks, etc. Navigate to worksheet PIVOT-DATE in the workbook BUSI201-LEC16-Workbook.xlsx. Replicate the table below using PivotTables:

		1/1/2023	1/2/2023	1/3/2023	1/4/2023	1/5/2023	1/6/2023
Branch 1	Item 1						
	Item 2						
	Item 3						
Branch 2	Item 1						
	Item 2						
	Item 3						

Filling each empty cell with the number of each items sold in each office by date, we get the table in Figure 1. The problem with this table is that it is quite “wide,” where the total number of columns add up to 34. So, we may want to aggregate sales data by week to reduce the number of columns in our table to have the table fit in one reasonable page.

Branch	Item	1/1/2023	1/2/2023	1/3/2023	1/4/2023	1/5/2023	1/6/2023
Atlanta	iPad	366	500	151	375	133	271
	iPhone	339	212	33	77	18	269
	MacBook	191	219	330	226	58	486
Atlanta Total		896	931	514	678	209	1026
Boston	iPad	35	76	238	145	412	236
	iPhone	172	361	182	269	69	404
	MacBook	59	433	153	457	55	335
Boston Total		266	870	573	871	936	676
Chicago	iPad	19	52	191	40	368	431
	iPhone	164	44	262	114	54	305
	MacBook	254	80	96	427	114	250
Chicago Total		437	176	549	581	936	986
Denver	iPad	500	71	150	351	481	417
	iPhone	151	374	309	302	392	162
	MacBook	362	55	96	393	308	299
Denver Total		1013	500	555	1046	1181	878
Grand Total		2612	2477	2191	3176	2462	3865

Figure 1: PIVOT-DATE

Grouping by Date

To group dates into weeks, first click on any of the dates in the PivotTable, right click, and then select **Group**. In the Grouping window that pops up, select **Days**, and then change the **Number of days** to 7 to group days into weeks.

Date	Branch	Item	Quantity	Sales
1/1/2023	Atlanta	iPhone	339	\$ 33,927.63
1/2/2023	Atlanta	iPhone	212	\$ 21,012.76
1/3/2023	Atlanta	iPhone	33	\$ 3,283.65
1/4/2023	Atlanta	iPhone	77	\$ 7,661.45
1/5/2023	Atlanta	iPhone	18	\$ 1,796.11
1/6/2023	Atlanta	iPhone	269	\$ 27,324.31
1/7/2023	Atlanta	iPhone	173	\$ 17,040.71
1/8/2023	Atlanta	iPhone	474	\$ 47,760.08
1/9/2023	Atlanta	iPhone	417	\$ 41,084.83
1/10/2023	Atlanta	iPhone	325	\$ 31,854.59
1/11/2023	Atlanta	iPhone	460	\$ 45,978.11
1/12/2023	Atlanta	iPhone	463	\$ 45,872.35
1/13/2023	Atlanta	iPhone	445	\$ 45,181.02
1/14/2023	Atlanta	iPhone	320	\$ 31,720.66
1/15/2023	Atlanta	iPhone	111	\$ 11,151.07
1/16/2023	Atlanta	iPhone	483	\$ 48,110.72
1/17/2023	Atlanta	iPhone	322	\$ 32,083.36
1/18/2023	Atlanta	iPhone	29	\$ 2,907.11
1/19/2023	Atlanta	iPhone	258	\$ 25,544.63
1/20/2023	Atlanta	iPhone	224	\$ 22,017.98
1/21/2023	Atlanta	iPhone	314	\$ 11,454.77
1/22/2023	Atlanta	iPhone	335	\$ 33,411.87
1/23/2023	Atlanta	iPhone	357	\$ 15,737.74
1/24/2023	Atlanta	iPhone	39	\$ 3,901.21
1/25/2023	Atlanta	iPhone	149	\$ 14,831.43
1/26/2023	Atlanta	iPhone	396	\$ 39,569.81

Figure 2: Grouping by Dates

The PivotTable with dates group into 7 days each shows up in Figure 3. You may want to change the number of days so that each column represents a similar number of days, or adjust the beginning and end dates before grouping the variables so that the table is “regular.”

Date	Branch	Item	Quantity	Sales
1/1/2023	Atlanta	iPhone	339	\$ 33,927.63
1/2/2023	Atlanta	iPhone	212	\$ 21,012.76
1/3/2023	Atlanta	iPhone	33	\$ 3,283.65
1/4/2023	Atlanta	iPhone	77	\$ 7,661.45
1/5/2023	Atlanta	iPhone	18	\$ 1,796.11
1/6/2023	Atlanta	iPhone	269	\$ 27,324.31
1/7/2023	Atlanta	iPhone	173	\$ 17,040.71
1/8/2023	Atlanta	iPhone	474	\$ 47,760.08
1/9/2023	Atlanta	iPhone	417	\$ 41,084.83
1/10/2023	Atlanta	iPhone	325	\$ 31,854.59
1/11/2023	Atlanta	iPhone	460	\$ 45,978.11
1/12/2023	Atlanta	iPhone	463	\$ 45,872.35
1/13/2023	Atlanta	iPhone	445	\$ 45,181.02
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1/15/2023	Atlanta	iPhone	111	\$ 11,151.07
1/16/2023	Atlanta	iPhone	483	\$ 48,110.72
1/17/2023	Atlanta	iPhone	322	\$ 32,083.36
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Figure 3: Grouped by Dates

Grouping by Numbers

We can also group the variables as long as it is numerical. Navigate to worksheet PIVOT-YEARS, which houses real world data on government expenditure as a proportion of GDP. One of the variables is Year, but note that it is not automatically recognized as dates. Generate a PivotTable with years being the row variables, Country being the column variables, and each value entry to be the average of G/GDP.

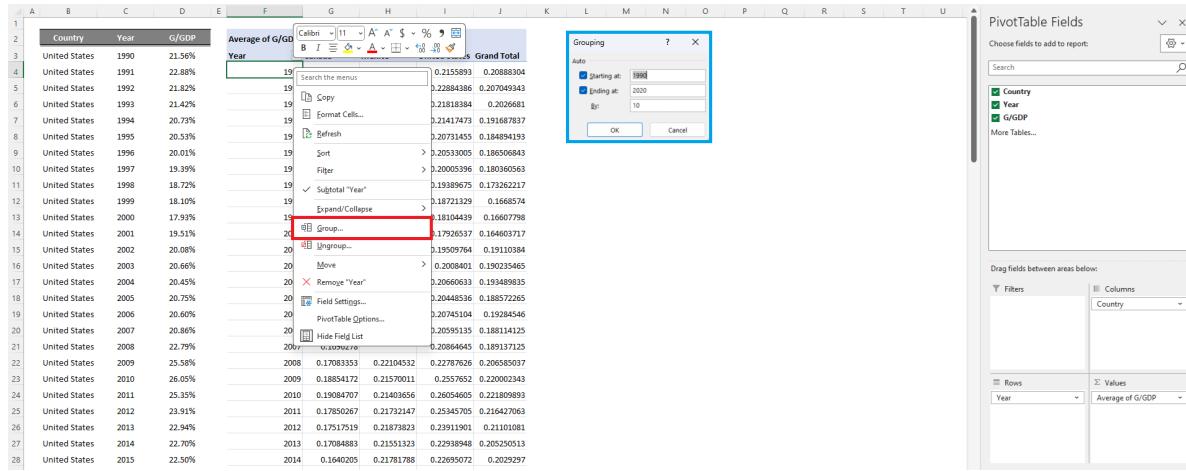


Figure 4: Grouping by Numbers

Right click any year in the PivotTable, and select **Group**. A slightly different grouping window will pop up in the **blue box**, as Excel does not recognize the years as a date variable. Figure 5 shows us what the PivotTable should look like when we group the data by 5 years.

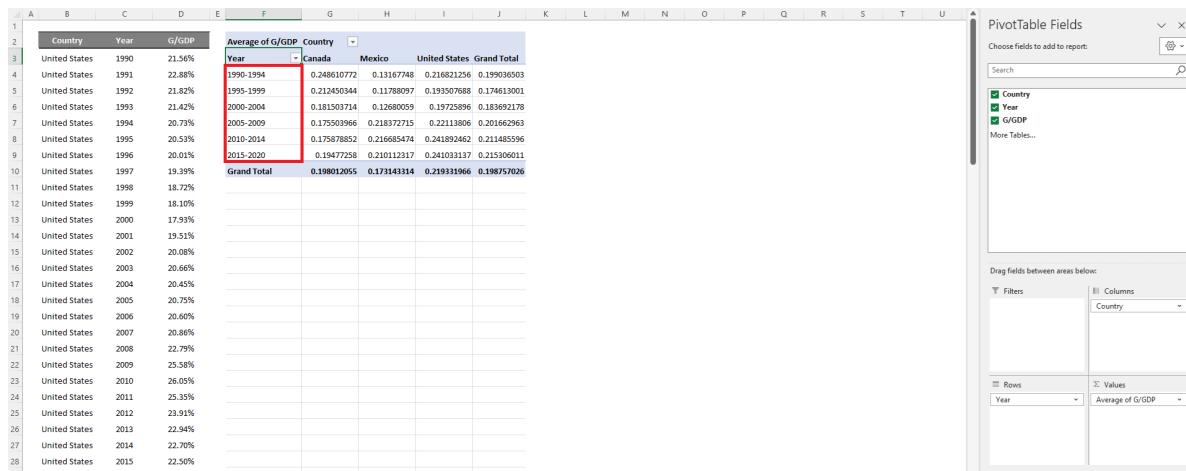


Figure 5: Grouped by Numbers

Topic 2. PivotTables: Filters

Up to this point, we have been primarily interested in three “boxes” when we were creating PivotTables; the Rows, Columns, and Values. However, the remaining fourth box, Filters, can also be quite useful. Adding a filter variable will create a filter above the PivotTable which we can use to filter the data. Let us try out this feature to understand what this filter does for us. Navigate to PIVOT-FILTERS for a hypothetical gradebook.

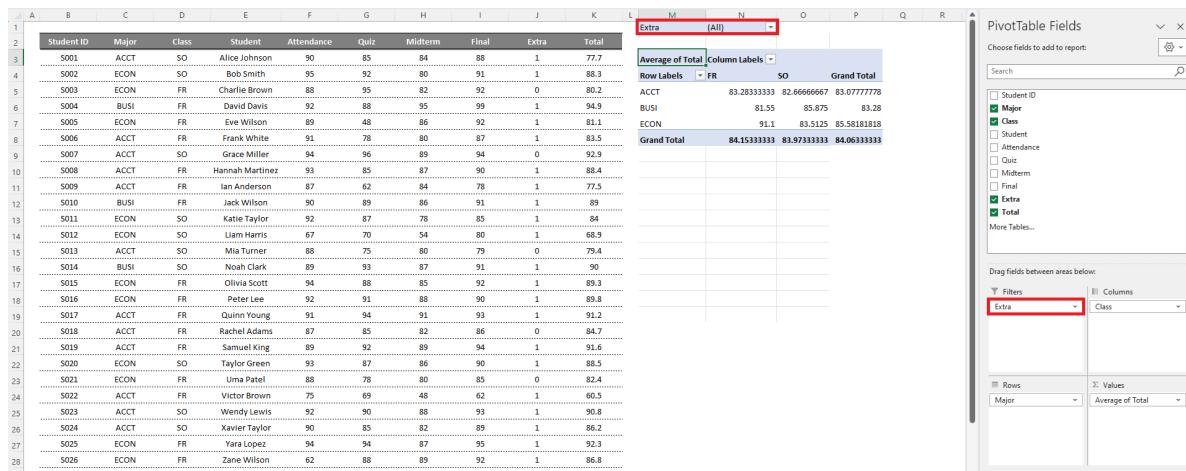


Figure 6: PivotTable Filters

This new filter in the red box allows us to filter the raw data so that only certain portions of the data is visible on the PivotTable. In this specific example, the filter is based on whether a student has extra credit or not.

If we select the value 0 in the filter shown in the blue box in Figure 7, the PivotTable will be show results based on only on the students without extra credit. If we select 1 in the filter, then the PivotTable will be calculated based on only the students who have extra credit.

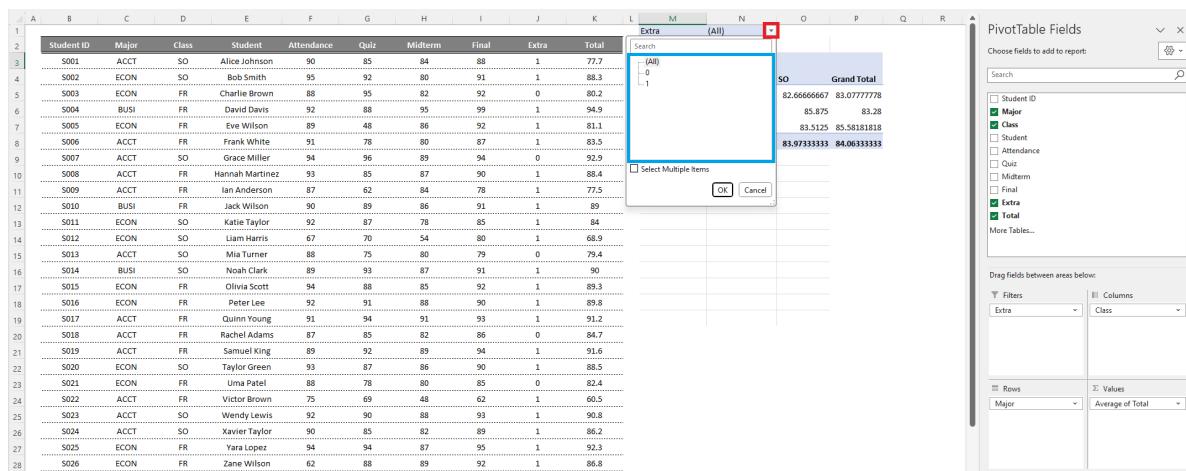


Figure 7: PivotTable Filtering

Other Filters on PivotTables

You may have also noticed that there are some filters that appear on the PivotTables by default. These can be seen in the **red boxes** in Figure 8. These filters can be used to remove certain variables, or sort the order of the variables on the PivotTable itself.

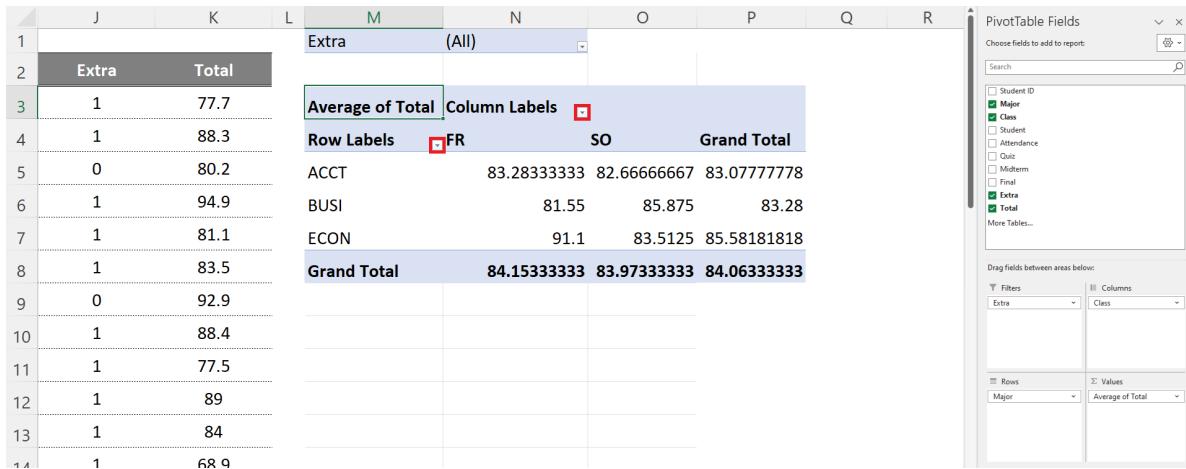


Figure 8: Other Filters in PivotTables

Topic 3. PivotTables: Calculated Fields

Sometimes, we may be interested in variables that are not already included in the source data. We can either edit the original data, but this editing the raw data manually is usually not considered “best practice,” as there is an associated risk of contamination. Instead, if the data is easily calculated from the existing variables, we can use **Calculated Fields** to add a variable in the PivotTable.

Navigate to worksheet PIVOT-CREATE, which has synthetic data on the housing market near Chicago. Suppose you wanted to create a new variable that tells us the average price per square foot.

Figure 9: Calculated Fields

After creating an appropriate PivotTable, left click on any cell in the PivotTable, navigate to the **PivotTable Analysis** tab that is made available after creating and selecting a PivotTable. Then, select **Fields, Items, & Sets**, and then **Calculated Fields**. This will result in a new pop-up window in the **green box** where we can specify the new variable we want to add.

In this case, we wanted to add the asking price per square foot of the property. So, we first change the name to match the description of the variable. Then we can set up the formula either by typing it directly, or selecting them from the list of variables given in the pop-up window.

H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
Bedrooms	Bathrooms	Asking Price	Year Built	AC	Garage Spaces	Days on Market	Lot Size	Home Type	Renovation	HOA										
3	2.5	\$450,000.00	1990	Yes	2	30	7500	Single Family	2015	250										
4	3	\$600,000.00	1985	Yes	2	45	8500	Single Family	2018	300										
5	4	\$750,000.00	2005	Yes	3	60	10000	Single Family	2017	350										
6	3	\$350,000.00	1950	Yes	1	20	6000	Single Family	2010	0										
7	4	\$550,000.00	1988	Yes	2	35	7200	Single Family	2012	0										
8	5	\$850,000.00	1995	Yes	3	50	9500	Single Family	2019	400										
9	2	\$300,000.00	1920	Yes	1	15	5000	Condo	2014	500										
10	1	\$200,000.00	1935	No	0	10	3500	Condo	2013	450										
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Figure 10: Calculated Fields with Errors

Resolving the #DIV/0! Error

In Figure 10, you will notice that there are a number of #DIV/0! errors. For instance, the value for one bedroom apartments in Evanston is #DIV/0!. This happened because there are no single bedroom apartments in Evanston, and thus Excel tried to fill the slot with $\frac{0}{0}$, which is undefined.

Figure 11: Correcting Errors in PivotTables

Left click on any of the #DIV/0! cells, right click, and then select **PivotTable Options**. In the new pop-up window, select the **Layout & Format** tab, and edit the options in the **orange box**. If you leave the box blank, any cells with error outputs will return an empty cell.

C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA		
1																										
2	State	County	City	ZIP Code	Street Address	Bedrooms	Bathrooms	Asking Price	Year Built	AC	Garage Spaces	Days on Market	Lot Size	Home Type	Renovation	HOA	Sum of \$ per sqft	Column Labels	1	2	3	4	5	6 Grand Total		
3	IL	Cook	Chicago	60601	123 Main St	3	2.5	\$ 450,000.00	1990	Yes	2	30	7500	Single Family	2015	250	Chicago	\$	55.71	\$ 65.33	\$ 65.64	\$ 73.25	\$	66.43		
4	IL	Cook	Chicago	60602	456 Elm St	4	3	\$ 600,000.00	1985	Yes	2	45	8500	Single Family	2018	300	Evanston									
5	IL	Cook	Evanston	60201	789 Oak St	5	4	\$ 750,000.00	2005	Yes	3	60	10000	Single Family	2017	350	Oak Park									
6	IL	Cook	Oak Park	60301	101 Maple Ave	3	2	\$ 350,000.00	1950	Yes	1	20	6000	Single Family	2010	0	Skokie									
7	IL	Cook	Skokie	60076	202 Pine St	4	2.5	\$ 550,000.00	1988	Yes	2	35	7200	Single Family	2012	0	Wilmette									
8	IL	Cook	Wilmette	60091	303 Cedar St	5	3.5	\$ 850,000.00	1995	Yes	3	50	9500	Single Family	2019	400	Grand Total	\$	55.71	\$ 62.50	\$ 66.67	\$ 76.18	\$	81.01	\$ 66.67	\$ 71.14
9	IL	Cook	Chicago	60603	404 Walnut St	2	1	\$ 300,000.00	1920	Yes	1	15	5000	Condo	2014	500										
10	IL	Cook	Chicago	60604	505 Cherry St	1	1	\$ 200,000.00	1935	No	0	10	3500	Condo	2012	450										
11	IL	Cook	Evanston	60202	606 Birch St	3	2	\$ 400,000.00	1965	Yes	1	25	5500	Single Family	2005	0										
12	IL	Cook	Oak Park	60302	707 Redwood St	4	3	\$ 500,000.00	1978	Yes	2	40	6800	Single Family	2015	0										
13	IL	Cook	Skokie	60077	808 Spruce St	3	2	\$ 350,000.00	1980	Yes	1	30	6000	Single Family	2012	0										
14	IL	Cook	Wilmette	60092	909 Cedar St	4	3	\$ 650,000.00	1992	Yes	2	55	8000	Single Family	2016	300										
15	IL	Cook	Chicago	60605	1010 Pine St	2	2	\$ 280,000.00	2000	Yes	1	18	4500	Condo	2010	350										

Figure 12: Corrected Errors in PivotTables

Topic 4. PivotTables: “Dividing” PivotTables

The use of filters in PivotTables also allows you to generate PivotTables across multiple sheets each corresponding to an item on the filter. Lets update the PivotTable we have in worksheet PIVOT-CREATE to the form you see in Figure 13. There were 5 cities in our data, and suppose we want to create a PivotTable telling us what the average price per sqft is for houses with 1,2,⋯,6 bedrooms in each city.

The screenshot shows a Microsoft Excel spreadsheet with a PivotTable set up. The PivotTable Fields pane on the right side lists fields for 'City' (selected), 'Bedrooms', and 'Average of \$ per sqft'. The main table area displays data for houses across five cities (Cook, Chicago, Evanston, Oak Park, Skokie) and various bedroom counts (1 to 6). The PivotTable summary shows the average price per square foot for each city and bedroom count combination.

City	Bedrooms	Average of \$ per sqft
Cook	1	55.71
Cook	2	62.50
Cook	3	66.67
Cook	4	76.18
Cook	5	81.03
Cook	6	66.67
Grand Total		71.14

Figure 13: New PivotTable in PIVOT-CREATE

Navigate to the **PivotTable Analyze**, and click on **Options**, and then select **Show Report Filter Pages**. This will automatically create 5 worksheets with a mini PivotTable of each city in the dataset.