Lecture Note #15: PivotTables Part #1

BUSI 201: Business Data Analysis

Fall 2023

Topic 1. PivotTables

Charts are among the most powerful methods we have in summarizing any trends in the data. We can observe the correlations between variables using scatter charts, discover long run trends using line charts, and uncover the distribution of some variable using histograms. However, while visualization does provide an overview of the data, it lacks some clarity and exactness that tables can provide.

In most scenarios, it is necessary to generate a table that summarizes the data on hand, which we call "summary statistics." Navigate to the worksheet PIVOT-01 in BUSI201-LEC15-Workbook.xlsx to find aggregated sales data for three employees over the period of roughly 3 years. In order to manually summarize this data, we must rely on functions.

A	В	С	D	E	F	G	Н	I	J	
1	Year	Month	Employee	Sales (\$)		Sun	nmary	Monthly Average Sales	Annual Total Sales	[
3	2021	January	A	\$ 88,940.81			Total			
4	2021	February	А	\$ 66,793.73			2021			
5	2021	March	А	\$ 74,497.90		A	2022			
6	2021	April	А	\$ 44,960.47			2023			
7	2021	May	A	\$ 47,151.75			Total			
8	2021	June	А	\$ 52,510.32			2021			
9	2021	July	Α	\$ 80,881.12		в	2022			
10	2021	August	А	\$ 69,283.09			2023			
11	2021	September	A	\$ 56,141.29			Total			
12	2021	October	А	\$ 68,160.26		6	2021			
13	2021	November	А	\$ 57,906.10		C	2022			
14	2021	December	Α	\$ 84,227.43			2023			
15	2022	January	А	\$ 80,006.05						

Figure 1: PIVOT-01

Specifically to fill out the empty table in worksheet PIVOT-01, we will be using the functions we handled in previous classes, AVERAGEIFS and SUMIFS. Please try out manually filling the empty table using the functions. As a hint, the cells I4 and J4 can be filled out using:

- I4: =AVERAGEIFS(\$E\$3:\$E\$104,\$D\$3:\$D\$104,\$G\$3,\$B\$3:\$B\$104,\$H4)
- J4: =SUMIFS(\$E\$3:\$E\$104,\$D\$3:\$D\$104,\$G\$3,\$B\$3:\$B\$104,\$H4)

Inserting Pivot Tables

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1																	_				
2		Year	• Month	Employee	Sales (\$) 💡		Sum	mary	Mo	nthly Ave	erage	Sales	An	nual Tot	al Sale	s					
3		2021	January	А	\$ 88,940.81			Total									-				
4		2021	February	А	\$ 66,793.73		^	2021													
5		2021	March	А	\$ 74,497.90		A	2022													
6		2021	April	А	\$ 44,960.47			2023													
7		2021	May	А	\$ 47,151.75			Total													
8		2021	June	А	\$ 52,510.32		B	2021													
9		2021	July	А	\$ 80,881.12		D	2022													
10		2021	August	А	\$ 69,283.09			2023													
11		2021	September	А	\$ 56,141.29			Total													
12		2021	October	А	\$ 68,160.26		c	2021													
13		2021	November	А	\$ 57,906.10		C	2022													
14		2021	December	Α	\$ 84,227.43			2023													

Figure 2: First Step of Inserting Pivot Table

Instead of manually filling the table, we can rely on Pivot Tables to produce a summary table instead. We will replicate the table we just created using Pivot Tables. To create a table using Pivot Tables, follow the steps illustrated in Figure 2. First select the data including the variable names as shown in the red box. Then, head over to the Insert tab, and select Pivot Table in the blue box.

	A	В	С	D	E	F	G	Н	I	J	K L N
2		Year	• Month	Employee	Sales (\$) 💡		Sum	mary	Monthly Average Sales	Annual Total Sales	
3		2021	January	А	\$ 88,940.81			Total			_
4	Ï	2021	February	А	\$ 66,793.73		^	2021			
5	Ĩ	2021	March	А	\$ 74,497.90		А	2022			
6	Ï	2021	April	А	\$ 44,960.47			2023			
7	1	2021	May	Α	\$ 47,151.75			Total			
8		2021	June	A	\$ 52,510.32		D	2021	PivotTable from table or range	7 × 7	
9		2021	July	А	\$ 80,881.12		в	2022	Select a table or range		
10	ï	2021	August	А	\$ 69,283.09			2023	Table/Range: 'PIVOT-01'ISBS2:SES104 Choose where you want the PivotTable to be place	1	
11		2021	September	Α	\$ 56,141.29			Total	New Worksheet		
12		2021	October	A	\$ 68,160.26		~	2021	Location: 'PIVOT-01'ISGS16	±	
13		2021	November	А	\$ 57,906.10		C	2022	Add this data to the Data Model		
14		2021	December	А	\$ 84,227.43			2023	0	Cancel	
15		2022	January	A	\$ 80,006.05						_
16		2022	February	А	\$ 70,020.74	Ī					
17		2022	March	А	\$ 45,976.12						
18		2022	April	A	\$ 52,075.45						

Figure 3: Second Step of Inserting Pivot Table

A new window should pop up, and the Table range will be pre-populated with the range of the data we selected in the previous step.¹ For this exercise, we want the new table to be visible in the same worksheet, so we will be choosing Existing Worksheet, and then we will select a cell that we will "begin" building the new table. In this example, we will be using G16 as the initial location, and click Ok.²

¹Note that it is not strictly necessary to select the table range before clicking the PivotTable button, as we can always add/change the range after we call up this new window by selecting a new data area in the orange box.

²Cell G16 will serve as the top left corner of the newly generated table.

A	В	C	D	E	F G H I J K PivotTable Fields V X
14	2021	December	Α	\$ 84,227.43	2023 Choose fields to add to report:
15	2022	January	Α	\$ 80,006.05	Search D
16	2022	February	Α	\$ 70,020.74	□ Year
17	2022	March	Α	\$ 45,976.12	DivotTabla1
18	2022	April	Α	\$ 52,075.45	Sales (5) More Tables
19	2022	May	Α	\$ 84,191.77	To build a report, choose fields from the
20	2022	June	Α	\$ 42,632.69	PivotTable Field List
21	2022	July	А	\$ 40,982.76	
22	2022	August	Α	\$ 59,977.70	
23	2022	September	Α	\$ 50,816.65	Drag fields between areas below:
24	2022	October	Α	\$ 58,858.40	Y Filters II Columns
25	2022	November	Α	\$ 61,842.25	
26	2022	December	Α	\$ 57,654.44	
27	2023	January	Α	\$ 53,521.77	■ Rows ∑ Values
28	2023	February	А	\$ 71,225.76	
29	2023	March	А	\$ 50,811.77	
30	2023	April	Α	\$ 68,667.63	

Figure 4: Third Step of Inserting Pivot Table

Figure 4 shows us an empty PivotTable, which we will fill out by clicking and dragging items in the red box down to the appropriate bins in the blue box. It is at this point we will look back to the table we are attempting to replicate. The "row" elements are "two-layered," in that the first (left) layer is divided up by employees, and the second (right) layer is divided by years. Then, there are two "values" that we will be calculating; the monthly average sales by years, and the annual total sales.

A	В	С	D	E	F G	н	l I	J		PivotTable Fields
14	2021	December	Α	\$ 84,227.43		2023				Choose fields to add to report:
15	2022	January	Α	\$ 80,006.05						Search D
16	2022	February	Α	\$ 70,020.74	Row Labels 📮					Vear
17	2022	March	А	\$ 45,976.12	А					Month Employee
18	2022	April	Α	\$ 52,075.45	в					Sales (\$) More Tables
19	2022	May	Α	\$ 84,191.77	с			· /		
20	2022	June	Α	\$ 42,632.69	Grand Total			· · · · · · · · · · · · · · · · · · ·		
21	2022	July	Α	\$ 40,982.76						
22	2022	August	Α	\$ 59,977.70						
23	2022	September	Α	\$ 50,816.65						Drag fields between areas below:
24	2022	October	Α	\$ 58,858.40					\mathbf{X}	T Filters II Columns
25	2022	November	Α	\$ 61,842.25						
26	2022	December	Α	\$ 57,654.44						
27	2023	January	Α	\$ 53,521.77						E Rous
28	2023	February	Α	\$ 71,225.76						Employee -
29	2023	March	Α	\$ 50,811.77						T I
30	2023	April	Α	\$ 68,667.63						
	2022	Mau	۸	C EA COC 01					,	

Figure 5: Fourth Step of Inserting Pivot Table

See Figure 5 as we start with the row elements. Click and drag the field Employee to the orange box. This will start to populate the Pivot Table which was previously empty. In the blue box, you can see some changes where the rows for each employees have been generated. Next, we will add the second layer of years, following a similar click-and-drag method shown in the green box and arrow. Make sure that the Year field is situated below Employee, as it is the inner most layer in our table.

A	В	С	D	E	F G	н	1	J	PivotTable Fie	elds v x
14	2021	December	Α	\$ 84,227.43		2023			_ Choose fields to add to	report:
15	2022	January	Α	\$ 80,006.05					Search	
16	2022	February	А	\$ 70,020.74	Row Labels	Sum of Sales (\$)			Year	
17	2022	March	А	\$ 45,976.12	A	2074144.742			Month Employee	
18	2022	April	А	\$ 52,075.45	2021	791454.2651			Sales (\$) More Tables	
19	2022	May	А	\$ 84,191.77	2022	705035.0215				
20	2022	June	Α	\$ 42,632.69	2023	577655.4556				
21	2022	July	А	\$ 40,982.76	В	2090376.318				
22	2022	August	А	\$ 59,977.70	2021	801088.0541				
23	2022	September	А	\$ 50,816.65	2022	744318.5372			Drag fields between an	eas below:
24	2022	October	А	\$ 58,858.40	2023	544969.7271			T Filters	III Columns
25	2022	November	А	\$ 61,842.25	C	1951789.754				
26	2022	December	А	\$ 57,654.44	2021	681590.6933				
27	2023	January	А	\$ 53,521.77	2022	682963.7802			E Rows	Σ Value
28	2023	February	А	\$ 71,225.76	2023	587235.28			Employee	Sum of Sales (\$)
29	2023	March	Α	\$ 50,811.77	Grand Total	6116310.814			100	
30	2023	April	А	\$ 68,667.63						

Figure 6: Fifth Step of Inserting Pivot Table

Now we have the rows all ready, we can start adding the other elements. In this case, we will be adding the monthly average value of each employee's sales. Lets move on to the steps illustrated in Figure 6. Click, and drag the field Sales(\$) down to Values in the orange box. You will see that a new column has been added to the PivotTable in the blue box. However, it does not display the values that we want at this point, so we must edit its properties.

A	В	С	D	E	F G	н	1	J	PivotTable Fields	~ ×
14	2021	December	Α	\$ 84,227.43		2023			Choose fields to add to report:	(ib +
15	2022	January	Α	\$ 80,006.05					Search	2
16	2022	February	А	\$ 70,020.74	Row Labels	Sum of Sales (\$)	Value Field Settings -	- ×	Vear	
17	2022	March	Α	\$ 45,976.12	A	2074144.742	Source Name: Sales (\$) <u>Sustom Name:</u> Average of Sales (\$)		Month	
18	2022	April	А	\$ 52,075.45	2021	791454.2651	Summarize Values By Show Values As		Sales (\$) More Tables	
19	2022	May	Α	\$ 84,191.77	2022	705035.0215	Summarize value field by Choose the type of calculation that you want to use to summa	rize		
20	2022	June	Α	\$ 42,632.69	2023	577655.4556	Sum Count			
21	2022	July	Α	\$ 40,982.76	В	2090376.318	Average Max Min			
22	2022	August	Α	\$ 59,977.70	2021	801088.0541	Product			Move <u>Up</u>
23	2022	September	Α	\$ 50,816.65	2022	744318.5372	Number Format OK	Cancel	Drag fields between areas be	Move <u>D</u> own Move to Beginning
24	2022	October	Α	\$ 58,858.40	2023	544969.7271			T Filters	Move to End
25	2022	November	А	\$ 61,842.25	c	1951789.754				Move to Report Filter Move to Row Labels
26	2022	December	А	\$ 57,654.44	2021	681590.6933				■ Move to Column Labels ∑ Move to Values
27	2023	January	А	\$ 53,521.77	2022	682963.7802			E Rows	Remove Field
28	2023	February	А	\$ 71,225.76	2023	587235.28			Employee ~	Sum of Sales (\$)
29	2023	March	А	\$ 50,811.77	Grand Total	6116310.814			Year *	
30	2023	April	Α	\$ 68,667.63						

Figure 7: Sixth Step of Inserting Pivot Table

Click the icon in the red box in Figure 7, and select Value Field Settings. Then, in the popup window Value Field Settings, select the option Average, and click Ok. It will automatically change the field's name to Average of Sales(\$), and the PivotTable will also have been updated. Compare the two values highlighted in Figure 8.

	Α	В		С	D	E	F	G	Н		1	J	К	L
1														
2	1	Year	v	Month	Employee	Sales (\$)			Summary	 Month	y Average Sales	Row Labels	Average of Sales (\$)	
3		2021		January	А	\$ 88,940.81			Total			A	61004.25712	
4		2021		February	Α	\$ 66,793.73		۵	2021	\$	65,954.52	2021	65954.52209	
5		2021		March	Α	\$ 74,497.90	· A		2022			2022	58752.91846	
6		2021		April	Α	\$ 44,960.47			2023			2023	57765.54556	
7		2021		May	Α	\$ 47,151.75			Total			B	61481.65642	
8		2021		June	Α	\$ 52,510.32		в	2021			2021	66757.33785	

Figure 8: Comparing Functions and Pivot Tables

A	В	С	D	E	F G	Н	1	J	PivotTable Fields	~ ×
14	2021	December	Α	\$ 84,227.43		2023			Choose fields to add to report:	@ ~
15	2022	January	А	\$ 80,006.05		_			Search	<u>ت</u> ام
16	2022	February	А	\$ 70,020.74	Row Labels	Average of Sales (\$)	Sum of Sales (\$)		Vear	
17	2022	March	А	\$ 45,976.12	A	61004.25712	2074144.742		Month Employee	
18	2022	April	А	\$ 52,075.45	2021	65954.52209	791454.2651		Sales (5) More Tables	
19	2022	May	А	\$ 84,191.77	2022	58752.91846	705035.0215			
20	2022	June	А	\$ 42,632.69	2023	57765.54556	577655.4556			
21	2022	July	А	\$ 40,982.76	в	61481.65642	2090376.318			
22	2022	August	Α	\$ 59,977.70	2021	66757.33785	801088.0541			
23	2022	September	А	\$ 50,816.65	2022	62026.54476	744318.5372		Durg fields between areas below:	
24	2022	October	А	\$ 58,858.40	2023	54496.97271	544969.7271		Y Filters	Columns Values
25	2022	November	А	\$ 61,842.25	c	57405.58099	1951789.754			
26	2022	December	А	\$ 57,654.44	2021	56799.22444	681590.6933		/	
27	2023	January	А	\$ 53,521.77	2022	56913.64835	682963.7802		E Rows Σ	Values
28	2023	February	А	\$ 71,225.76	2023	58723.528	587235.28		Employee v /	iverage of Sales (S) *
29	2023	March	Α	\$ 50,811.77	Grand Total	59963.83151	6116310.814			uni or seres (3)
30	2023	April	Α	\$ 68,667.63						

Figure 9: Final Step of Inserting Pivot Table

We will now add the second element, annual total sales. To achieve this, simply click and drag the Sales(\$) down to Values in the orange box once more. In order to place this new entry to the right of the existing column, make sure to place it below the Average of Sales(\$).

F	G	Н	I		J	К	L	М	Ν
			1						
1	Sum	mary	Monthly Average Sales	A	Annual Total Sales		Row Labels	Average of Sales (\$)	Sum of Sales (\$)
		Total	\$ 61,004.26	\$	2,074,144.74		A	61004.25712	2074144.742
	٨	2021	\$ 65,954.52	\$	791,454.27		2021	65954.52209	791454.2651
	~	2022	\$ 58,752.92	\$	705,035.02		2022	58752.91846	705035.0215
		2023	\$ 57,765.55	\$	577,655.46		2023	57765.54556	577655.4556
		Total	\$ 61,481.66	\$	2,090,376.32		В	61481.65642	2090376.318
	D	2021	\$ 66,757.34	\$	801,088.05		2021	66757.33785	801088.0541
	в	2022	\$ 62,026.54	\$	744,318.54		2022	62026.54476	744318.5372
		2023	\$ 54,496.97	\$	544,969.73		2023	54496.97271	544969.7271
		Total	\$ 57,405.58	\$	1,951,789.75		c	57405.58099	1951789.754
	c	2021	\$ 56,799.22	\$	681,590.69		2021	56799.22444	681590.6933
	C	2022	\$ 56,913.65	\$	682,963.78		2022	56913.64835	682963.7802
_		2023	\$ 58,723.53	\$	587,235.28		2023	58723.528	587235.28
							Grand Total	59963.83151	6116310 814

Figure 10: Completed PivotTable

Comparing the table manually generated using functions to the Pivot Table, we can see that they are identical. The only minor difference in the values would be their formatting.

Topic 2. PivotTable Columns

Navigate to the next worksheet PIVOT-02, which has revenue and profit data on a large corporation with offices in multiple cities. Suppose that we want to see how each offices' revenue evolved over time.

	2014	2015	2016	2017	2018	2019	2020	2021	2022
Atlanta									
Boston									
Chicago									
Denver									
Eugene									
Fort Worth									
Galesburg									
Houston									

Table 1: Empty Table to Replicate

That is, we want to use PivotTables to automatically fill out Table 1. In addition to the "rows" that we learned how to deal with in the previous section, we will now add "columns." To start off this process, select the data and start off the PivotTable.

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Paste	X Cut Copy → S Format Painter Clipboard 5	Celibri B I U ~	- 11 - A^ A' ⊞ - <u>A</u> - <u>A</u> - Font 5	= = = * * • = = = = = = Ab;	B Wrap Text	General S ~ % 5 S Numbe	Condition Formatting	Al Format as Table *	Percent 2 Good	Normal Neutral	insert Delete Format Cells	∑ Aut	toSum * Ary O Sort & Find & ar* Filter* Select* Editing	Add-ins Analyze Data	
12	▼ X ✓	fx Sum of Rev	venue												~
A	В	С	D	E	F	G	H	J	К	L	M N	1	PivotTable Fields		
1								_				-1	rivotiable rields		
2	Office	Year	Revenue	Profit	Profit Margin	Sales	Sum of Revenu	e Column Labels 🕞					Choose fields to add to repo	rc	W *
3	Atlanta	2014	\$818,403.33	\$ 83,477.14	10.2%	907	Row Labels	· 2014	2015	2016	2017 2018		Search		2
4	Atlanta	2015	\$462,975.20	\$ 92,132.06	19.9%	542	Atlanta	818403.33	462975.2	430191.58	219155.35 570443.14	8	Office		
5	Atlanta	2016	\$430,191.58	\$ 61,517.40	14.3%	981	Boston	587791.22	932301.96	137105.11	709333.24 304546.65	7	Revenue		
6	Atlanta	2017	\$219,155.35	\$ 11,615.23	5.3%	614	Chicago	430907.74	775170.75	552446.08	599624.31 645867.48	- 41	Profit Profit Margin		
7	Atlanta	2018	\$570,443.14	\$ 56,473.87	9.9%	533	Denver	595079.59	952827.8	655636.46	105466.36 532064.37	8	Sales		
8	Atlanta	2019	\$863,517.26	\$ 54,401.59	6.3%	973	Eugene	850002.7	261420.05	798342.97	433765.68 776052.14	9	More Tables		
9	Atlanta	2020	\$422,946.78	\$ 25,376.81	6.0%	547	Fort Worth	183354.42	972272.19	904482.44	778191.84 791010.74	- 3(
10	Atlanta	2021	\$402,477.10	\$ 22,538.72	5.6%	1,009	Galesburg	980725.87	470698.13	165685.09	670793.84 803818.87	9			
11	Atlanta	2022	\$255,117.35	\$ 42,604.60	16.7%	588	Houston	447294.17	106501.22	908074.37	474887.35 751431.21	2			
12	Boston	2014	\$587,791.22	\$101,687.88	17.3%	623	Grand Total	4893559.04	4934167.3	4551964.1	3991217.97 5175234.6	53	Dece fields between some b		
13	Boston	2015	\$932,301.96	\$ 99,756.31	10.7%	663							Thus	II. Caluma	_
14	Boston	2016	\$137,105.11	\$ 11,105.51	8.1%	878							1 Pikes	Year	
15	Boston	2017	\$709,333.24	\$140,447.98	19.8%	693									
16	Boston	2018	\$304,546.65	\$ 53,295.66	17.5%	973									
17	Boston	2019	\$713,085.68	\$124,789.99	17.5%	531									
18	Boston	2020	\$699,168.62	\$ 91,591.09	13.1%	630							Rows	Σ Values	
19	Boston	2021	\$497,796.15	\$ 99,061.43	19.9%	907							Office ~	Sum of Revenu	e ~
20	Boston	2022	\$204,172.14	\$ 26,542.38	13.0%	993									
21	Chicago	2014	\$430,907.74	\$ 35,765.34	8.3%	952									
	Chicago	2015	¢77E 170 7E	¢ 90.010.91	11.69/	013									

Figure 11: Completed PivotTable

Replicate Figure 11 by moving Office to the red box, Year to the orange box, and Revenue to the blue box. Double check if the results are correct by comparing this new table to the table in the next worksheet, PIVOT-03.