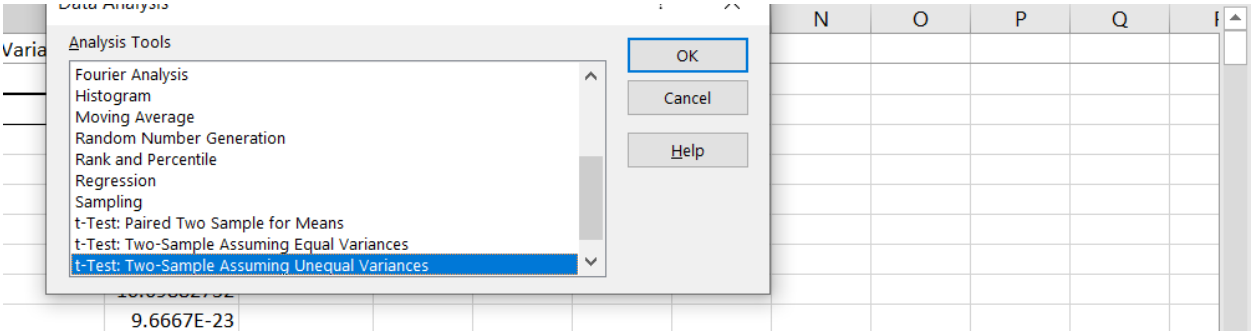
T-TESTS FOR BUSINESS IMPACT – DEMO NOTES

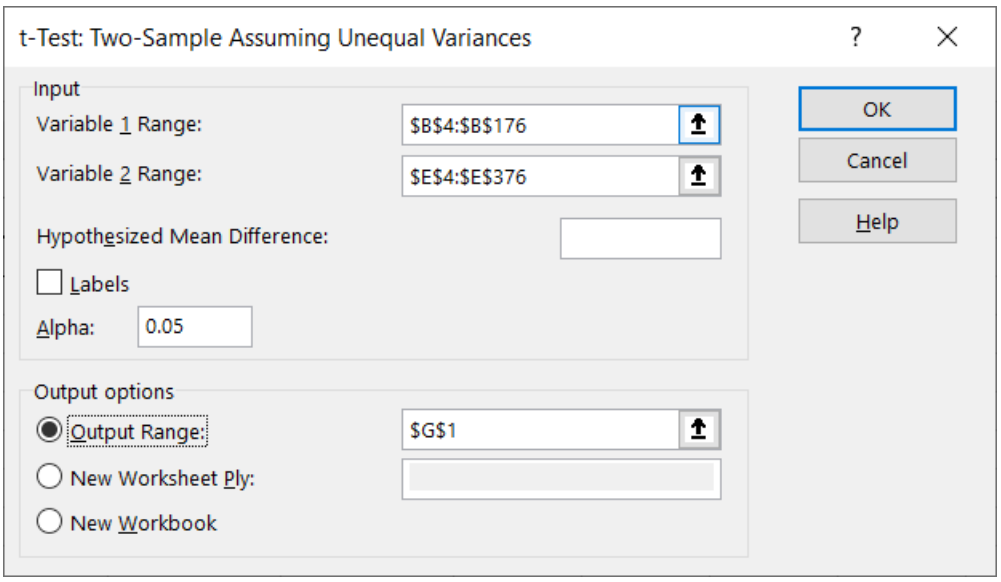
1. Create a new worksheet, including the PivotTables with the records of the two categories you want to compare.

	A	B	C	D	E
1	airco	yes		airco	no
2					
3	**Row Labels**	**Sum of price**		**Row Labels**	**Sum of price**
4	6	66000		1	42000
5	10	88500		2	38500
6	11	90000		3	49500
7	16	37900		4	60500
8	21	48500		5	61000
9	23	37900		7	66000
10	28	44000		8	69000
11	29	44500		9	83800
12	30	44900		12	30500
13	32	48000		13	27000

2. On the ribbon, go to Data -> Data Analysis -> t-Test: Two-Sample Assuming Unequal Variances



3. Select your variable ranges, and set the output range to somewhere on the same worksheet.



4. This gives you the p-value. Return to slides for explanation of confidence interval.

5. To calculate the confidence interval, follow with the formulas used below.

	F	G	H	I	J	K
1		Ho: μ1 - μ2 = 0 Ha: μ1 - μ2 ≠ 0				
2						
3		t-Test: Two-Sample Assuming Unequal Variances				
4						
5			*yes*	*no*		
6		Mean	85880.5896	59884.85255		
7		Variance	810167352.2	455341801		
8		Observations	173	373		
9		Hypothesized Mean Difference	0			
10		df	265			
11		t Stat	10.69882732			
12		P(T<=t) one-tail	9.6667E-23			
13		t Critical one-tail	1.650623976			
14		P(T<=t) two-tail	1.93334E-22			
15		t Critical two-tail	1.968956281			
16						
17		total sample size	546	=SUM(H8:I8)		
18		mean difference	25995.73705	=H6-I6		
19		standard error of difference	2429.774429	=SQRT((H7/H8)+(I7/I8))		
20						
21		Margin of error	4784.119625	=H19*H15		
22		Lower limit	21211.61742	=H18-H21		
23		Upper limit	30779.85667	=H18+H21		
24						

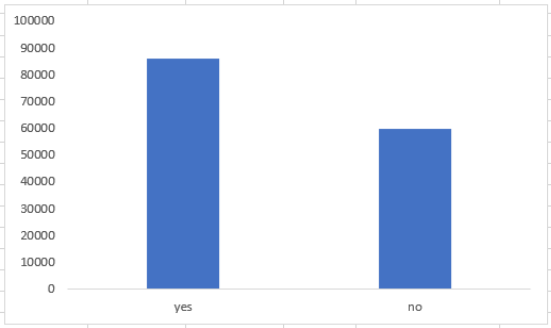
Return to slides for explanation of visualizing t-test results

6. To visualize t-test results, first set up the below formulas.

	J	K	L	M	N	O	P	Q
1								
2								
3								
4								
5			*yes*	*no*		*yes*	*no*	
6		Mean	85880.5896	59884.85255		=H6	=I6	
7		Variance	810167352.2	455341801		=H7	=I7	
8		Observations	173	373		=H8	=I8	
9		Standard error	2164.035184	1104.878047		=SQRT(L7)/SQRT(L8)	=SQRT(M7)/SQRT(M8)	
10		m.e. upper	4260.890669	2175.456571		=L$9*$H$15	=M$9*$H$15	
11		m.e. lower	4260.890669	2175.456571		=L$9*$H$15	=M$9*$H$15	
12								
13								
14								

7. Create a bar chart based on the means of each category

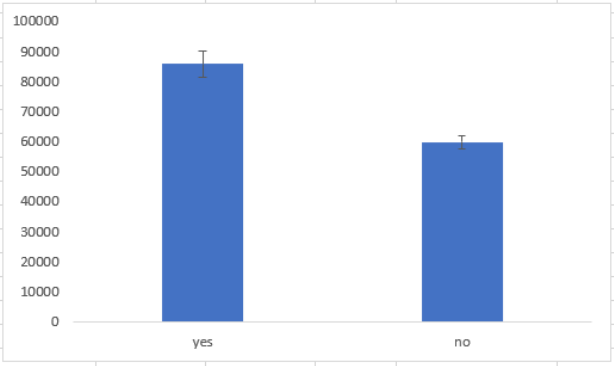
	H	I	J	K	L	M	N	O	P
1									
2									
3	s								
4									
5	*yes*	*no*			*yes*	*no*		*yes*	*n*
6	85880.5896	59884.85255		Mean	85880.5896	59884.8525		=H6	=I6
7	810167352	455341801		Variance	810167352	455341801		=H7	=I7
8	173	373		Observations	173	373		=H8	=I8
9	0			Standard error	2164.03518	1104.87805		=SQRT(L7)/SQRT(L8)	=SQRT(M7)
10	265			m.e. upper	4260.89067	2175.45657		=L$9*$H$15	=M$9*$H$
11	10.6988273			m.e. lower	4260.89067	2175.45657		=L$9*$H$15	=M$9*$H$
12	9.6667E-23								
13	1.65062398								
14	1.9333E-22								
15	1.96895628								
16									
17	546	=SUM(H8:I8)							
18	25995.737	=H6-I6							
19	2429.77443	=SQRT((H7/H8)+(I7/I8))							
20									
21	4784.11962	=H19*H15							
22	21211.6174	=H18-H21							
23	30779.8567	=H18+H21							
24									
25									
26									
27									
28									
29									
30									
31									



readme | housing | ac-descriptive | **ac-inferential** | basement-inferential-1 | basement-inferen

8. Click on the plus-sign next to the bar chart and select Error Bars, hit the right arrow next to it and select More Options.
9. Go to Custom and the bottom and set the error bars to be the margin of error values.
10. The bar chart now has error bars representing the 95% confidence interval for each sample. If the bars intersect between the two charts, there is no significant difference in means.

	H	I	J	K	L	M	N	O	P	Q
1										
2										
3	s									
4										
5	*yes*	*no*			*yes*	*no*		*yes*	*no*	
6	85880.5896	59884.85255		Mean	85880.5896	59884.8525		=H6	=I6	
7	810167352	455341801		Variance	810167352	455341801		=H7	=I7	
8	173	373		Observations	173	373		=H8	=I8	
9	0			Standard error	2164.03518	1104.87805		=SQRT(L7)/SQRT(L8)	=SQRT(M7)/SQRT(M8)	
10	265			m.e. upper	4260.89067	2175.45657		=L$9*$H$15	=M$9*$H$15	
11	10.6988273			m.e. lower	4260.89067	2175.45657		=L$9*$H$15	=M$9*$H$15	
12	9.6667E-23									
13	1.65062398									
14	1.9333E-22									
15	1.96895628									
16										
17	546	=SUM(H8:I8)								
18	25995.737	=H6-I6								
19	2429.77443	=SQRT((H7/H8)+(I7/I8))								
20										
21	4784.11962	=H19*H15								
22	21211.6174	=H18-H21								
23	30779.8567	=H18+H21								
24										
25										
26										
27										
28										
29										
30										



11. Adjust the y axis depending on the circumstances, with the knowledge that it is the best practice to start a y axis at zero.

Demo: `margin-of-error.xlsx`

Column position	Column label	Formula
C	Sample mean	=AVERAGE($B$3:INDEX($B$3:$B$548,$A4))
D	Variance	=VAR.S($B$3:INDEX($B$3:$B$548,$A4))
E	Standard Error	=SQRT(D4)/SQRT(A4)
F	Critical value	=VLOOKUP($A4,'critical-value'!$A$1:$B$34,2)
G	Margin of error	=E4*F4
H	Margin of error as % of mean	=G4/C4

Plot column H as a line chart.