



Using Regression Analysis in the Market Approach (GCTM)

C. Fred Hall MBA, CBA, CVA



NACVA and the CTI's
Financial Valuation SuperConference

Ft. Lauderdale, Florida
December 10–12, 2018

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Annual Consultants Conference

Using Regression in the Market Approach

GCTM

I. Shortcomings of Median and Harmonic Mean

- a. When Using Median and Mean with Average Performing Companies
Revenue Multiplier Value and Cash Flow Multiplier Value Will Align.
- b. When Using Median and Mean with High-Performing Companies
Revenue Multiplier Value is Too Low; Cash Flow Multiplier Value is Too High.
- c. When Using Median and Mean with Low-Performing Companies
Revenue Multiplier Value is Too High; Cash Flow Multiplier Value is Too Low.

II. Add Another Dimension to your Sample Table

- a. Correlation between SDE Profit Margin and Revenue Multipliers
- b. Graphing the Relationship between SDE% and Revenue Multipliers

III. Using Regression

- a. Why Regression Properly Identifies Where the Market is and Mean Doesn't
- b. Using Regression to Identify Outliers
- c. The Inverted Relationship between Profitability and Cash Flow Multiplier:
The more profitable a company is the LOWER its Cash Flow Multiplier.

IV. Selecting Comps When Using Regression and SDE%

- a. Use the narrowest range of revenues as possible consistent with a sample size of 15 to 25. If sample size is too small, increase the range of SIC classifications first before increasing revenue range.
- b. If your Subject has inventory and fixtures, select comparables that do too.
- c. Reject all comparables with Cash Flow Multipliers > 10 or negative.
- d. Reject all stock sales.
- e. Reject all transactions with assumed liabilities.
- f. Reject all transactions with Real Estate



Selecting a Sample of Comparables

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Observation	Selling Price (b)	Gross Revenue (c)	Cash Flow (SDE) (d)	Revenue Multiplier $b \div c$	Cash Flow Multiplier $b \div d$
1	170,000	1,250,000	37,000	0.14	4.66
2	252,000	1,405,000	49,000	0.18	5.14
3	315,000	1,193,000	83,000	0.26	3.81
4	300,000	1,291,000	90,000	0.23	3.33
5	312,000	1,278,000	94,000	0.24	3.32
6	509,000	1,175,000	97,000	0.43	5.25
7	575,000	1,225,000	115,000	0.47	5.00
8	575,000	1,200,000	103,000	0.48	5.58
9	347,000	1,120,000	105,000	0.31	3.30
10	430,000	1,345,000	142,000	0.32	3.03
11	575,000	1,386,000	151,000	0.41	3.81
12	550,000	1,376,000	168,000	0.40	3.27
13	690,000	1,017,000	126,000	0.68	5.46
14	568,000	1,183,000	157,000	0.48	3.63
15	391,000	1,255,000	178,000	0.31	2.20
16	520,000	1,282,000	186,000	0.41	2.80
17	275,000	1,172,000	171,000	0.23	1.61
18	594,000	1,315,000	203,000	0.45	2.93
19	700,000	1,176,000	215,000	0.59	3.26
20	565,000	1,049,000	172,000	0.54	3.29
21	577,000	1,280,000	213,000	0.45	2.71
22	650,000	1,050,000	210,000	0.62	3.10
23	545,000	1,017,000	204,000	0.54	2.67
24	700,000	1,250,000	275,000	0.56	2.55
	Price	Revenue	Cash Flow	Revenue Mult Range	Cash Flow Mult Range
Avg	\$487,000	\$1,220,000	\$148,000	0.41	3.57
Lower Quartile				=	0.30
Median				=	0.42
Upper Quartile				=	0.49
Harmonic Mean				=	0.34



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Selecting a Sample of Comparables

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	Price	Revenue	Cash Flow	Revenue Mult Range	Cash Flow Mult Range
Avg	\$487,000	\$1,220,000	\$148,000	0.41	3.57
	Lower Quartile =			0.30	2.89
	Median =			0.42	3.30
	Upper Quartile =			0.49	4.02
	Harmonic Mean =			0.34	3.27

Shortcomings of Median and Harmonic Mean

1. Average-Performing Subject Company:

Revenue \$1,200,000

Cash Flow \$150,000

Median Revenue Multiplier Value

\$1,200,000 x 0.42 = \$508,833

Median Cash Flow Multiplier Value

\$150,000 x 3.30 = \$494,413

Opinion of Value is: **\$502,000**



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Selecting a Sample of Comparables

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	Price	Revenue	Cash Flow	Revenue Mult Range	Cash Flow Mult Range
Avg	\$487,000	\$1,220,000	\$148,000	0.41	3.57
Lower Quartile				= 0.30	2.89
Median				= 0.42	3.30
Upper Quartile				= 0.49	4.02
Harmonic Mean				= 0.34	3.27

Shortcomings of Median and Harmonic Mean

2. Low-Profit Subject Company:

Revenue \$1,200,000
Cash Flow \$85,000

Using Median Multiplier Values

\$1,200,000 x 0.42 = \$508,833

\$85,000 x 3.30 = \$280,167

OR:

Using Lower Quartile Multiplier Values

\$1,200,000 x 0.30 = \$358,102

\$85,000 x 2.89 = \$245,948

Opinion of Value is: ?

Which one is it?



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Selecting a Sample of Comparables

Page 7

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Shortcomings of Median and Harmonic Mean

3. High-Profit Subject Company:

Revenue \$1,200,000
Cash Flow \$220,000 18.3%

Using Median Multiplier Values

\$1,200,000 x 0.42 = \$508,833

\$220,000 x 3.30 = \$725,139

OR:

Using Upper Quartile Multiplier Values

\$1,200,000 x 0.49 = \$592,935

\$220,000 x 4.02 = \$884,496

Opinion of Value is: ?

Which one is it?



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The Problem

Median and Harmonic Mean are One Dimensional

i.e. The Subject is accorded the median revenue multiplier regardless of how profitable it was.

The Solution - Add Another Dimension

Include a column with Cash Flow ÷ Revenues (SDE%)

Sort the table by the SDE% Column

Observation	Selling Price (b)	Gross Revenue (c)	Cash Flow (SDE) (d)	SDE% $d \div c$	Revenue Multiplier $b \div c$	Cash Flow Multiplier $b \div d$
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1. Companies with the lowest SDE% have the lowest Revenue Multipliers.

Observations #1-5 have an average SDE% of 5.5%

Observations #1-5 have average Revenue Multiplier of 0.21

2. Companies with the highest SDE% earn the highest Revenue Multipliers.

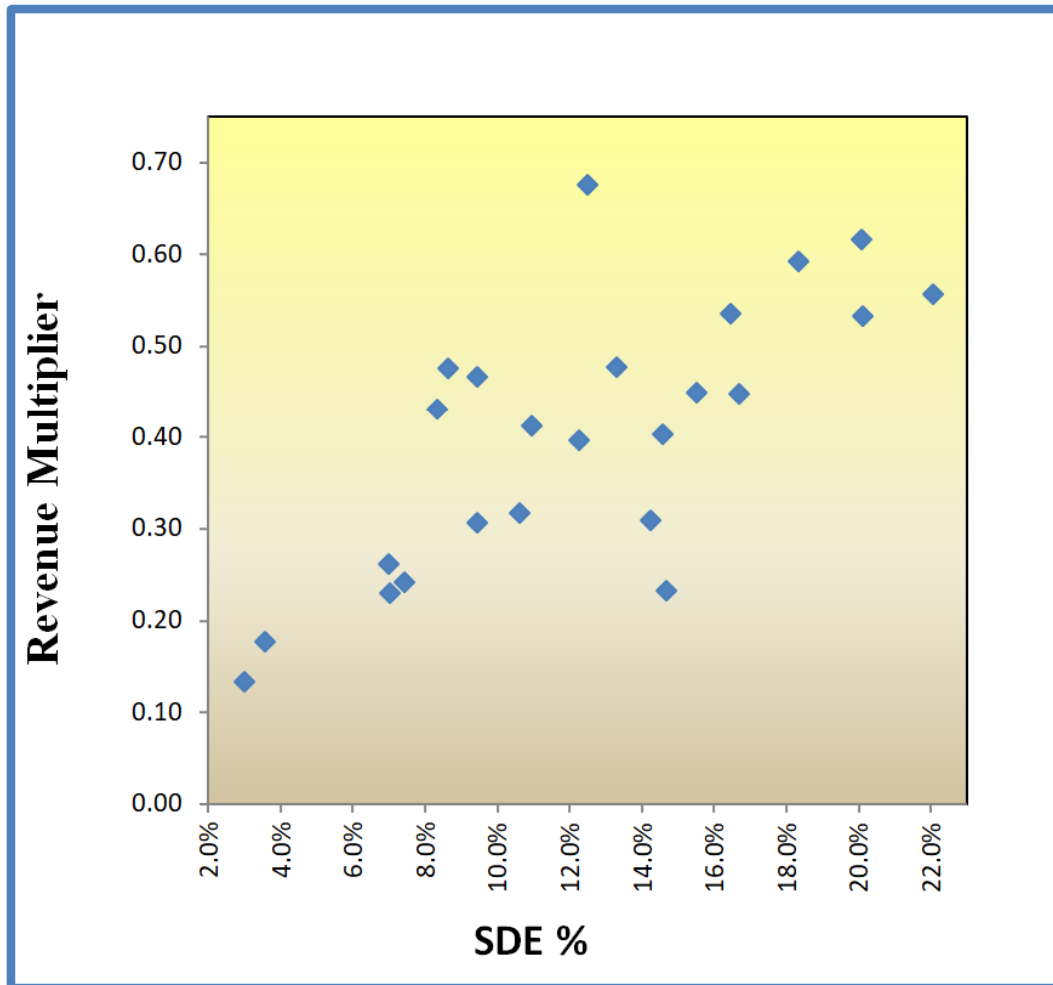
Observations #20-24 have an average SDE% of 19%

Observations #20-24 have average Revenue Multiplier of 0.54

Simple Logic: The more profitable the business, the higher its revenue multiplier.



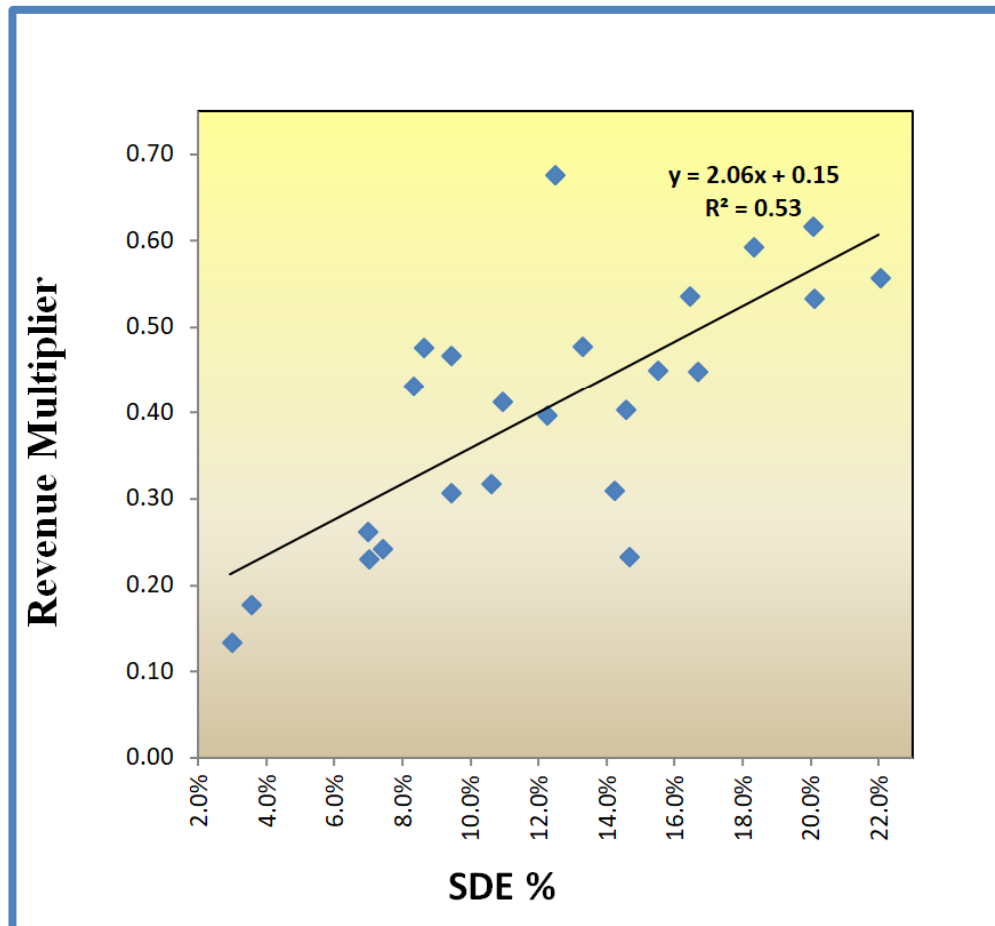
Relationship Between Cash Flow & Revenue Multipliers



SDE%	Revenue Multiplier	
2.9%	0.14	1
3.5%	0.18	2
6.9%	0.26	3
7.0%	0.23	4
7.4%	0.24	5
8.3%	0.43	6
9.4%	0.47	7
8.6%	0.48	8
9.4%	0.31	9
10.6%	0.32	10
10.9%	0.41	11
12.2%	0.40	12
12.4%	0.68	13
13.2%	0.48	14
14.2%	0.31	15
14.5%	0.41	16
14.6%	0.23	17
15.4%	0.45	18
18.3%	0.59	19
16.4%	0.54	20
16.6%	0.45	21
20.0%	0.62	22
20.1%	0.54	23
22.0%	0.56	24



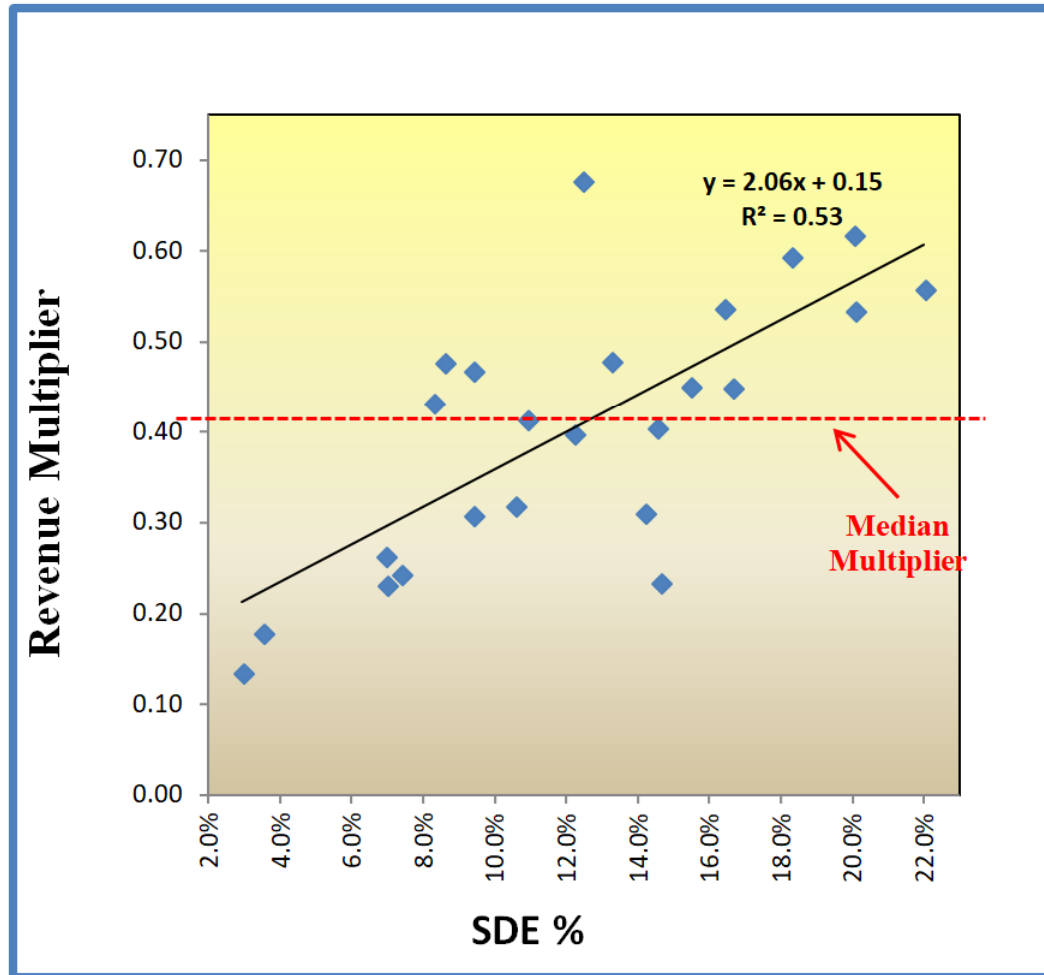
Relationship Between Cash Flow & Revenue Multipliers



SDE%	Revenue Multiplier	
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12.4%	0.68	13
13.2%	0.48	14
14.2%	0.31	15
14.5%	0.41	16
14.6%	0.23	17
15.4%	0.45	18
18.3%	0.59	19
16.4%	0.54	20
16.6%	0.45	21
20.0%	0.62	22
20.1%	0.54	23
22.0%	0.56	24



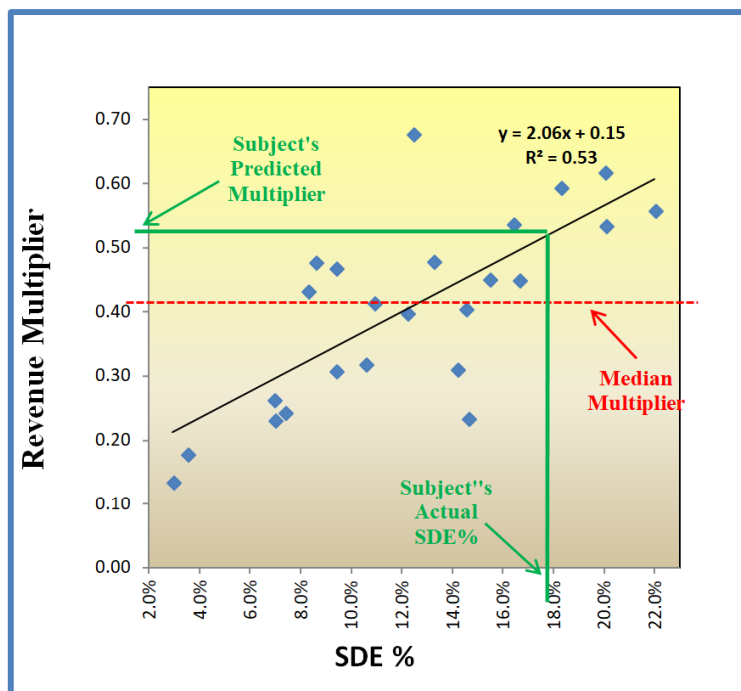
Relationship Between Cash Flow & Revenue Multipliers



SDE%	Revenue Multiplier	
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13.2%	0.48	14
14.2%	0.31	15
14.5%	0.41	16
14.6%	0.23	17
15.4%	0.45	18
18.3%	0.59	19
16.4%	0.54	20
16.6%	0.45	21
20.0%	0.62	22
20.1%	0.54	23
22.0%	0.56	24



Relationship Between Cash Flow & Revenue Multipliers



SDE%	Revenue Multiplier	
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14.2%	0.31	15
14.5%	0.41	16
14.6%	0.23	17
15.4%	0.45	18
18.3%	0.59	19
16.4%	0.54	20
16.6%	0.45	21
20.0%	0.62	22
20.1%	0.54	23
22.0%	0.56	24

Revenue = \$1,200,000

Cash Flow = \$220,000 SDE% = 18.3%

$$\begin{aligned}\text{Multiplier} &= 2.06 \times \text{SDE\%} + 0.15 \\ &= 2.06 \times .183 + .15\end{aligned}$$

Revenue Multiplier = 0.53

Estimated Value = **\$632,376**

Value using 0.42 Median = \$508,833

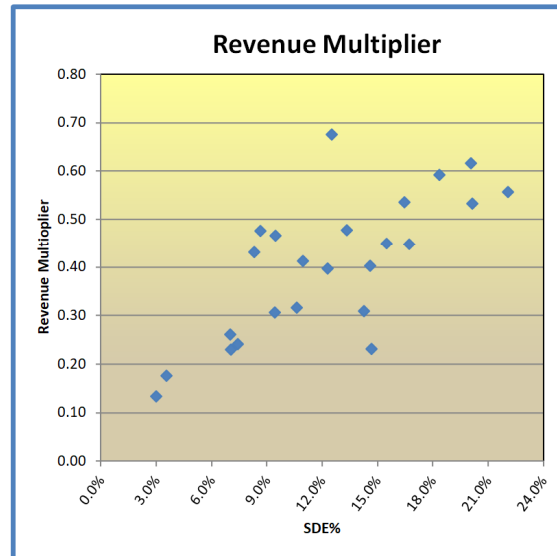
Value Using .34 Harmonic Mean = \$408,000



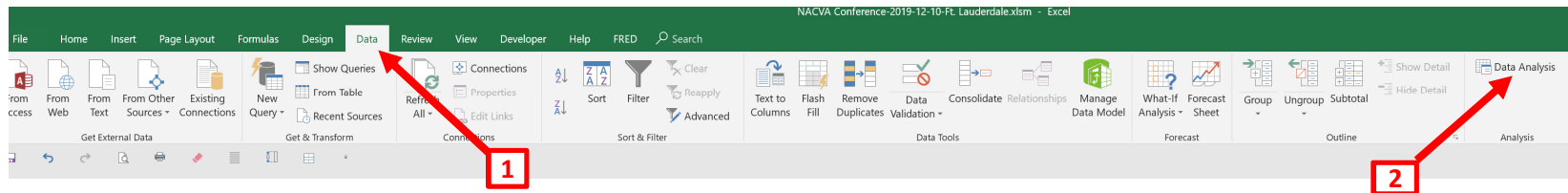
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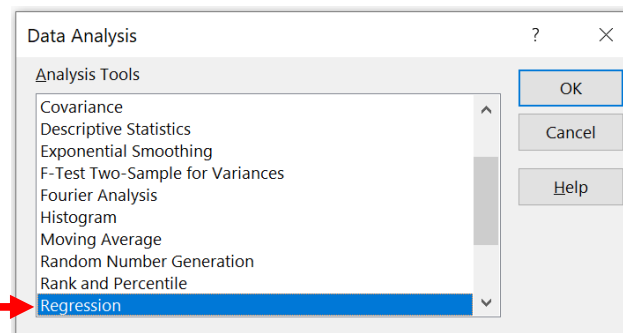
Using Standard Error to Identify Outliers

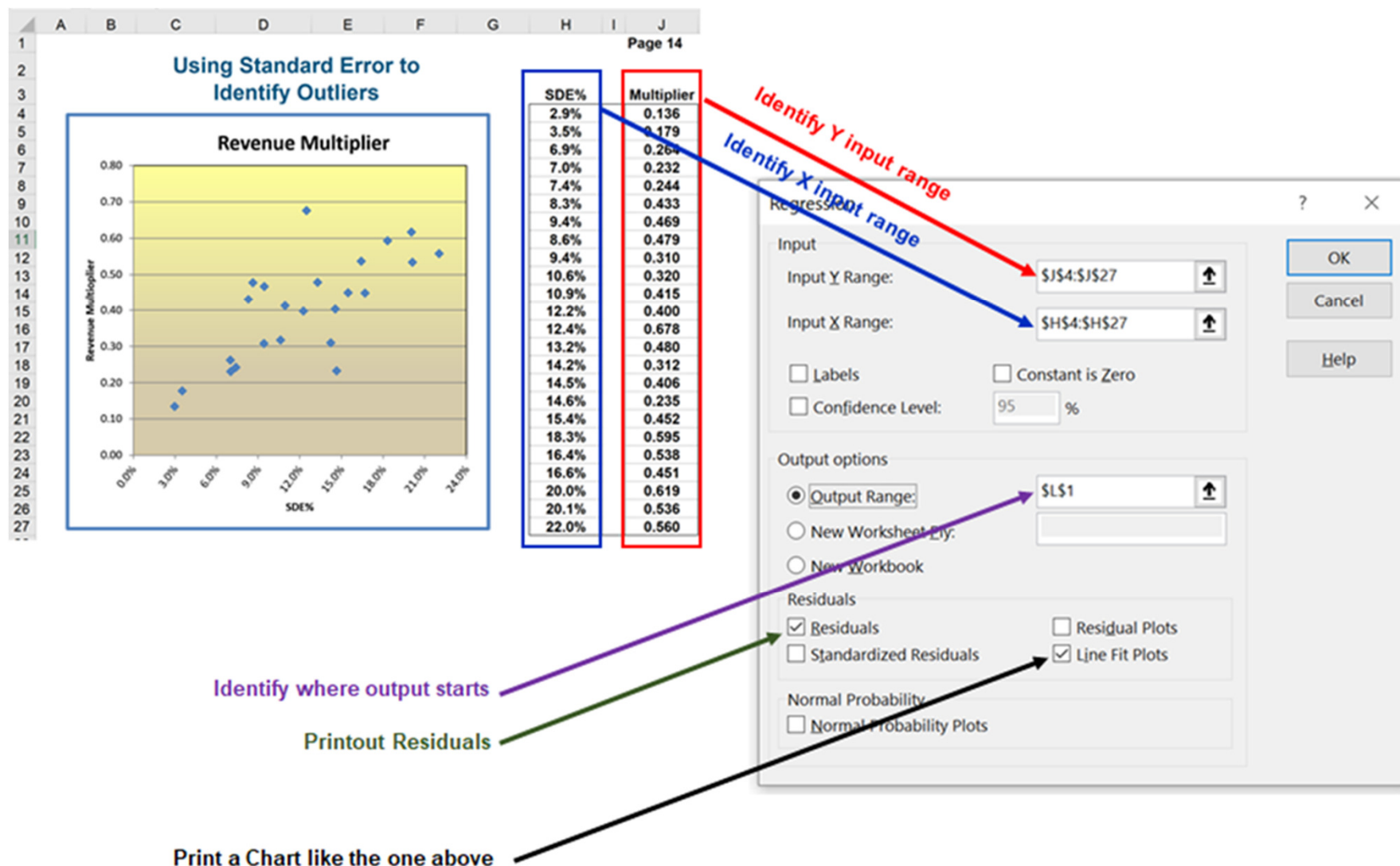


SDE%	Multiplier	
2.9%	0.136	1
3.5%	0.179	2
6.9%	0.264	3
7.0%	0.232	4
7.4%	0.244	5
8.3%	0.433	6
9.4%	0.469	7
8.6%	0.479	8
9.4%	0.310	9
10.6%	0.320	10
10.9%	0.415	11
12.2%	0.400	12
12.4%	0.678	13
13.2%	0.480	14
14.2%	0.312	15
14.5%	0.406	16
14.6%	0.235	17
15.4%	0.452	18
18.3%	0.595	19
16.4%	0.538	20
16.6%	0.451	21
20.0%	0.619	22
20.1%	0.536	23
22.0%	0.560	24

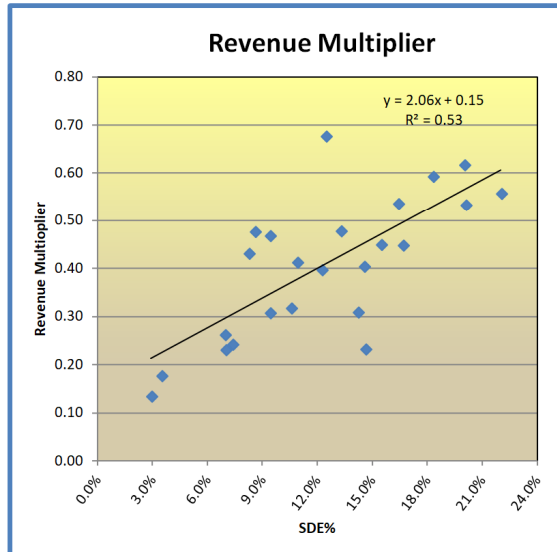


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Using Standard Error to Identify Outliers



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SUMMARY OUTPUT

SDE%	Multiplier
2.9%	0.136
3.5%	0.179
6.9%	0.264
7.0%	0.232
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18.3%	0.595
16.4%	0.538
16.6%	0.451
20.0%	0.619
20.1%	0.536
22.0%	0.560

Regression Statistics	
Multiple R	0.73
R Square	0.53
Adjusted R Square	0.51
Standard Error	0.10
Observations	24

ANOVA		
	df	SS
Regression	1	0.25881333
Residual	22	0.2300191
Total	23	0.48883243

	Coefficients	Standard Error
Intercept	0.15	0.05500458
X Variable 1	2.06	0.41446264

RESIDUAL OUTPUT

Actual Value	Predicted Value	Residuals
0.136	0.21	-0.08
0.179	0.22	-0.05
0.264	0.30	-0.03
0.232	0.30	-0.06
0.244	0.30	-0.06
0.433	0.32	0.11
0.469	0.35	0.12
0.479	0.33	0.15
0.31	0.35	-0.04
0.32	0.37	-0.05
0.415	0.38	0.04
0.4	0.40	0.00
0.678	0.41	0.27
0.480	0.43	0.05
0.312	0.45	-0.13
0.406	0.45	-0.05
0.235	0.45	-0.22
0.452	0.47	-0.02
0.595	0.53	0.07
0.538	0.49	0.05
0.451	0.50	-0.05
0.619	0.57	0.05
0.536	0.57	-0.03
0.56	0.61	-0.05



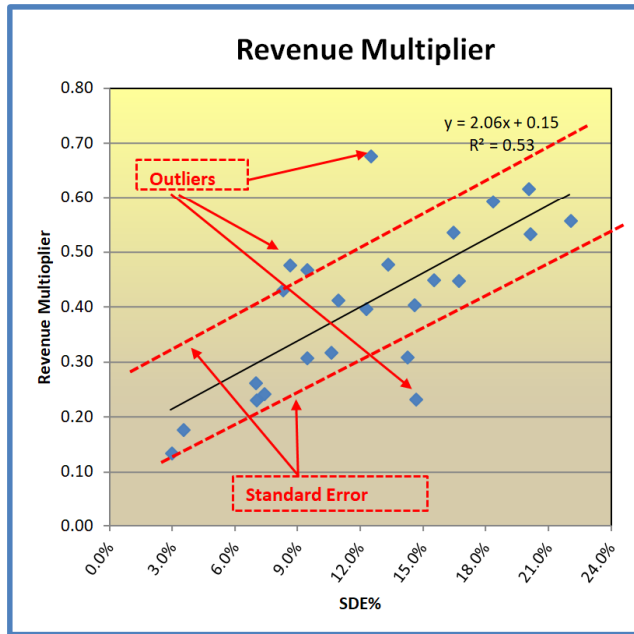
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9.4%	0.310
10.6%	0.320
10.9%	0.415
12.2%	0.400
12.4%	0.678
13.2%	0.480
14.2%	0.312
14.5%	0.406
14.6%	0.235
15.4%	0.452
18.3%	0.595
16.4%	0.538
16.6%	0.451
20.0%	0.619
20.1%	0.536
22.0%	0.560

Regression Statistics	
Multiple R	0.55
R Square	0.30
Adjusted R Square	0.25
Standard Error	0.12
Observations	18

ANOVA

	df	SS
Regression	1	0.0910092
Residual	16	0.21510621
Total	17	0.30611541

	Coefficients	Standard Error
Intercept	0.16	0.08099227
X Variable 1	1.97	0.75680562

RESIDUAL OUTPUT

Actual Value	Predicted Value	Residuals
0.136	0.22	-0.08
0.179	0.23	-0.05
0.264	0.30	-0.03
0.232	0.30	-0.06
0.244	0.30	-0.06
0.433	0.32	0.11
0.469	0.34	0.12
0.479	0.33	0.15
0.31	0.34	-0.03
0.32	0.37	-0.05
0.415	0.37	0.04
0.4	0.40	0.00
0.678	0.40	0.27
0.48	0.42	0.06
0.312	0.44	-0.13
0.406	0.45	-0.04
0.235	0.45	-0.21
0.452	0.46	-0.01



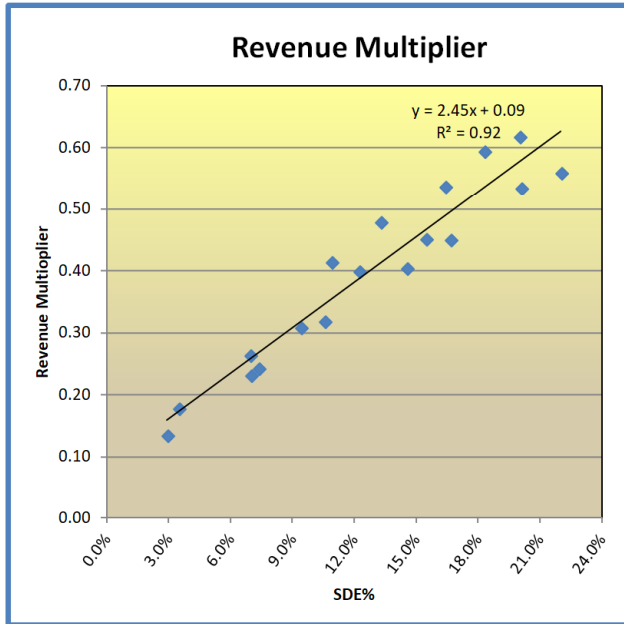
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Removing Outliers with Regression



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SUMMARY OUTPUT

SDE%	Multiplier
2.9%	0.136
3.5%	0.179
6.9%	0.264
7.0%	0.232
7.4%	0.244
9.4%	0.310
10.6%	0.320
10.9%	0.415
12.2%	0.400
13.2%	0.480
14.5%	0.406
15.4%	0.452
16.4%	0.538
16.6%	0.451
18.3%	0.595
20.0%	0.619
20.1%	0.536
22.0%	0.560

Regression Statistics	
Multiple R	0.96
R Square	0.92
Adjusted R Square	0.92
Standard Error	0.04
Observations	18

ANOVA		
	df	SS
Regression	1	0.3360548
Residual	16	0.02867174
Total	17	0.36472654

	Coefficients	Standard Error
Intercept	0.09	0.02470456
X Variable 1	2.45	0.17900424

RESIDUAL OUTPUT

Actual Value	Predicted Value	Residuals
0.136	0.16	-0.02
0.179	0.17	0.01
0.264	0.26	0.01
0.232	0.26	-0.03
0.244	0.27	-0.02
0.31	0.32	-0.01
0.32	0.35	-0.03
0.415	0.35	0.06
0.4	0.39	0.01
0.48	0.41	0.07
0.406	0.44	-0.04
0.452	0.47	-0.01
0.538	0.49	0.05
0.451	0.49	-0.04
0.595	0.53	0.06
0.619	0.58	0.04
0.536	0.58	-0.04
0.56	0.63	-0.07



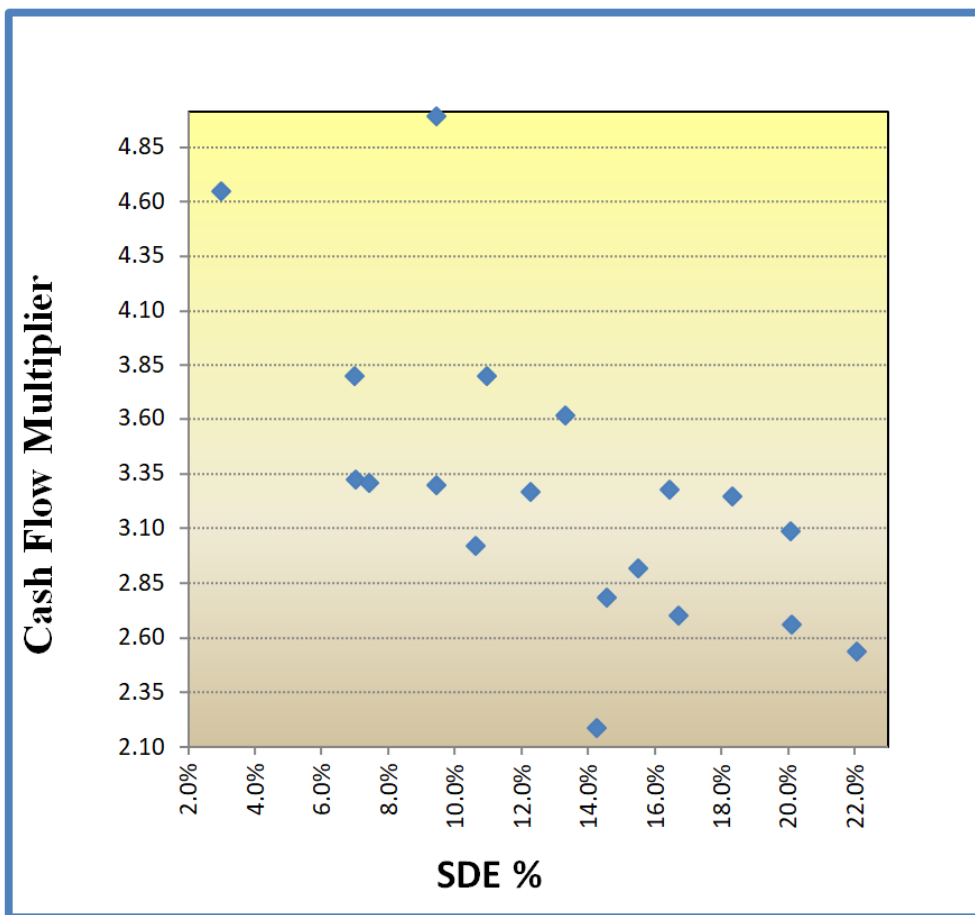
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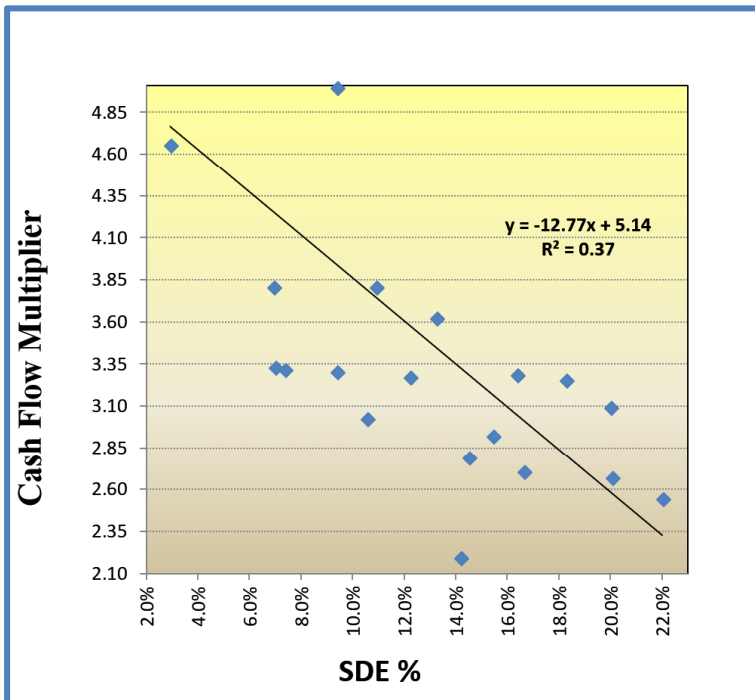
Cash Flow Multiplier Regression



SDE%	Cash Flow Multiplier	
2.9%	4.658	1
3.5%	5.143	2
6.9%	3.808	3
7.0%	3.333	4
7.4%	3.319	5
8.3%	5.247	6
9.4%	5.000	7
8.6%	5.584	8
9.4%	3.305	9
10.6%	3.028	10
10.9%	3.808	11
12.2%	3.274	12
12.4%	5.457	13
13.2%	3.625	14
14.2%	2.197	15
14.5%	2.796	16
14.6%	1.608	17
15.4%	2.926	18
18.3%	3.256	19
16.4%	3.287	20
16.6%	2.709	21
20.0%	3.095	22
20.1%	2.672	23
22.0%	2.545	24



Cash Flow Multiplier Regression



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SDE%	Cash Flow Multiplier	
2.9%	4.658	1
3.5%	5.143	2
6.9%	3.808	3
7.0%	3.333	4
7.4%	3.319	5
8.3%	5.247	6
8.6%	5.584	7
9.4%	3.305	8
9.4%	5.000	9
10.6%	3.028	10
10.9%	3.808	11
12.2%	3.274	12
12.4%	5.457	13
13.2%	3.625	14
14.2%	2.197	15
14.5%	2.796	16
14.6%	1.608	17
15.4%	2.926	18
16.4%	3.287	19
16.6%	2.709	20
18.3%	3.256	21
20.0%	3.095	22
20.1%	2.672	23
22.0%	2.545	24

SUMMARY OUTPUT

F

Regression Statistics	
Multiple R	0.611
R Square	0.373
Adjusted R	0.345
Standard E	0.870
Observations	24

ANOVA

	df	SS
Regression	1	9.923551
Residual	22	16.64696
Total	23	26.57051

Coefficients and Standard Error		
Intercept	5.138	0.467934
X Variable	-12.769	3.525908

RESIDUAL OUTPUT

Actual Value	Predicted Value	Difference
4.658	4.765	-0.107
5.143	4.692	0.450
3.808	4.252	-0.444
3.333	4.247	-0.915
3.319	4.199	-0.879
5.247	4.084	1.164
5.584	4.042	1.542
3.305	3.941	-0.636
5	3.939	1.061
3.028	3.790	-0.762
3.808	3.747	0.061



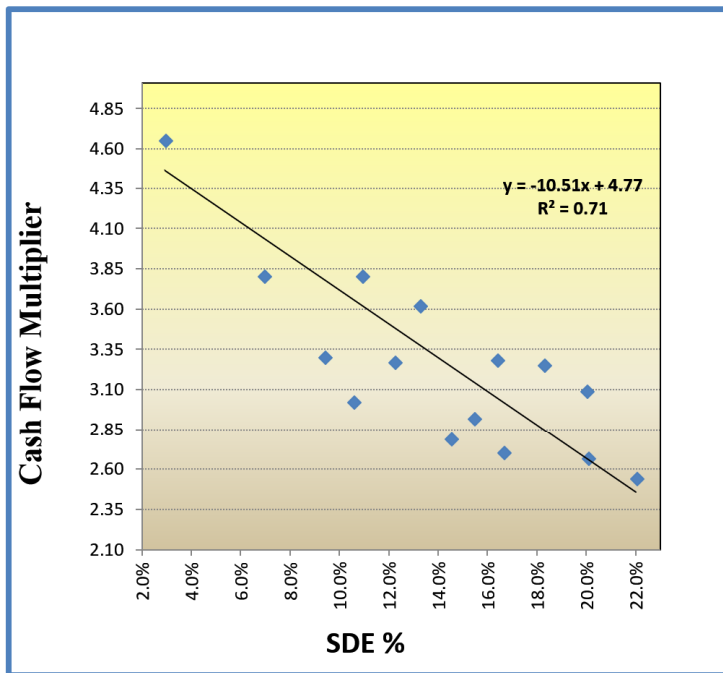
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Cash Flow Multiplier Regression



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Cash Flow Multiplier

SDE%		
2.9%	4.658	1
3.5%	5.143	2
6.9%	3.808	3
9.4%	3.305	4
10.6%	3.028	5
10.9%	3.808	6
12.2%	3.274	7
13.2%	3.625	8
14.5%	2.796	9
15.4%	2.926	10
16.4%	3.287	11
16.6%	2.709	12
18.3%	3.256	13
20.0%	3.095	14
20.1%	2.672	15
22.0%	2.545	16
		17
		18
		19
		20
		21
		22
		23
		24

SUMMARY OUTPUT

Regression Statistics

Multiple R	0.845
R Square	0.715
Adjusted R	0.694
Standard E	0.394
Observation	16

ANOVA

	df	SS
Regression	1	5.437049
Residual	14	2.169795
Total	15	7.606844

Coefficients

	Standard Error
Intercept	4.770 0.255863
X Variable	-10.511 1.774695

RESIDUAL OUTPUT

Actual Value	Predicted Value	Difference
4.658	4.463	0.195
5.143	4.403	0.740
3.808	4.040	-0.232
3.305	3.784	-0.480
3.028	3.660	-0.632
3.808	3.625	0.183
3.274	3.486	-0.213
3.625	3.377	0.248
2.796	3.245	-0.449
2.926	3.147	-0.221
3.287	3.048	0.239



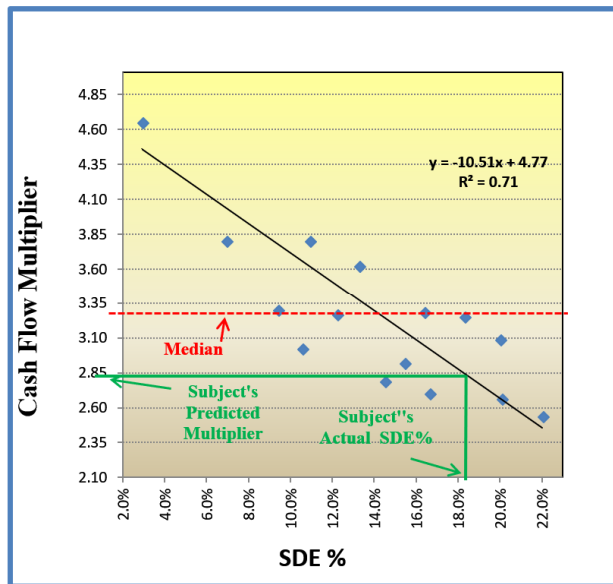
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Cash Flow Multiplier Regression



Revenues = \$1,200,000
 Cash Flow = \$220,000 SDE% = 18.3%

$$\text{Multiplier} = -10.51 \times \text{SDE\%} + 4.77$$

$$= -10.51 \times 18.3\% + 4.77$$

Cash Flow Multiplier = 2.84

Estimated Value = \$624,800

Value Using 3.30 Median = \$725,139

Revenue Multiplier = 0.54

Estimated Value = \$648,000

Value using 0.42 Median = \$508,833

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SDE%	Cash Flow Multiplier
2.9%	4.658
3.5%	5.143
6.9%	3.808
9.4%	3.305
10.6%	3.028
10.9%	3.808
12.2%	3.274
13.2%	3.625
14.5%	2.796
15.4%	2.926
16.4%	3.287
16.6%	2.709
18.3%	3.256
20.0%	3.095
20.1%	2.672
22.0%	2.545

Reasonably Similar Values

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.845
R Square	0.715
Adjusted R	0.694
Standard E	0.394
Observations	16

ANOVA		
	df	SS
Regression	1	5.437049
Residual	14	2.169795
Total	15	7.606844

Coefficients		
	Standard Error	
Intercept	4.770	0.255863
X Variable	-10.511	1.774695

RESIDUAL OUTPUT

Actual Value	Predicted Value	Difference
4.658	4.463	0.195
5.143	4.403	0.740
3.808	4.040	-0.232
3.305	3.784	-0.480
3.028	3.660	-0.632
3.808	3.625	0.183
3.274	3.486	-0.213
3.625	3.377	0.248
2.796	3.245	-0.449
2.926	3.147	-0.221
3.287	3.048	0.239
2.709	3.021	-0.312
3.256	2.849	0.407
3.095	2.667	0.428
2.672	2.661	0.010
2.545	2.457	0.088
0		
0		

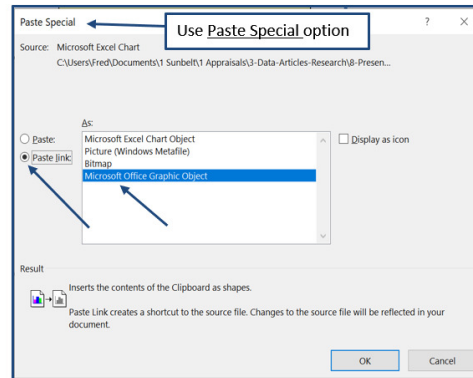


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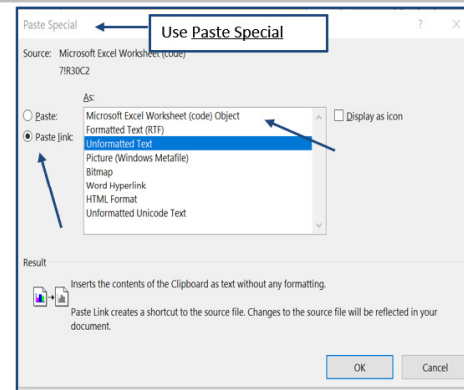
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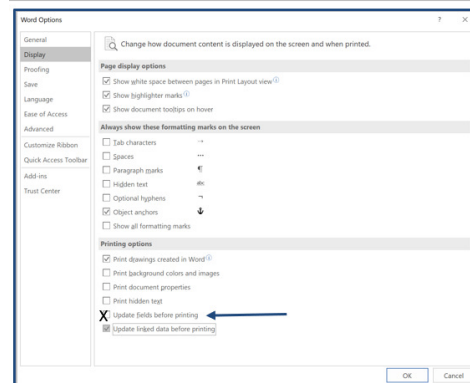
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Issues to Be Aware of When Using SDE% to Predict Multipliers

I. Use a Narrow Revenue Range in the Selected Sample

a. Revenue Multipliers and Cash Flow Multipliers Tend to Increase as Revenue Increases

b. SDE% Tends to Decrease as Revenue Increases

As companies grow, they add more layers of bureaucracy. Thus, a portion of the increased profits is diverted to pay these salaries, which decreases profit margins.

EXHIBIT I Size Effect on Multipliers and SDE Profit Margin					
Total Transactions	Total Sales		Cash Flow Multiplier	Gross Revenue Multiplier	SDE Margin (SDE%)
	Sales Range	Median Sales	Median	Median	Median
3,595	\$0-\$500,000	241,197	2.11	0.50	24.7%
1,387	\$500,000-\$1,000,000	693,701	2.51	0.44	18.4%
897	\$1,000,001-\$2,000,000	1,375,624	2.77	0.44	15.6%
545	\$2,000,001-\$5,000,000	3,097,922	2.96	0.45	14.7%
143	\$5,000,001-\$8,000,000	6,305,046	3.95	0.53	13.3%
242	\$8,000,001-\$25,000,000	13,856,490	4.87	0.66	14.6%
284	\$25,000,001+	65,588,925	6.28	0.64	11.4%
Overall Totals					
7,144	All Transactions	772,200	2.50	0.48	20.2%

c. A small homogeneous sample of 15 to 25 observations will generally be much more statistically relevant than a large diverse sample.

II. Don't Use Comps with Cash Flow Multipliers > 10 or Negative

Companies with Cash Flow Multipliers > 10 or negative are unprofitable companies.

Unprofitable companies do not conform to our premise of value - on-going concerns.

These companies are sold on the basis of their ASSET VALUES not their cash flow.

Using these companies in your sample will significantly skew the statistical analysis.



	Selling Price (b)	Gross Revenues (c)	Cash Flow (SDE) (d)	SDE% d ÷ c	Revenue Multiplier b ÷ c	Cash Flow Multiplier b ÷ d	Inventory (e)	Fixtures (f)
1	175,000	1,050,000	30,000	2.9%	0.17	5.83	55,000	125,000
2	200,000	950,000	45,000	4.7%	0.21	4.44	53,000	300,000
3	225,000	875,000	50,000	5.7%	0.26	4.50	12,000	688,000
4	201,000	877,000	55,000	6.3%	0.23	3.65	142,000	102,000
5	205,000	774,000	50,000	6.5%	0.26	4.10	25,000	47,000
6	300,000	979,000	67,000	6.8%	0.31	4.48	30,000	36,000
7	415,000	1,490,000	110,000	7.4%	0.28	3.77	35,000	144,000
8	650,000	1,279,000	125,000	9.8%	0.51	5.20	15,000	516,000
9	425,000	1,113,000	110,000	9.9%	0.38	3.86	43,000	419,000
10	350,000	876,000	100,000	11.4%	0.40	3.50	12,000	500,000
11	205,000	774,000	95,000	12.3%	0.26	2.16	38,000	67,000
12	775,000	975,000	175,000	17.9%	0.79	4.43	25,000	25,000
13	485,000	1,205,000	255,000	21.2%	0.40	1.90	100,000	5,000
14	220,000	550,000	125,000	22.7%	0.40	1.76	20,000	250,000
15	1,200,000	1,000,000	250,000	25.0%	1.20	4.80	50,000	1,000,000
16	285,000	572,000	157,000	27.4%	0.50	1.82	25,000	150,000
17	275,000	505,000	169,000	33.5%	0.54	1.63	90,000	250,000
18	725,000	1,156,000	391,000	33.8%	0.63	1.85	82,000	168,000
19	565,000	959,000	325,000	33.9%	0.59	1.74	20,000	353,000
20	475,000	714,000	245,000	34.3%	0.67	1.94	30,000	255,000
21	950,000	1,222,000	547,000	44.8%	0.78	1.74	157,000	256,000
22	925,000	1,021,000	459,000	45.0%	0.91	2.02	30,000	354,000
23	1,050,000	1,220,000	572,000	46.9%	0.86	1.84	20,000	150,000
Average					0.50	3.17	48,000	268,000
Median					0.40	3.50		
Harmonic Mean					0.38	2.62		
Multipliers without Comp #15				Average	0.47	3.10		
				Median	0.40	2.83		
				Harmonic Mean	0.37	2.57		

III. Inventory, Fixtures and Equipment

Include Inventory and FF& E in your Table

Inventory or Fixtures can distort Multipliers.

If your Subject carries inventory and/or has fixtures, so should your comparables.

Reject comparables with blanks or zeros but try not to let sample size fall below 15.

You may need to increase your SIC range or slightly increase your revenue range to get a big enough sample.

The regression analysis will usually identify these outliers which should be removed from sample.

IV. Stock Sales

The selling price of a Stock Sale is calculated differently than an Asset Sale.

Often Includes receivables, cash, other assets, and **Transactions with ASSUMED LIABILITIES.**

V. Transactions with Real Estate

Buyers and sellers often agree to increase the real estate price allocation and decrease the business price allocation to get better financing.



SELECTING THE SAMPLE

Summary of Preliminary Filtering Criteria

- 1. Use the narrowest range of revenues as possible consistent with a sample size of 15 to 25. If the sample size is too small, increase the range of SIC classifications first before increasing the revenue range.**
- 2. If your Subject has inventory and fixtures, select comparables that do too.**
- 3. Reject all comparables with Cash Flow Multipliers > 10 or negative.**
- 4. Reject all Stock Sales that can't be reconciled to an Asset Sale.**
- 5. Reject all transactions with assumed liabilities.**
- 6. Reject all transactions with real estate also sold.**



Exhibit I

Date Range		Count	Average Revenue Multipliers	Average Cash Flow Multipliers	Average SDE% (SDE/Rev)
From	To				
1-1-1999	12-31-1999	339	0.566	2.908	22.9%
1-1-2000	12-31-2000	327	0.580	3.144	21.9%
1-1-2001	12-31-2001	423	0.539	2.711	24.3%
1-1-2002	12-31-2002	544	0.559	2.830	24.7%
1-1-2003	12-31-2003	519	0.570	2.975	23.8%
1-1-2004	12-31-2004	698	0.576	3.014	23.7%
1-1-2005	12-31-2005	770	0.587	3.058	23.9%
1-1-2006	12-31-2006	777	0.589	3.049	23.6%
1-1-2007	12-31-2007	896	0.577	2.832	25.3%
1-1-2008	12-31-2008	1221	0.556	2.541	26.6%
1-1-2009	12-31-2009	850	0.561	2.437	27.9%
1-1-2010	12-31-2010	960	0.528	2.206	28.7%
1-1-2011	12-31-2011	887	0.552	2.426	26.9%
1-1-2012	12-31-2012	989	0.525	2.355	27.0%
1-1-2013	12-31-2013	1067	0.551	2.411	26.6%
1-1-2014	12-31-2014	1183	0.572	2.489	27.3%
1-1-2015	12-31-2015	1170	0.548	2.539	25.5%
1-1-2016	12-31-2016	1337	0.553	2.542	25.4%
1-1-2017	12-31-2017	1098	0.580	2.667	24.7%
Average			0.561	2.68	25.4%
Lower Quartile			0.550	2.46	23.9%
Upper quartile			0.576	2.92	26.7%

Source: 17,129 Transactions taken from Pratt's Stats Database

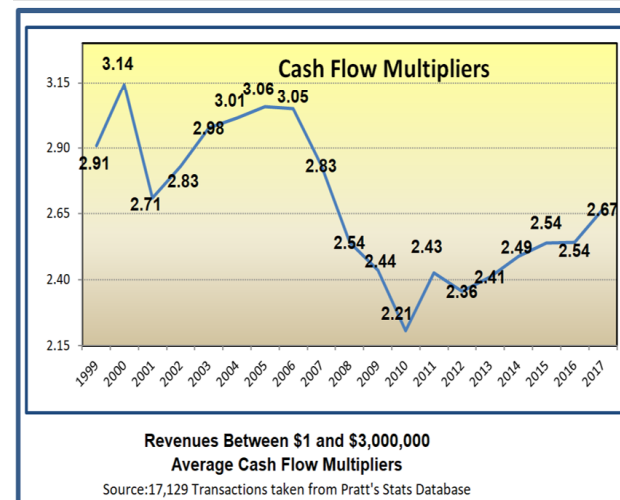
RECESSION VS. REGRESSION

Recently, there have been some concerns raised within the appraisal community that the recession has produced a significant amount of volatility in transactional multipliers during the last five to seven years which may skew one's results when employing the market approach[1]. To test that theory I assembled a sample of transactions obtained from the Pratt's Stats database. The sample was filtered for all transactions between 1999 through 2013 with revenues under \$3 million. Stock sale transactions were eliminated, as were companies with breakeven or negative cash flow.

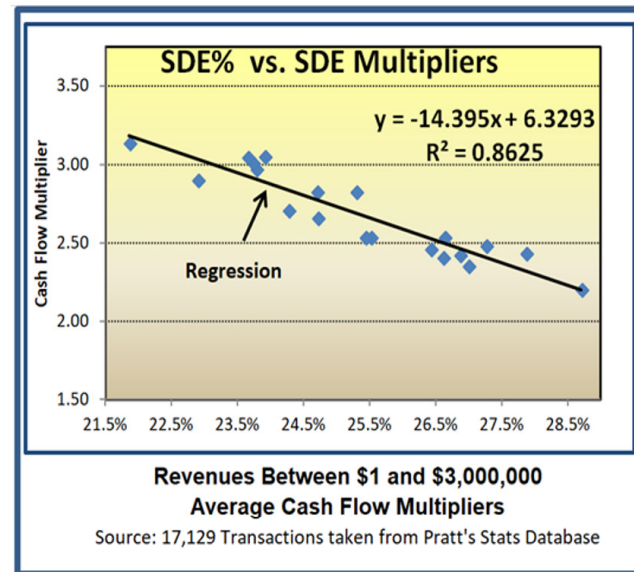
The Revenue Multipliers and Cash Flow Multipliers were calculated from each transaction's revenues, seller's discretionary earnings (SDE, or cash flow), and selling price. The data was sorted by the year in which the sale took place and the resulting median value of the multipliers from each year was determined. The resulting sample of 17,129 transactions is listed on the table in Exhibit I above

As we expected from our initial discussion of the effects of time on multipliers we find that the Revenue Multipliers have been relatively stable over time. From the top table in Exhibit I we observe that the average Revenue Multiplier over the last nineteen years was .561. The lower quartile was .55 and the upper quartile was .576. Thus, Revenue Multipliers fluctuate within a narrow range from year to year and using comparables that are several years old should not inappropriately skew our results.

Exhibit II



**Exhibit III
CASH FLOW MULTIPLIERS FROM 1999 TO 2017**



Cash Flow Multipliers, however, have fluctuated significantly over the years. Exhibit II is a visual presentation of the data from the table. The graph clearly shows that Cash Flow Multipliers (SDE) have declined significantly since the start of the recession. One's initial reaction is that appraisers should only use multipliers exhibited during the most recent years to account for this attrition. Toby Tatum advanced an approach where an index would be created that reflects the current level of the multiplier with respect to its long-term average. The index would then be applied to the Subject's calculated multiplier to adjust it to the current trend. A third alternative involves the use of regression analysis which will allow us to use transactions over the last fifteen years regardless of the level of multipliers any one year.

As was discussed during the presentation, there is a moderate correlation between a company's Cash Flow Multiplier and its operating profit margin. [The operating profit margin (SDE%) is calculated by dividing a company's SDE (cash flow) by its total revenues.] By using regression analysis we can plot the above sample's average SDE% values against the corresponding Cash Flow Multipliers for each year. Exhibit M gives a visual presentation of the resulting regression analysis.

The regression line shows that the level of a company's profitability, as measured by SDE%, closely tracks its Cash Flow Multiplier. This fact is underscored by the regression analysis' very high R squared factor of 0.862. *An R squared of 1.0 would mean there is a perfect correlation between Cash Flow Multipliers and SDE% whereas an R squared of 0.0 would mean there is no correlation.*

Predicting 2010 Cash Flow Multiplier:

$$Y = -14.395 \times \text{SDE\%} + 6.3293$$

$$Y = -14.395 \times .287 + 6.3293 = 2.19$$

$$\text{Actual average Multiplier} = 2.206$$

Predicting 2006 Cash Flow Multiplier:

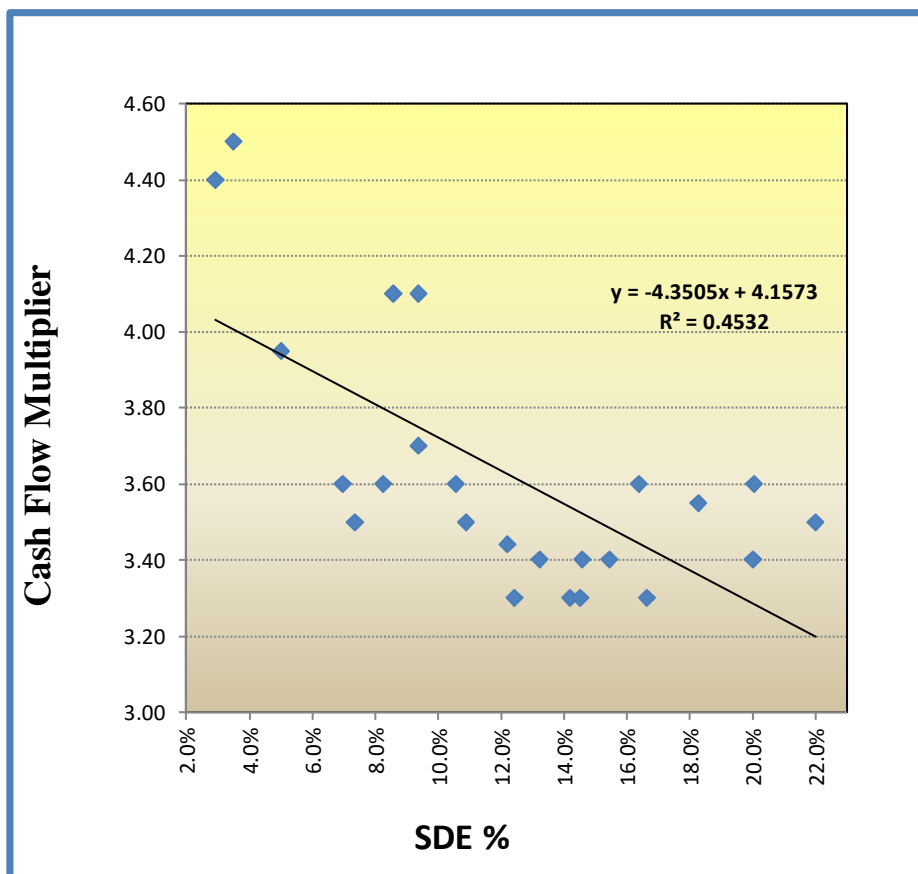
$$Y = -14.395 \times .236 + 6.3293 = 3.19$$

$$\text{Actual average Multiplier} = 3.05$$

Analysis: The search criteria used by the Appraiser when selecting guideline companies from the various databases, therefore, does not need to exclude transactions based on the timing of the sale when using each comparable's SDE% will be used to estimate the Subject's Cash Flow Multiplier.



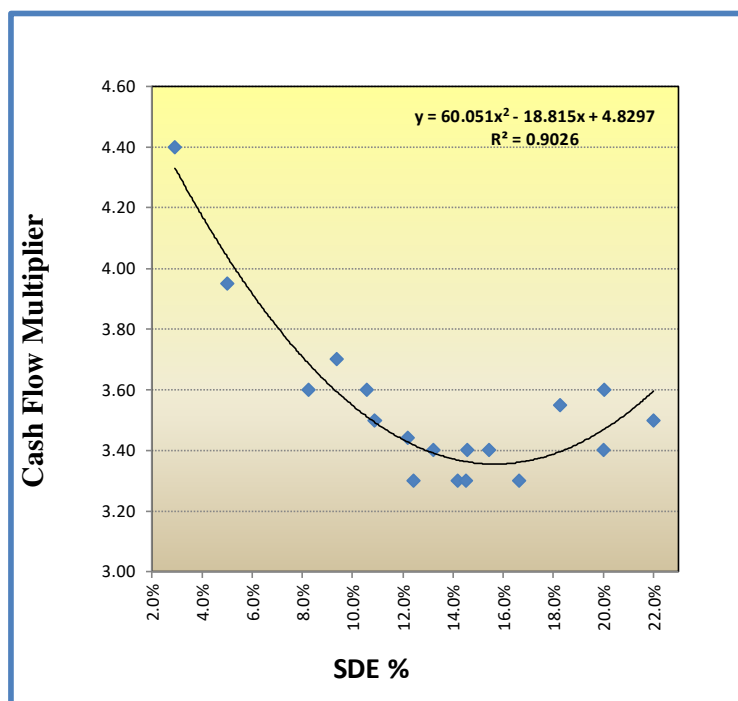
Polynomial Regression Line



	Cash Flow Multiplier	SDE%
1	4.400	2.9%
2	4.500	3.5%
3	3.950	5.0%
4	3.600	7.0%
5	3.500	7.4%
6	3.600	8.3%
7	4.100	8.6%
8	3.700	9.4%
9	4.100	9.4%
10	3.600	10.6%
11	3.500	10.9%
12	3.440	12.2%
13	3.300	12.4%
14	3.400	13.2%
15	3.300	14.2%
16	3.300	14.5%
17	3.400	14.6%
18	3.400	15.4%
19	3.600	16.4%
20	3.300	16.6%
21	3.550	18.3%
22	3.400	20.0%
23	3.600	20.1%
24	3.500	22.0%



Polynomial Regression Line



Revenue \$1,200,000
 SDE \$260,000
 SDE% 21.7%
 Polynomial Regression Multiplier 3.57
 Value \$928,200

 Linear Regression Multiplier 3.22
 Value \$836,550

 Median 3.470
 Value \$902,200

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	Cash Flow Multiplier	SDE%	SDE% ²
1	4.400	2.9%	0.00085
2	3.950	5.0%	0.00250
3	3.600	8.3%	0.00682
4	3.700	9.4%	0.00879
5	3.600	10.6%	0.01115
6	3.500	10.9%	0.01187
7	3.440	12.2%	0.01491
8	3.300	12.4%	0.01545
9	3.400	13.2%	0.01755
10	3.300	14.2%	0.02012
11	3.300	14.5%	0.02105
12	3.400	14.6%	0.02130
13	3.400	15.4%	0.02383
14	3.300	16.6%	0.02769
15	3.550	18.3%	0.03340
16	3.400	20.0%	0.04000
17	3.600	20.1%	0.04024
18	3.500	22.0%	0.04840
19			
20			
21			
22			
23			
24			



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VALUATION TEMPLATE

ABC Plumbing Company									
	Selling Price (b)	Gross Revenues (c)	Cash Flow (SDE) (d)	Inventory (e)	Fixtures (f)	SDE% d ÷ c	Revenue Multiplier b ÷ c	Cash Flow Multiplier b ÷ d	
1	850,000	1,395,000	202,000	10,000	10,000	14.5%	0.61	4.21	
2	860,000	1,415,000	214,000	10,000	10,000	15.1%	0.61	4.02	
3	665,000	730,242	125,887	50,000	565,000	17.2%	0.91	5.28	
4	450,000	785,955	153,143	136,502	132,104	19.5%	0.57	2.94	
5	995,000	1,673,000	329,000	651,000	125,000	19.7%	0.59	3.02	
6	1,120,000	1,629,000	330,000	700,000	20,000	20.3%	0.69	3.39	
7	550,000	662,242	147,272	15,000	110,000	22.2%	0.83	3.73	
8	708,891	1,495,046	367,516	163,837	72,612	24.6%	0.47	1.93	
9	750,000	908,000	228,000	7,808	16,191	25.1%	0.83	3.29	
10	520,000	538,871	141,459	3,705	231,060	26.3%	0.96	3.68	
11	1,330,000	1,600,000	439,000	125,000	1,100,000	27.4%	0.83	3.03	
12	750,000	807,000	237,000	400,000	100,000	29.4%	0.93	3.16	
13	340,000	501,995	161,998	71,577	148,422	32.3%	0.68	2.10	
14	565,000	1,135,715	383,368	31,889	234,650	33.8%	0.50	1.47	
15	1,025,000	966,576	329,544	24,144	50,066	34.1%	1.06	3.11	
16	1,576,466	1,232,034	527,550	194,558	403,433	42.8%	1.28	2.99	
17	885,000	830,000	375,000	400,000	100,000	45.2%	1.07	2.36	
18	1,320,000	1,079,000	490,000	215,000	22,000	45.4%	1.22	2.69	
19	1,300,000	910,000	439,000	195,212	404,787	48.2%	1.43	2.96	
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
Avg =	872,798	1,049,982	301,041	188,624	213,629	SDE % Range	Revenue Mult Range	Cash Flow Mult Range	
						Lower Quartile	20.0%	0.61	2.82
						Median	26.3%	0.83	3.03
						Upper Quartile	34.0%	1.01	3.54
						Average	28.6%	0.85	3.12
						Harmonic Mean	25.1%	0.77	2.88

F

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Sort By
SDE%

Hide
Inventory
Column

Hide
Fixtures
Column

Show All
Columns

CLEAR OLD
DATA

Data Entry Instructions

- 1) Enter Comparable data in appropriate columns
- 2) Click "HIDE" or "SHOW" buttons as desired.
- 3) Click "SORT BY SDE%" button
- 4) GO TO the "REGRESSION" worksheet
Click on "REFORMAT CHARTS" button at top of worksheet.
Click "Revenue Curved" or "Cash Flow Curved" buttons as desired.
- 5) GO TO the "VALUATION" worksheet and enter in your company's data.

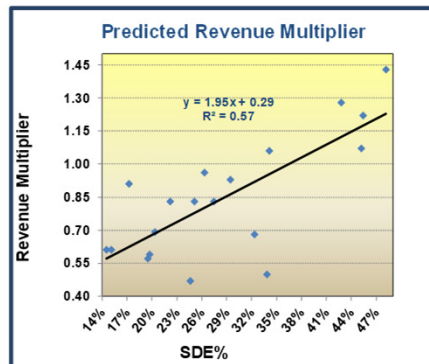


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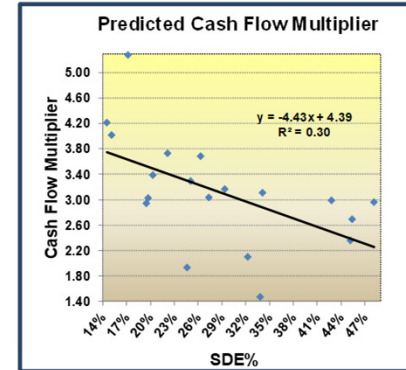
R Sq. = 0.57

Standard Error Outliers > **+/- 0.185**Regression Formula = $1.95 \times \text{SDE\%} + 0.29$

Subject SDE% = 32.5%

First Estimated Multiplier = 0.92

Revenue Multiplier Data				
	SDE%	Actual Multiplier	Predicted Multiplier	Difference
#1	14.5%	0.61	0.57	0.04
#2	15.1%	0.61	0.58	0.03
#3	17.2%	0.91	0.63	0.28
#4	19.5%	0.57	0.67	-0.10
#5	19.7%	0.59	0.67	-0.08
#6	20.3%	0.69	0.69	0.00
#7	22.2%	0.83	0.72	0.11
#8	24.6%	0.47	0.77	-0.30
#9	25.1%	0.83	0.78	0.05
#10	26.3%	0.96	0.80	0.16
#11	27.4%	0.83	0.82	0.01
#12	29.4%	0.93	0.86	0.07
#13	32.3%	0.68	0.92	-0.24
#14	33.8%	0.50	0.95	-0.45
#15	34.1%	1.06	0.95	0.11
#16	42.8%	1.28	1.12	0.16
#17	45.2%	1.07	1.17	-0.10
#18	45.4%	1.22	1.18	0.04
#19	48.2%	1.43	1.23	0.20



R Sq. = 0.30

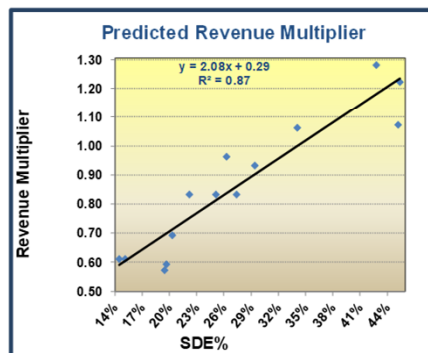
Standard Error Outliers > **+/- 0.748**Regression Formula = $-4.43 \times \text{SDE\%} + 4.39$

Subject SDE% = 32.5%

First Estimated Multiplier = 2.95

Cash Flow Multiplier Data				
	SDE%	Actual Multiplier	Predicted Multiplier	Difference
#1	14.5%	4.21	3.75	0.46
#2	15.1%	4.02	3.72	0.30
#3	17.2%	5.28	3.63	1.65
#4	19.5%	2.94	3.53	-0.59
#5	19.7%	3.02	3.52	-0.50
#6	20.3%	3.39	3.49	-0.10
#7	22.2%	3.73	3.41	0.32
#8	24.6%	1.93	3.30	-1.37
#9	25.1%	3.29	3.28	0.01
#10	26.3%	3.68	3.22	0.46
#11	27.4%	3.03	3.18	-0.15
#12	29.4%	3.16	3.09	0.07
#13	32.3%	2.10	2.96	-0.86
#14	33.8%	1.47	2.89	-1.42
#15	34.1%	3.11	2.88	0.23
#16	42.8%	2.99	2.49	0.50
#17	45.2%	2.36	2.39	-0.03
#18	45.4%	2.69	2.38	0.31
#19	48.2%	2.96	2.25	0.71

FINAL REGRESSION WITH OUTLIERS REMOVED



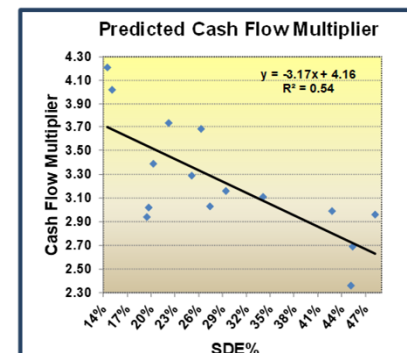
R Sq. = 0.87

Regression Formula = $2.08 \times \text{SDE\%} + 0.29$

Subject SDE% = 32.5%

Predicted Multiplier = **0.97**

Relevant Comparables			Outliers Removed	
	SDE%	Actual Multiplier		
1	#1 14.5%	0.61	#3 17.2%	0.91
2	#2 15.1%	0.61	#8 24.6%	0.47
3	#4 19.5%	0.57	#13 32.3%	0.68
4	#5 19.7%	0.59	#14 33.8%	0.50
5	#6 20.3%	0.69	#19 48.2%	1.43
6	#7 22.2%	0.83		
7	#9 25.1%	0.83		
8	#10 26.3%	0.96		
9	#11 27.4%	0.83		
10	#12 29.4%	0.93		
11	#15 34.1%	1.06		
12	#16 42.8%	1.28		
13	#17 45.2%	1.07		
14	#18 45.4%	1.22		



R Sq. = 0.54

Regression Formula = $-3.17 \times \text{SDE\%} + 4.16$

Subject SDE% = 32.5%

Predicted Multiplier = **3.13**

Relevant Comparables			Outliers Removed	
	SDE%	Actual Multiplier		
1	#1 14.5%	4.21	#3 17.2%	5.28
2	#2 15.1%	4.02	#8 24.6%	1.93
3	#4 19.5%	2.94	#13 32.3%	2.10
4	#5 19.7%	3.02	#14 33.8%	1.47
5	#6 20.3%	3.39		
6	#7 22.2%	3.73		
7	#9 25.1%	3.29		
8	#10 26.3%	3.68		
9	#11 27.4%	3.03		
10	#12 29.4%	3.16		
11	#15 34.1%	3.11		
12	#16 42.8%	2.99		
13	#17 45.2%	2.36		
14	#18 45.4%	2.69		
15	#19 48.2%	2.96		



VALUATION TEMPLATE

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ABC Plumbing Company																					
Company Information			Financial Data																		
Prepared For:	March 8, 2013	Date of Valuation / Financial Statement Date:	December 31, 2012	Annual Revenues =	\$1,203,000																
Company Name:	C. Fred Hall, III	Cash Flow (SDE) =	\$391,000	Current Inventory =	\$3,400																
Address:	ABC Plumbing Company	Current Fixtures =	\$350,000	SDE% 32.5%																	
City, State:	123 Any Street																				
SIC Code:	Anytown, CA																				
	1711 Plumbing Contractors																				
Statistical Analysis of Sold Comparables																					
<p>ABC Plumbing Company's SDE % is 32.5%</p> <p>The Subject is between the Mid to Upper Range of SDE%.</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <thead> <tr> <th style="width: 40%;"></th> <th style="width: 10%;"></th> <th style="width: 10%;">Revenue Multiplier Range</th> <th style="width: 10%;">Cash Flow Multiplier Range</th> </tr> </thead> <tbody> <tr> <td>The Lowest 16% of Companies have SDE% of Less Than 17.1%</td> <td>=</td> <td>0.64</td> <td>3.62</td> </tr> <tr> <td>The Mid Range of Companies have SDE% of 27.6%</td> <td>=</td> <td>0.86</td> <td>3.23</td> </tr> <tr> <td>The Highest 16% of Companies have SDE% of More Than 38.2%</td> <td>=</td> <td>1.08</td> <td>2.95</td> </tr> </tbody> </table>								Revenue Multiplier Range	Cash Flow Multiplier Range	The Lowest 16% of Companies have SDE% of Less Than 17.1%	=	0.64	3.62	The Mid Range of Companies have SDE% of 27.6%	=	0.86	3.23	The Highest 16% of Companies have SDE% of More Than 38.2%	=	1.08	2.95
		Revenue Multiplier Range	Cash Flow Multiplier Range																		
The Lowest 16% of Companies have SDE% of Less Than 17.1%	=	0.64	3.62																		
The Mid Range of Companies have SDE% of 27.6%	=	0.86	3.23																		
The Highest 16% of Companies have SDE% of More Than 38.2%	=	1.08	2.95																		
REVENUE MULTIPLIER VALUE																					
Regression Formula: $SDE\% \times 2.08 + 0.288 = .0.97$																					
R Sq. = 0.87																					
<u>Multiplier</u>	<u>Revenue</u>	<u>Predicted Value</u>	<u>Weight</u>	<u>Weighted Value</u>																	
0.97	x \$1,203,000	= \$1,167,000	x 61.7%	=	\$720,582																
CASH FLOW MULTIPLIER VALUE																					
Regression Formula: $SDE\% \times -3.172 + 4.159 = 3.13$																					
R Sq. = 0.54																					
<u>Multiplier</u>	<u>Cash Flow</u>	<u>Predicted Value</u>	<u>Weight</u>	<u>Weighted Value</u>																	
3.13	x \$391,000	= \$1,223,800	x 38.3%	=	\$468,146																
Probable Selling Price Including Inventory = \$1,190,000																					

Data Entry Instructions

F

Values Using Other Methodologies (From Samples Worksheet)

F2

Revenue Multipliers

Median	Harmonic Mean
0.83	0.77
x 1,203,000	x 1,203,000
<u>\$998,490</u>	<u>\$926,310</u>

Cash Flow Multipliers

Median	Harmonic Mean
3.03	2.88
x 391,000	x 391,000
<u>\$1,184,730</u>	<u>\$1,126,080</u>

Average of Above Multiplier Values

<u>\$1,091,610</u>	<u>\$1,026,195</u>
--------------------	--------------------

Spread between Above Multiplier Values

\$186,240	\$199,770
-----------	-----------

Spread between Regression Values

\$56,800



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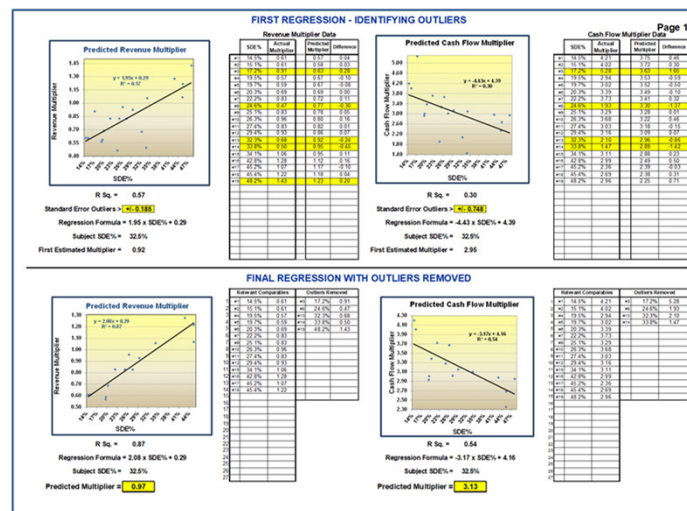
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VALUATION TEMPLATE

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REGRESSION TEMPLATE						
ABC Plumbing Company						
	Selling Price (\$)	Gross Revenues (\$)	Cash Flow (\$)	SDE% 4 ± 2	Revenue Multiplier 3 ± 2	Cash Flow Multiplier 3 ± 2
1	850,000	1,395,000	202,000	14.5%	0.61	4.21
2	860,000	1,415,000	214,000	15.1%	0.61	4.02
3	665,000	730,242	125,887	17.2%	0.91	5.28
4	450,000	785,955	153,143	19.5%	0.57	2.94
5	995,000	1,673,000	329,000	19.7%	0.59	3.02
6	1,120,000	1,629,000	330,000	20.3%	0.68	3.39
7	550,000	662,242	147,272	22.2%	0.83	3.73
8	708,891	1,495,046	367,516	24.6%	0.47	1.93
9	750,000	968,000	228,000	25.1%	0.83	3.29
10	520,000	538,871	141,459	26.3%	0.96	3.68
11	1,330,000	1,800,000	439,000	27.4%	0.83	3.03
12	750,000	867,000	237,000	29.4%	0.93	3.16
13	340,000	501,995	161,998	32.3%	0.68	2.10
14	565,000	1,155,715	353,368	33.8%	0.50	1.47
15	1,025,000	966,576	329,544	34.1%	1.06	3.11
16	1,576,466	1,232,034	527,550	42.8%	1.28	2.99
17	885,000	830,000	375,000	45.2%	1.07	2.35
18	1,320,000	1,079,000	490,000	45.4%	1.22	2.69
19	1,300,000	910,000	439,000	48.2%	1.43	2.96
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
Reg	872,798	1,048,982	301,041	SDE % Range	Revenue Mult Range	Cash Flow Mult Range
				Lower Quartile 20.0%	0.61	2.82
				Median 26.3%	0.83	3.03
				Upper Quartile 34.0%	1.01	3.54
				Average 28.6%	0.85	3.12
				Harmonic Mean 25.1%	0.77	2.88



ABC Plumbing Company				
Company Information			Financial Data	
Prepared For:	March 8, 2013	Date of Valuation /	December 31, 2012	
Company Name:	C. Fred Hall, III	Annual Revenue:	\$1,263,000	SDE% 32.5%
Address:	ABC Plumbing Company	Cash Flow (SDE):	\$391,000	
City, State:	123 Any Street	Current Inventory:	\$1,400	
SIC Code:	Anytown, CA	Current Payables:	\$350,000	
	1711 Plumbing Contractors			
Statistical Analysis of Sold Comparables				
ABC Plumbing Company's SDE % is 32.5%				
The Subject is between the Mid to Upper Range of SDE%.				
The Lowest 16% of Companies have SDE% of Less Than 17.1%	=	0.64	3.62	
The Mid Range of Companies have SDE% of 27.6%	=	0.86	3.23	
The Highest 16% of Companies have SDE% of More Than 38.2%	=	1.08	2.95	
REVENUE MULTIPLIER VALUE				
Regression Formula: SDE% x 2.08 + 0.288 = 0.97				
Multiplier	Revenue	Predicted Value	Weight	Weighted Value
0.97	x	\$1,203,000	= \$1,167,000	x 61.7% = \$720,582
CASH FLOW MULTIPLIER VALUE				
Regression Formula: SDE% x -3.172 + 4.159 = 3.13				
Multiplier	Cash Flow	Predicted Value	Weight	Weighted Value
3.13	x	\$391,000	= \$1,223,800	x 38.3% = \$468,146
Probable Selling Price Including Inventory =				\$1,190,000

Print out the three template pages to make a complete valuation booklet.



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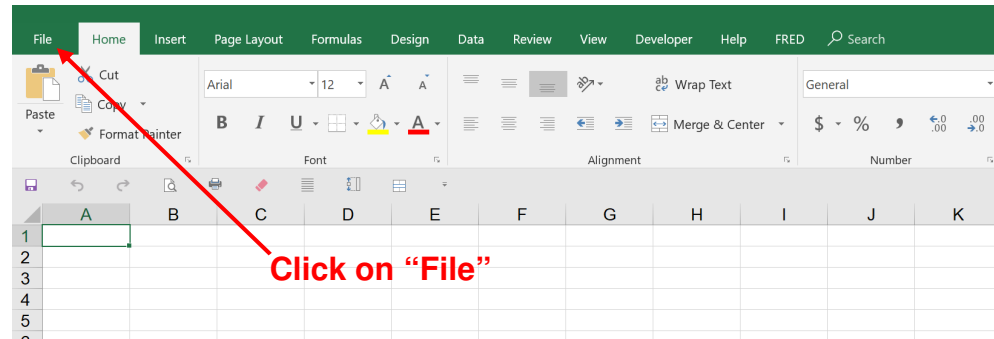
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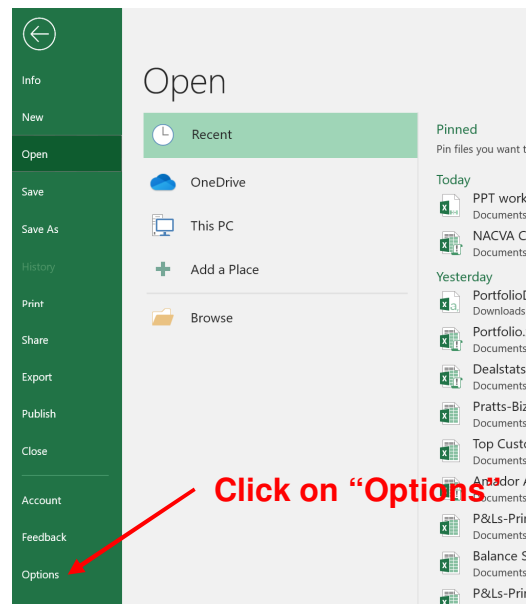
INSTALLING EXCEL'S REGRESSION UTILITY

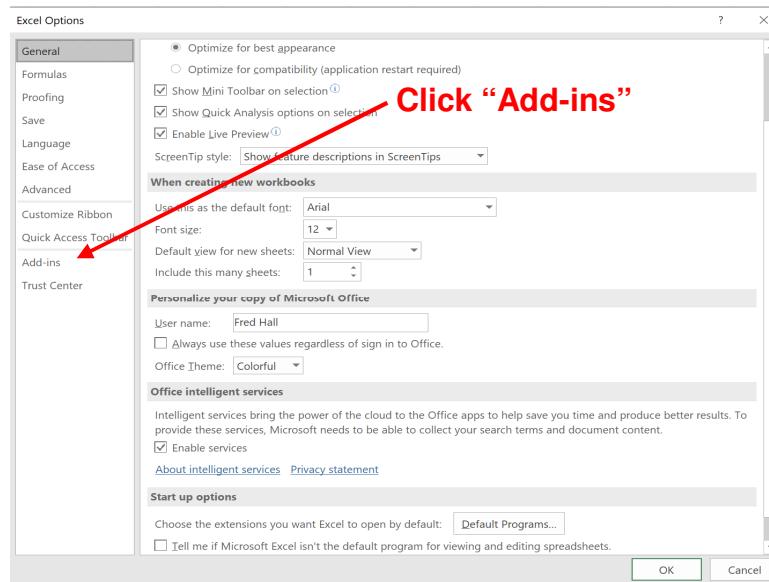
Your computer and Excel do not come pre-installed with the Excel Regression Utility. You must preform the following steps with each computer to enable using the Regression. You only need to do this once for each computer.

First start by clicking the "File" menu in the upper left corner of the Excel Worksheet.

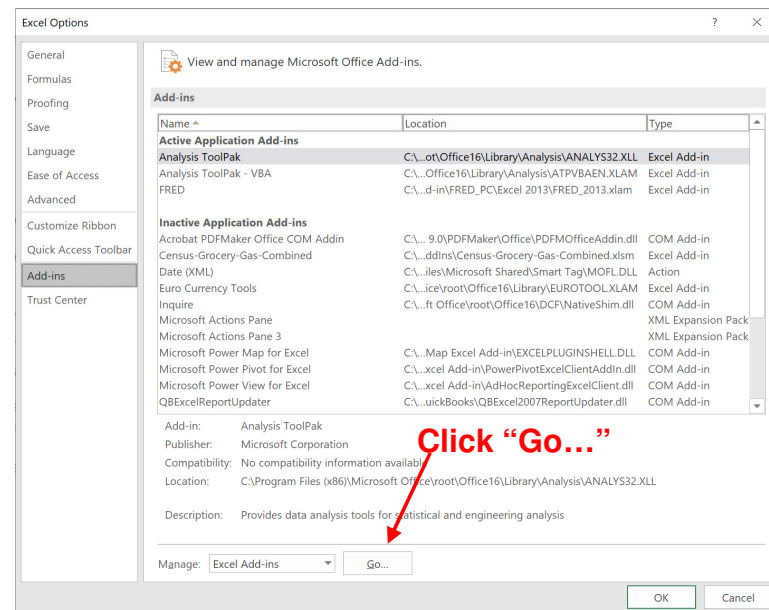


Next Click the "Options" link in the lower left corner of the screen>



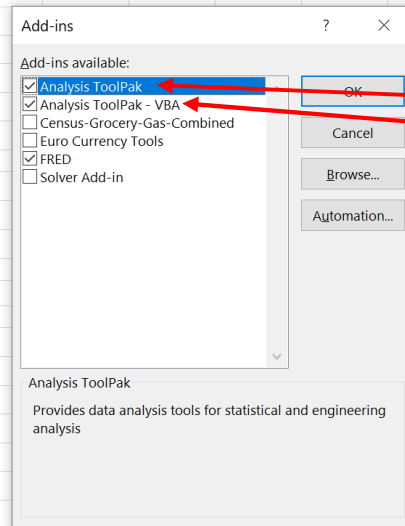


Next, click the “Add-ins”
ink in the lower left corner
of the Options window



Next, click the “Go..” at bottom
of the Add-ins window.



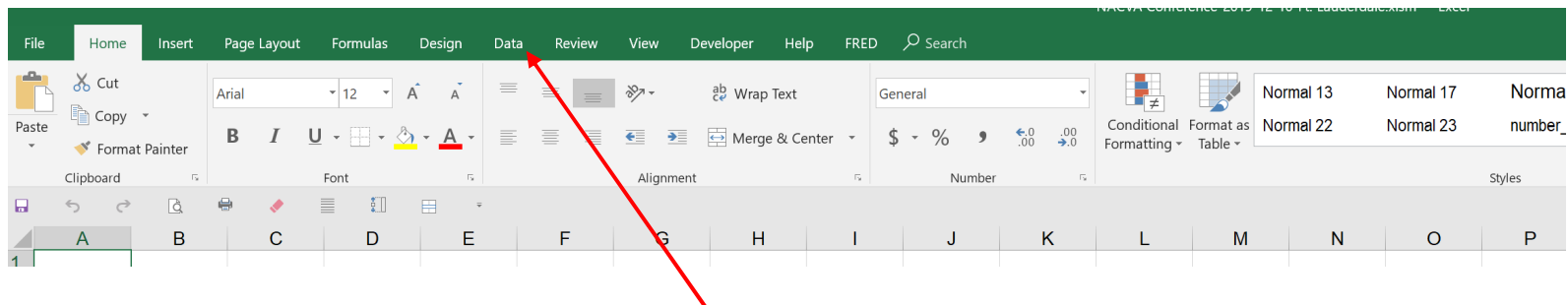


Next, from the Add-ins window check off box:

Analysis ToolPak
Analysis ToolPak - VBA

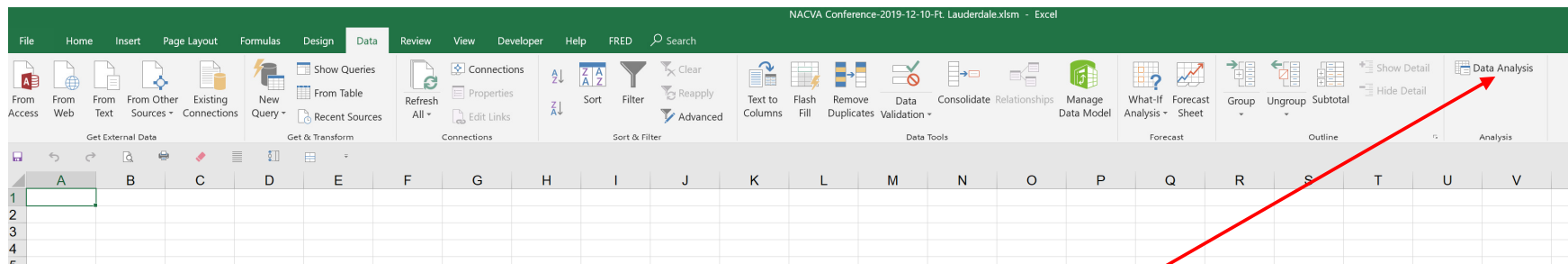
Using Excel's Regression Utility

You will now find a new Excel menu option on the menu ribbon called "DATA".



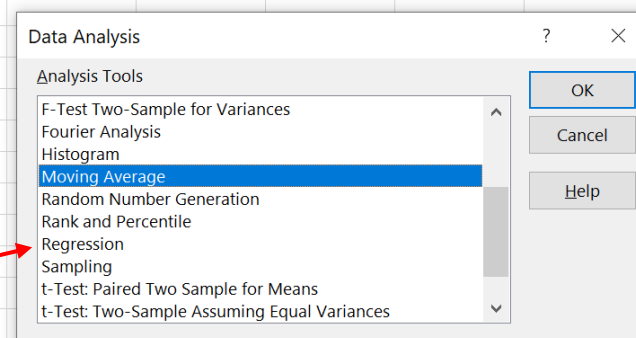
Click the "DATA" option and the following window will appear:





To access the Regression Utility click "Data Analysis"

Scroll down and Click "Regression"



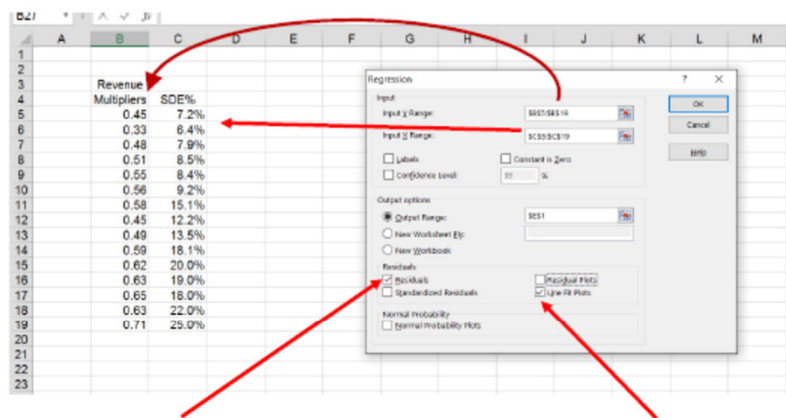
The Regression Utility Window will appear as shown below:

In “Input Y Range” box enter the range of Multiplier data. (In this example - \$B\$5:\$B\$19)

In “Input X Range” box enter the range of SDE% data. (In this example - \$C\$5:\$C\$19)

In the “Output Range” box enter where you want to start printing all the Regression data.

(In this example \$E\$1. Caution - the Regression printout will delete out any data in the range \$E\$1:\$M\$40, that is 9 columns wide and 40-60+ rows deep depending on how many comparables you are regressing. Make sure there is nothing important in this area.)



Check the “Residuals” box and, if you wish to see a graph of the data, check the “Line Fit Plots” box.

NOTES:

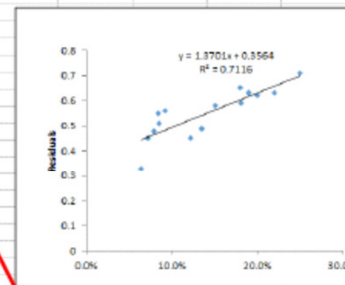
In the above example, SDE% is referred to as the independent variable, or Input X (the predictor), and, Revenue Multiplier is the dependent variable, or Input Y. In single independent-variable regressions (as opposed to multiple-variable regressions), the two columns of data in the example above do not have to be next to each other or, even on the same worksheet, but, they must have exactly the same number of rows (in this example 15 rows).

There cannot be any blank cells in the two ranges of data that you have selected. You will get an error message from Excel. If a particular cell is blank, (for example, say, the third revenue multiplier was blank instead of 0.48), then either remove the transaction from the list (preferred option) or enter a zero in the cell.

The regression printout will look like this:



E	F	G	H	I	J	K	L	M
SUMMARY OUTPUT								
<i>Regression Statistics</i>								
Multiple R	0.844							
R Square	0.712							
Adjusted R Square	0.689							
Standard Error	0.095							
Observations	15							
<i>ANOVA</i>								
	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>			
Regression	1	0.095675	0.095675	32.07032	7.76E-05			
Residual	13	0.038758	0.002981					
Total	14	0.134433						
	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>	<i>Lower 95.0%</i>	<i>Upper 95.0%</i>
Intercept	0.356	0.036763	9.69453	2.58E-07	0.276975	0.435876	0.276975	0.435876
X Variable 1	1.370	0.241337	5.663067	7.76E-05	0.847431	1.892776	0.847431	1.892776
<i>RESIDUAL OUTPUT</i>								
	<i>Observation</i>	<i>Predicted</i>	<i>Residuals</i>					
	1	0.455048	-0.00574					
	2	0.444082	-0.11408					
	3	0.464634	0.015366					
	4	0.472854	0.037146					
	5	0.471484	0.078516					
	6	0.482445	0.075555					
	7	0.563291	0.016719					
	8	0.523548	-0.07355					
	9	0.541359	-0.05136					
	10	0.604384	-0.01438					
	11	0.630416	-0.01042					
	12	0.515715	0.013285					
	13	0.603014	0.046985					
	14	0.657918	-0.02782					
	15	0.698921	0.01179					



The Regression Equation for the straight line is in the standard form of

$$Y = mx + b$$

Or in our case:

Multiplier = **m** times SDE% **+ b**, or carried farther:

$$\text{Multiplier} = 1.370 \times \text{SDE\%} + 0.356$$

RESIDUALS AND USING STANDARD ERROR TO IDENTIFY OUTLIERS

"Residuals" is the term Excel uses to describe the difference between a transaction's actual multiplier versus the multiplier that was predicted by the above linear equation. For example, Observation #1 from the table on page 5 had an actual revenue multiplier of 0.45 and an SDE% of 7.2%. If we plug 7.2% into the above regression equation we get:

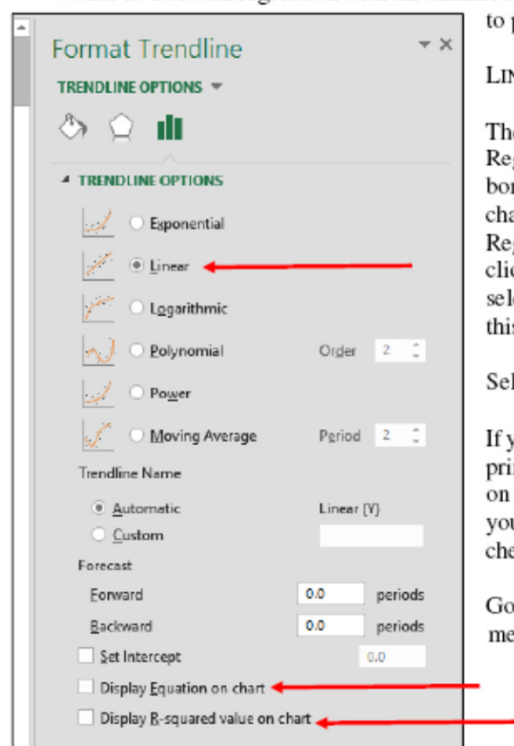
$$1.37 \times 0.072 + 0.356 = 0.455$$



0.455 is the predicted multiplier for #1, which is shown on the “*Predicted*” column of the Residual Output table. The transaction had an actual multiplier of 0.45. Therefore, the difference, or Residual, is -0.005 ($0.45 - 0.455$), which is shown on the “*Residuals*” column.

At the top of the Regression Output you will find the Standard Error calculation, which was 0.055 in this example. This is a similar statistic to Standard Deviation. Theoretically, 16% of the transactions in the sample will have an actual multiplier that is more than plus or minus one Standard Error away from its predicted multiplier. For example, observation #2 in the Residual Output table above, the actual multiplier was 0.33 (from the table on Page 5) and the predicted multiplier using the regression equation was 0.444. The difference, or Residual, was - 0.114 ($0.33 - 0.444$). The residual is greater than minus one Standard Error of 0.55 and, therefore, should probably be considered an outlier.

Once you remove the outliers from your sample (there were four in the example above), you would do a second regression with the smaller filtered sample and use that regression equation to predict your subject’s multipliers.



LINE FIT PLOT – THE REGRESSION CHART

The “Line-Plot” chart that also appears with the Regression Output can be formatted with colors, borders, titles, etc. Just right-hand click on the chart and follow the menus. You can also add the Regression Trend Line to the chart by right-clicking on any of the blue dots on the chart and selecting “Add Trend Line.” When you click on this button you will get the window on the left.

Select “Linear” (the default).

If you wish to have the regression linear equation printed on the chart, check the “Display Equation on Chart” box at the bottom of the screen and, if you wish to see the R-squared value on the chart, check the “Display R-Squared on the Chart” box.

Good luck. If you get lost, don’t hesitate to call me:



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Regression Template Tool - ARTICLE 1

A write up of this presentation - ARTICLE 2

**For instructions on how to use Excel's Regression
program - ARTICLE 3**



Publications:

- * NACVA, "Quick Read," January 2018
- * NACVA, "The Value Examiner," July/August 2016
- * Thomson-Reuter, "Valuation Strategies," July/August 2016
- * Business Valuation Resources, "What's It Worth," April 2012
- * IBA, "Business Appraisal Practice," Second Quarter 2012
- * Business Valuation Resources, "Best of 2012 - What's it Worth," July 2012

Presentations:

- * NACVA Annual Conference - Las Vegas, June 2018
- * CTI Financial Consultants Conference- Las Vegas, December 2017
- * NACVA Annual Conference - San Diego, June 2016
- * CPA's of New York State Annual Conference - Wall Street, May 2014
- * CTI Financial Consultants Conference- Fort Lauderdale, December 2019

Webinars:

- * Jim Hitchner's Around the Valuation World - January 23, 2017
- * Business Valuation Resources - May 5, 2015
- * Morgan and Westfield - February 10, 2015
- * Sunbelt Business Brokers of San Jose - October 23, 2013
- * NACVA - March 19, 2013



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