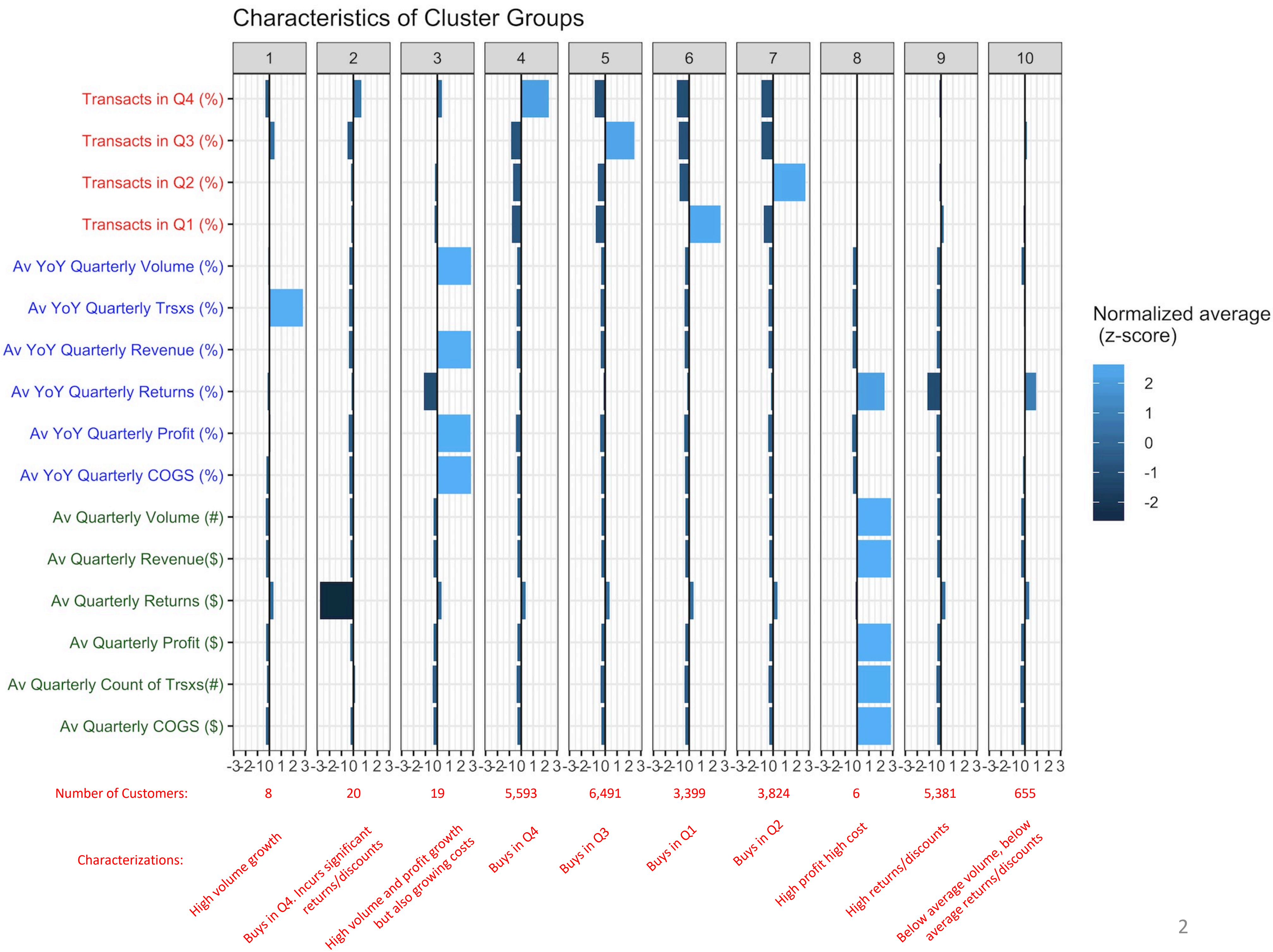
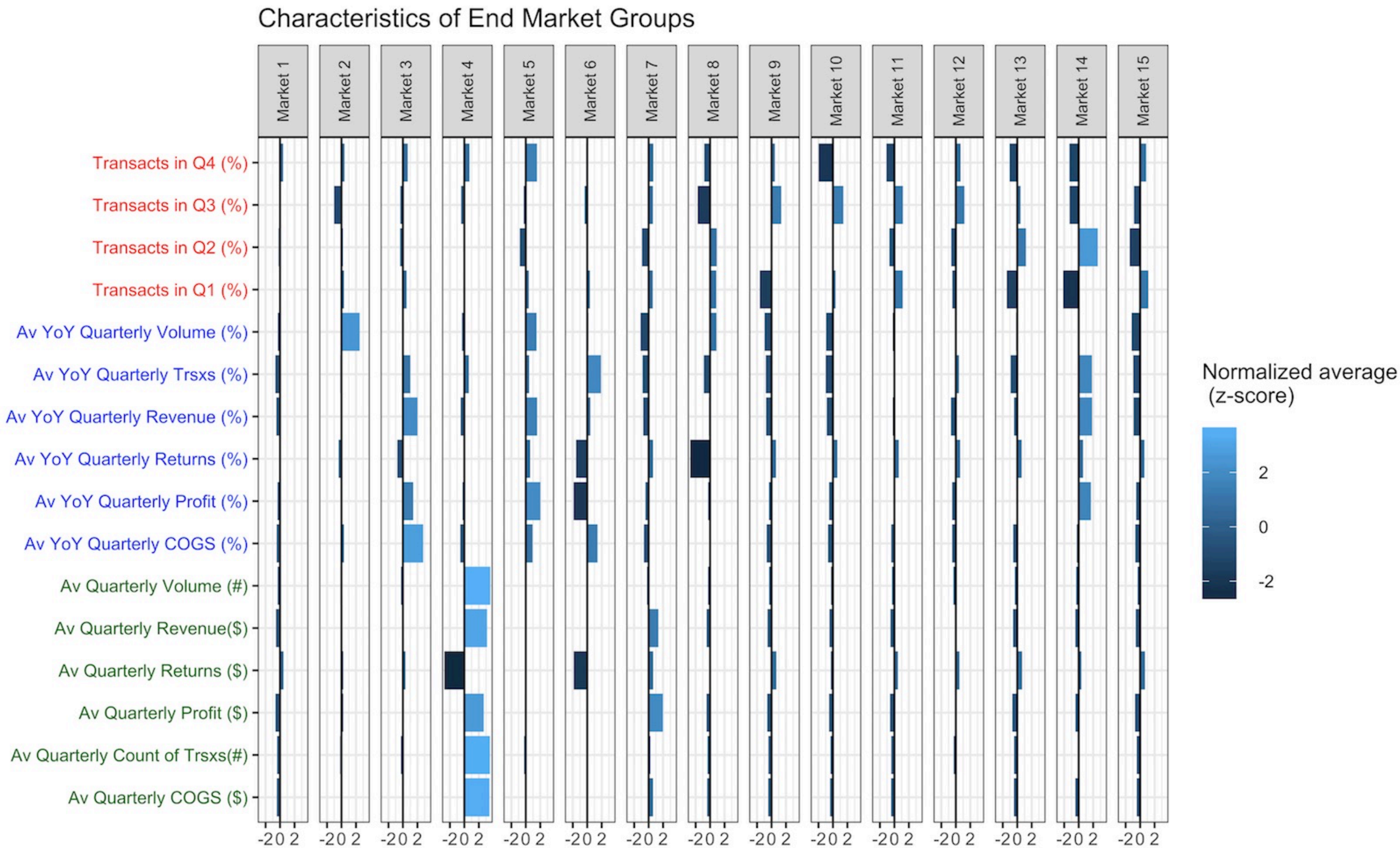
Summary

1. The current practice of "End Market" classification fails because "Market 1" makes up >98% of all customers
2. By segmenting customers based on purchasing behavior (e.g., how much, how often, when, where) we can identify like-groupings of customers
3. Targeting underperforming customers may result in incremental revenue and cost improvement
4. Back-of-the-envelope analysis suggests ~700K in potential annual savings:
    - $333K in potential annual revenue headroom at 25% under-performer lift rate
    - $361K in potential annual cost reduction at 25% under-performer lift rate
5. Additional areas for exploration:
    - Implement a targeted sales function (BAU: engineers solely responsible for sales)
    - Plant optimization / reduce redundancy
    - Seasonality of purchasing (consolidation, targeting)
    - How sensitive are customers to price increases?
    - Which customers/markets are most influenced by regulations?
    - Target customers based on likelihood of gains (predictive modeling)


Characteristics of Cluster Groups
1
2
3
4
5
6
7
8
9
10
Transacts in Q4 (%)
Transacts in Q3 (%)
Transacts in Q2 (%)
Transacts in Q1 (%)
Av YoY Quarterly Volume (%)
Av YoY Quarterly Trsxs (%)
Av YoY Quarterly Revenue (%)
Av YoY Quarterly Returns (%)
Av YoY Quarterly Profit (%)
Av YoY Quarterly COGS (%)
Av Quarterly Volume (#)
Av Quarterly Revenue($)
Av Quarterly Returns ($)
Av Quarterly Profit ($)
Av Quarterly Count of Trsxs(#)
Av Quarterly COGS ($)
-3-2-10 1 2 3
Normalized average
(z-score)
2
1
0
-1
-2
Number of Customers:
8
20
19
5,593
6,491
3,399
3,824
6
5,381
655
Characterizations:
High volume growth
Buys in Q4. Incurs significant returns/discounts
High volume and profit growth but also growing costs
Buys in Q4
Buys in Q3
Buys in Q1
Buys in Q2
High profit high cost
High returns/discounts
Below average volume, below average returns/discounts

“End Market” Segmentation Fails because 98% of customers are labeled “Market 1”



	Market 1	Market 2	Market 3	Market 4	Market 5	Market 6	Market 7	Market 8	Market 9	Market 10	Market 11	Market 12	Market 13	Market 14	Market 15
Number of Customers:	26,023	47	36	125	33	38	7	8	8	36	125	33	38	7	8
Characterizations:	Entire Portfolio, mostly unremarkable	…?	…?	…?											

Targeting Customers for Interventions

Process:

- Assign a cluster to each customer along with information about common cluster behavior (e.g., average profit, average cost, etc.)
- Identify customers that are under-performing relative to their cluster
- Target customers in order of potential upside (delta from group mean)
- For future exploration: Target customers based on *likelihood of incremental gain (predictive modeling)*

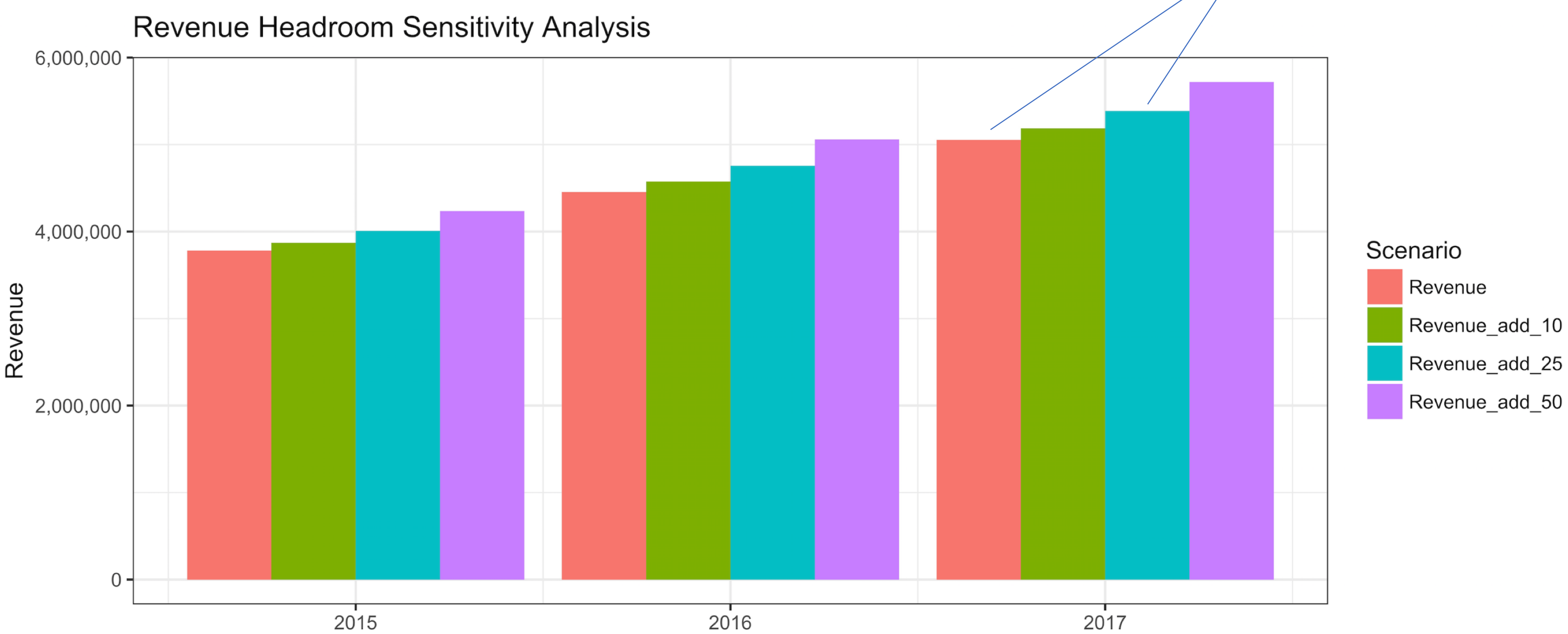
Example: Top 10 Underperforming Customers by profit:

Customer	Cust. Av Quarterly Profit	Cluster Av Quarterly Profit	Delta
Customer 243	$13,192	$20,595	$(7,402)
Customer 126	$13,422	$20,595	$(7,173)
Customer 21670	$18,175	$20,595	$(2,420)
Customer 10569	$20	$433	$(413)
Customer 76	$20,256	$20,595	$(339)
Customer 11669	$40	$361	$(321)
Customer 6118	$51	$361	$(310)
Customer 12692	$70	$361	$(292)
Customer 6108	$100	$361	$(262)
Customer 8197	$169	$361	$(193)

Potential Upside: Increasing Revenues

If we increased underperformer revenues by 10%-50%, how much would that be worth?

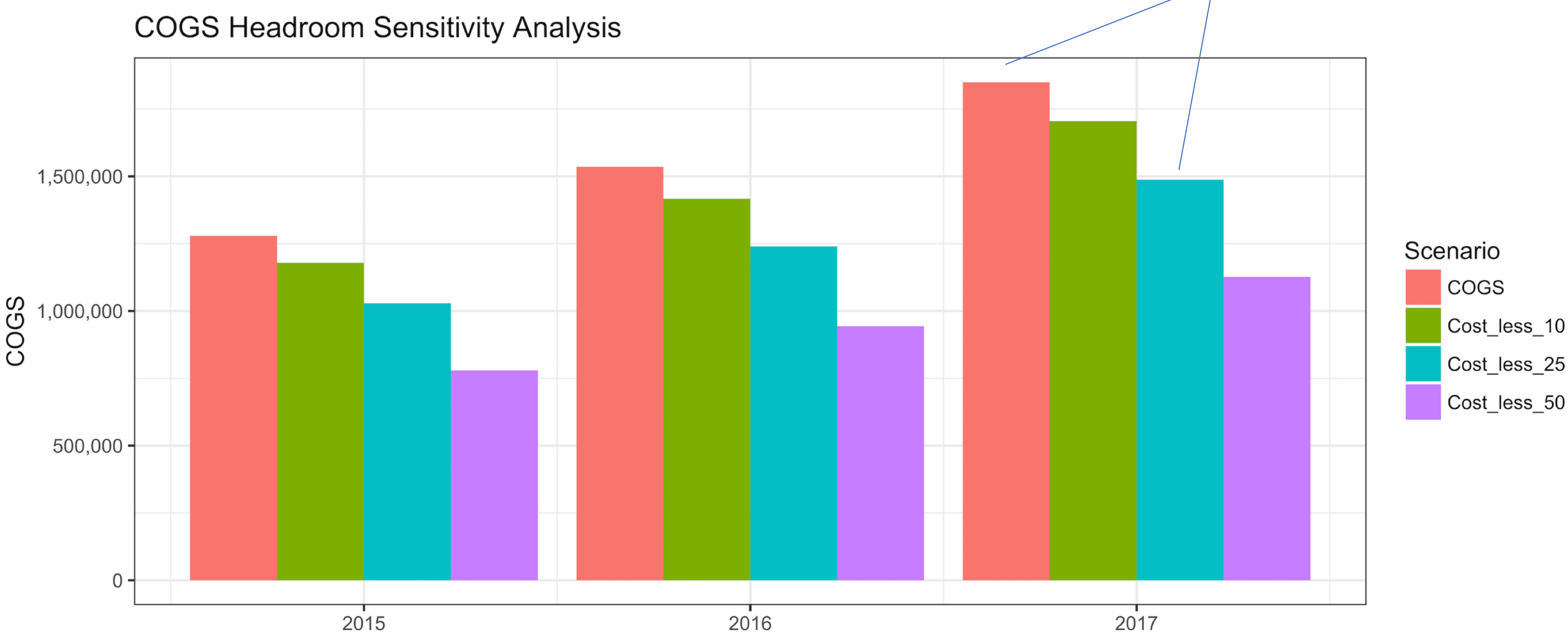
$333K in potential incremental revenue at 25% increase



Potential Upside: Decreasing COGS

If we decreased underperformer costs by 10%-50%, how much would that be worth?

$361K in potential cost reduction at 25% reduction



Appendix

Future Topics:

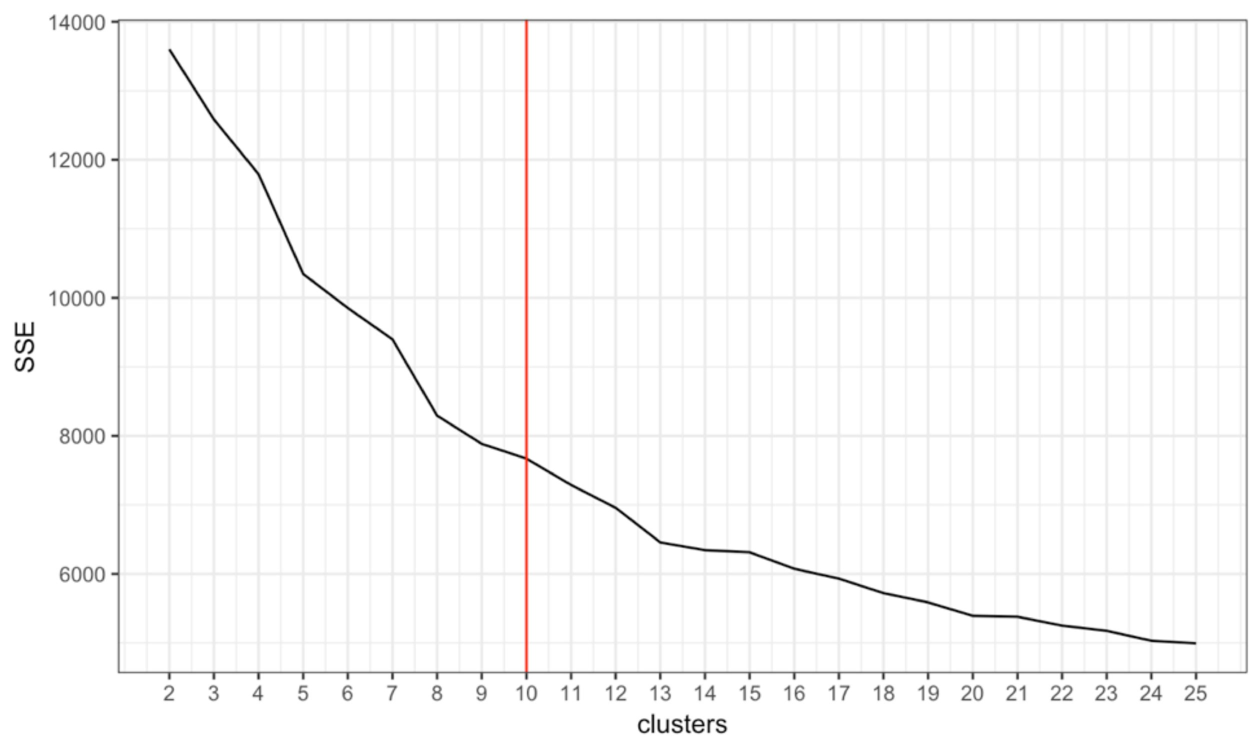
- Employ predictive modeling to target customers based on things like:
    - Predicted sensitivity to increased prices
    - Likelihood of attrition
    - Likelihood to consolidate plants/products
    - Additional data to enhance models:
        - Price of eventual goods sold by customers using our parts
        - Part classifications (materials, intended use, etc.)
        - Factory locations and customer locations
- Network Analysis
    - Which products are antecedents of other products?
    - Opportunities for cross selling?
- Optimization of product mix / manufacturing output
    - What is the exact right mix of products to produce so as to:
        - Maximize revenue
        - Minimize cost
        - Maximize LTV of customer
- Plant optimization
    - Redundancy in plants
    - Consolidation
    - Logistics optimization
    - "Data Envelopment Analysis" to determine relative efficiency of plants

Appendix

Why choose 10 clusters?

- “Elbow” method reveals 10 clusters is optimal
- Few enough to be understandable, and increasing group size incrementally decreases the Sum of Squared Errors within clusters

Within-Cluster Sum of Squared Errors for kmeans across different k



Appendix

Cluster Averages:

Characteristics	Clusters: 1	2	3	4	5	6	7	8	9	10
count	8	20	19	5,593	6,491	3,399	3,824	6	5,381	655
Av Quarterly Volume (#)	6,674	11,208	2,970	322	328	415	378	1,156,063	2,375	1,408
Av Quarterly Revenue($)	$619	$1,009	$104	$44	$41	$47	$43	$41,876	$156	$136
Av Quarterly Profit ($)	$361	$433	$77	$33	$31	$36	$33	$20,595	$107	$102
Av Quarterly COGS ($)	$258	$576	$27	$11	$10	$11	$11	$21,281	$48	$34
Av Quarterly Count of Trsxs (#)	111	318	4	3	3	3	3	1,829	6	8
Av Quarterly Returns ($)	-416%	-44022%	-246%	-65%	-50%	-68%	-54%	-7095%	-136%	-214%
Av YoY Quarterly Volume (%)	4387%	22%	57103%	18%	6%	-40%	-70%	6%	119%	967%
Av YoY Quarterly Revenue (%)	590%	27%	5918%	1%	0%	0%	-5%	11%	45%	551%
Av YoY Quarterly Profit (%)	649%	26%	4027%	-35%	-7%	0%	-3%	8%	41%	536%
Av YoY Quarterly COGS (%)	1355%	47%	44506%	21%	17%	8%	13%	16%	238%	2543%
Av YoY Quarterly Trsxs (%)	2843%	32%	310%	0%	-2%	0%	0%	14%	26%	268%
Av YoY Quarterly Returns (%)	0%	0%	-5%	0%	0%	0%	0%	13%	-5%	6%
Transacts in Q1 (%)	22%	18%	16%	1%	1%	94%	2%	24%	29%	20%
Transacts in Q2 (%)	22%	18%	17%	4%	6%	1%	95%	24%	19%	21%
Transacts in Q3 (%)	35%	12%	26%	3%	84%	2%	0%	24%	25%	28%
Transacts in Q4 (%)	21%	48%	40%	91%	6%	2%	4%	28%	26%	31%