

PART A: CLUSTER ANALYSIS

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Justification:

- Variables: Using all 9 numerical financial variables
- Standardization: Z-score normalization for equal weighting
- Algorithm: K-means clustering (suitable for continuous data)
- Clusters: 4 clusters (based on elbow method)

Cluster assignments:

	Symbol	Name	Cluster
1	ABT	Abbott Laboratories	2
2	AGN	Allergan, Inc.	4
3	AHM	Amersham plc	2
4	AZN	AstraZeneca PLC	2
5	AVE	Aventis	3
6	BAY	Bayer AG	4
7	BMJ	Bristol-Myers Squibb Company	2
8	CHTT	Chattem, Inc	3
9	ELN	Elan Corporation, plc	3
10	LLY	Eli Lilly and Company	2
11	GSK	GlaxoSmithKline plc	1
12	IVX	IVAX Corporation	3
13	JNJ	Johnson & Johnson	1
14	MRX	Medicis Pharmaceutical Corporation	3
15	MRK	Merck & Co., Inc.	1
16	NVS	Novartis AG	2
17	PFE	Pfizer Inc	1

18	PHA	Pharmacia Corporation	4
19	SGP	Schering-Plough Corporation	2
20	WPI	Watson Pharmaceuticals, Inc.	3
21	WYE	Wyeth	2

PART B: CLUSTER INTERPRETATION

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Cluster means for numerical variables:

A tibble: 4 × 10

Cluster	Market_Cap	Beta	PE_Ratio	ROE	ROA	Asset_Turnover	Leverage	Rev_Growth	Net_Profit_Margin
<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>	<dbl>
1	157.	0.48	22.2	44.4	17.7	0.95	0.22	18.5	19.6
2	55.8	0.41	20.3	28.7	12.7	0.74	0.37	5.59	19.4
3	9.23	0.65	19.4	17.3	5.98	0.48	1.25	23.5	13.5
4	26.9	0.64	55.6	10.1	4.2	0.7	0.32	7	5.13

PART C: CATEGORICAL VARIABLE PATTERNS

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Median Recommendation by cluster:

	Hold	Moderate	Buy	Moderate	Sell	Strong	Buy
1	2		2		0		0
2	4		1		2		1
3	1		3		2		0
4	2		1		0		0

Location by cluster:

CANADA FRANCE GERMANY IRELAND SWITZERLAND UK US

1	0	0	0	0	0	1	3
2	0	0	0	0	1	2	5
3	0	1	0	1	0	0	4
4	1	0	1	0	0	0	1

Exchange by cluster:

AMEX NASDAQ NYSE

1	0	0	4
2	0	0	8
3	1	1	4
4	0	0	3

PART D: CLUSTER NAMING

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Cluster 1 : Large Low Risk High Profit Companies

Companies: GlaxoSmithKline plc, Johnson & Johnson, Merck & Co., Inc., Pfizer Inc

Cluster 2 : Large Low Risk High Profit Companies

Companies: Abbott Laboratories, Amersham plc, AstraZeneca PLC, Bristol-Myers Squibb Company, Eli Lilly and Company, Novartis AG, Schering-Plough Corporation, Wyeth

Cluster 3 : Small High Risk Low Profit Companies

Companies: Aventis, Chattem, Inc, Elan Corporation, plc, IVAX Corporation, Medicis Pharmaceutical Corporation, Watson Pharmaceuticals, Inc.

Cluster 4 : Small High Risk Low Profit Companies

Companies: Allergan, Inc., Bayer AG, Pharmacia Corporation