

# Findings

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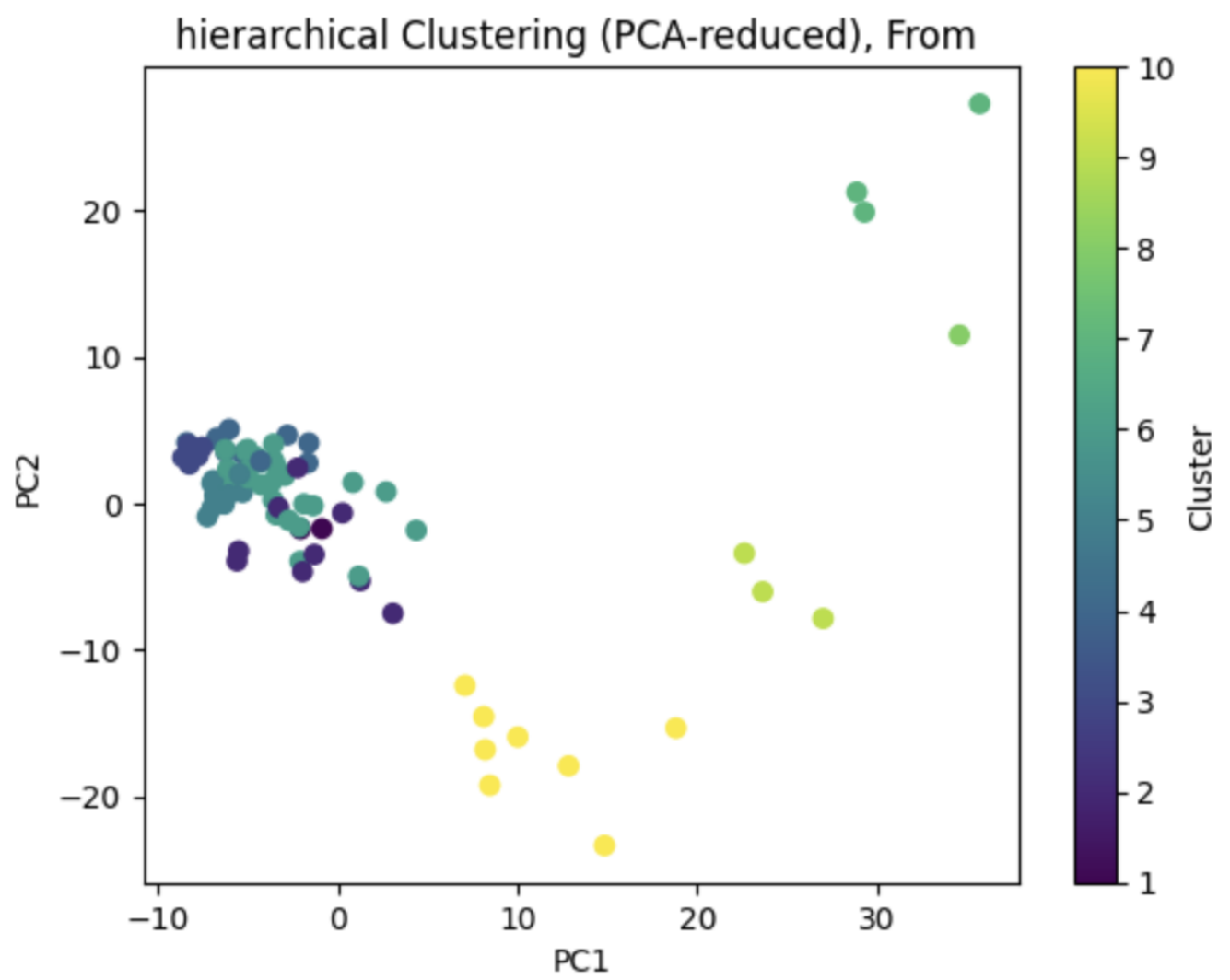
## Methodology

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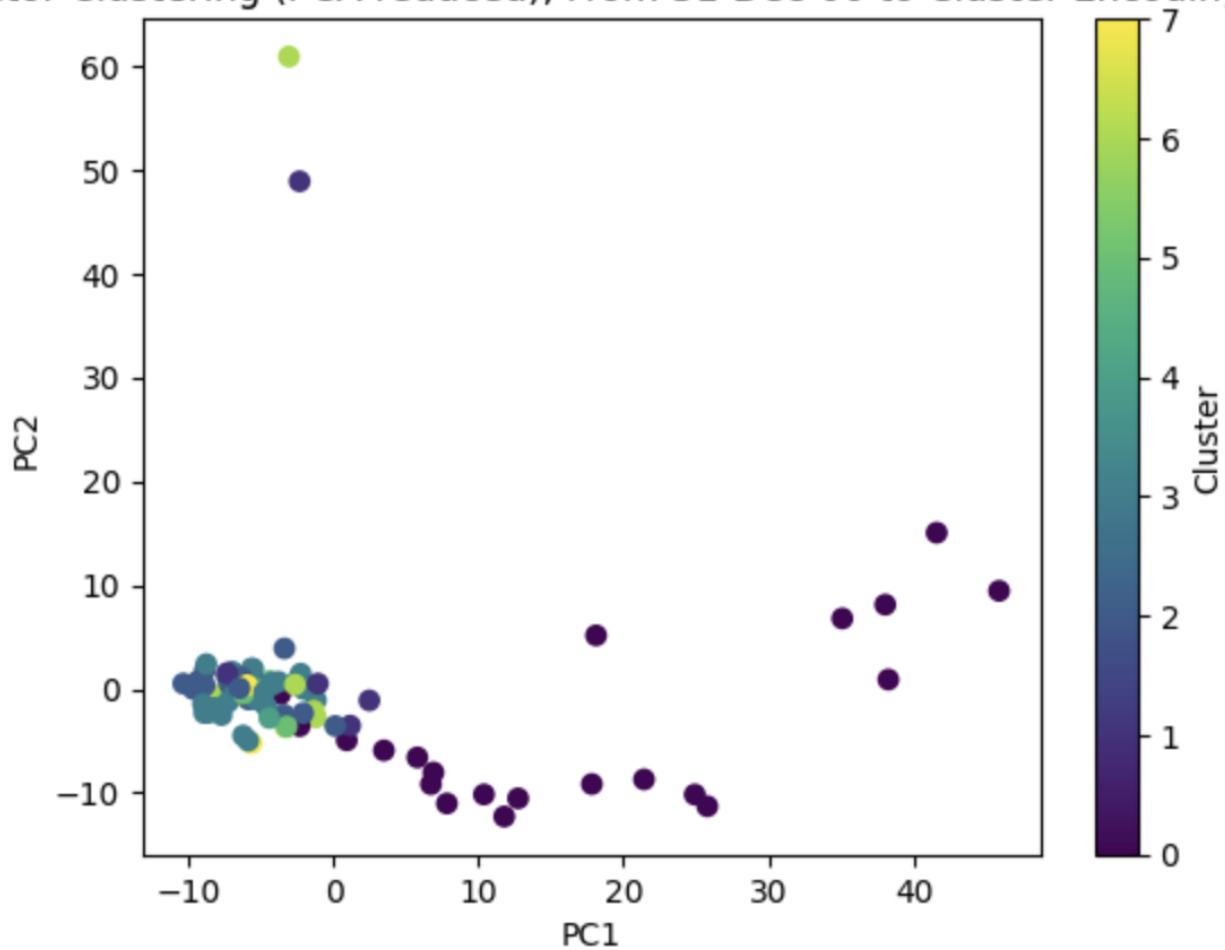
Here is what i did: First i got weekly return data off bloomberg for the top 100 market cap stocks on the JSE. Some outliers were removed leaving us with 90 stocks. some stocks did not have data for the weeks so i did a correlation backfill(choosing top 3 correlating stocks and replaced it with the average of their values). I then removed the Market effect. This was done by regressing the return on PC1 and taking the residual values using LinearRegression. The data was then standardised onto a Z scale and any deviation above  $\pm 10$  standard deviations were clipped at  $\pm 10$  standard deviations. We used data from 01-Aug-10 to 01-Jun-25. 2 Models were fitted: Kmeans evaluating using Xie benni index and elbow plot and Hierarchical clustering with a varying amount of clusters. The best Model was Hierarchical clustering with 10 clusters at the end using wards method. Then evaluations were done on sector based clustering and Hierarchical clustering comparing within cluster correlations and between cluster correlations. attached are the PCA Plots.

## PCA Plots

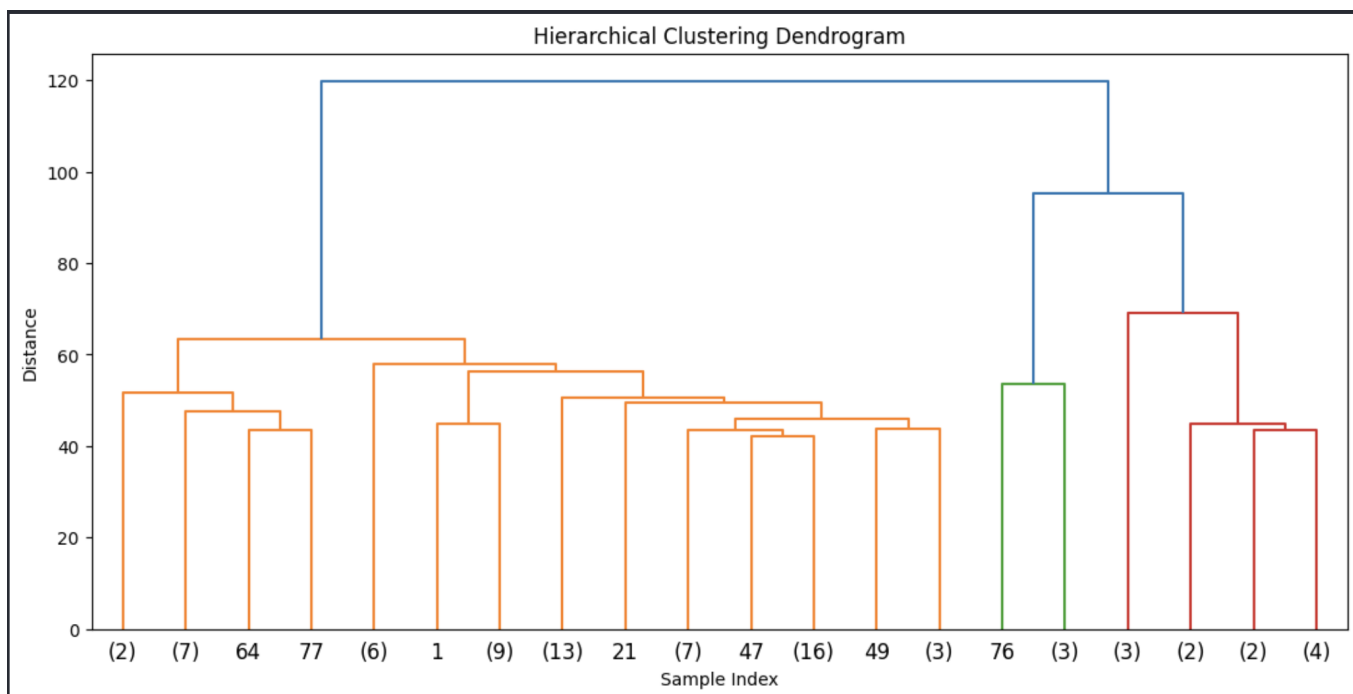
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Sector Clustering (PCA-reduced), From 31-Dec-00 to Cluster Encoding



## Dendrogram



# Within and Between Cluster Correlations

## With Market Effect

### Within Cluster/Sector Correlations:

**Sector Raw Weekly Returns Table, With Average: 0.28**

Cluster	Within Cluster Average Pairwise Correlation
6(Technology)	0.193
2(Consumer Services)	0.316
7(Telecommunications)	0.269
4(Health Care)	0.393
3(Financials)	0.305
1(Consumer Goods)	0.16
5(Industrials)	0.311
0(Basic Materials)	0.328

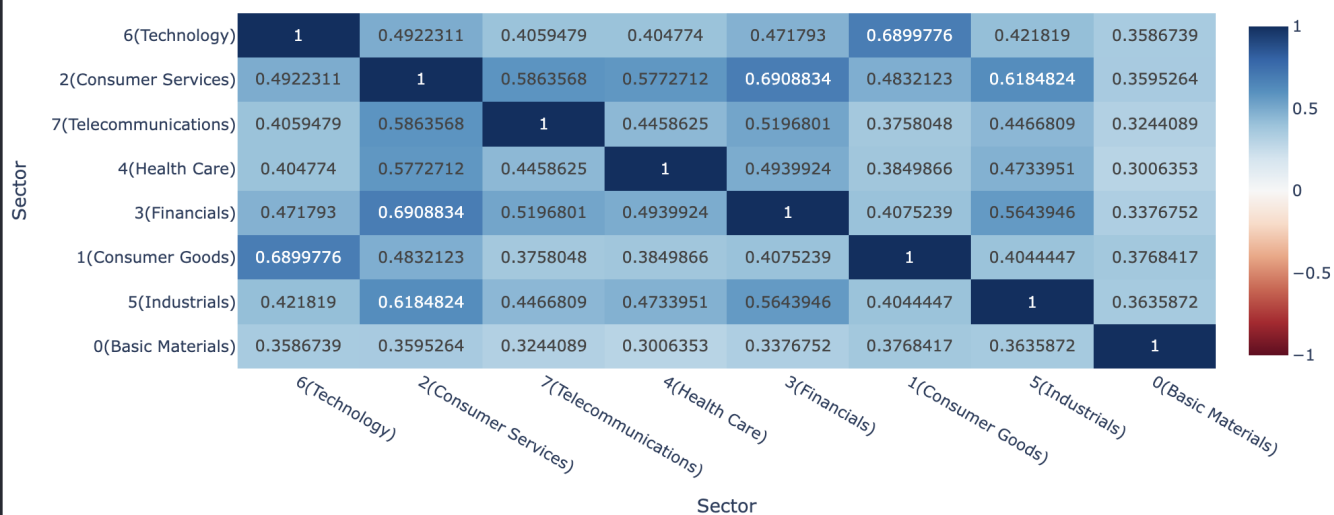
**Cluster Raw Weekly Returns Table, With Average: 0.55**



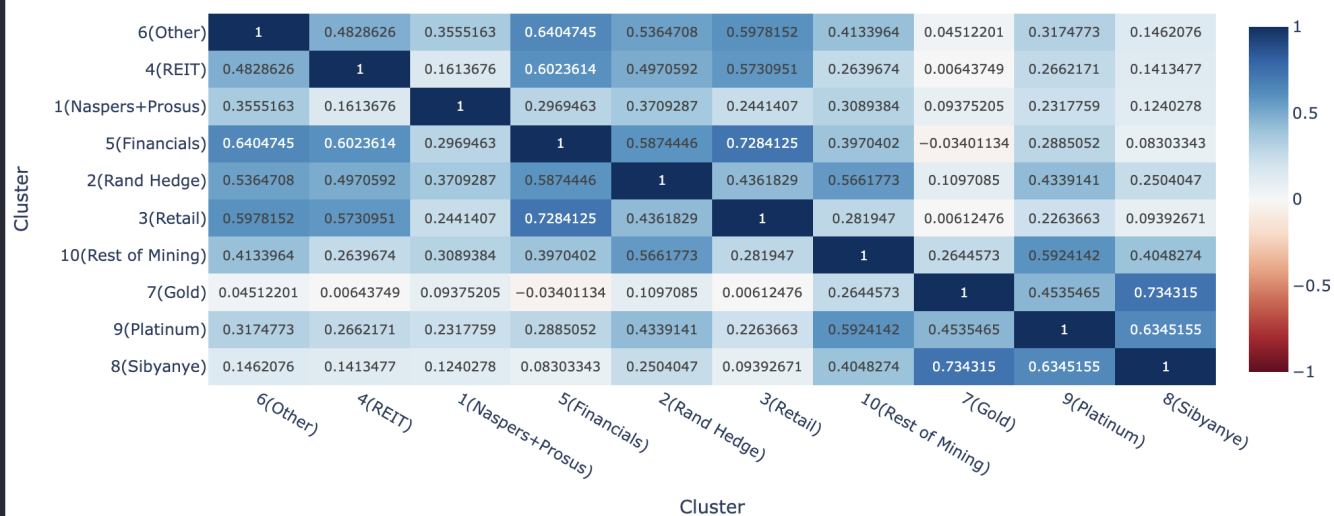
Cluster	Within Cluster Average Pairwise Correlation
6(Other)	0.199
4(REIT)	0.37
1(Naspers+Prosus)	0.845
5(Financials)	0.526
2(Rand Hedge)	0.335
3(Retail)	0.617
10(Rest of Mining)	0.595
7(Gold)	0.762
9(Platinum)	0.692
8(Sibyanje)	null

### Between Cluster/Sector Correlations:

Sector Correlation Heatmap on Raw Returns, Average 0.46



Cluster Correlation Heatmap on Raw Returns, Average 0.34



# Without Market Effect

## Within Cluster/Sector Correlations:

### Sector Weekly Returns Excluding Market Effect Table, with Average: 0.07

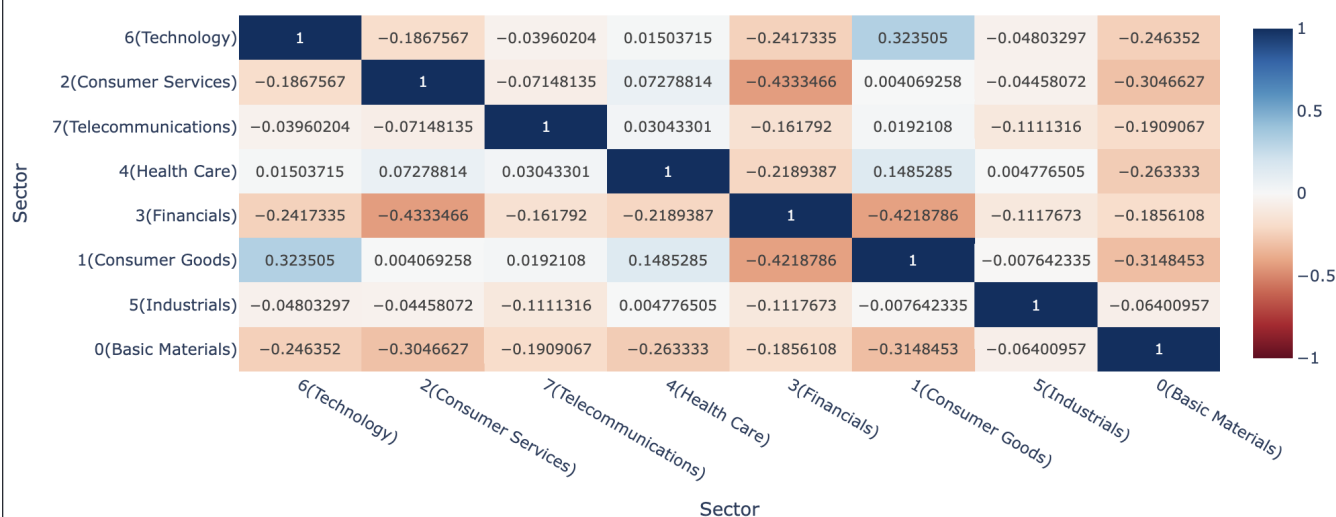
Cluster	Within Cluster Average Pairwise Correlation
6(Technology)	0.039
2(Consumer Services)	0.049
7(Telecommunications)	0.092
4(Health Care)	0.197
3(Financials)	0.032
1(Consumer Goods)	0.12
5(Industrials)	0.035
0(Basic Materials)	0.002

### Cluster Weekly Returns Excluding Market Effect Table, with Average: 0.32

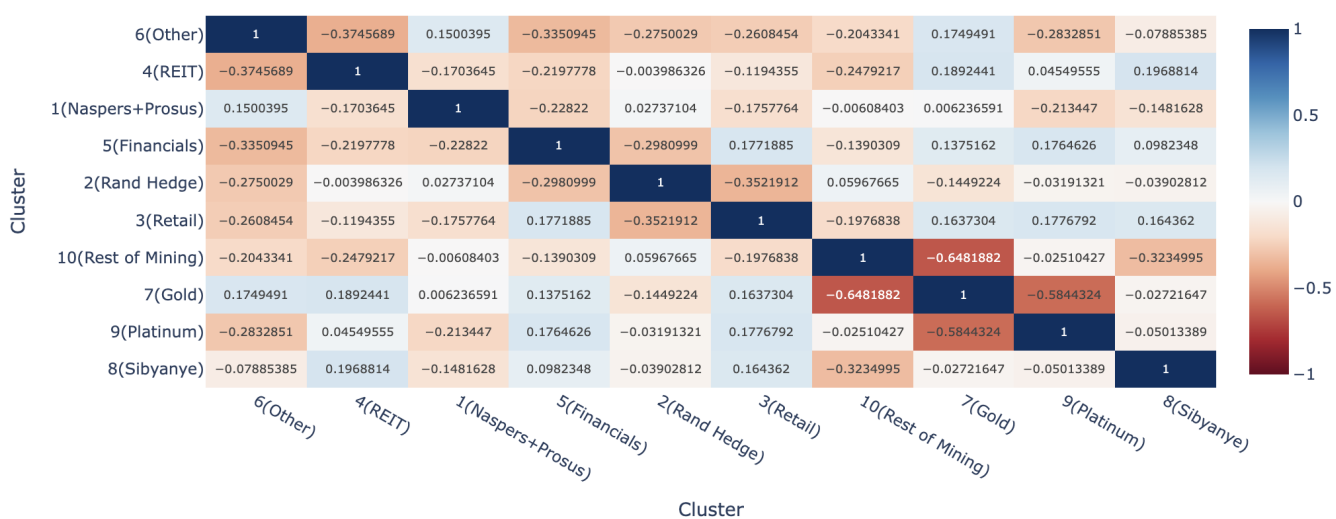
Cluster	Within Cluster Average Pairwise Correlation
6(Other)	0.034
4(REIT)	0.191
1(Naspers+Prosus)	0.835
5(Financials)	0.162
2(Rand Hedge)	0.139
3(Retail)	0.302
10(Rest of Mining)	0.371
7(Gold)	0.442
9(Platinum)	0.379
8(Sibanye)	null

**Between Cluster/Sector Correlations:**

Sector Correlation Heatmap Excluding Market Effect, With Average -0.11



Cluster Correlation Heatmap Excluding Market Effect, With Average -0.09



## Cluster Analysis

### Cluster 6(Other)

	Code	Company	Market Cap	Sector
13	VOD SJ Equity	Vodacom Group Limited (JSE:VOD)	288425000000	Telecommunications
14	MTN SJ Equity	MTN Group Limited (JSE:MTN)	256660000000	Telecommunications
17	SHP SJ Equity	Shoprite Holdings Limited (JSE:SHP)	167337000000	Consumer Services

	Code	Company	Market Cap	Sector
21	BID SJ Equity	Bid Corporation Limited (JSE:BID)	155313000000	Consumer Services
35	CLS SJ Equity	Clicks Group Limited (JSE:CLS)	87717100000	Consumer Services
42	TBS SJ Equity	Tiger Brands Limited (JSE:TBS)	53817500000	Consumer Goods
43	APN SJ Equity	Aspen Pharmacare Holdings Limited (JSE:APN)	52907700000	Health Care
44	MCG SJ Equity	MultiChoice Group (JSE:MCG)	51924400000	Consumer Services
47	SNT SJ Equity	Santam Limited (JSE:SNT)	49436300000	Financials
57	AVI SJ Equity	AVI Limited (JSE:AVI)	33235700000	Consumer Goods
58	BOX SJ Equity	Boxer Retail Limited (JSE:BOX)	32599400000	Consumer Services
60	N91 SJ Equity	Ninety One plc (JSE:N91)	28178900000	Financials
61	DCP SJ Equity	Dis-Chem Pharmacies Limited (JSE:DCP)	27909700000	Consumer Services
62	KST SJ Equity	PSG Konsult Limited (JSE:KST)	27545000000	Financials
72	BAW SJ Equity	Barloworld Limited (JSE:BAW)	21922600000	Industrials
73	SPP SJ Equity	Spar Group Limited (JSE:SPP)	21546400000	Consumer Services
75	LHC SJ Equity	Life Healthcare Group (JSE:LHC)	21173800000	Health Care
77	PIK SJ Equity	Pick n Pay Stores Limited (JSE:PIK)	20483200000	Consumer Services
78	NTC SJ Equity	Netcare Limited (JSE:NTC)	18996000000	Health Care
79	ADH SJ Equity	ADvTECH Limited (JSE:ADH)	18485600000	Consumer Services



	Code	Company	Market Cap	Sector
87	CML SJ Equity	Coronation Fund Managers (JSE:CML)	15370200000	Financials
88	DTC SJ Equity	Datatec Limited (JSE:DTC)	15037900000	Technology
90	ITE SJ Equity	Italtile Limited (JSE:ITE)	13216500000	Consumer Services
91	OMN SJ Equity	Omnia Holdings Limited (JSE:OMN)	12858800000	Basic Materials
93	WBO SJ Equity	Wilson Bayly Holmes-Ovcon Limited (JSE:WBO)	12712300000	Industrials
96	SUI SJ Equity	Sun International Limited (JSE:SUI)	12165500000	Consumer Services
97	NY1 SJ Equity	Ninety One Limited (JSE:NY1)	11709000000	Financials
98	JSE SJ Equity	JSE Limited (JSE:JSE)	11354900000	Financials
99	AFH SJ Equity	Alexander Forbes Group Holdings Limited (JSE:AFH)	11045800000	Financials

	Code	Company	Market Cap	Sector
49	GRT SJ Equity	Growthpoint Properties Limited (JSE:GRT)	47276200000	Financials
56	RDF SJ Equity	Redefine Properties Limited (JSE:RDF)	33708200000	Financials
67	FFB SJ Equity	Fortress REIT Limited - B (JSE:FFB)	24675900000	Financials
68	VKE SJ Equity	Vukile Property Fund Limited (JSE:VKE)	24631200000	Financials
69	SRI SJ Equity	Supermarket Income REIT (JSE:SRI)	23940300000	Financials
71	RES SJ Equity	Resilient REIT Limited (JSE:RES)	22982300000	Financials
76	BYI SJ Equity	Bytes Technology Group (JSE:BYI)	21031200000	Technology

	Code	Company	Market Cap	Sector
83	HYP SJ Equity	Hyprop Investments Limited (JSE:HYP)	17486600000	Financials
85	LTE SJ Equity	Lighthouse Capital Limited (JSE:LTE)	17067200000	Financials
92	EQU SJ Equity	Equites Property Fund Limited (JSE:EQU)	12720300000	Financials

	Code	Company	Market Cap	Sector
0	PRX SJ Equity	Prosus N.V. (JSE:PRX)	2287790000000	Technology
6	NPN SJ Equity	Naspers Limited - N (JSE:NPN)	881232000000	Technology

	Code	Company	Market Cap	Sector
9	FSR SJ Equity	Firststrand Limited (JSE:FSR)	419646000000	Financials
10	CPI SJ Equity	Capitec Bank Holdings Limited (JSE:CPI)	415417000000	Financials
12	SBK SJ Equity	Standard Bank Group (JSE:SBK)	372867000000	Financials
16	SLM SJ Equity	Sanlam Limited (JSE:SLM)	188024000000	Financials
20	ABG SJ Equity	Absa Group Limited (JSE:ABG)	160630000000	Financials
23	DSY SJ Equity	Discovery Limited (JSE:DSY)	149836000000	Financials
25	OUT SJ Equity	OUTsurance Holdings Limited (JSE:OUT)	121798000000	Financials
26	NED SJ Equity	Nedbank Group Limited (JSE:NED)	118317000000	Financials
34	REM SJ Equity	Remgro Limited (JSE:REM)	89072500000	Financials
36	BVT SJ Equity	Bidvest Group (JSE:BVT)	81240500000	Industrials

	Code	Company	Market Cap	Sector
39	OMU SJ Equity	Old Mutual Limited (JSE:OMU)	57261700000	Financials
50	MTM SJ Equity	Momentum Metropolitan Holdings (JSE:MTM)	46336800000	Financials
66	WBC SJ Equity	We Buy Cars Holdings Limited (JSE:WBC)	24956100000	Technology

	Code	Company	Market Cap	Sector
2	ANH SJ Equity	Anheuser-Busch Inbev (JSE:ANH)	2201800000000	Consumer Goods
3	BTI SJ Equity	British American Tobacco (JSE:BTI)	1987650000000	Consumer Goods
4	CFR SJ Equity	Compagnie Fin Richemont (JSE:CFR)	1783080000000	Consumer Goods
24	MNP SJ Equity	Mondi plc (JSE:MNP)	127083000000	Basic Materials
33	INP SJ Equity	Investec plc (JSE:INP)	90532500000	Financials
40	SOL SJ Equity	Sasol Limited (JSE:SOL)	56935100000	Basic Materials
53	INL SJ Equity	Investec Limited (JSE:INL)	38567000000	Financials
54	HMN SJ Equity	Hammerson plc (JSE:HMN)	34955300000	Financials
82	SAP SJ Equity	Sappi Limited (JSE:SAP)	17625300000	Basic Materials

	Code	Company	Market Cap	Sector
28	PPH SJ Equity	Pepkor Holdings Limited (JSE:PPH)	103966000000	Consumer Services
38	MRP SJ Equity	Mr Price Group (JSE:MRP)	57588200000	Consumer Services
45	WHL SJ	Woolworths Holdings Limited	51768100000	Consumer

	Code	Company	Market Cap	Sector
	Equity	(JSE:WHL)		Services
51	TFG SJ Equity	The Foschini Group (JSE:TFG)	45380500000	Consumer Services
59	TRU SJ Equity	Truworths International Limited (JSE:TRU)	30184000000	Consumer Services
81	MTH SJ Equity	Motus Holdings Limited (JSE:MTH)	17955300000	Consumer Services

	Code	Company	Market Cap	Sector
1	BHG SJ Equity	BHP Group Limited (JSE:BHG)	2238510000000	Basic Materials
5	GLN SJ Equity	Glencore plc (JSE:GLN)	964367000000	Basic Materials
7	AGL SJ Equity	Anglo American plc (JSE:AGL)	626228000000	Basic Materials
18	S32 SJ Equity	South32 Limited (JSE:S32)	161631000000	Basic Materials
32	KIO SJ Equity	Kumba Iron Ore (JSE:KIO)	96261800000	Basic Materials
41	EXX SJ Equity	Exxaro Resources Limited (JSE:EXX)	54104100000	Basic Materials
52	ARI SJ Equity	African Rainbow Minerals (JSE:ARI)	39660000000	Basic Materials
95	TGA SJ Equity	Thungela Resources Limited (JSE:TGA)	12361900000	Basic Materials

	Code	Company	Market Cap	Sector
8	ANG SJ Equity	Anglogold Ashanti (JSE:ANG)	419908000000	Basic Materials
11	GFI SJ Equity	Gold Fields Limited (JSE:GFI)	387134000000	Basic Materials
19	HAR SJ Equity	Harmony Gold Mining Company (JSE:HAR)	161155000000	Basic Materials

	Code	Company	Market Cap	Sector
15	VAL SJ Equity	Valterra Platinum Limited (JSE:VAL)	225498000000	Basic Materials
22	IMP SJ Equity	Impala Platinum Holdings Limited (JSE:IMP)	154737000000	Basic Materials
37	NPH SJ Equity	Northam Platinum Holdings Limited (JSE:NPH)	79780500000	Basic Materials

	Code	Company	Market Cap	Sector
30	SSW SJ Equity	Sibanye Stillwater Limited (JSE:SSW)	98900000000	Basic Materials