SAPM ASSIGNMENT

GROUP 11

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Priyansh Goyal	2020A4PS1879H
Raghav Krishna Regalla	2020B3PS1382H
Sridhara Sri Rama Jayanth	2020A4PS2299H
G.Karunya Varma	2020A4PS2244H
Sai Aravind Inkollu	2020A4PS2308H
Lingutla Sai Charan	2020A7PS1296H
Nandiraju Venkata Sai Kartik	2020A4PS1998H
Yogeswar P	2020A4PS1908H
Manas Kumar Khandwal	2020A4PS2272H
P B V Shivani	2020A5PS2543H

BACKGROUND

- An asset is a resource with economic value that an individual, corporation, or country owns or controls with the expectation that it will provide a future benefit.

Least Correlated Assets : **HINDALCO & NESTLE**

BACKGROUND

- Keeping our goal in mind of maximizing profit for the long term with minimizing our risk, we picked strong companies from different sectors to diversify our portfolio based on their returns**.** We have taken 20 Assets. These assets were chosen from high-growth sectors (For example, under FMCG, we have Nestle India Ltd and ITC Ltd).

- But, from our analysis done on these assets, we selected the assets which were outperforming their respective sector companies. In doing so, we found out few assets, though from different sectors, had a high correlation coefficient.

LIST OF ASSETS

DLF Ltd	Adani Ports & SEZ Ltd	Asian Paints Ltd	BITCOIN	Dr Reddy's Laboratories Ltd	Gujarat Alkalies & Chemicals Ltd
Hindustan Aeronautics Ltd	HINDALCO Industries Ltd	Infosys Ltd	ITC Ltd	Nestlé India Ltd	Jindal Steel & Power Ltd
L & T Infotech	Mahindra & Mahindra Ltd	MRF Ltd	RIL	Bharat Electronics Ltd	HDFC Ltd
		TATA Motors Ltd	TCS Ltd		

MARKOWITZ PORTFOLIO THEORY

Assumptions:

- Investors believe every investment alternative has a probability distribution of expected returns over a defined holding period.
- Risk of the portfolio is gauged based on variability of expected returns
- For a given expected return, investors prefer less risk to more risk and for a given risk, they prefer higher returns to lower returns.

MARKOWITZ PORTFOLIO THEORY

- The Efficient Frontier is a set of portfolios with the maximum rate of return for every given level of risk, or the minimum risk for every level of return.
- Given Risk, Max Return

  $\max(u_{px}) = x^1 u$ (subjected to x1,x2,x3)

  $\sigma_{px}^2 = x' \sum x \; ; \; x^1 1 = 1$
- For a Target Return, Min Risk

  $\min(\sigma_{px}^2) = x' \Sigma x$ (subjected to x1,x2,x3)

  $u_{px} = x^1 u \; ; \; x^1 1 = 1$

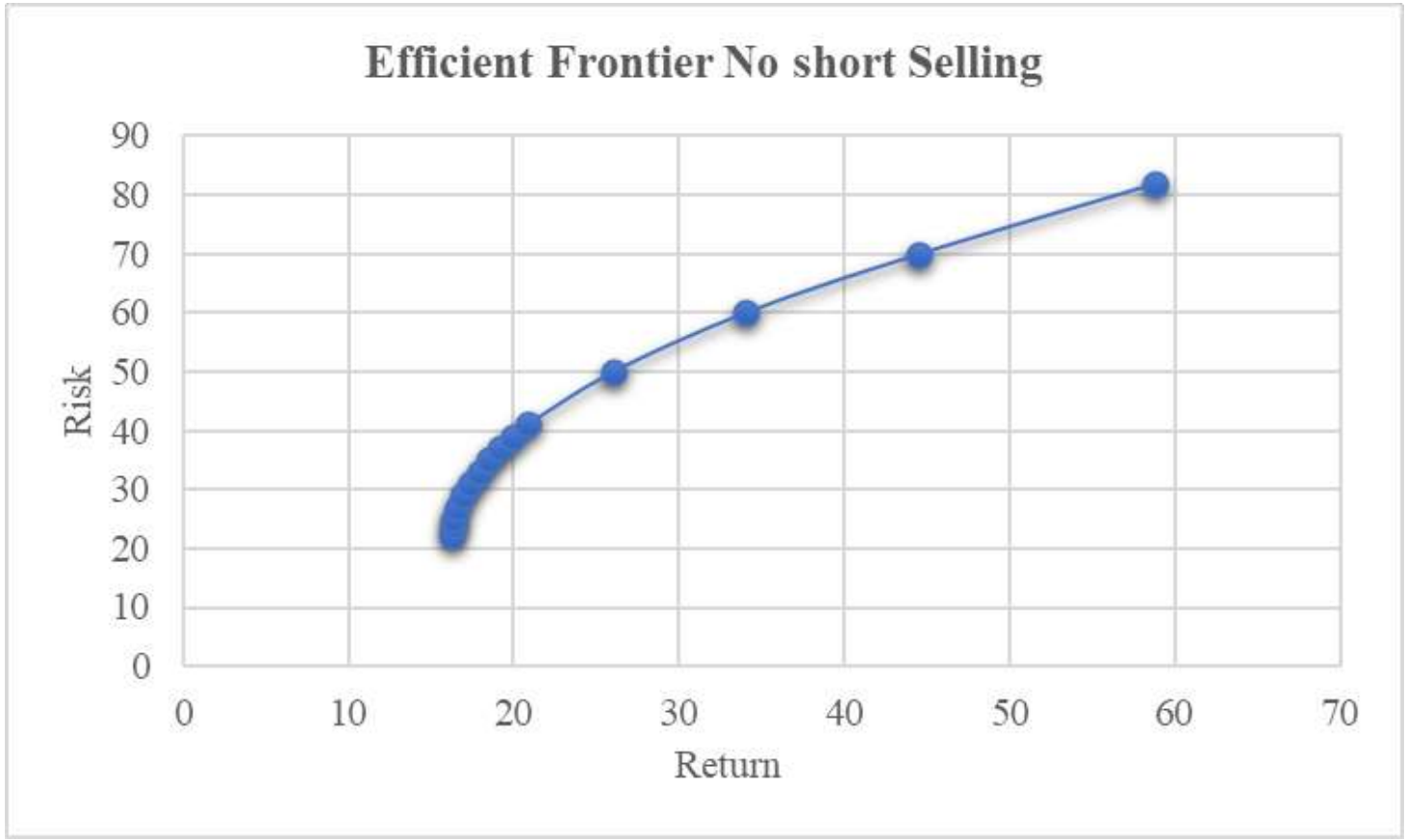
MARKOWITZ PORTFOLIO THEORY Vs MARKET MODEL

- For n risky assets, MPT requires a total of 2n + (n2-n)/2 parameters, while Market Model requires only 3n + 2 parameters.
- This is a major limitation of MPT as more number of parameters lead to more assumptions which has adverse effects, especially when dealing with volatile markets.

HISTORICAL DATA ANALYSIS (EXCEL)

NO SHORT SELLING

- The graph shows the Efficient Frontier when Short Selling is not allowed.

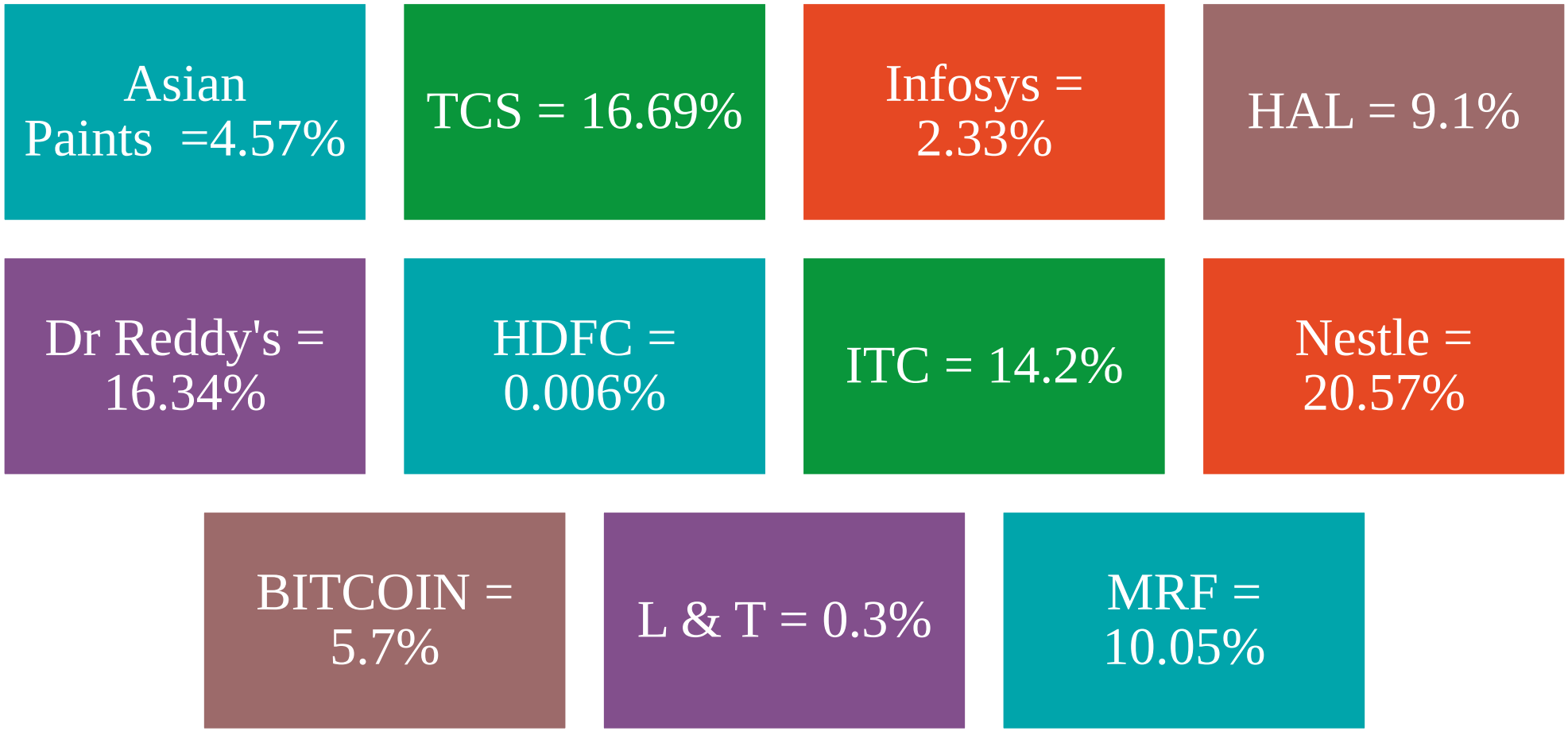


Minimum Variance Portfolio (MVP)

Expected Return = 22.06%

Risk = 16.25%

Asset Allocation



GRAPHICAL REPRESENTATION OF WEIGHTS

WITH SHORT SELLING

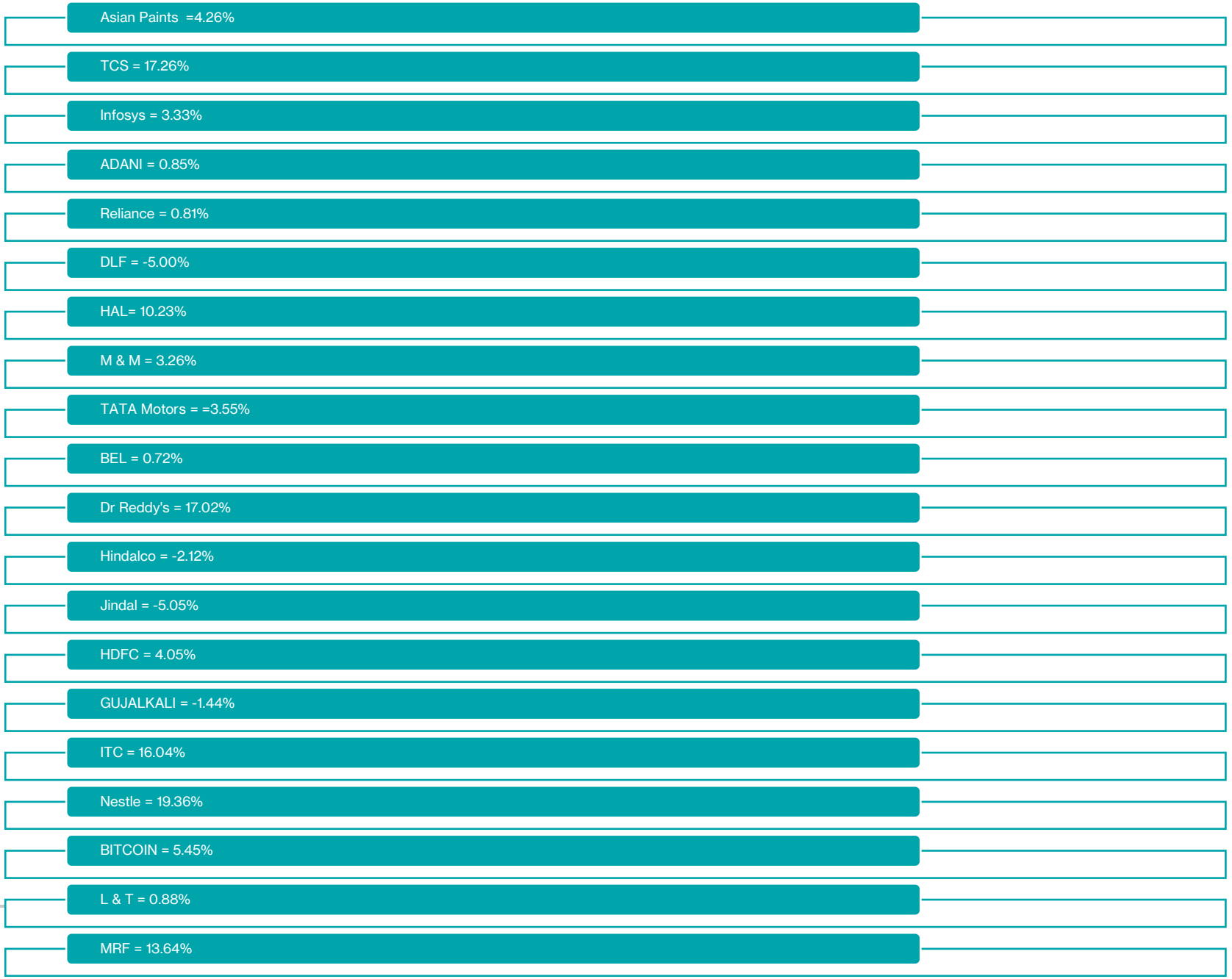
- The graph shows the Efficient Frontier when Short Selling is allowed.

Minimum Variance Portfolio (MVP)

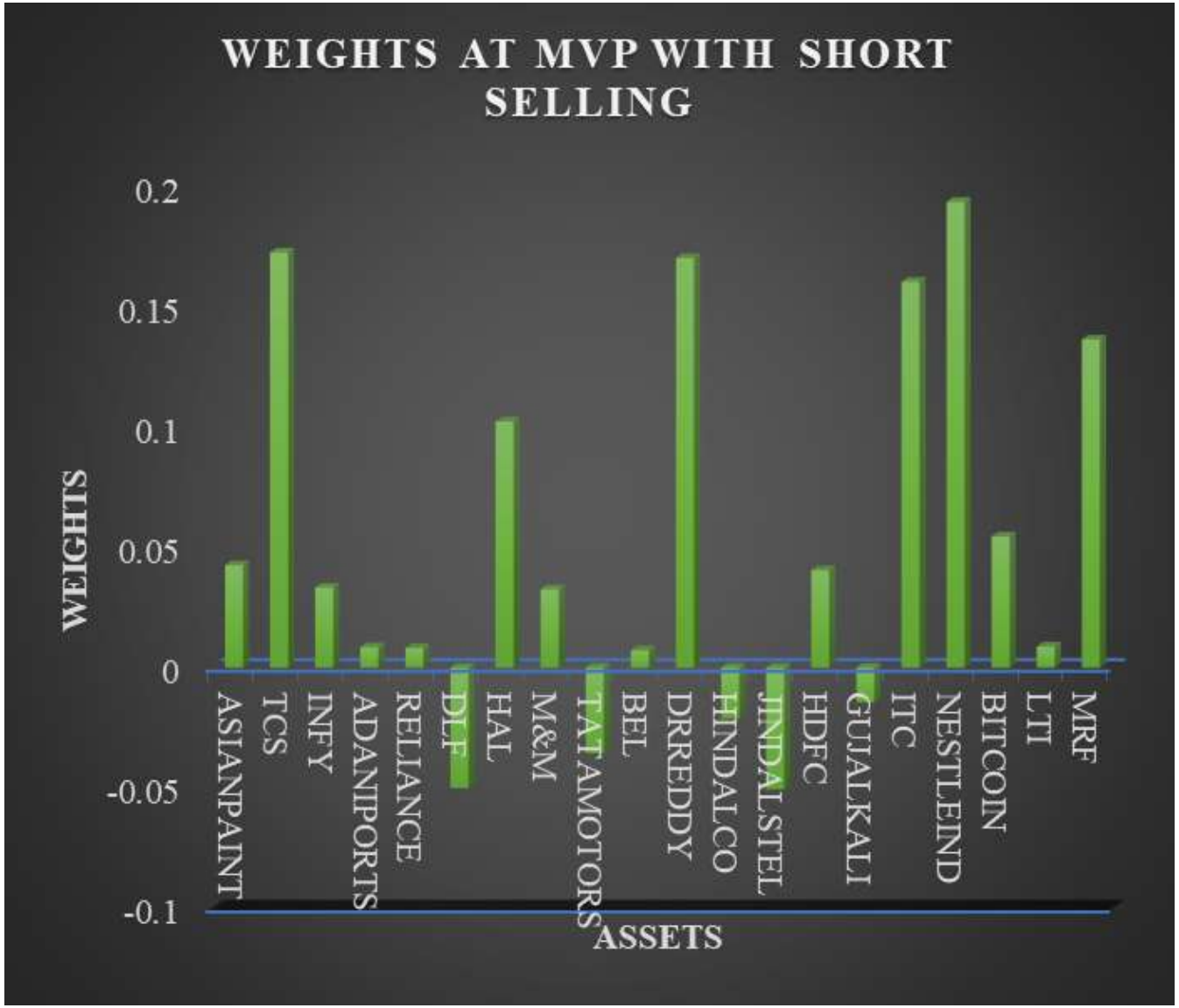
Expected Return=18.94%

Risk = 15.60%

Asset Allocation



GRAPHICAL REPRESENTATION OF WEIGHTS



USING MATRIX MULTIPLICATION IN EXCEL

$$\begin{pmatrix} 2\Sigma & \mathbf{1} \\ \mathbf{1}' & 0 \end{pmatrix} \begin{pmatrix} \mathbf{m} \\ \lambda \end{pmatrix} = \begin{pmatrix} \mathbf{0} \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} 2\Sigma & \mu & \mathbf{1} \\ \mu' & 0 & 0 \\ \mathbf{1}' & 0 & 0 \end{pmatrix} \begin{pmatrix} \mathbf{x} \\ \lambda_1 \\ \lambda_2 \end{pmatrix} = \begin{pmatrix} \mathbf{0} \\ \mu_{p,0} \\ 1 \end{pmatrix}$$

$$\mathbf{A}_x \mathbf{z}_x = \mathbf{b}_0$$

$$\mathbf{A}_x = \begin{pmatrix} 2\Sigma & \mu & \mathbf{1} \\ \mu' & 0 & 0 \\ \mathbf{1}' & 0 & 0 \end{pmatrix}, \ \mathbf{z}_x = \begin{pmatrix} \mathbf{x} \\ \lambda_1 \\ \lambda_2 \end{pmatrix} \text{ and } \mathbf{b}_0 = \begin{pmatrix} \mathbf{0} \\ \mu_{p,0} \\ 1 \end{pmatrix}$$

$$\mu_{p,x} = \mathbf{x}'\mu$$

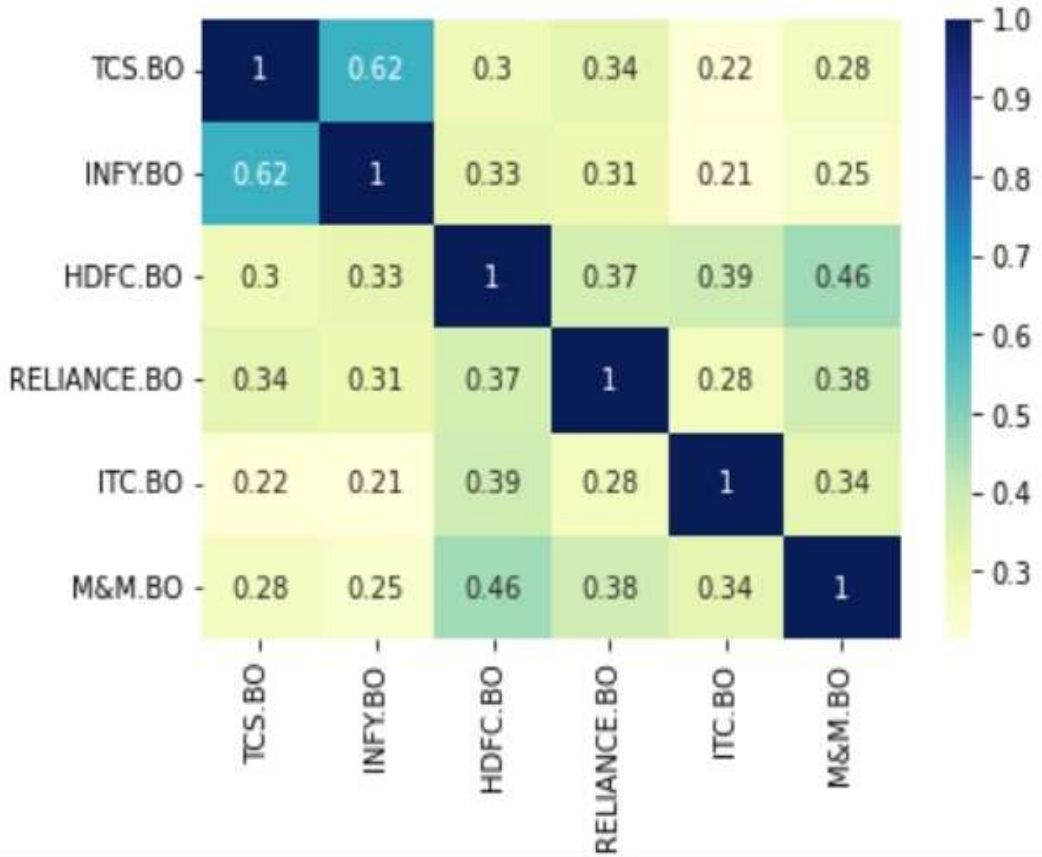
$$\sigma^2_{p,x} = \mathbf{x}'\Sigma\mathbf{x}$$

CORRELATION MATRIX

	DLF	ADANI	ASIANPAIN	BITCOIN	DRREDDY	GUJALKAL	HAL	HINDALCC	INFOSYS	ITC	NESTLE	JINDAL STI	L &T INFO	M&M	MRF	RELIANCE	BEL	HDFC	TATA	TCS
DLF	1																			
ADANI	0.976051	1																		
ASIANPAIN	0.973891	0.999831	1																	
BITCOIN	0.971772	0.99964	0.999824	1																
DRREDDY	0.970904	0.999562	0.999768	0.999868	1															
GUJALKAL	0.981407	0.980052	0.978838	0.977071	0.976759	1														
HAL	-0.97135	-0.99962	-0.99986	-0.99993	-0.99994	-0.97697	1													
HINDALCC	-0.97231	-0.99975	-0.99992	-0.99994	-0.99993	-0.97761	0.999964	1												
INFOSYS	-0.97515	-0.99897	-0.99895	-0.99883	-0.99871	-0.97827	0.99869	0.998828	1											
ITC	-0.95207	-0.99429	-0.99527	-0.9961	-0.99627	-0.9639	0.996262	0.995912	0.992414	1										
NESTLE	0.972907	0.999785	0.999958	0.999913	0.999878	0.978081	-0.99994	-0.99998	-0.99887	-0.99569	1									
JINDAL STI	0.974418	0.999867	0.999916	0.999837	0.999783	0.978976	-0.99984	-0.99992	-0.99885	-0.99512	0.999939	1								
L &T INFO	0.974408	0.999745	0.999815	0.999669	0.999586	0.979188	-0.99968	-0.99976	-0.99888	-0.99493	0.9998	0.999805	1							
M&M	-0.97524	-0.99679	-0.99678	-0.99667	-0.99607	-0.97769	0.996305	0.996554	0.995831	0.989991	-0.99666	-0.99677	-0.99679	1						
MRF	-0.96774	-0.99909	-0.99945	-0.99975	-0.9998	-0.97442	0.999774	0.999726	0.998167	0.997068	-0.99963	-0.99943	-0.99922	0.995613	1					
RELIANCE	0.979317	0.999191	0.998997	0.998508	0.998287	0.982484	-0.99845	-0.99866	-0.99818	-0.99182	0.998828	0.999011	0.998934	-0.99683	-0.99752	1				
BEL	-0.96467	-0.99747	-0.99801	-0.9983	-0.99849	-0.97351	0.998505	0.998272	0.996413	0.996591	-0.9982	-0.99794	-0.99776	0.993472	0.99854	-0.99594	1			
HDFC	-0.96946	-0.99939	-0.99969	-0.99987	-0.9999	-0.97608	0.999899	0.999889	0.998469	0.996678	-0.99983	-0.99967	-0.99951	0.996095	0.99988	-0.99799	0.998438	1		
TATA	0.878434	0.779889	0.774093	0.766301	0.763993	0.834738	-0.76575	-0.76826	-0.77942	-0.72113	0.770665	0.774797	0.77633	-0.78388	-0.75515	0.795884	-0.7517	-0.75937	1	
TCS	-0.9736	-0.9997	-0.99979	-0.99976	-0.99972	-0.97834	0.999718	0.999795	0.998593	0.995088	-0.99982	-0.99978	-0.99965	0.996416	0.999344	-0.99881	0.997822	0.999582	-0.77283	1

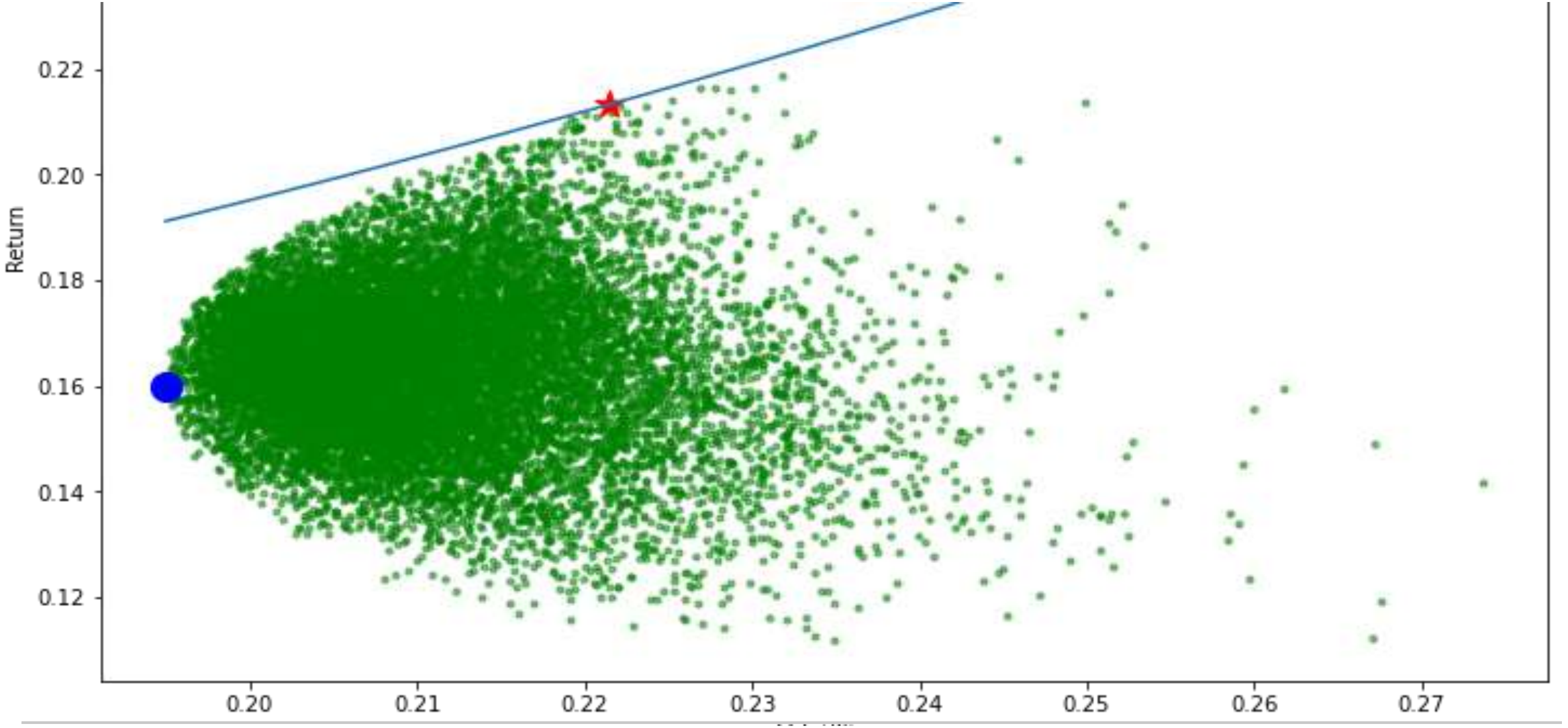
HISTORICAL DATA ANALYSIS (USING PYTHON)

PYTHON RESULTS



Heatmap of Variance Covariance Matrix deduced from Python Code file

EFFICIENT FRONTIER

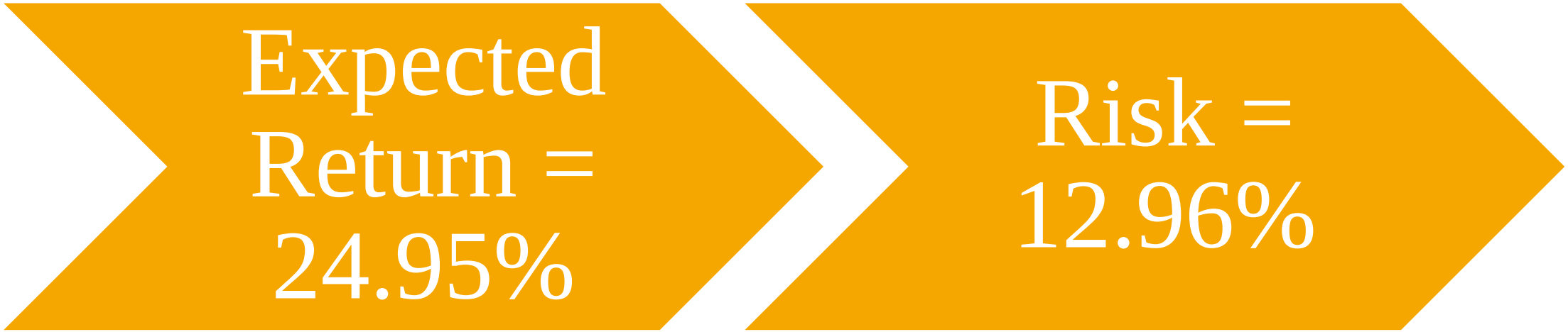


MARKET MODEL ANALYSIS (EXCEL)

NO SHORT SELLING

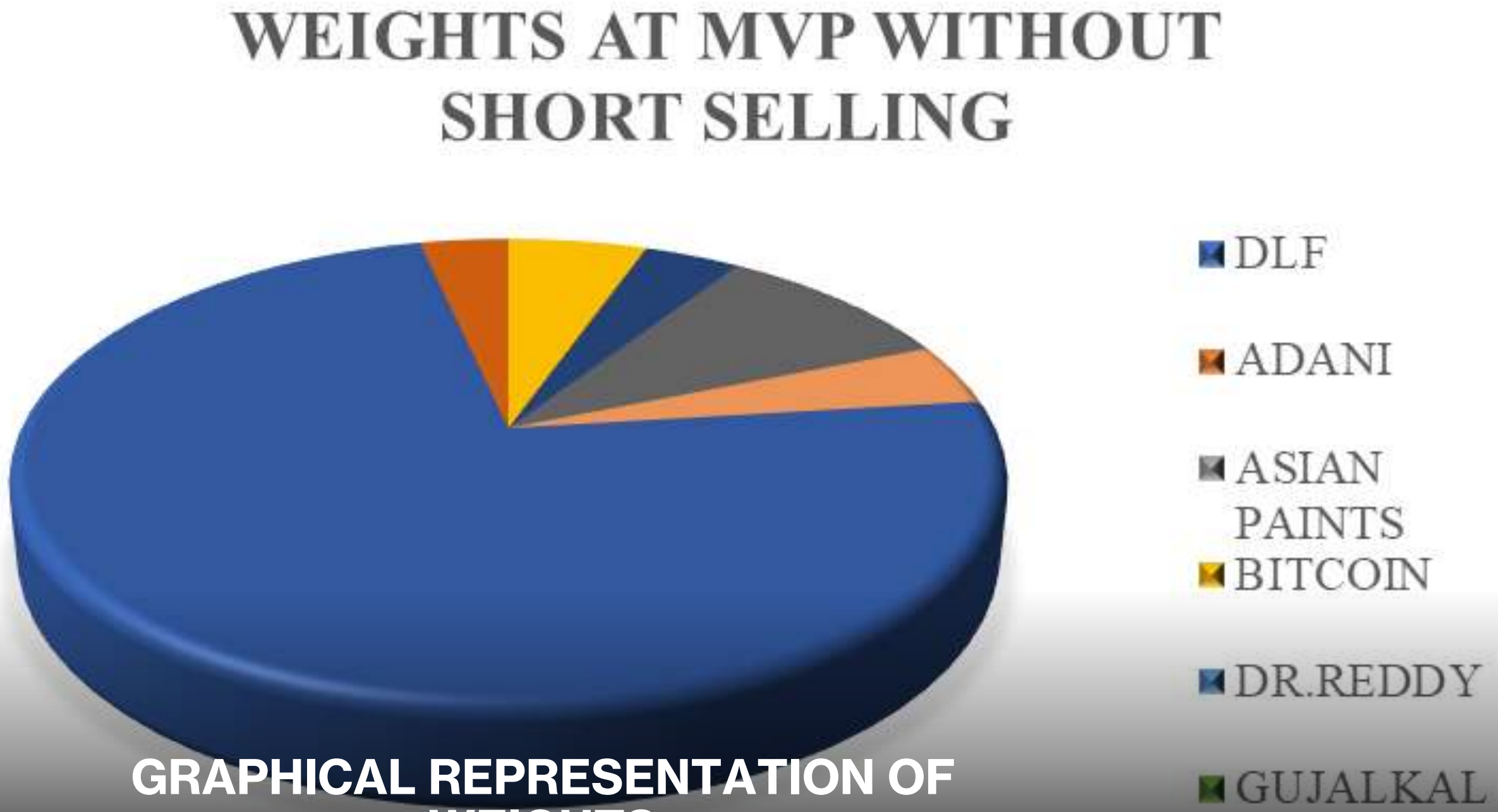
The graph shows the Efficient Frontier when Short Selling is not allowed.

Minimum Variance Portfolio (MVP)



Asset Allocation

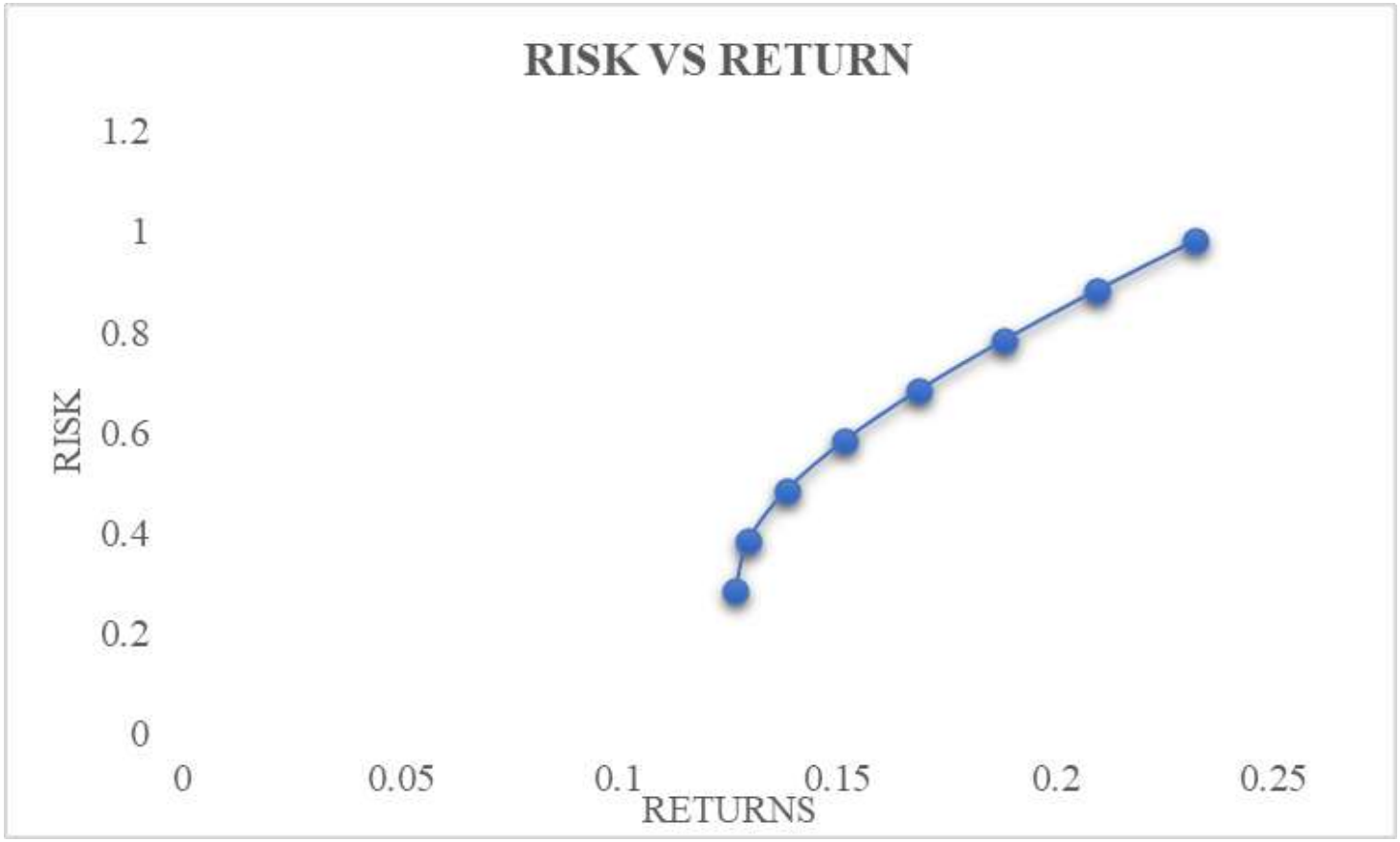
- TATA =73.49%
- TCS = 3.46%
- Infosys = 9.605%
- HAL = 3.76%
- M & M = 4.26%
- Hindalco = 0.00008292116%
- BITCOIN = 5.42%
- REMAINING=0%



GRAPHICAL REPRESENTATION OF WEIGHTS

WITH SHORT SELLING

- The graph shows the Efficient Frontier when Short Selling is allowed.

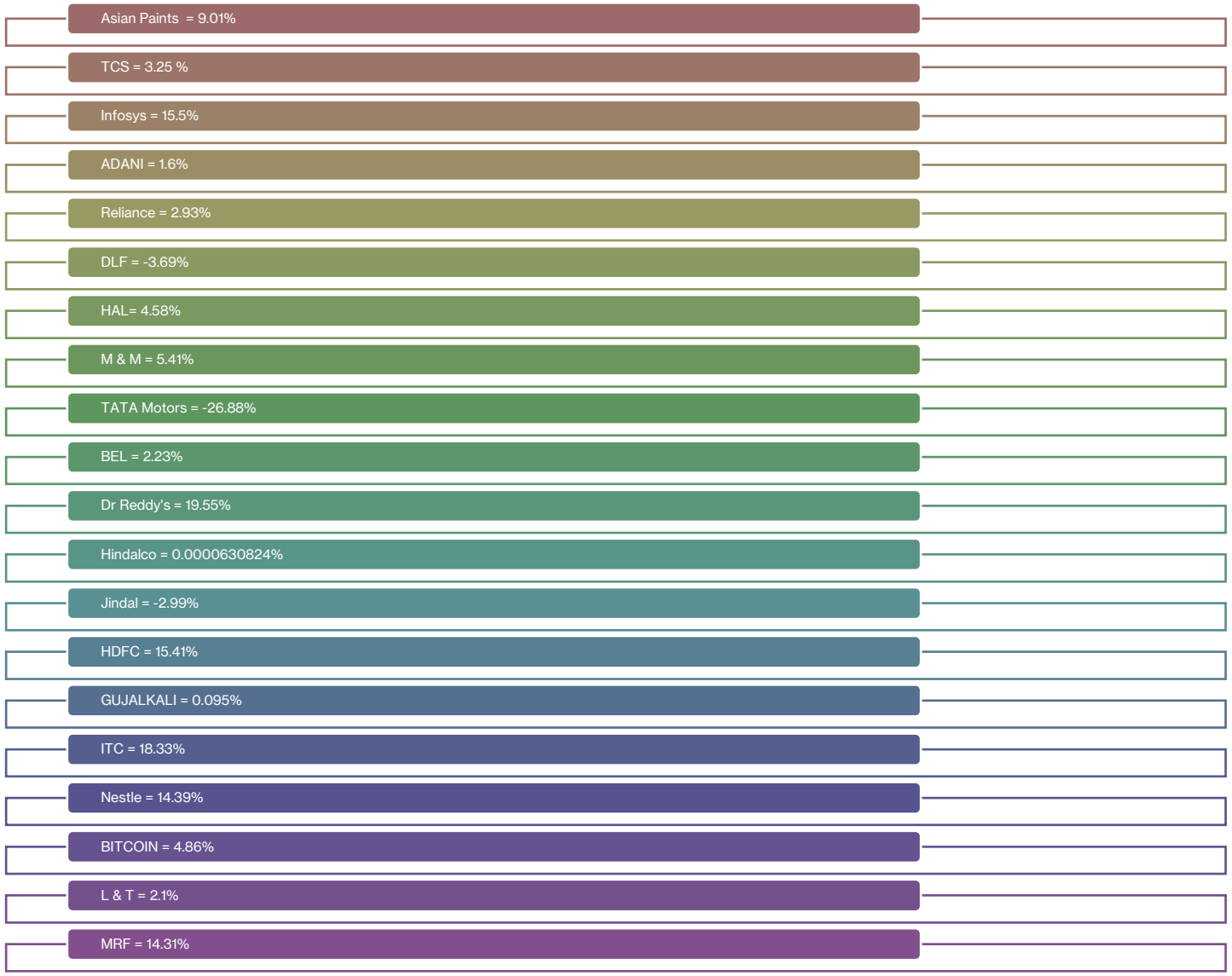


Minimum Variance Portfolio (MVP)

Expected Return = 11.84%

Risk = 13.473%

Asset Allocation



GRAPHICAL REPRESENTATION OF WEIGHTS

MARKET MODEL ANALYSIS (USING PYTHON)

Python Results

Out[55]:

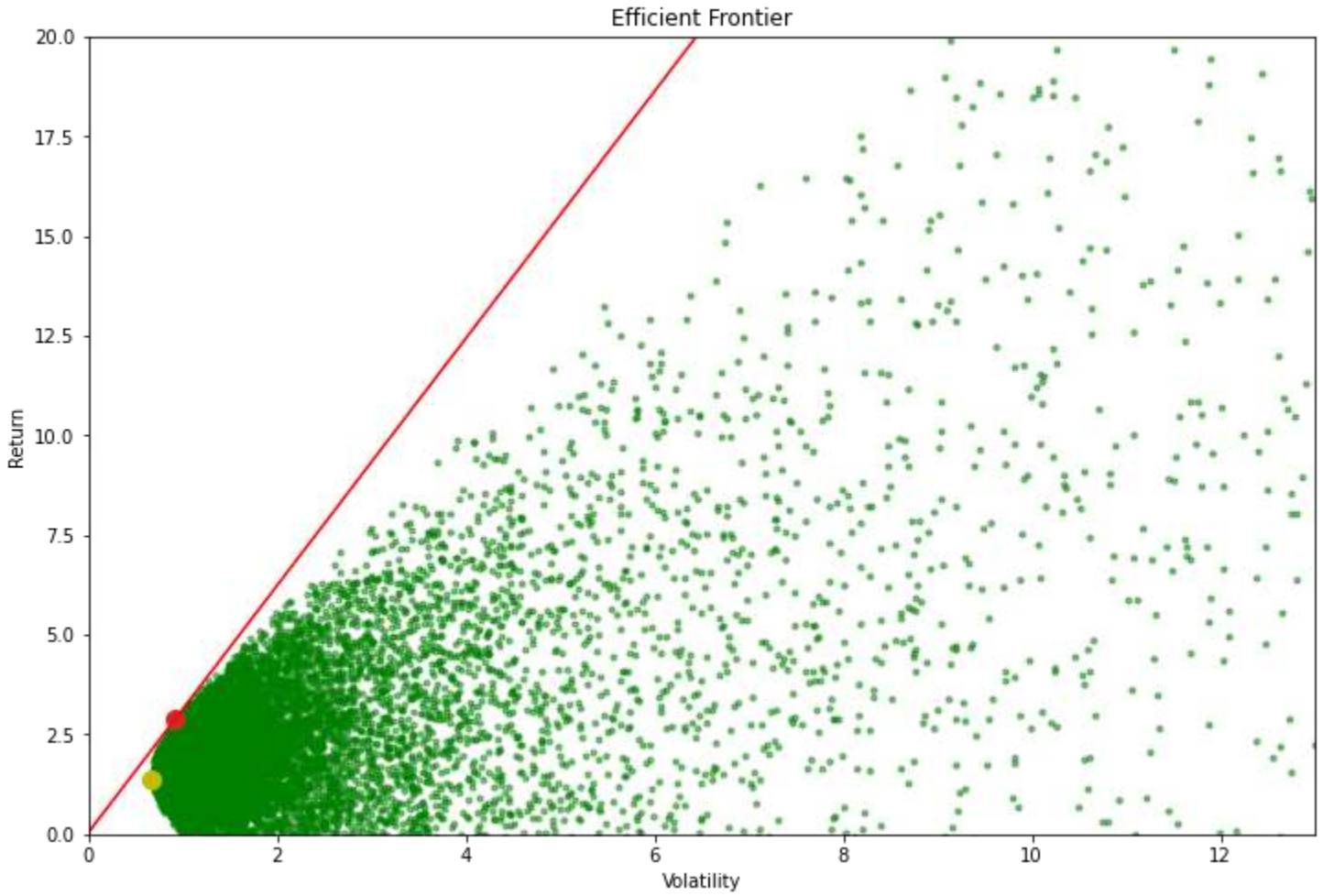
	ADANIPORTS.BO	DRREDDY.BO	HDFC.BO	MRF.BO	RELIANCE.BO	TCS.BO	^BSESN
ADANIPORTS.BO	0.116693	-0.002307	0.050754	0.039826	0.041869	0.017849	0.048266
DRREDDY.BO	-0.002307	0.067875	0.001269	-0.009989	0.029553	0.014737	0.005900
HDFC.BO	0.050754	0.001269	0.072862	0.027562	0.033558	0.024142	0.045175
MRF.BO	0.039826	-0.009989	0.027562	0.057529	0.007389	0.003785	0.020693
RELIANCE.BO	0.041869	0.029553	0.033558	0.007389	0.086380	0.031952	0.038266
TCS.BO	0.017849	0.014737	0.024142	0.003785	0.031952	0.056760	0.022762
^BSESN	0.048266	0.005900	0.045175	0.020693	0.038266	0.022762	0.038874

VARIANCE COVARIANCE MATRIX

Efficient Frontier

- **YELLOW POINT- Minimum Volatility**

- **RED POINT – Optimum Tangency**




THANK
YOU