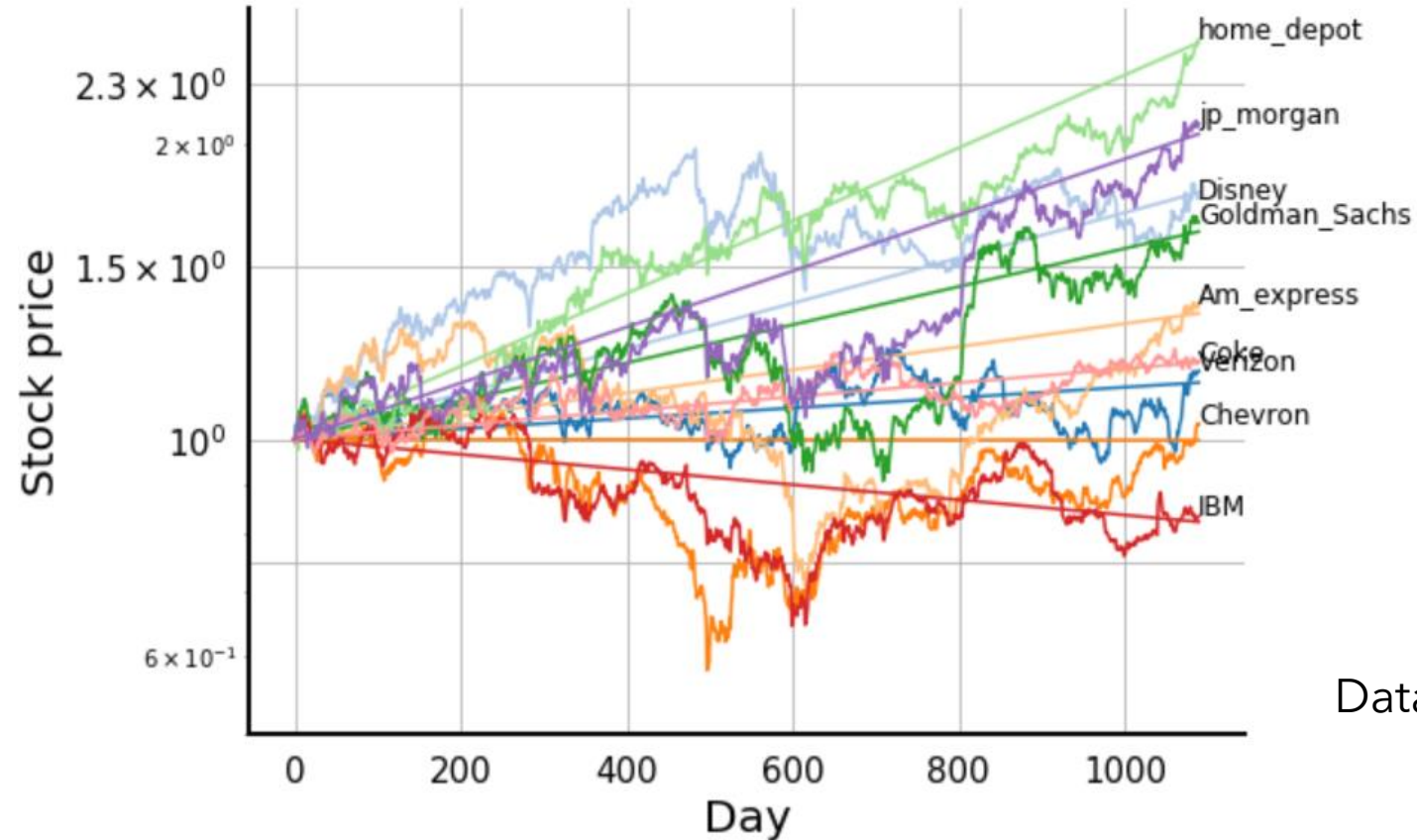




# Optimum Portfolio for a risk averse investor

Cesar Nieto

# Analyzing the fluctuations of the stock market (2013-2017)



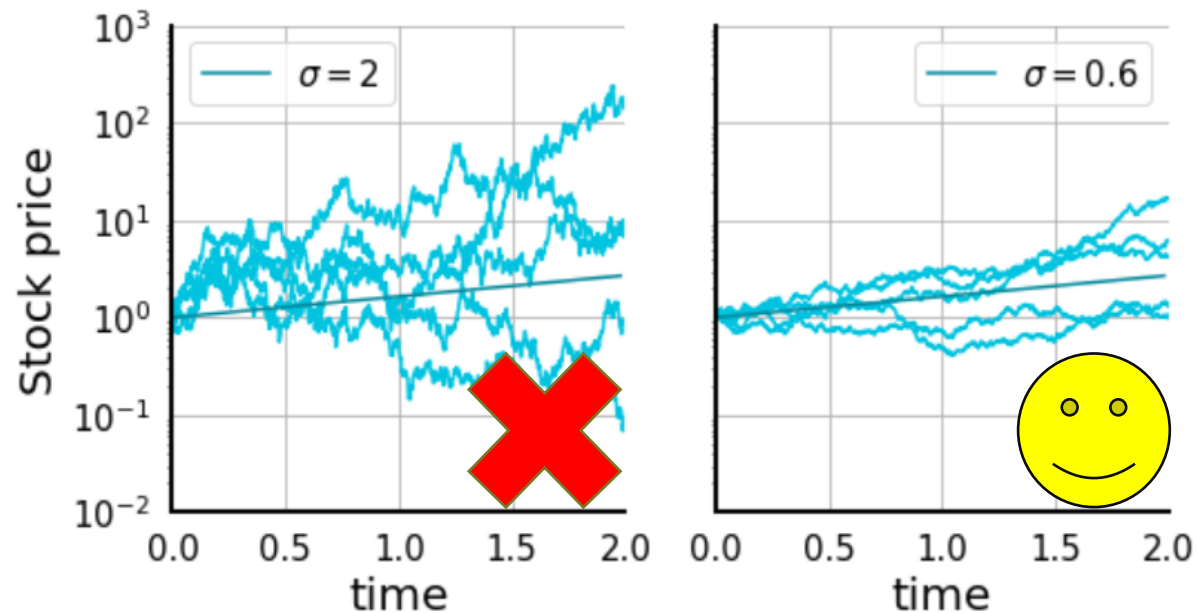
Data obtained from Quandl

	Date	Open	High	Low	Close	Volume	Dividend	Split	Adj_Open	Adj_High	Adj_Low	Adj_Close	Adj_Volume	Name
0	12/28/2017	53.410	53.5500	53.160	53.43	6725691	0.00	1	47.889966	48.015496	47.665804	47.907899	6725691	Verizon
1	12/27/2017	53.410	53.5000	53.090	53.28	8361890	0.00	1	47.889966	47.970664	47.603038	47.773402	8361890	Verizon
2	12/26/2017	53.130	53.6900	53.130	53.22	6595751	0.00	1	47.638904	48.141027	47.638904	47.719603	6595751	Verizon
3	12/22/2017	53.100	53.6300	53.060	53.19	13657015	0.00	1	47.612005	48.087228	47.576139	47.692703	13657015	Verizon
4	12/21/2017	52.920	53.6000	52.605	53.01	12778042	0.00	1	47.450608	48.060329	47.168164	47.531307	12778042	Verizon
5	12/20/2017	53.130	53.3500	52.680	52.77	11642878	0.00	1	47.638904	47.836167	47.235413	47.316111	11642878	Verizon
6	12/19/2017	53.400	53.5900	52.695	52.83	13972964	0.00	1	47.880999	48.051362	47.248862	47.369910	13972964	Verizon
7	12/18/2017	52.950	53.3900	52.660	53.25	15874378	0.00	1	47.477508	47.872033	47.217480	47.746502	15874378	Verizon
8	12/15/2017	52.560	52.8900	52.390	52.67	28935342	0.00	1	47.127815	47.423709	46.975385	47.226446	28935342	Verizon
9	12/14/2017	52.469	52.7400	52.085	52.34	18773593	0.00	1	47.046220	47.289212	46.701907	46.930552	18773593	Verizon
10	12/13/2017	52.990	53.1900	52.280	52.89	17704769	0.00	1	47.513374	47.692703	46.876754	47.423709	17704769	Verizon
11	12/12/2017	52.350	53.3400	52.330	53.19	22898635	0.00	1	46.939519	47.827200	46.921586	47.692703	22898635	Verizon
12	12/11/2017	51.220	51.9300	50.970	51.84	13542530	0.00	1	45.926307	46.562927	45.702145	46.482228	13542530	Verizon
13	12/8/2017	50.500	51.1750	50.360	51.09	13638871	0.00	1	45.280720	45.885958	45.155190	45.809743	13638871	Verizon

# Main Goal

- Minimize the possible volatility of our utility!

Type equation here.



$$ds = s(\mu dt + \sigma dW)$$

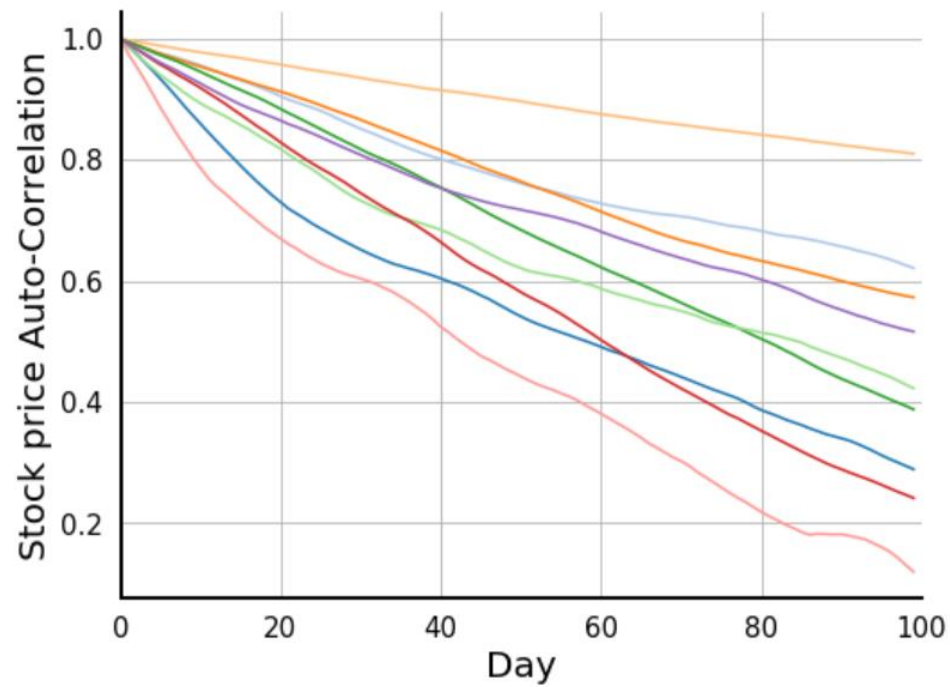
# The portfolio investment

Invest 10.5% on Verizon  
Invest 11.0% on Disney  
Invest 12.4% on Chevron  
Invest 12.4% on Am\_express  
Invest 12.8% on Goldman\_Sachs  
Invest 10.2% on home\_depot  
Invest 10.9% on IBM  
Invest 7.8% on Coke  
Invest 12.0% on jp\_morgan

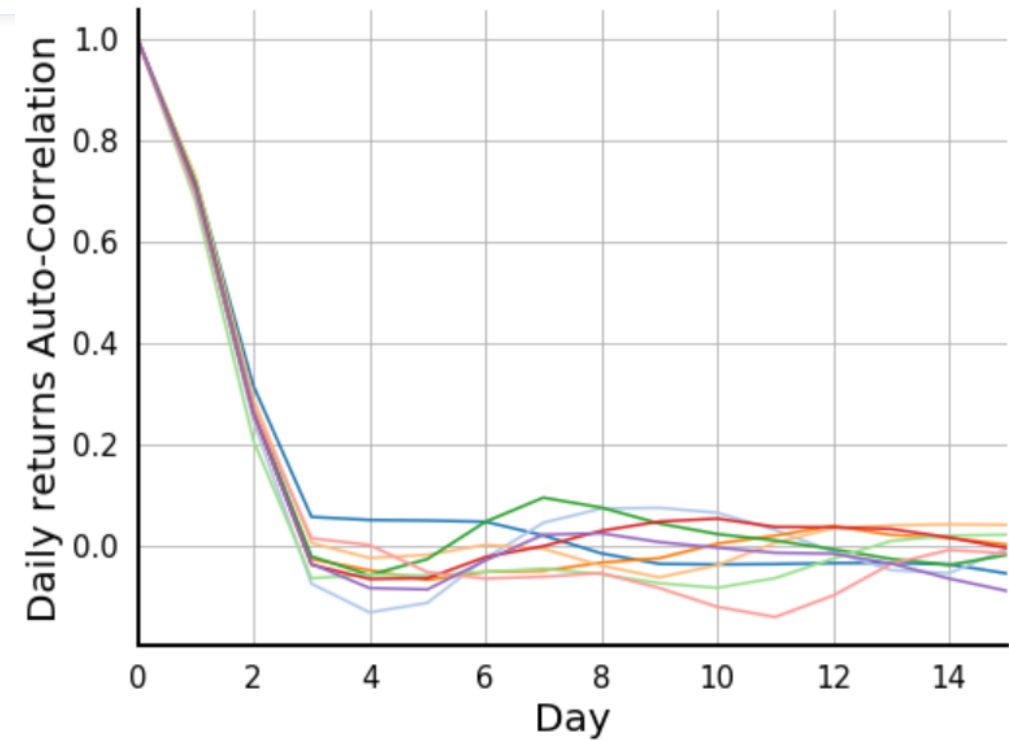
$$x = \begin{pmatrix} 0.105 \\ 0.110 \\ 0.124 \\ 0.124 \\ 0.128 \\ 0.102 \\ 0.109 \\ 0.078 \\ 0.120 \end{pmatrix} \quad \sum_i x_i = 1$$



# Autocorrelation



$$S_j - S_0$$



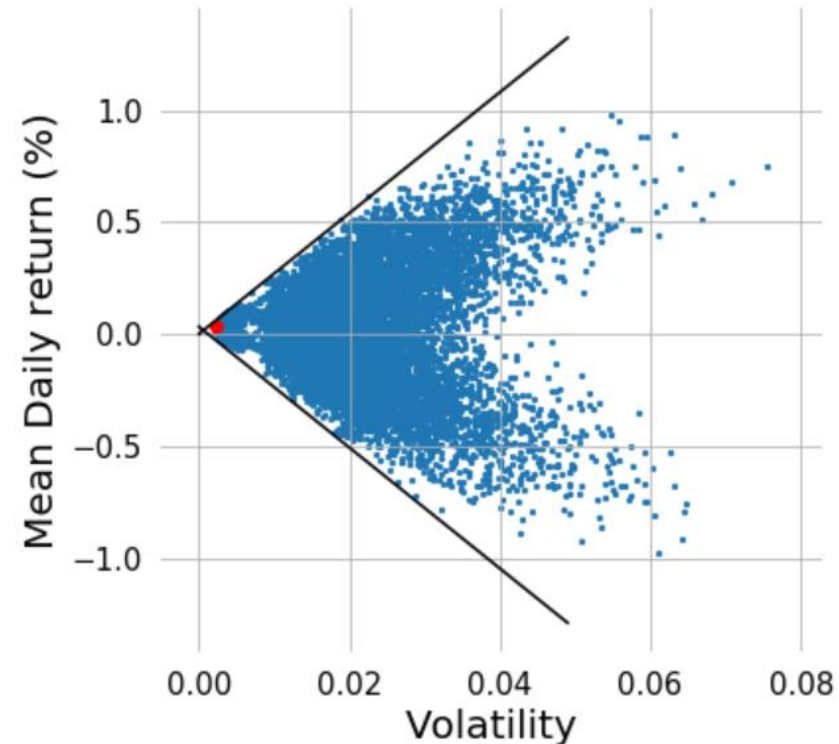
$$r_j = \frac{S_j}{S_{j-1}}$$

Combining different portfolio distributions, we can minimize volatility

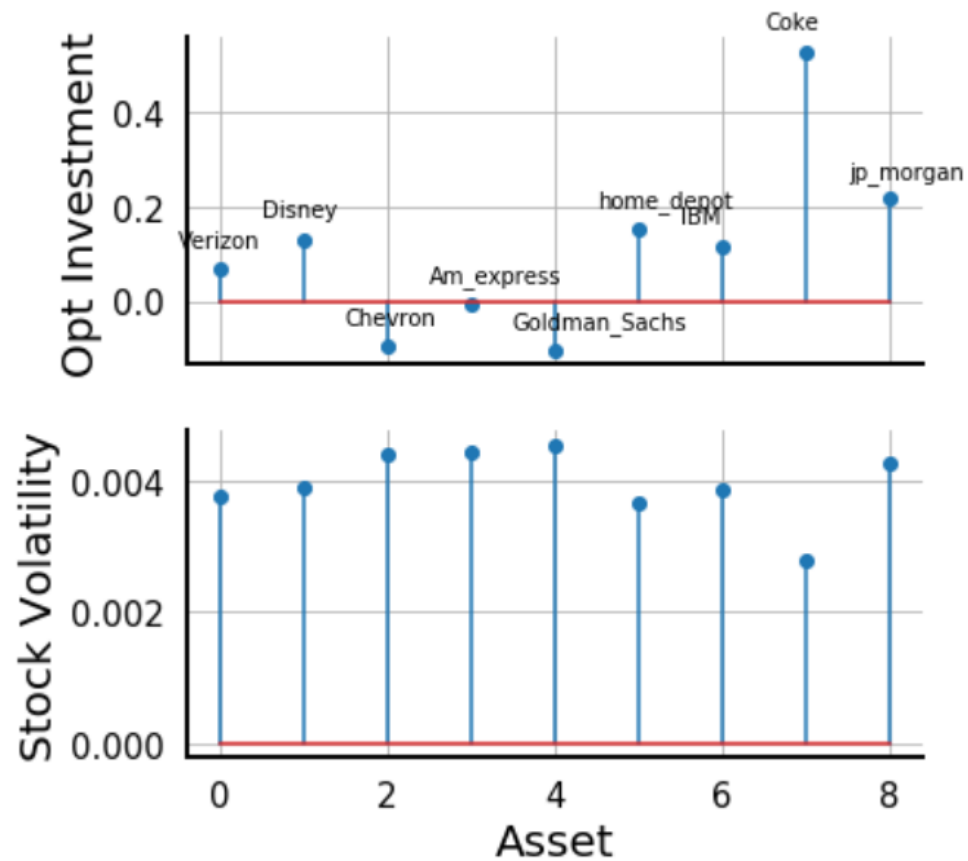
$$\mu = \sum_{i=1}^N x_i \bar{r}_i$$

$$\sigma^2 = x^+ V x$$

$$V_{lm} = \text{cov}(r_l, r_m)$$



# How is the optimum portfolio?



To minimize the risk,  
Invest 6.7% on Verizon  
Invest 12.9% on Disney  
Invest -9.8% on Chevron  
Invest -0.7% on Am\_express  
Invest -10.4% on Goldman\_Sachs  
Invest 15.3% on home\_depot  
Invest 11.6% on IBM  
Invest 52.9% on Coke  
Invest 21.6% on jp\_morgan  
And you will obtain a return of: 12.5%, at the end of the year