Markowitz Efficient Frontier Curve

CAN A RATIONAL INVESTOR EARN HIGHER RETURNS BY TAKING LOW RISK?

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INTRODUCTION

Rational Investor is one who uses the Mean Variance Optimization Technique to optimise his risk and return. In 1952 Harry Markowitz in his doctoral research propounded that a rational investor operating in a world where there are two risky assets both whose returns are perfectly negatively correlated to each other would hold on to a Minimum Variance Portfolio

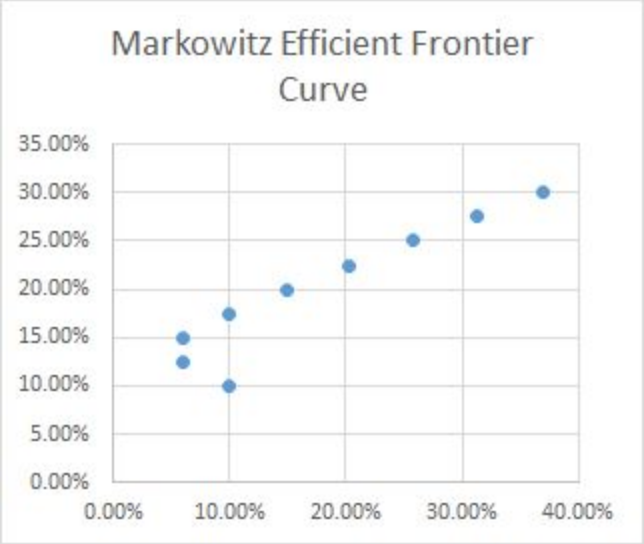
and earn a return. The then went on to suggest that by allocating his capital in part to this MVP and in part to a Riskless asset which has no standard deviation and had zero correlation with the market the rational investor could reduce his risk further all the way to zero which his returns would also suffer. In the final stage he concluded that a rational investor could earn returns higher than what he would earn by investing in purely risky assets by borrowing at the risk free rate and investing it in the market portfolio (MVP).

Efficient Frontier Curve.

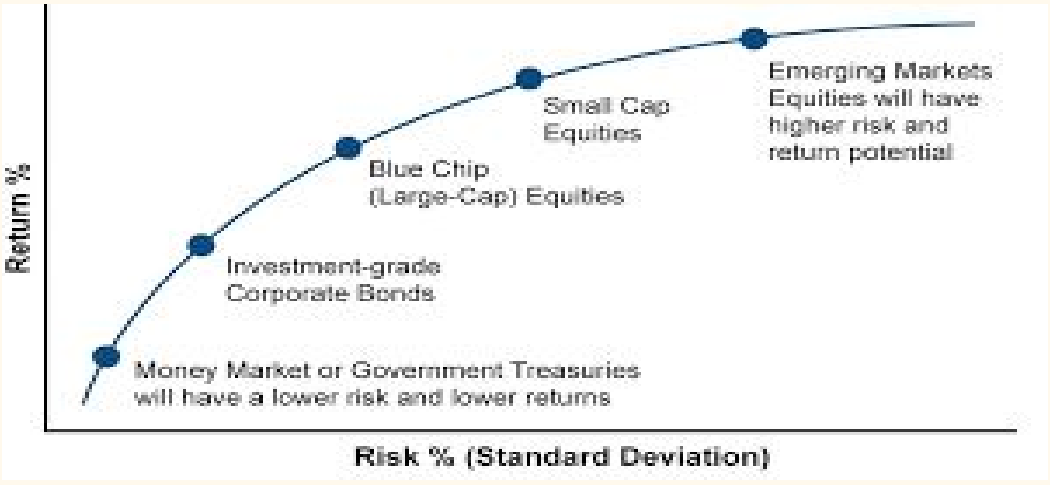
Suppose we have two risky assets Stock A and Stock B with Expected Returns of 20% and 10% and Standard Deviation (measure of the total risk) of 15% and 10% respectively with a correlation of -0.6 the by allocating his capital as shown in table below the investor will be able to earn an expected return as indicated . He will also have to withstand the risk.

W a	Wb	E (R)	Variance	Stdev
200%	-100%	30.00%	0.136	36.88%
175%	-75%	27.50%	0.098	31.33%
150%	-50%	25.00%	0.067	25.81%
125%	-25%	22.50%	0.041	20.35%
100%	0%	20.00%	0.023	15.00%
75%	25%	17.50%	0.010	9.95%
50%	**50%**	**15.00%**	**0.004**	**6.02%< MVP**
25%	75%	12.50%	0.004	6.05%
0%	100%	10.00%	0.010	10.00%

Thus a rational investor allocates 50% of his capital to Stock A and 50% to Stock B and his Expected Return is 15% and his standard deviation is 6.02%



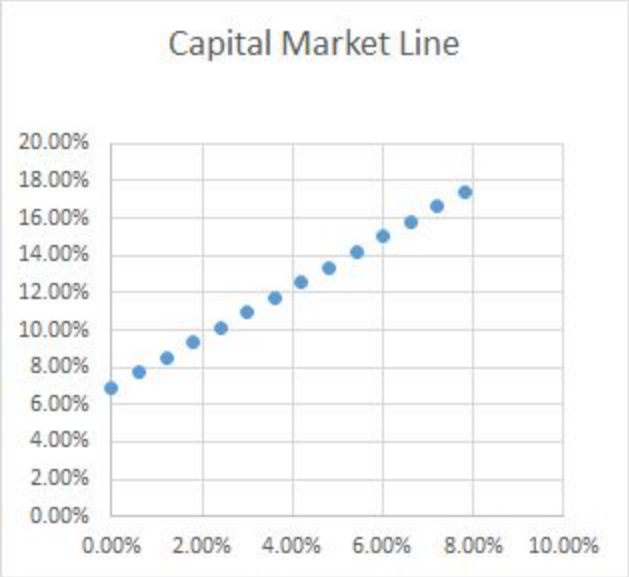
Incorporating the Risk on the X axis and Expected return on the Y axis gives us a bullet shaped curve known as efficient frontier curve. The north west frontier curves are called the efficient set because they represent the highest returns one can earn for a given capacity to withstand losses or alternatively the lowest risk one must take to achieve a desired target returns. Now what will be the impact of introducing a risk free asset into this scheme of things? The risk free asset has no standard deviation and zero correlation with the market.



Suppose the Risk free asset is a 10 year Government Bond at it is today yielding 6.9% . This is a guaranteed returns with no ifs and buts. The rational investor who had till now invested 100% of his money in the MVP will start to move his money into the Risk free asset. The result is the image shown below.

W MVP	W Rf	E (R)	Variance	stdev
180%	-80%	21.48%	0.01175	10.84%
170%	-70%	20.67%	0.01048	10.24%
160%	-60%	19.86%	0.00928	9.63%
150%	-50%	19.05%	0.00816	9.03%
140%	-40%	18.24%	0.00711	8.43%
130%	-30%	17.43%	0.00613	7.83%
120%	-20%	16.62%	0.00522	7.22%
110%	-10%	15.81%	0.00439	6.62%
100%	0%	15.00%	0.00363	6.02%
90%	10%	14.19%	0.00294	5.42%
80%	20%	13.38%	0.00232	4.82%
70%	30%	12.57%	0.00178	4.21%
60%	40%	11.76%	0.00131	3.61%
50%	50%	10.95%	0.00091	3.01%
40%	60%	10.14%	0.00058	2.41%
30%	70%	9.33%	0.00033	1.81%
20%	80%	8.52%	0.00015	1.20%
10%	90%	7.71%	0.00004	0.60%
0%	100%	6.90%	-	0.00%

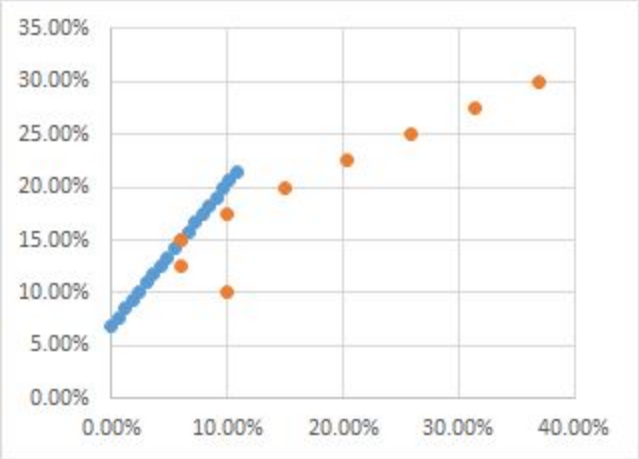
Portfolios built by allocating a portion of the capital into risky assets is called - Lending Portfolios and the Portfolios built by allocating borrowed money also into Risk portfolios in called - Borrowing Portfolios.



Again the Risk is on the X axis and Expected Return is on the Y axis. An investor now observes that the relationship between risk and return is linear. Tell me the standard deviation of your stock and I will tell you the required rate of return needed to ustify holding the stock.

Superimposing the Efficient Frontier Curve on the Capital Market Line.

An investor will choose to allocate his capital between Minimum Variance Portfolio comprising of risky assets and zero risk Government bonds only if that strategy is superior to investing only in risky assets. Thus now superimposing the Efficient Frontier curve on the Capital Market Line we get the following image.



We notice that the blue line the Capital Market Line dominates the efficient frontier curve. Thus at the end of this first foray into understanding the nature of the best called Risk we see that a strategy of investing a portion of one’s capital into risky assets and less risky assets can provide us the benefits of diversification. The strategy of investing in a combination of risky and riskless assets can help reduce risk but it will come at the cost of lower returns and finally a strategy of leveraging one's capital and investing in risky assets gives the most explosive returns but this is for the brave hearts who are guided by professional stock investment advisors. ntis in iis qui facit eorum claritatem.

Conclusion

Standard deviation is the measure of total risk and it can be split into Systemic risk and Unsystematic risk . Further on we shall see the measure of the systemic risk of the stock. The aim of this article was to communicate about Risk in a simple easy to understand manner and to eliminate misunderstanding caused by intense usage of mathematics.