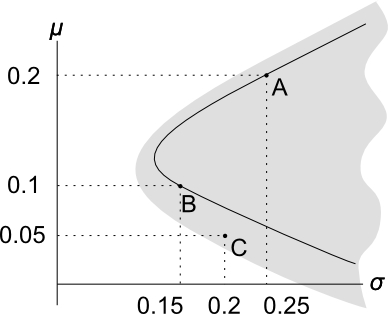
***Portfolios of 3 or More Stocks***

* Portfolios of only 2 stocks are restricted to a combination line. The combination line comprising stocks A and B is shown in black.
* After adding stock C, a whole area of portfolios are possible. There is a portfolio possibility ‘cloud’, which is the grey area in the graph.

***Constructing the 3+ Stock Markowitz Bullet***

This requires a formula for multi-stock portfolio variance.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  | The grey-shaded part of the table is called the variance-covariance matrix. It has the variance of each stock along the diagonal, and covariances elsewhere.  Note that and |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

Portfolio variance is equal to the sum of each term in the variance-covariance matrix multiplied by its corresponding two weights.

After collecting like terms and re-arranging, we have the 4-stock portfolio variance equation:

Here’s the 3-stock portfolio variance equation: