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Assembling a client portfolio: a simplified theoretical perspective.

by PK Mwangi

The complexity of a client's financial affairs will vary substantially according to their age, gender, marital status, income, career type, stage in career, etc. From a portfolio manager's perspective it is thereon important, through a client fact-find, to establish the client's future intentions, goals and ideals as well as determine his attitude to making investments, in terms of risk and time frames or even ethics. This will assist in drawing up realistic measurable investment objectives and listing them in order of priority.

An investment policy statement agreed between the portfolio manager and the client will be instrumental at this stage to formalise the agreed investment goals and objectives of the client, timeframes within which to achieve these as well as describing the strategies that the manager will employ to achieve the stated objectives.

As stated, through the client fact-find, the manager is able to establish the client's risk profile and this will be instrumental in selecting an appropriate strategic asset allocation specific to the client. This risk profile will cover both the client's attitude to risk as well as his capacity for risk. Pursuant to the client's identified investment objective (s), the manager is further able to identify a desired return profile for the client.

Assuming a client investment of KES 10,000,000 the investment default option is to fully diversify the funds across sector, investment style and asset class following which the portfolio manager conducts an analysis of the forecasts for the economy to assist in determining the future market return. These forecasts relate to such macro-factors as interest rate movements, inflation, GDP numbers, business and consumer confidence, etc. More specific industry and/or sector activity forecasts may also assist in forecasting the future market return profile. The expected market return, considering predictions of GDP movements alone, then becomes simply the sum (6.5% in the example below) of the products of the scenario return multiplied in each case by the likelihood of that scenario (-2%, 4% and 4.5% in the example below). From these values market risk as measured by standard deviation (β) - here 8.79%- is also derived.

Future GDP growth	**Probability P**	**Scenario Return SR**	**Probability x Scenario Return P x SR**	**Scenario Variance SV = $(SR – ER)^2$**	**Probability x Scenario Variance P x SV**
Contraction < 0%	20%	-10%	-2%	0.027225	0.005445
0% - 3% growth	50%	8%	4%	0.000225	0.ooo1125
> 3% growth	30%	15%	4.5%	0.007225	0.0021675
	100%	**Expected (mean) Return**		Variance (σ^2) =	0.007725

		(ER) =	**6.5%**	or 0.77%
				Standard deviation (σ) = 8.79%

For a more accurate assessment of the future market return a similar consideration involving each macro-factor (changes in interest rates, changes in inflation, changes in consumer confidence, etc) is conducted. Thus the process is repeated for each macro-variable by taking possible returns under each scenario and multiplying in each case by the likelihood of that scenario. The market return then becomes simply the sum of the products of the scenario return multiplied in each case by the likelihood of that scenario.

From all the derived market returns and standard deviation figures the representative market return and standard deviation become their weighted averages as shown below.

Macro-factor	**Market Return as predicted by macro-factor**	**Standard Deviation as predicted by macro-factor**	**Relative importance of macro-factor in predicting future market return**
Movements in GDP	6.5%	8.8%	.30
Changes in interest rates	4.5%	7.0%	.20
Changes in inflation	4.0%	6.0%	.20
Changes in consumer confidence	5.0%	8.0%	.20
Unemployment changes	5.5%	7.5%	.10
Representative Market return = (.065 x .30) + (.045 x .20) + (.04 x .20) + (.05 x .20) + (.055 x .10) = 5.2% **Representative Standard Deviation (market risk) = (.088 x .30) + (.07 x .20) + (.06 x .20) + (.08 x .20) + (.075 x .10) = 7.6%**			

Assuming a normal distribution of returns (in reality this may not be the case) it becomes possible to lay out the following overall probabilities relating to returns.

Standard deviation (σ)	**Probability**	+ (in excess of the expected or mean return)	**-** (less than the expected or mean return)
1	68%	12.8%	-2.4%
2	95%	20.4%	-10.0%
3	99.7%	28.0%	-17.6%

Thus there is a 68% likelihood that the overall return will be between 12.8% (5.2% + 7.6%) at the +1 sigma level or -2.4% (5.2% -7.6%) at the -1 sigma level. Further, there is a 95% probability that the return could lie in the interval between 20.4% and -10.0% and a 99.7% chance that the return level will lie between 28.0% and -17.6%. The uncertain future economic outlook (for example a 20% chance of contraction and a 30% chance of a more than 3% rise in GDP) has led to a relatively high investment risk environment as measured by the **standard deviation** of future returns at 7.6%.

Standard deviation is a measure of the volatility of a return series or the variability of a return series around the expected value or mean.

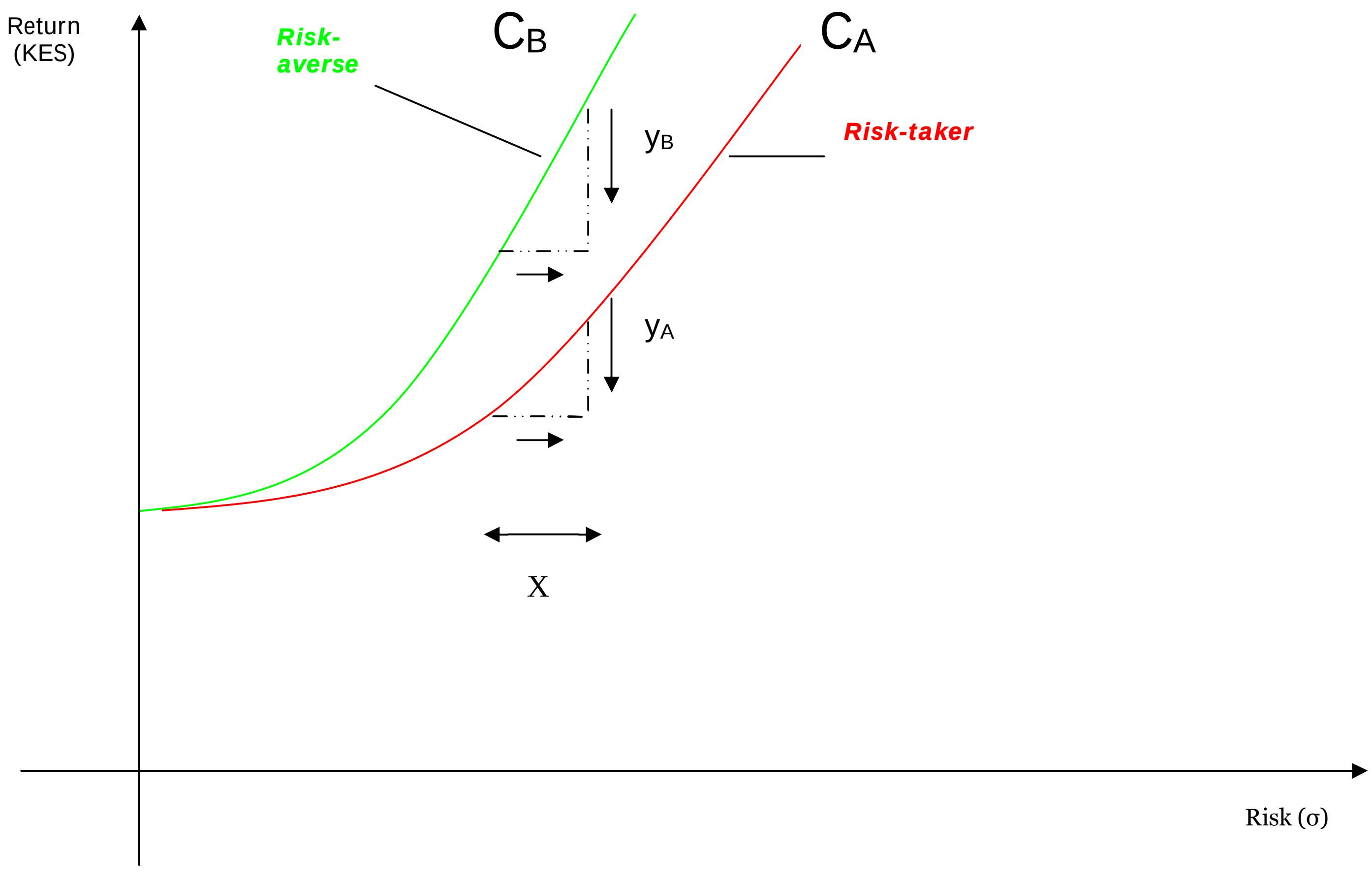
From the inclusion of a **Value at risk (VaR)** analysis

where Value at Risk (VaR) = expected return – portfolio volatility x t-statistic for the confidence level
(from the above example VaR = 0.052 – (0.076 x 1.645) = - 0.07302 or 7.3% at a 95% confidence interval)

it becomes possible to further quantify the likelihood of incurring a specified loss during a certain investment holding period (with a given level of confidence). A confidence interval of 95%, for example, means that on 19 times out of 20 a loss of less than the VaR calculation would be the expected outcome but 1 in 20 times a loss of at least the VaR amount should be expected. In the example above it can be expected that 95 times out of 100 a monthly loss of7.3% will be avoided but 5 times out of a 100 a monthly loss of 7.3% from this portfolio should be expected. For shorter investment horizons it means that every 20 months a loss of at least 7.3% should be expected in one month.

Having identified the risk-return profile of the market it becomes possible to predict the future direction of the market, namely whether a bull or bear market is on the horizon. This prediction has a direct impact on the asset allocation determined for the client. A 'risk on' environment will lead to the inclusion of riskier securities within the client's portfolio in contrast to an impending 'risk off' market environment where less risky securities will need to be included in his portfolio.

Further on, utilising the client's identified risk and return preferences the manager can draw up a set of indifference curves that reflect the risk-return profile of the client. Risk will be measured by the standard deviation or variance[1] of the client's expected returns. The indifference curves will depict combinations of risk and return to which the client is indifferent to i.e. all points on a particular indifference curve will reflect risk-return combinations that are equally acceptable to the client. However, more risk-averse clients will have indifference curves of a steeper nature than their less risk-averse counterparts as shown below.



In the diagram above client C_B requires a larger return y_B to take on the additional amount of risk that is required in the move to the right (denoted by the movement X) on his indifference curve. For client C_A the increase in return required is equivalent to y_A on the diagram and it can be seen that this is less than that required by client C_B.

[1] Standard deviation as denoted by σ refers to the variability of returns around their mean value. The more variable these returns are the greater the possibility that attained returns will not match client future expectations or meet an expected future liability. Variance denoted as σ^2 and given as the square of σ is an alternative measure of risk.

Introducing the **efficient frontier** line to this process will help identify the combination of investable securities that maximise return at any given risk level or minimise risk at any given return level. The efficient frontier is derived by considering possible combinations of securities in a portfolio. Once the expected returns and standard deviation (risk) of each security comprising the portfolio are identified it becomes possible to derive the expected returns of the different portfolio combinations at various levels of risk taking into account different correlation levels between the securities. This is shown below.

Taking a simplified example involving a two-security portfolio the efficient frontier can be derived as thus.

Variance of a portfolio is given as

$$pA^2 \sigma A^2 + pB^2 \sigma B^2 + [2 \times pA \times pB \times \sigma A \times \sigma B \times Cor_{A,B}]$$

where

pA is the proportion of the portfolio allocated to security A

pB is the proportion of the portfolio allocated to security B

σA^2 is the variance of security A while σA is the standard deviation of security A

σB^2 the variance of security B while σB the standard deviation of security B

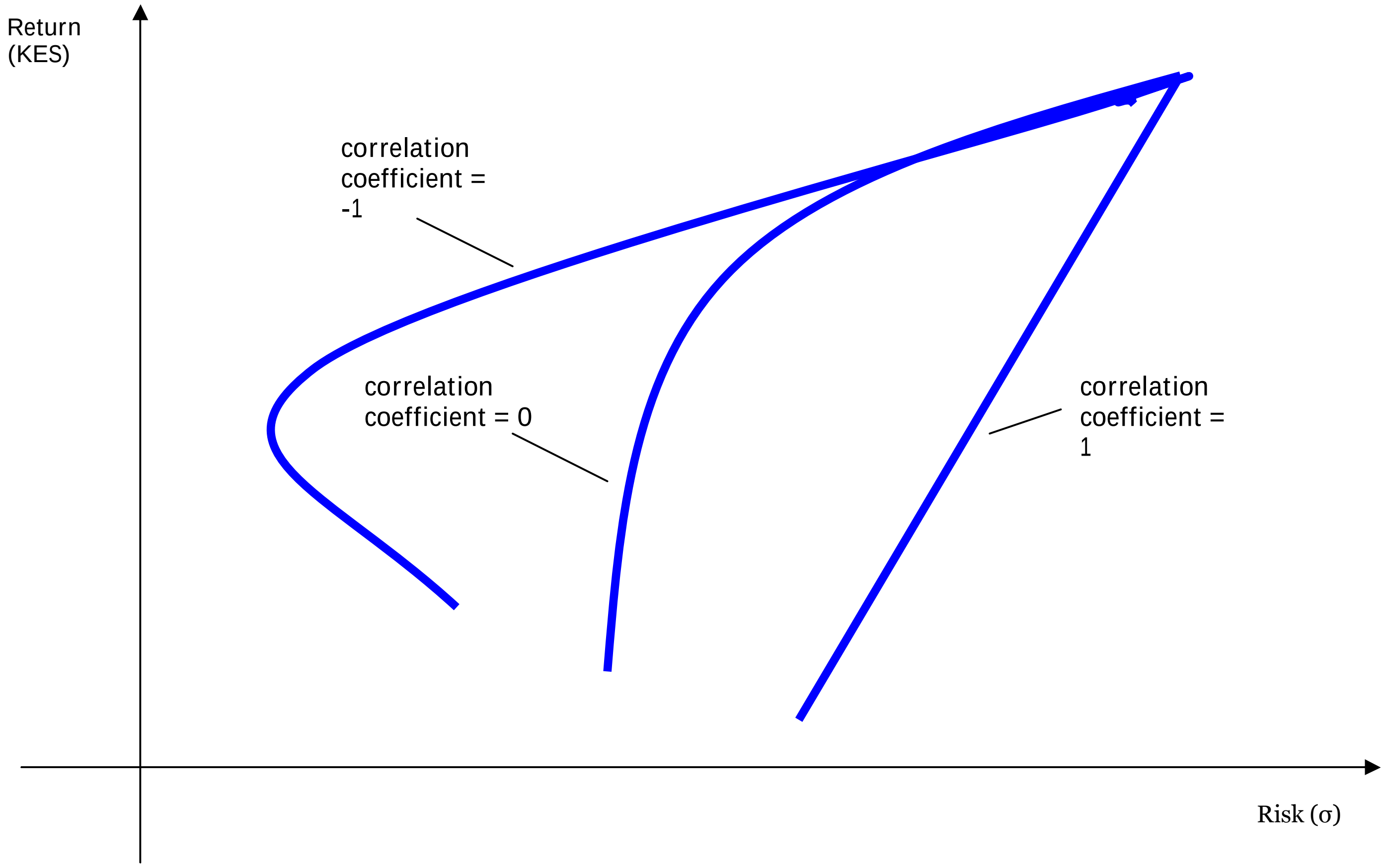
$Cor_{A,B}$ is the coefficient of correlation between the expected returns of securities A and B

Standard deviation of the portfolio is given as the square root of the variance of the portfolio.

Security A **Expected return (10%)** **Standard deviation (10%)**				**Security B** **Expected return (20%))** **Standard deviation (15%)**		
Proportion of portfolio allocated to security A (%)	Expected return of portfolio (%)	Portfolio standard deviation applicable when correlation coefficient between A and B has these values				
		-1	-0.5	0	0.5	1
0%	**20%**	15.0	15.0	15.0	15.0	15.0
25%	**18%**	8.8	10.2	11.5	12.7	13.8
50%	**15%**	2.5	6.6	9.0	10.9	12.5
75%	**13%**	3.8	6.5	8.4	9.9	11.3
100%	**10%**	10.0	10.0	10.0	10.0	10.0

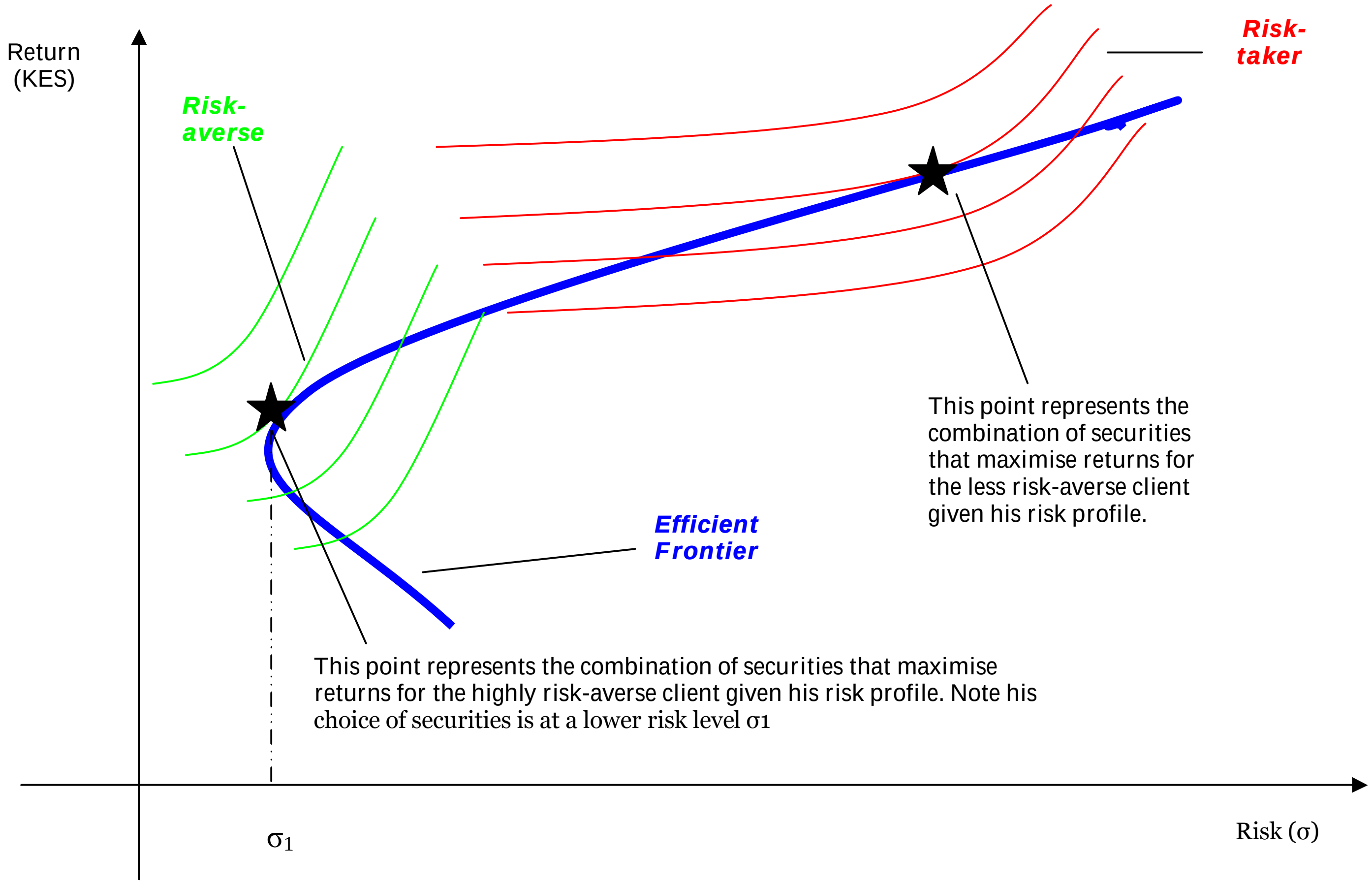
Using the above data the manager can derive risk-return curves showing the relationship between portfolios with varying allocations of security A and security B at different degrees of correlation (here represented by the correlation coefficient). Of course the procedure is much more complex where the various portfolio combinations comprise more than two securities.

The diagram below reveals the approximate risk-return curves at the coefficient correlation levels of -1, 0 and 1 from the data above.



The extreme curve to the right shows the risk-return combinations when the coefficient correlation is 1 i.e. perfect positive correlation. The middle curve reveals the risk-return combinations when the correlation coefficient is zero i.e. there is no correlation in return levels between securities A and B. The extreme curve to the left shows the risk-return combinations when the correlation coefficient is -1 i.e. there is perfect negative correlation between securities A and B. This extreme left curve also represents the highest returns at the calculated risk levels above. It is, in effect, **the Efficient Frontier.**

The point of tangency between the client's particular indifference curve and the efficient frontier represents the combination of securities that maximise returns for the client given his risk profile (risk appetite and risk tolerance). Thus when the client wishes to consider several different choices and combine them in a portfolio the optimum allocation among the choices will be determined by the point of tangency between his indifference curve and the efficient frontier. This is again shown below.

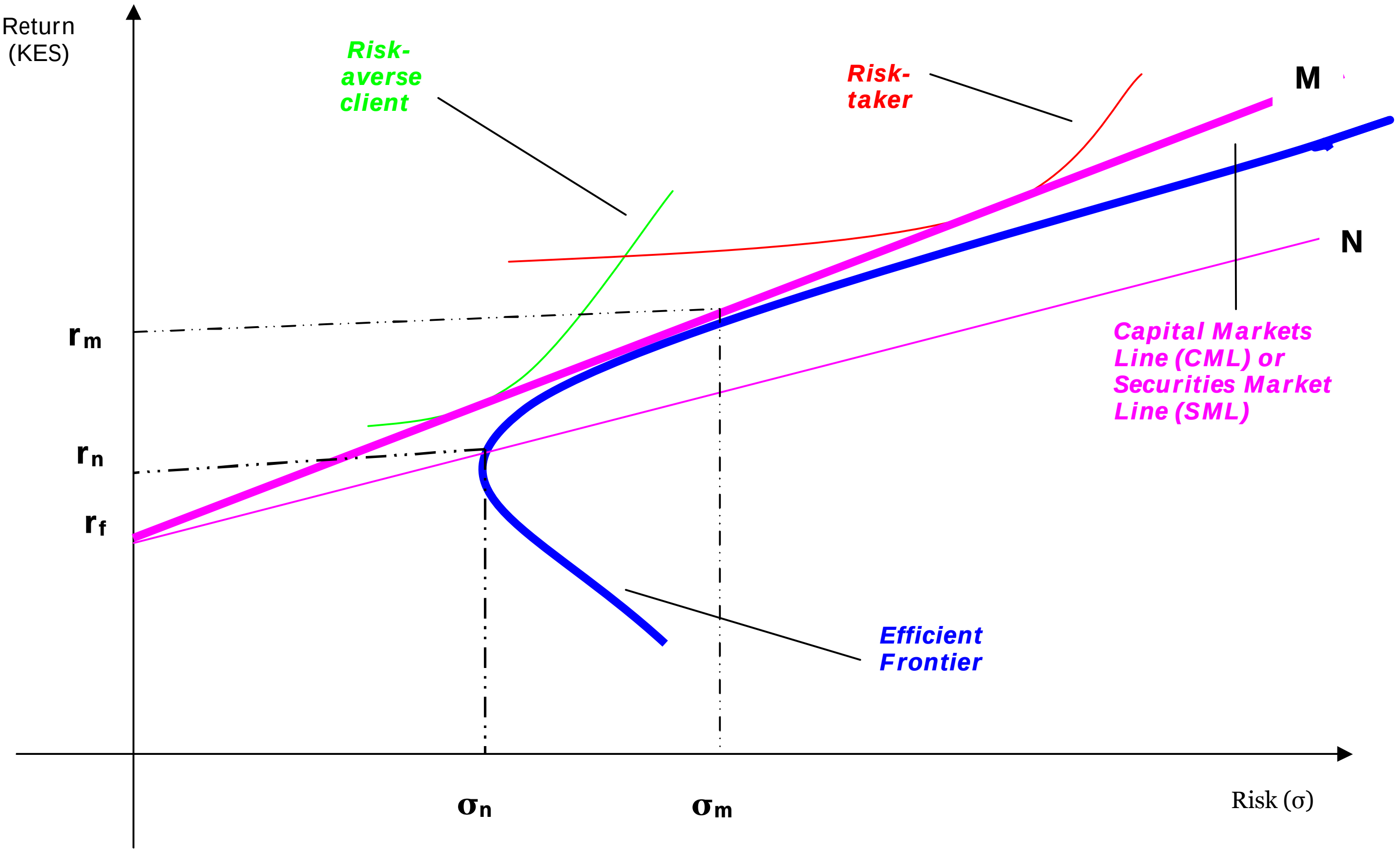


However, one drawback is that the efficient frontier assumes an investable universe of risky securities and ignores the possibility of holding a risk-free security within the portfolio. Such a risk-free security (for example a three-month Treasury Bill) would increase returns to the client without necessarily increasing his risk exposure.

The **Capital Markets Line** or **Securities Market Line** helps establish the combination of investable securities that will increase client returns beyond the offer of the Efficient Frontier by including a risk-free security within the portfolio. The Securities Market Line is the line from r_f in the diagram below to the point of tangency with the Efficient Frontier. All points on the Securities Market Line represent superior offers of return at any given risk level than points on the Efficient Frontier. All diversified investors will seek to invest somewhere along the Securities Market Line (namely choose a portfolio comprising a combination of both risky securities and a non-risky security) with the exact proportions being determined by reference to individual indifference curves as shown below.

Portfolios on the efficient frontier are fully diversified across sector, style and asset class. For the international client this would include diversification also across region. Thus all specific or idiosyncratic risk (pertaining to individual securities) has been removed. As a result, the risk and return obtained will be similar to that of the market for all securities. The suggestion here is that the major focus of the efficient frontier and the Securities Market Line is the achievement of beta. Passive managers will attempt to hold portfolios found on the efficient frontier or, better still, those on the Securities Market Line due to the additional return offered by the risk-free asset at no additional risk. Active managers, on the other hand, will seek to hold portfolios found above both the efficient frontier and Securities Market Line by seeking out undervalued securities to populate their portfolios while selling off overpriced securities so as to ultimately generate alpha for their clients.

All points below the Capital Markets Line (whether on the Efficient Frontier or say **r_fN** as shown below) are suboptimal, regardless of the client's risk preference, since they provide a lower return at each risk level. Looked at alternatively, they involve a higher risk at all return levels than points on the Securities Market Line (**r_fM**).



Following up on the security pricing model- **the Capital Asset Pricing Model (CAPM)**- we can also further establish whether the adopted portfolio is in line with the client risk profile. This model is the tool which will confirm the creation of a portfolio where the required rate of return desired by the client has already been established.

The Capital Asset Pricing Model takes the form

$$R_C = R_f + \beta (R_m - R_f)$$

where

R_C = required rate of return by the client

R_f = risk-free rate of return as offered by the 3-month Treasury Bill

R_m = rate of return as offered by the market portfolio. A market-capitalisation weighted average of the returns on all asset classes (measured by the returns on their all-composite indices) would act as proxy for the market[2]

β = proportion of client funds that need to be held in the same proportion as that in the market portfolio on a market-capitalisation basis in order to achieve the desired return

Having established earlier (through the fact-find) the client's required rate of return, the portfolio manager can derive the beta specific to the client and hence get a better insight into what security allocation to assemble within the client's portfolio. The derived beta figure determines the proportion of client funds that need to be held in the same proportion as that in the market portfolio on a market-capitalisation basis in order to achieve the client desired return. The closer the beta is to 1 the more the client portfolio will need to hold the entire spectrum of asset classes and individual securities contained within the market portfolio. Beta values in excess of 1 will

[2] This suggests an allocation of client funds in direct proportion to a hypothetical market index that represents holdings in all asset classes (equity, bonds, cash, property, alternative investments, funds, etc.) on a market-capitalisation basis. Namely, as an example, if the hypothetical market index comprises a 30% allocation and a 10% allocation to equities and bonds respectively, the client portfolio must hold similar proportions of these asset classes in its composition.

recommend an overweight in riskier securities that carry less significant weight within the market portfolio say small-cap stocks or long-dated bonds[3]

For the client who is less risk-averse a portfolio with a higher beta (greater than 1) will be more appropriate to reflect his appetite for risk. This will therefore comprise the universe of high beta securities including small cap stocks, high yield bonds, alternative investments (private equity and derivatives).

For the more risk-averse client, beta values of 1 or less would be appropriate and assembled portfolios should reflect these with holdings of large-cap stocks, investment grade bonds, funds, cash deposits and property.

Caveats

Despite the obvious relevance of the above process to the assembling of a client portfolio, it is open to a number of criticisms primarily drawn from the assumptions it makes about market conditions and which may not hold true in the real world.

1) Most of the models and calculations used here, in particular expected return or mean value, the standard deviation as a measure of risk and the Capital Asset Pricing Model all assume normal distribution of returns. In reality, however, most return series are skewed in nature involving extreme values that lead to fat-tailed (rather than symmetrical) return distributions.
2) The Efficient Frontier assumes that portfolios found on it are fully diversified, namely that all idiosyncratic or unsystematic risk has been diversified away. However, unsystematic risk can never really be completely eliminated. Where the portfolio selection seeks to mimic the performance of a benchmark index the performance of certain bellwether stocks (here influenced by specific risk) is bound to impact the performance of the entire portfolio.
3) The risk-free rate considered above is not entirely risk free as there still remains the spectre of short-term inflation which may erode client returns in a high inflation environment. Thus adding the risk-free asset to the optimum portfolio identified on the Efficient Frontier is not entirely without additional risk.

The above failings, however, do not entirely discredit the portfolio-assembling process described here which undoubtedly can provide useful insights to portfolio managers engaged in meeting client requirements.

Resources:

Chartered Institute for Securities & Investment (2011) *Portfolio Construction Theory* London: Chartered Institute for Securities & Investment

Reilly, F.K. and Brown, K.C. (2000) *Investment Analysis and Portfolio Management.* Sixth Edition. The Dryden Press

[3] The assumption here is that of an upward sloping bond yield curve with both 20-year bonds and 30-year bonds offering a higher yield and representing more risk than the benchmark 10-year bond which is more representative of the bond index value.