

All these Lines ... - CAL, CML, SML, EF

The concepts of the Capital Allocation Line (CAL), Capital Market Line (CML), and Security Market Line (SML) are often mixed up. This is not only because their graphs look alike, but also because the ideas behind are not dissimilar.

Before shedding light on these line concepts, one more idea needs to be introduced: When making an investment, regardless whether in a risk-free or a risky asset, an investor usually pays for that from funds avail. However, an investor could actually also borrow funds to pursue the intended investment (whereby, somehow optimistically, but for reasons of simplicity, interest expenses equal the risk-free rate). And, in another scenario, same investor could invest any (excess) amount of funds held, at risk-free rate.

A Capital Allocation Line (CAL) can be drawn for each risky asset (or a portfolio of risky assets). All combinations of this risky asset (or portfolio of risky assets) and a risk-free asset lie on the CAL. – Different from asset allocation (the allotment of funds across different types of assets with different risks and returns), capital allocation refers to the allotment of funds between risk-free assets and risky assets. The slope of the CAL equals exactly the Sharpe Ratio of the risky asset.

Therefore, along the return axis the CAL blends the risk-free rate with the expected return of an individual asset. Whereby, points on the CAL left from the risk-return combination of an individual asset reflect the expected risk-return from a portfolio composed of the risky asset and the risk-free asset. Points on the CAL right from the risk-return combination of an individual asset reflect the expected return from a portfolio whereby the investor not only invests in the risky asset, but in addition also borrows funds at risk-free rate to

acquire even more of the very risky asset. Therefore, this reflects the expected return from adding leverage (i.e. debt).

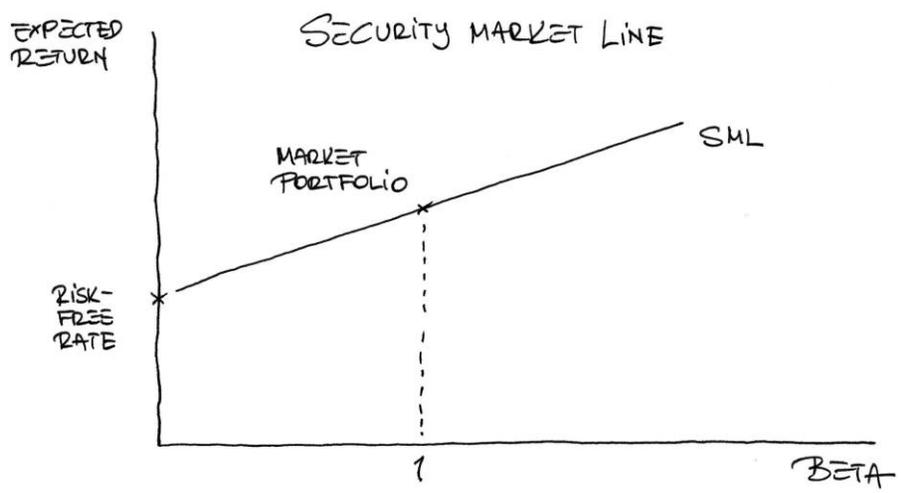
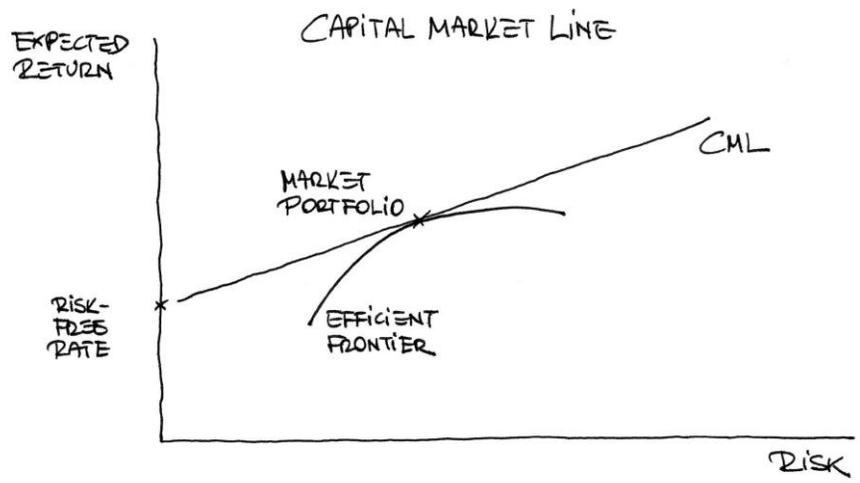
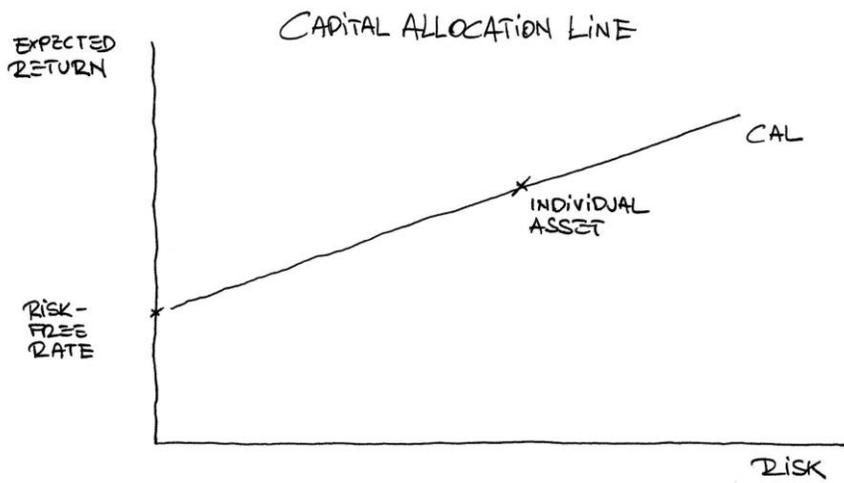
If there were an investment opportunity resulting in a risk-return combination positioned above (below) the CAL, then this would provide a better (worse) investment proposition than that of the given asset.

The Capital Market Line (CML) is basically the CAL for the market portfolio. One may assume that in an efficient market the market portfolio (representing the most superior portfolio available) is among all feasible risky portfolios the one with the highest Sharpe Ratio. Conceptually, it can be seen as the portfolio comprising all financial assets one can possibly invest in.

Next to the CML, the risk-return combination of the market portfolio also defines the Efficient Frontier (EF). – Now, the EF is the set of optimal portfolios of risky assets offering the highest expected return for a defined level of risk (or: indicating the lowest risk for a given level of expected return). Portfolios that lie below the EF are not optimal, because they do not provide sufficient return for the assumed level of risk.

Such as is the case with the CAL, points on the CML left of the risk-return combination of the market portfolio represent capital allocations whereby part is invested in the market portfolio and part in risk-free assets. Points on the CML right to the market portfolio represent levered portfolios.

The Security Market Line (SML) is derived from the CML displaying the expected return of an individual security, whereby the horizontal axis for the SML represents the systematic, non-diversifiable risk – the beta. This is different from the CML, where the horizontal axis represents the total risk of return of a portfolio (i.e. its volatility or standard deviation).



CS

S/E

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