All these Lines … - CAL, CML, SML, EF

The concepts of the Capital Allocation Line (CAL), the Capital Market Line (CML), and the Security Market Line (SML) are often mixed up. This is not only because their graphs look very much alike, but also as the ideas behind are not that 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 an intended investment (whereby, somehow optimistically, but for reasons of simplicity, interest expenses are assumed to equal the risk-free rate). - In another scenario, same investor would also be allowed to 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 possible combinations of a certain risky asset (or portfolio of risky assets) and a risk-free asset lie on the CAL. – In contrast to 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. Hence, the slope of the CAL equals exactly the Sharpe Ratio of a certain risky asset.
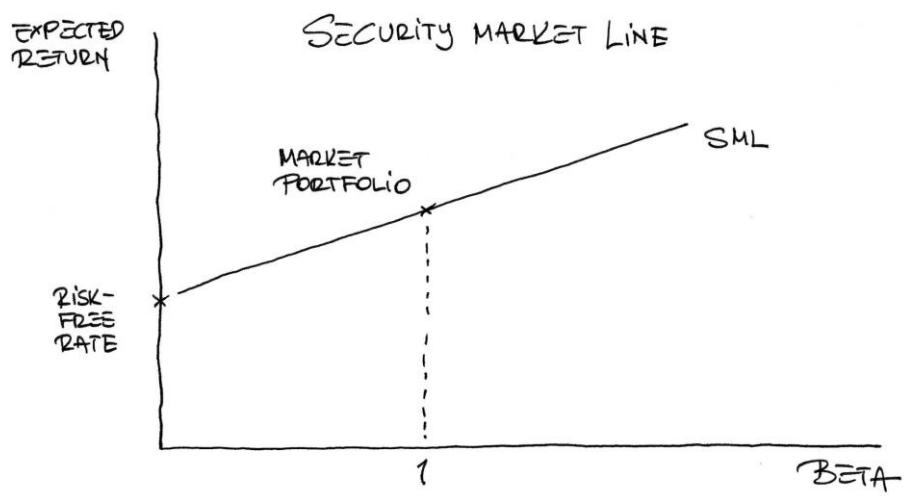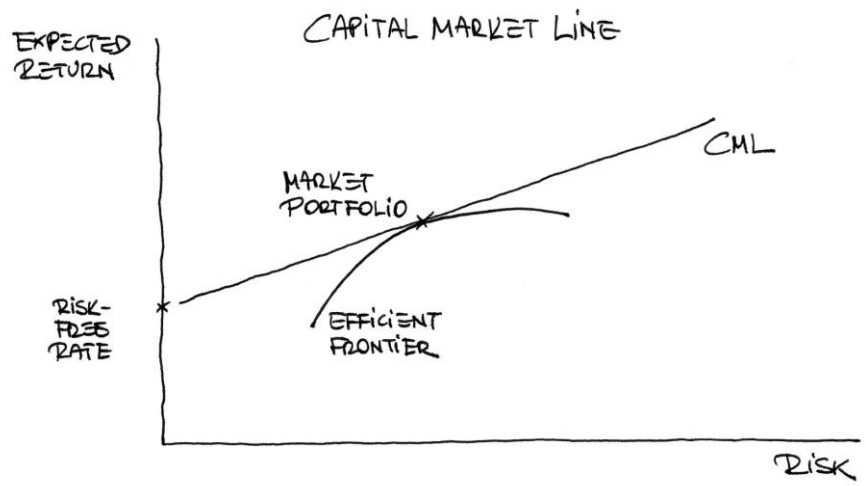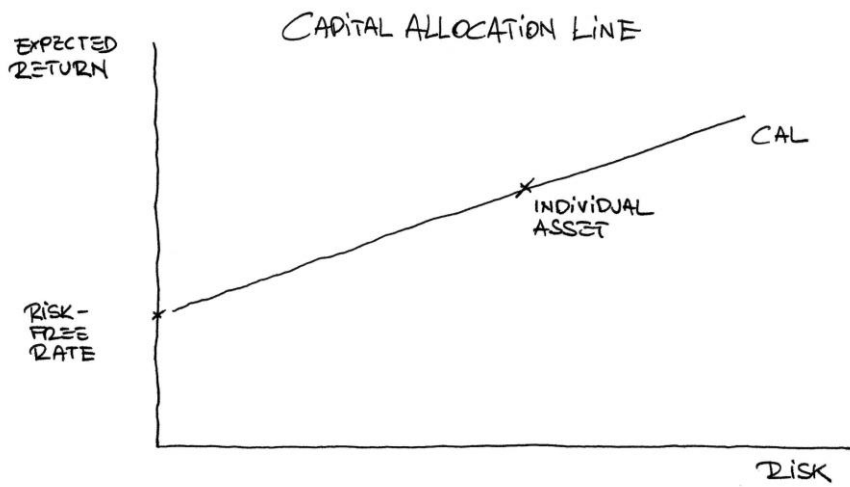
Therefore, along the return axis the CAL blends the risk-free rate with the expected return of an individual asset. Whereby, points on the CAL left from the risk-return combination of an individual asset reflect the expected risk-return profile of a portfolio composed of some combination of the risky 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 invests not only own funds in the risky asset, but in addition also borrows funds at risk-free rate to acquire even more of the risky asset. Therefore, this reflects the expected return when 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 essentially the CAL for the market portfolio (i.e. the portfolio comprising all financial assets one can possibly invest in). Hence, the CML illustrates combinations of holding the market portfolio and a risk-free asset. Whereby the Efficient Frontier (EF) indicates all optimal combinations of assets within the market portfolio 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. - Like in the case of the CAL, points on the CML to the 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 CAL to the right of the market portfolio represent levered portfolios.
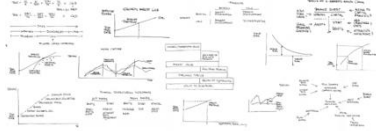
The Security Market Line (SML) is derived from the CML displaying the expected return of an individual security, whereby the horizontal axis for the SML represents the systematic, non-diversifiable risk: the beta. This is in contrast to the CML, where the horizontal axis represents the total risk of return of a portfolio (i.e. its volatility or standard deviation).
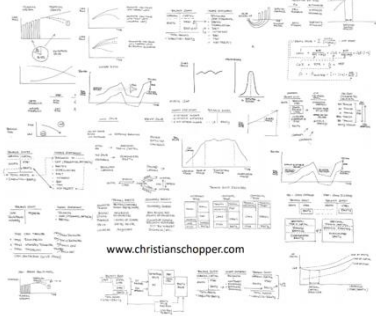
CAPITAL ALLOCATION LINE

EXPECTED RETURN

CAL

INDIVIDUAL ASSET

RISK-FREE RATE

RISK

CAPITAL MARKET LINE

EXPECTED RETURN

CML

MARKET PORTFOLIO

RISK-FREE RATE

EFFICIENT FRONTIER

RISK

SECURITY MARKET LINE

EXPECTED RETURN

SML

MARKET PORTFOLIO

RISK-FREE RATE

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BETA

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