Capital Asset Pricing Model: Beta & Alpha

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As one could imagine in the financial markets, thousands of investment strategies exist, which all have some arguments for and against them. Bottom line is that they all attempt to have some sort of predicting power. By acquiring an asset you believe it to have some sort of return, whether it is economic, environmental or any other kind. In this case, we'll look at one of the most well-known models, Capital Asset Pricing Model (CAPM). Even though it finds it origins in the early 1960s, it still is widely used due to its clear approach and allows for straightforward comparisons of investment alternatives, whether it be stocks, funds or portfolios.

CAPM tries to captivate the **Expected Return** of an investor **(ER)**, who wants to be rewarded for the time his capital is invested as well as for the risk he takes. CAPM accounts for both, the risk-free rate for the time value and the other part for risk. Formula 1 shows the different components, on which we'll later elaborate.

GENERAL MARKET PARAMETERS

If we leave any form of risk aside, the first thing an investor wants to be rewarded for is the time his capital is invested. So is there a more suitable name for the first variable that compensates for no risk and only time than the **Risk-free Rate (R_f)**. As you must have heard from your private banker, in practice there is no such thing as a riskless investment, thus often used as an approximation, for this number, are the three-month US Treasury Bill for American investments and the German or Swiss short-term government bills for investments respectively in EUR and CHF. Reasoning here is that the market considers there to be virtually no chance of these governments to default on their (short-term) obligations.

Formula 1: CAPM

$$ER = R_f + ß\,(ER_m - R_f)$$

ER = Expected return of the investment
R_f = Risk-free Rate
ß = Beta of the investment
$(ER_m - R_f)$ = Market Risk Premium

Where the Risk-free return represents the minimum an investor expects, one should definitely want a premium for the additional risk an investment holds. This is where the **Market Risk Premium** or MRP **$(ER_m - R_f)$** comes in, which in this case is computed by taking the **Expected Market Return** (ER_m) and subtracting the risk-free rate. Just as the R_f this variable is derived from the general market and isn't directly focused on the one security you're analyzing. Again, in practice, there is no such thing as computing the average return of the entire market, which is why instead we should use a large pool of assets that relates to asset, referred to as the benchmark. For example, if we're analyzing Microsoft, we could use a general index such as the S&P500[1] as our benchmark, since it is regarded as one of the best gauges of prominent American equities' performance. On the other hand, we could also go for an index that is more focused on the sector such as the S&P North American Technology Sector Index[2].

SYSTEMATIC RISK

Now that we've covered the general market parameters, we now include a variable that is specific to the security, **Beta (ß)** in this case. It is a commonly used metric in finance to compare an asset's characteristics to a benchmark. It basically measures the relationship between the markets' volatility and a specific asset. A beta larger(/less) than 1,0 indicates that the security's price is theoretically more(/less) volatile than the market. Let's take our previous example of Microsoft and compute its Beta benchmarked to the S&P 500 over the past 2 years, which gives us 1,16. This would predict that the stock is 16% more volatile than the benchmark.

Table 1 shows an example where we compare three American Large-Cap stocks to the S&P 500, in terms of Beta, Alpha and the return they have realized over the past two years, both total as annualized. Let's continue with Microsoft, which has a rounded beta of 1,16. The expected return, according to CAPM, would thus be higher than the markets' 32,3%, and after plugging in all the components we arrive at an ER_i of 37,4%. However,

Table 1: Example
Sources: Bloomberg, St Louis FED.

Statistics: Jun '20 - Jun '22	Beta	Alpha	Return (%)	
			CAPM	Realized
Microsoft	1,16	11,9	37,4	49,3
Berkshire Hathaway	0,72	42,4	23,2	65,6
Meta	1,45	(62,6)	46,7	(15,9)
S&P 500	1,00	-	-	32,3

* We apply a Risk-free rate of 0,17%, the average 3m US T-bill rate from June '20 - June '22van desbetreffend jaar

[1] The S&P 500 is a float-weighted index that consists of the 500 largest American Equities, in terms of market capitalization
[2] The S&P North American Technology Sector Index provides investors with a benchmark that represents U.S. securities classified under the GICS information technology sector as well as the internet & direct marketing retail, interactive home entertainment, and interactive media & services sub-industries.

Microsoft's total return over that period was actually 49,3%. The difference between the expected and actual return is shown in the form of Alpha. The reasons behind this difference and the meaning of alpha, we'll explain further on.

Now that we've established that CAPM's expected return isn't necessarily equal to the actual return, next we're going to proof that Beta isn't always positively correlated to the actual return. Let's look at the other two stocks, Meta has the highest Beta and Berkshire the lowest, and thus according to CAPM we would expect the highest Return for Meta and the lowest for Berkshire. However, if we look at **Graph 1**, we see that this is not the case, as 100 USD invested in Meta in June 2020 would have left you 84,1 USD after two years. The same investment in Berkshire would have left you with 165,6 USD. It seems that CAPM doesn't really hold in practice, or should we just look at it in a different manner?

MARKET EFFICIENCY

Under the assumption that financial markets function fully efficient, assets with the same Beta whilst using the same Rf would have the same expected return according to CAPM. If this thesis would hold in reality, we would be able to predict returns to perfection. Clearly this is not the case, for numerous reasons. The main critique against CAPM is that (1) securities markets are not as highly competitive and efficient to absorb all available information quickly and correctly and (2) that markets are not fully dominated by rational, risk-averse investors, who seek to maximize return on investment. Our opinion on this critique is probably more pragmatic, in the way that (1) markets are still more efficient than they are inefficient, (2) as well that market participants are still mostly human, whom inherently are both rational as irrational, irrationality in the markets is inevitable. This however doesn't mean that CAPM is useless, as it is still an easy and quick way to compare investment alternatives. But to make it more practical we can add one more component.

ALPHA

The last variable isn't included in the original CAPM model, but can be added to give more color. Since CAPM assumes that return and risk have a linear relationship, where more risk means more return and vice versa, this model doesn't allow room for perhaps an investor's stock picking skills which might result in a higher return for a relative lower risk. This is where **Alpha (α)** comes in, also known as "Jensen's Measure" or "Excess Return". Formula 2 shows how Alpha is calculated.

Formula 2: Alpha

$$\alpha = R_i - [\, R_f + \beta_i \, (ER_m - R_f) \,]$$

Simplified as:

$$\alpha = R_i - ER_i$$

R_i = Realized return of the investment
α = Alpha

Alpha looks at the difference between the **Realized Return (R_i)** and the Expected return as predicted by CAPM (ER_i), in formula 1. A positive(/negative) alpha indicates that the investment has performed better(/worse) than expected. In practice you'll find that alpha will almost never equal zero, for which there might be tons of reasons. The main idea though is that a positive(/negative) alpha, indicates that the investor has beaten(/underperformed) the market. In this case it would thus be the result of active management, whereas others might believe that Alpha represents unidentified risks, that Beta hasn't captured. This discussion once again leans close to the previous one about the efficiency of the markets. Anyway, next time you see a financial article, website or newspaper talking about Alpha, you know they allude to their added value of active management.

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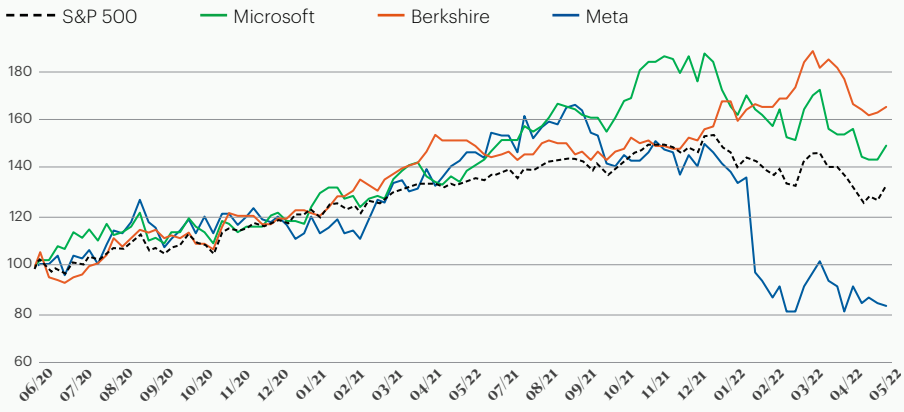
Today the Capital Asset Pricing Model still serves well, mainly to compare investment alternatives in a straightforward manner. Beta is a useful tool to compare how securities have performed in terms of volatility compared to a common benchmark whilst Alpha shows which securities have performed better or worse than expected. •

Graph 1: Cumulative Return o 100 USD Investment Jun '20 – Jun '22
Source: Bloomberg 3/6/2022



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