The purpose of this site is to outline how to calculate the fixed annual commitments that are required in order to have one's private equity investments reach a specified weight at a specific point in the future.

For example, let's say it is 2023 and a user wants to model 3 years into the future (year 2025). Currently, based on current market values and projected transactions, they expect the following scenario:

1) Start year: 2023
2) End Year: 2025
3) Projected Total Market Value: 2,637,365,10
4) Projected PE Market Value: 184,162,045.35
5) Projected weight: 7.81%

Now say the user wants to know how much they need to commit to private equity funds in order to increase that weight from 7.81% to **10%** of the total portfolio.

For starters, we will give the user the option of assuming an annual growth rate to the portfolio, therefore we will need to apply that growth rate to the Total and PE market values to get new future market value projections.

Say the user selects a growth rate of **2.5%**. Our new market values become:

$$Total\ MV = 2,637,365,101 * (1 + 0.025)^3 = 2,840,153,752$$
$$PE\ MV = 184,162,045.35 * (1 + 0.025)^3 = 198,322,380$$

Now we need to find the funds needed in order to change the ending weight to 10%. Unfortunately, it is not as simple as multiplying the new Total MV by 10% as we need to assume that whatever funds are being added to the PE investments are also being added to the total market value. In other words, they are not selling an equivalent amount of other investments to help achieve this new weighting.

The formula to solve for this is simply:

$$\frac{(a - (b * w))}{(w - 1)}$$

Where:

a = current projected PE market value
b = current projected total portfolio market value
w = new weight of PE investments

Plug our numbers into the above formula and we get:

$$\frac{(198,322,380 - (2,840,153,752 * 0.10))}{(0.10 - 1)} = 95,214,438.98$$

So now that we know the amount of funds that we need at the end of the period, we need to calculate the **Commitment Factor** to back into the required annual commitment. I find the best way to illustrate this is to back into the formula with known annual commitments up front. So next we will calculate the future value of known annual PE commitments in order to arrive at the same market value as above.

To calculate this commitment factor, there are five things we need to consider:

1) Annual commitments
2) Capital call %
3) Distributions
4) Growth factor
5) Number of years

Let's start with a simple case of a 3 year investment with an annual growth rate of 2.5%, annual commitments of $70,000,000, and the below capital call and distribution rates:

Year	C %	D %
1	25%	1.13%
2	30%	3.13%
3	35%	6.42%

Each year, a capital call is taken from the remaining funds less the capital calls from previous years. For example, year 1 will have a capital call of 17,500,000 (70,000,000 * 0.25) and year 2 will have a capital call of $15,750,000 ((70,000,000 – 17,500,000) * 0.30).

We need to convert the annual capital percentage to a **cumulative capital percentage**, so we can easily apply it to the commitment amount each year to find the market value. We do that with:

$$cc = Product(c_{current} * (1 - c_0) : (1 - c_{current-1}))$$

Where:

c_0 = capital call rate at $t_0 = 1$

$c_{current-1}$ = capital call rate the year before the year that you are calculating for

So the cumulative capital factors for this exercise are:

Year	C %	CC %	D %
1	25%	25.00%	1.13%
2	30%	22.50%	3.13%
3	35%	18.38%	6.42%

Now we need to figure out the starting market value of each capital call, which can be calculated as:

$$MV = C * cc$$

Where:

C = commitment

cc = cumulative capital call %

Which brings us to:

Year	C %	CC %	D %	MV
1	25%	25.00%	1.13%	$17,500,000
2	30%	22.50%	3.13%	$15,750,000
3	35%	18.38%	6.42%	$12,866,000

Each capital call will have distributions drawn down from it in its first year and again in each subsequent year. In order to factor this in, we need to calculate a **cumulative distribution** factor for each market value.

For example, the market value from year 1 will be drawn down each year by rates of 1.13%, 3.13% and then 6.42% whereas the market value from year 2 will only be drawn down by the rates of 3.13% and 6.42%.

The cumulative distribution of each market value can be calculated as the product of 1 minus the distribution rate of its current year and all subsequent years.

$$CD = Product\left(1 - D_{Current} : 1 - D_{n}\right)$$

Where:

$D_{current}$ = Distribution factor in the year that you are calculating for

D_{n} = Distribution factor in the last year

Year	D %	1 – D %	CD %
1	1.13%	98.87%	0.8963
2	3.13%	96.87%	0.9065
3	6.42%	93.58%	0.9358

Next, we need to remove the expected distributions from each market value. So adding this to our equation, the new market value of each capital call can be calculated as:

$$MV = (C * cc) * Product\left(1 - D_{Current} : 1 - D_{n}\right)$$

Which brings us to:

Year	C %	CC %	D %	1 – D %	CD %	MV
1	25%	25.00%	1.13%	98.87%	0.8963	$15,684,653
2	30%	22.50%	3.13%	96.87%	0.9065	$14,277,524
3	35%	18.38%	6.42%	93.58%	0.9358	$12,040,003

Now considering these market values occur in different years, in order to calculate the future value of each of them we need to multiply each by their respective growth factor.

$$MV = (C * cc) * Product\left(1 - D_{Current} : 1 - D_n\right) * (1 + g)^{n-year+1}$$

Where:

$(1 + g)^{n-year+1}$ = growth factor

Which brings us to:

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656
2	30%	22.50%	3.13%	96.87%	0.9065	1.0506	$15,000,324
3	35%	18.38%	6.42%	93.58%	0.9358	1.0250	$12,341,003

The Final NAV would simply be a sum of these market values:

$$16,890,656 + 15,000,324 + 12,341,003 = 44,231,983$$

This is the final NAV if we committed $70,000,000 only in the first year, but what if we wanted to commit the same amount each year? We simply apply the formula three times, decreasing N by one each time, and sum the results.

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656
2	30%	22.50%	3.13%	96.87%	0.9065	1.0506	$15,000,324
3	35%	18.38%	6.42%	93.58%	0.9358	1.0250	$12,341,003

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656
2	30%	22.50%	3.13%	96.87%	0.9065	1.0506	$15,000,324

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656

SUM(MVs) = **$95,214,438.98**

Now for the fun part. What if we wanted to find out what amount of annual commitments would be required to hit a specific market value? Simple, all we have to do is refactor the equation.

Remember that the future value of each capital call is equal to:

$$MV = \sum(C * cc) * Product\left(1 - D_{Current} : 1 - D_{n}\right) * (1 + g)^{n-year+1}$$

Because we expect C (annual commitment) to be constant, we can strip out the Commitment to find what we can call the **Commitment Factor**:

$$Commitment\ Factor = \frac{MV}{C}$$

or

$$\frac{MV}{C} = \sum(cc) * CD * (1 + g)^{n-year+1}$$

Rewriting that to isolate for the commitment:

$$C = \frac{MV}{\sum(cc)*CD*(1+g)^{n-year-1}}$$

Redoing the previous example but stripping out the commitment, we arrive at:

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV	Commitment Factor
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656	0.24130
2	30%	22.50%	3.13%	96.87%	0.9065	1.0506	$15,000,324	0.21429
3	35%	18.38%	6.42%	93.58%	0.9358	1.0250	$12,341,003	0.17630

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV	Commitment Factor
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656	0.24130
2	30%	22.50%	3.13%	96.87%	0.9065	1.0506	$15,000,324	0.21429

Year	C %	CC %	D %	1 – D %	CD %	Growth Factor	MV	Commitment Factor
1	25%	25.00%	1.13%	98.87%	0.8963	1.0769	$16,890,656	0.24130

SUM(Commitment Factors) = **1.36021**

Knowing the NAV at the end is expected to be **$95,214,438.98**, we can calculate the required annual commitment by:

$$\frac{MV}{SUM(Commitment\ Factors)}$$

$$\frac{95{,}214{,}438.98}{1.36021} = \$70,000,000$$