Working with Asset Allocation

MORNINGSTAR Direct

Contents

This page left intentionally blank

Working with the Asset Allocation Module

___

The Asset Allocation module in Morningstar Direct^{SM} allows users to determine how much of a portfolio to invest in cash, equity, fixed income, alternatives, and other asset classes. To keep users from having to repeat this process for every model portfolio or investment, the Asset Allocation module allows users to create a series of asset mixes to be reused in a variety of cases.

Overview

Finally, you can also use a Presentation Studio template to create a meaningful report to analyse the asset class line-up.

Asset Allocation traditionally relies on two components: Log-normal distributions to build assumptions of asset class risk and return, and mean-variance optimisation to identify efficient asset mixes that provide the greatest expected return for a given amount of expected risk – the series of portfolios known as the efficient frontier.

When developing asset-class assumptions, Morningstar Direct users have access to three distribution models:

> ▶ Traditional log-normal distribution
> ▶ An enhanced version of log-normal known as the Johnson model, and
> ▶ The historical-data-based bootstrap method.

Log-Normal distribution, which is traditionally used for modelling asset classes, underestimates the chance of extreme events and it is considered thin-tailed. The Johnson distribution model has the ability to capture those extreme events by accounting for skewness and kurtosis, and it is considered fat-tailed.

Users can also bootstrap historical data, applying these distribution models, to create asset class assumptions. (For the sake of simplicity, this document focuses on the Log-Normal model.)

Once asset allocation assumptions are established, users can run optimisation to build efficient frontiers with various return and risk measures. After identifying optimal asset mixes, users can forecast the future performance of those asset mixes using Wealth and Return Percentiles, Wealth and Return Histograms, Target Wealth and Returns, and Probability of Loss. Users can apply inflation adjustment, cash flows, and rebalancing to forecasting for a more specific prediction of future returns and risk.

How is the work of asset allocation done?

Morningstar Direct provides several asset class line-ups, input files, and case files by default. Using the Asset Allocation module includes the following tasks:

> ▶ Determine whether an existing asset class set meets your needs, or if one needs to be created
> ▶ Review the inputs for an asset class set, to set necessary constraints and other settings for the asset classes as needed
> ▶ Optimise for risk and return in the asset allocation you design
> ▶ Generate a report demonstrating the details of the asset allocation.

Once a set of asset classes is built and selected, much of the work within the Asset Allocation module involves understanding how to modify both the input variables and various charts and tables within a series of workspaces. Being able to change these settings will add depth and breadth to the asset allocation analysis users perform

What is the general workflow of using the Asset Allocation module?

To begin, you can launch the **Asset Allocation** tool in one of three ways:

- ► Visit the Morningstar the web-based Direct homepage at https://direct.morningstar.com, then click the menu bar in the top-left corner and click Asset Allocation on the menu.

  ☞   **Note:** You will need to enter your Morningstar Direct credentials.
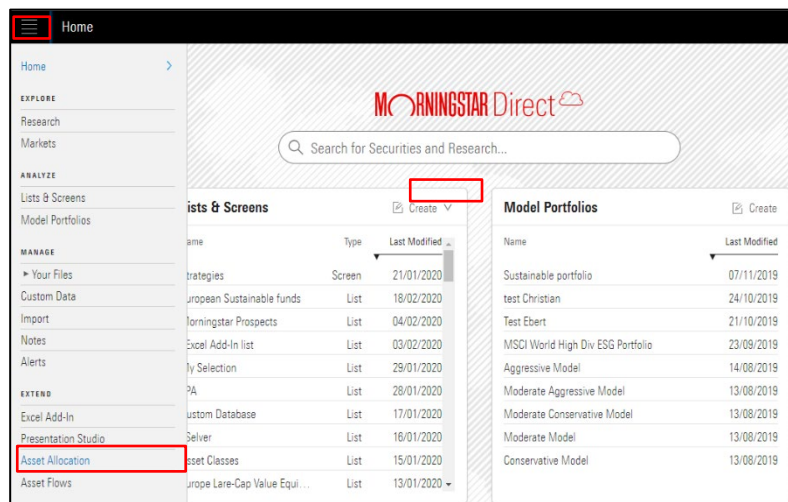
- ► Type http://assetallocation.morningstar.com directly into your web browser (Google Chrome works best).

- ► Open the Morningstar Direct desktop application, and then in the left navigation panel, click **Asset Allocation**.
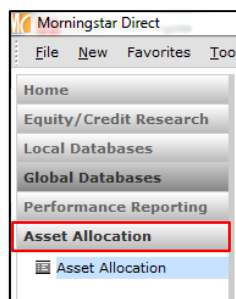
Before creating our case study, we first need to input our asset class assumptions.

☞ **Note:** It will be useful to save the indices which will represent your asset classes in an **Investment List**.
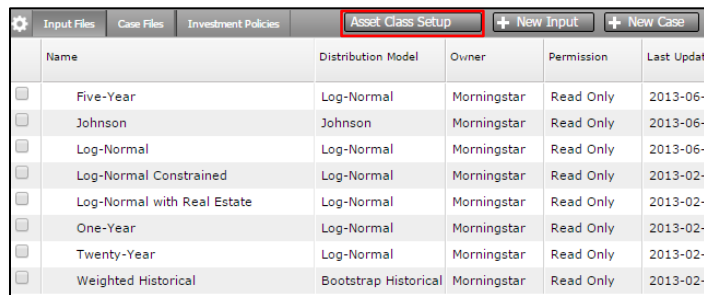
To create your asset class set, do the following:
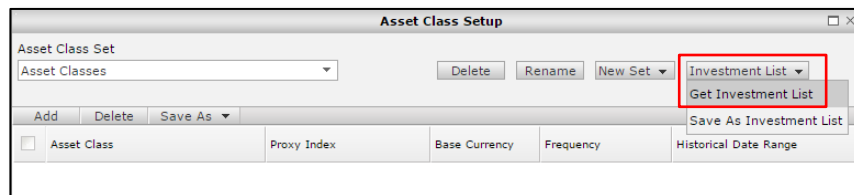
1. Click **Asset Class Setup** at the top of the page. The **Asset Class Setup** dialogue box opens.

Click **Asset Class Setup**

2. Click **Investments > Get Investment List**. The **Select Investment List** dialogue box opens.
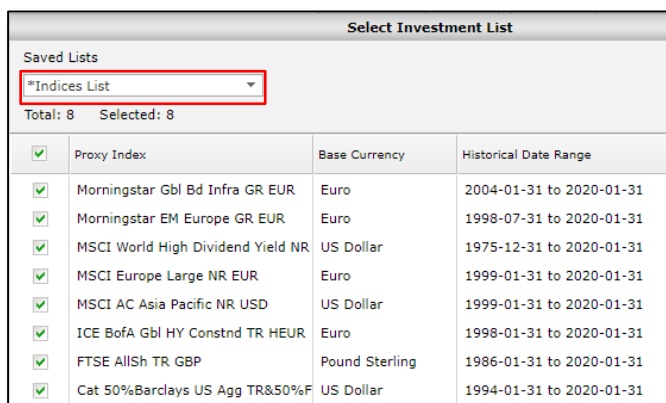
3. Using the **Saved Lists** drop-down menu, select your saved list of indices (***Indices list** in this instance). The list populates on screen.

Select your investment list

☞ **Note:** You may choose to deselect one or two asset classes by deselecting the relevant checkbox.

4. Click **OK**. The indices display in the **Asset Class Setup** dialogue box.

Exercise 2: Setting up Asset Classes

5.   Under the **Asset Class** column, double-click in a cell to rename the **Asset Class** name as shown below.
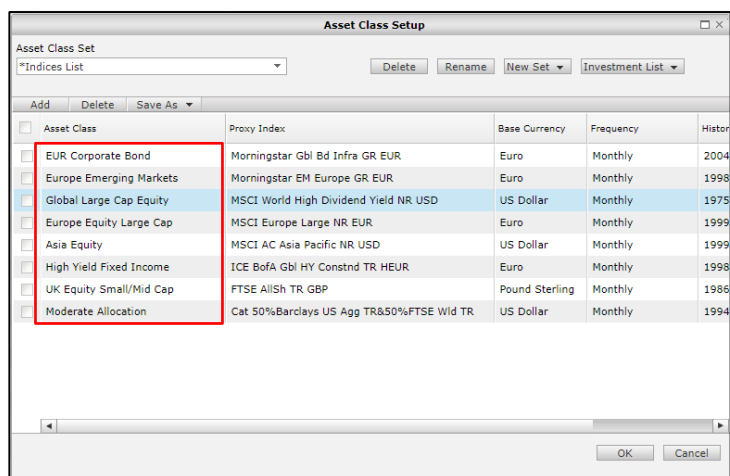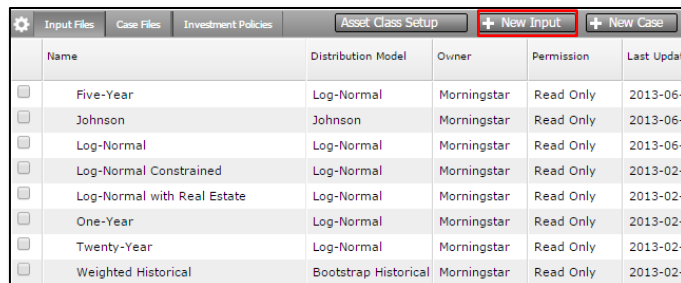
6.   Click **OK**. The **Asset Class Setup** dialogue box closes.

Input files are used to store your asset classes, distribution calculations and other data information, and to get started in the main part of the **Asset Allocation** tool.

Exercise 3: Creating an Input file

To get started, do the following:
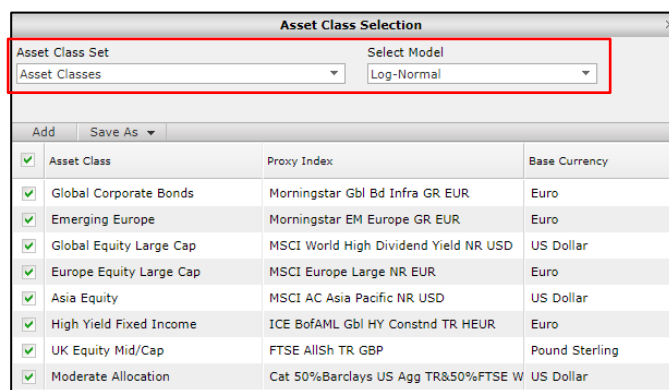
1. From the **Asset Allocation Home** screen, click **New Input**. The **Asset Class Selection** dialogue box opens.

Click **New Input** to get started

2. Using the **Asset Class Set** drop-down menu, select your saved set of indices.

☞ **Note:** You still have the possibility to add or delete asset classes from this dialogue box using the **Add/Delete** buttons.

3. Using the **Select Model** drop-down menu, select the **Log Normal** model.

Select your **Asset Class Set** and **Model**

4. Click **OK**. The **Input Settings** dialogue box opens.

This **Input Settings** tab allows you to change the frequency of data input, the way that returns are calculated within the simulation – either additive (estimate) or compounded (precise) – the number of simulations, random seeding for an extra layer of randomisation, and the ability to designate an asset class as a model for inflation in forecasting.

Exercise 4: Input Settings

The **Set-Up** tab offers the possibility to further model your asset class assumptions.

The **Baseline Settings** tab offers additional customisation when using Building Blocks, CAPM or Black-Litterman settings.

Since we are using the Historical model in this exercise, we can disregard the Baseline Settings and click **OK**. The **Morningstar Asset Allocation** window opens.

We work first with the **Input Workspace** tab. By default, it is composed of three elements:

▶ Under **Input Summary**, we see the calculated annual Arithmetic Mean and Standard Deviation for each asset class over the course of its available time-series data.

▶ The **Correlation** component likewise shows us how each asset class correlates with the others over their commonly available time period.

▶ **Asset Class Statistics** shows the results calculated from the simulation based on the asset classes commonly available time period. (The user inputs are the starting point for each simulation, but when the same figures are calculated from the simulation and not from actual historical performance, the return and risk metrics can differ slightly.)
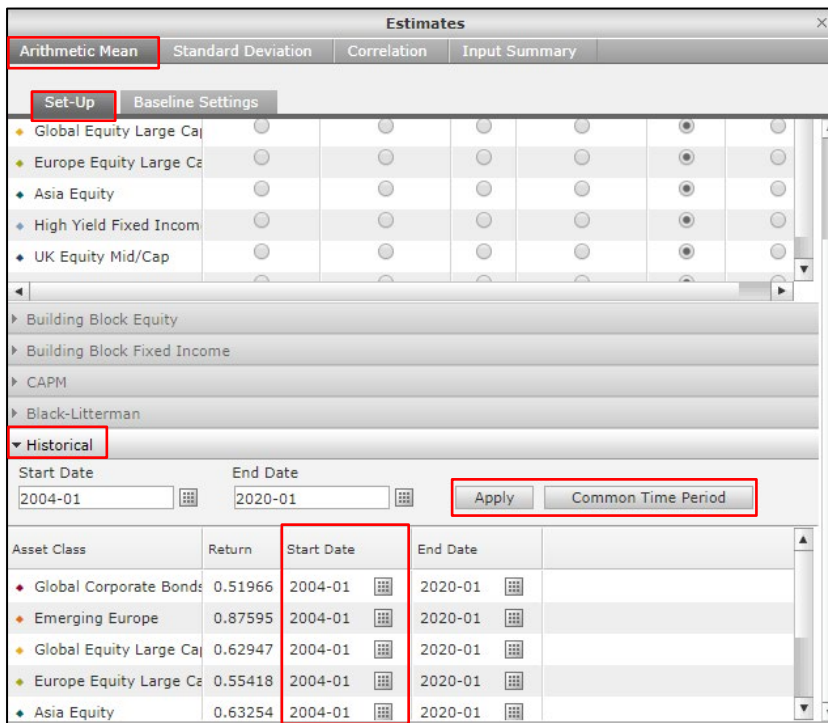
Before going further into our analysis, we must first check the time horizon for our analysis. Do the following:

1. Click the **Estimates** button from the **Input** toolbar.
2. From the **Arithmetic** tab, under the **Set-Up** sub-tab, expand the **Historical** section.

Each asset class start date is listed below, and the **Input Summary** component (top-right of your Input page) is using these time periods to calculate each asset class's arithmetic mean. We want to run an analysis on a common time period. Do the following:

3. Under the **Historical** section, click the **Common Time Period** button.
4. Click **Apply**.

☞ **Note:** The Start Date for each asset class updates to display the common start date.

Exercise 5: Setting the Time Horizon for your Analysis

Arithmetic Mean and Standard Deviation

Click **Common Time Period** and then click **Apply**

You have now applied a common time period to evaluate each asset class's arithmetic mean.

We can now apply the same to the Standard Deviation.

1. From the **Estimates** window, click the **Standard Deviation** tab.
2. Click **Common Time Period** and then click **Apply**.

☞ **Note:** The Start Date for each asset class updates to display the common start date.

Estimates				
Arithmetic Mean	**Standard Deviation**	Correlation	Input Summary	
Start Date 2004-01	End Date 2020-01		Apply	Common Time Period
Asset Class	Standard Deviation	Start Date	End Date	
◆ Global Corporate Bonds	1.84079	2004-01	2020-01	
◆ Emerging Europe	6.95281	2004-01	2020-01	
◆ Global Equity Large Cap	4.19142	2004-01	2020-01	
◆ Europe Equity Large Cap	3.81226	2004-01	2020-01	
◆ Asia Equity	4.63585	2004-01	2020-01	
◆ High Yield Fixed Income	2.57730	2004-01	2020-01	
◆ UK Equity Mid/Cap	3.57244	2004-01	2020-01	
◆ Moderate Allocation	2.17999	2004-01	2020-01	
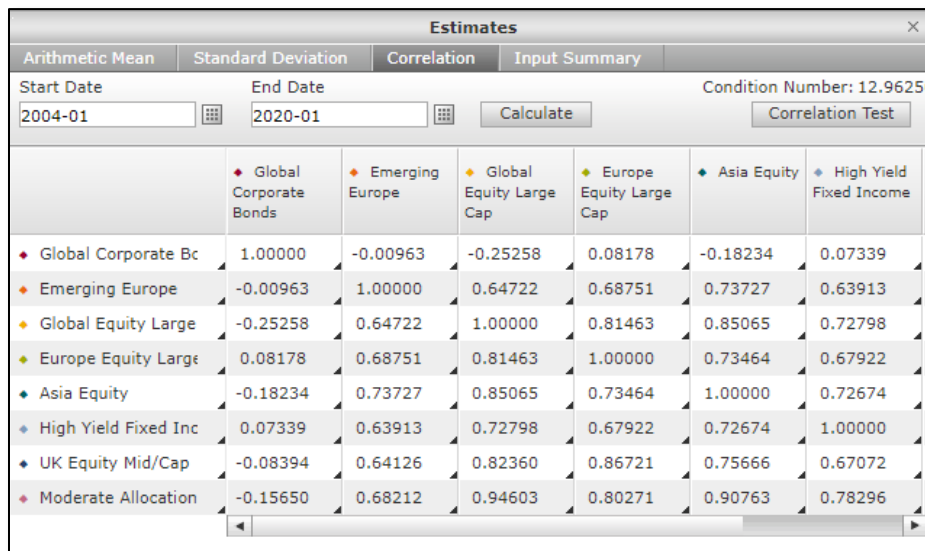
Click **Common Time Period** and then click **Apply**

When running your analysis, it is important to run a correlation test to ensure there is no overlap of asset classes.

Correlation Test

1. From the **Estimates** window, click the **Correlation** tab. Notice how the common time period of all asset classes is already set by default.

The **Condition Number** displays in the top-right corner of the window. This number should be below 20%. Anything higher signifies too much overlap between asset classes. If your condition number is too high, consider removing overlapping asset classes or changing representative indices.

Estimates						
Arithmetic Mean	Standard Deviation	**Correlation**	Input Summary			
Start Date 2004-01	End Date 2020-01		Calculate		Condition Number: 12.9625 Correlation Test	
	◆ Global Corporate Bonds	◆ Emerging Europe	◆ Global Equity Large Cap	◆ Europe Equity Large Cap	◆ Asia Equity	◆ High Yield Fixed Income
◆ Global Corporate Bo	1.00000	-0.00963	-0.25258	0.08178	-0.18234	0.07339
◆ Emerging Europe	-0.00963	1.00000	0.64722	0.68751	0.73727	0.63913
◆ Global Equity Large	-0.25258	0.64722	1.00000	0.81463	0.85065	0.72798
◆ Europe Equity Large	0.08178	0.68751	0.81463	1.00000	0.73464	0.67922
◆ Asia Equity	-0.18234	0.73727	0.85065	0.73464	1.00000	0.72674
◆ High Yield Fixed Inc	0.07339	0.63913	0.72798	0.67922	0.72674	1.00000
◆ UK Equity Mid/Cap	-0.08394	0.64126	0.82360	0.86721	0.75666	0.67072
◆ Moderate Allocation	-0.15650	0.68212	0.94603	0.80271	0.90763	0.78296

2. Click **OK** to validate your choices.

The Input Summary and Asset Class Statistics (Historical) components recalculate.

We are working with asset classes from various currencies; to reflect the impact of the exchange rate fluctuation, we want to convert those to Euro. To do so, do the following:

Exercise 6: Currency Conversion

1. Click **Currency**. The **Currency** dialogue box opens.
2. Select all asset classes in **US Dollar** and **Pound Sterling** and convert them to **Euro** using the relevant checkboxes to the left.
3. Using the Currency Operation drop-down menu, select **Convert**.
4. Using the **Convert To** drop-down menu, select **Euro**.
5. In the bottom-right corner of the dialogue box, click **Apply**.

☞ **Note:** You will also find **Hedging** options under the **Currency Operation** drop-down menu.

☞ **Note:** You can save a converted asset class as a Custom Benchmark by selecting it and clicking **Save as Custom Benchmark** (it will then be saved under Portfolio Management > Custom Benchmarks in the Direct software.

6. Click **OK**.

Before moving on to **Optimisation**, we can save our work. Each workspace in Morningstar Asset Allocation makes use of two files:

▶ The **Input file** contains your CMAs (asset classes, distribution model, expected return methodology, constraints)

▶ The **Case file** contains your asset mixes, the efficient frontier, forecasting information and the layout of your report (how your report looks like, the components you display)

☞ **Note:** To create an input file, you don't require a case file and input files can be used in more than one case file. Changes made to an input file in one case file will show up in another case file that is using those inputs. Therefore, be mindful when saving changes to input files.

☞ **Note:** To create a case file, you require an input file; a case file can also support multiple input files.

To save the **Input file**, do the following:

1. In the top-left corner of the **Morningstar Asset Allocation** window, click the **Gear** icon ⚙.
2. Click **Save Inputs as**. The **Save Input File** dialogue box opens.
3. Type **Input A**.
4. Click **OK**.
5. Click **OK** again on prompt.

Save Input File

Name	Input A

E.g. asset classes, expect return methodology, capital market assumptions, distribution models, constraints, currency settings, inflation series

Saved Input Files

Five-Year
Johnson
Log-Normal
Log-Normal Constrained
Log-Normal with Real Estate
One-Year
Twenty-Year
Weighted Historical

Message

Saved Successfully

The file(s) have been saved successfully.

OK

To save the **Case file**, do the following:

1. In the top-left corner of the **Morningstar Asset Allocation** window, click the **Gear** icon ⚙.
2. Click **Save Case as**. The **Save Case File** dialogue box opens.
3. Type **Case A**.
4. Click **OK**.
5. Click **OK** again on prompt.

Save Case File

Name	Case A

E.g. workspace layout, associated inputs file(s), asset mixes, optimization settings, forecasting settings such as initial assets and cash flo

Saved Case Files

Custom Workspaces
Downside Risk Optimization (CVaR)
Multiple Frontiers
Non-Normal Input Construction
Weighted Historical Periods

Message

Saved Successfully

The file(s) have been saved successfully.

OK

Having established our capital-market assumptions and correlations, the system can build an efficient frontier using **Mean-Variance Optimisation (MVO)**. Each frontier is a series of 100 different asset mixes that provide the greatest expected return (Y-axis) for a specified level of risk (X-axis).

Exercise 8: Running Mean-Variance Optimisation using Resampling

Before running the simulation, do the following:

1. To access the **Efficient Frontier**, click the **Optimiser Workspace** tab.
2. From the **Toolbar**, click **Optimisation**. The **Optimisation Settings** dialogue box opens.
3. To the right of the screen, tick the **Resample** checkbox.

   ☞ **Note:** Resampling produces more diversified and robust portfolios where it recognises that Capital Market Assumptions are forecasts and not a "sure thing".

4. Click **OK**. The **Efficient Frontier** reloads on screen.
5. Click **Run Simulation** on the **Toolbar**.
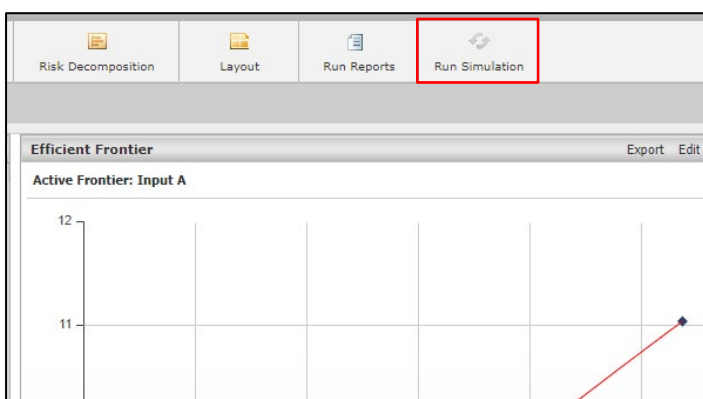
Click **Run Simulation** to generate the data

We want a better overview of the asset mixes possibilities. The **Asset Allocation Spectrum** chart can help us do that.

To display this chart, do the following:

1. At the bottom of the **Morningstar Asset Allocation** window, expand the charts and table section by clicking the three dots.
2. On the left, switch to the **Optimizer** section.
3. Drag and drop the **Asset Allocation Spectrum** chart onto the **Efficient Frontier**. The box splits into two parts and our chart displays below the **Efficient Frontier**.

Exercise 9: Asset Allocation Spectrum
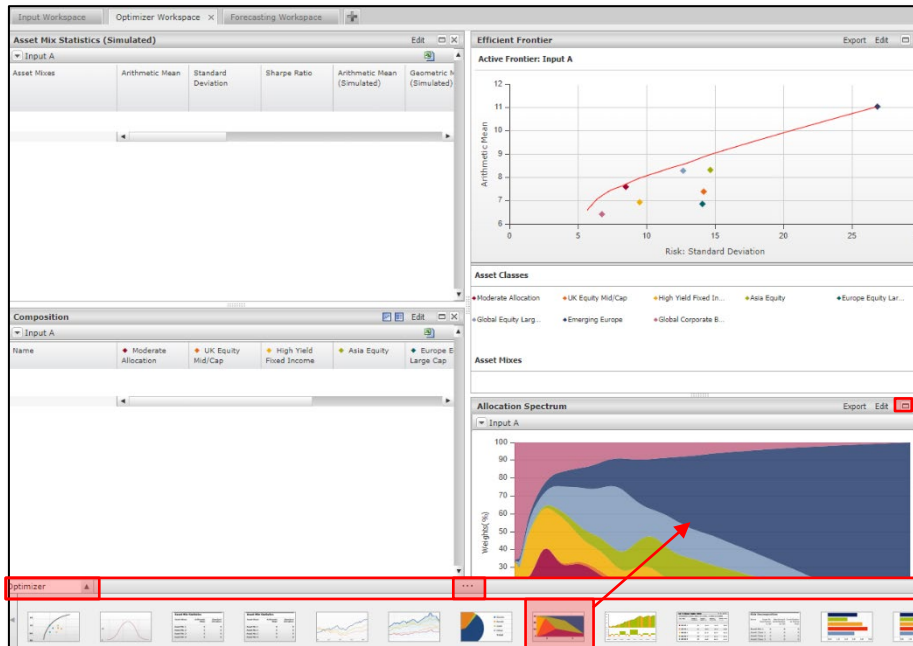
Expand the chart window

Add the **Asset Allocation Spectrum** chart

4. Click the **Expand** icon. The chart displays on the whole screen.

The **Asset Allocation Spectrum** chart provides a perfect representation of all 100 asset mixes on our Efficient Frontier at a single glance.
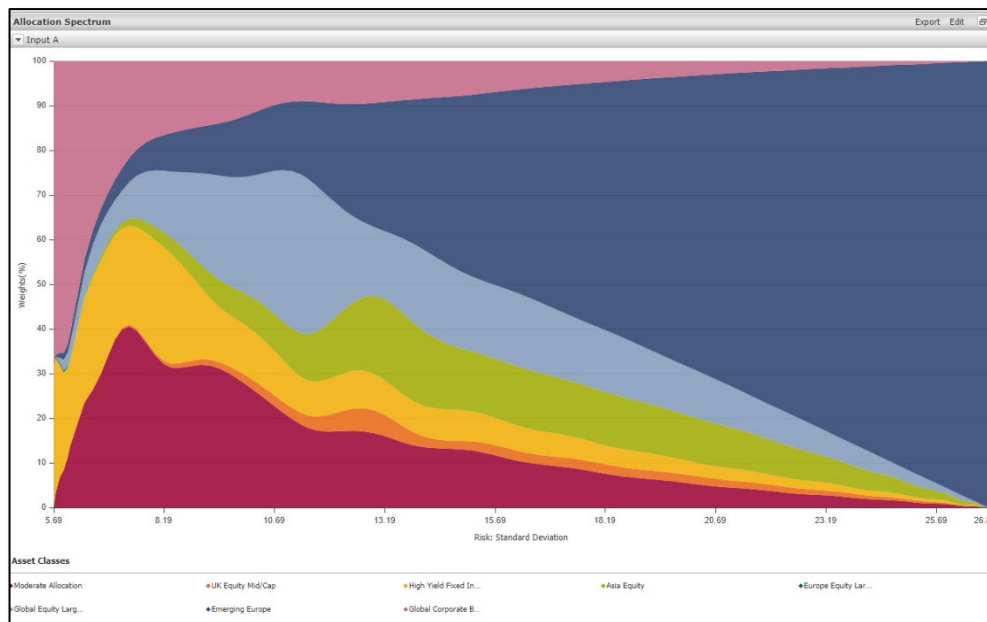
See all asset mixes in one view

We can easily conclude that as our risk increases, our allocation to Emerging Europe increases, and our allocation to Moderate Allocation and High Yield Fixed Income (and a few others) decreases.

Europe Equity Large Cap is completely kept out of the equation.

We can easily address this situation by using **Constraints**.

Constraints are saved as part of our **Inputs file** and are set to ensure a minimum/maximum allocation per asset class or group of asset classes.

Exercise 10: Assigning Constraints

To set **Constraints**, do the following:

1. From the Optimizer toolbar, click **Constraints**.

    ☞ **Note:** There are three types of constraints: **Individual**, **Group**, and **Relative**.

2. Set your constraints as shown below:

Asset Class	Min Holding	Max Holding
Moderate Allocation	0	100
UK Equity Mid/Small Cap	5	100
High Yield Fixed Income	0	100
Asia Equity	5	100
Europe Equity Large Cap	15	100
Global Equity Large Cap	0	100
Emerging Europe Equity	0	70
Global Corporate Bond	7.5	100

3. Click **OK**.

The **Efficient Frontier** and the **Allocation Spectrum** charts update.
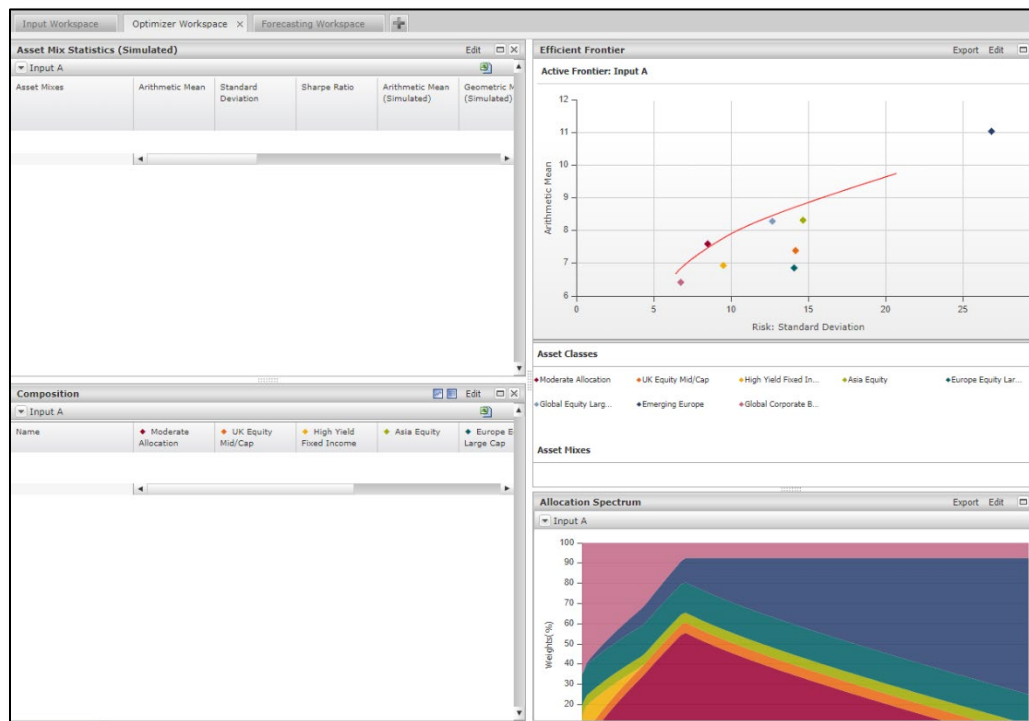
Adding components automatically splits the screen into additional sections

4. Click the **Gear** icon to save your **Inputs file**.
5. Click the **Gear** icon to save your **Case file**.

We now want to see where our current policy fits on the **Efficient Frontier**.

To add our policy as an **Asset Mix**, do the following:

1. From the **Optimiser** tab, click **Asset Mixes** on the **Toolbar**.

Exercise 11: Plotting our Current Allocation
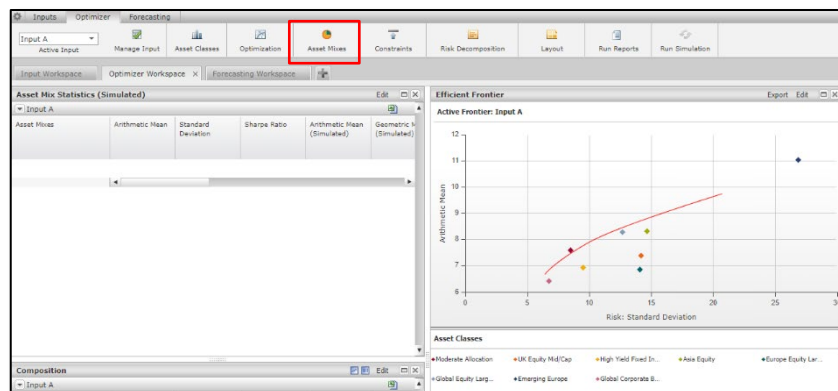
Click here to work with **Asset Mixes**

The **Asset Mixes** dialogue box opens.
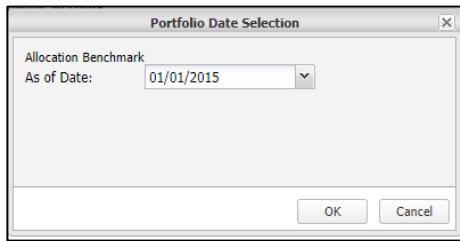
☞ **Note:** You can manually enter positions, or select an existing Custom Benchmark representing your policy.

Import a **Custom Benchmark** or manually add an asset mix

2. Click **Import From > Custom Benchmark**. The **Select Custom Benchmark** dialogue box opens.
3. Type your custom benchmark name (**Allocation Benchmark** in this instance) and click **Go**.
4. Select your Custom Benchmark from the **Available Records** field and click **OK**.

Search for the **Custom Benchmark** representing your current policy

5. Select the benchmark **As of Date** (this represents the dates of the positions entered in your Custom Benchmark in Portfolio Management).

The benchmark and its positions are added to the **Asset Mixes** dialogue box.

6. Double-click the Custom Benchmark name and rename it **Current Policy**.

7. Click **OK** to view the asset mix on the **Efficient Frontier** graph.
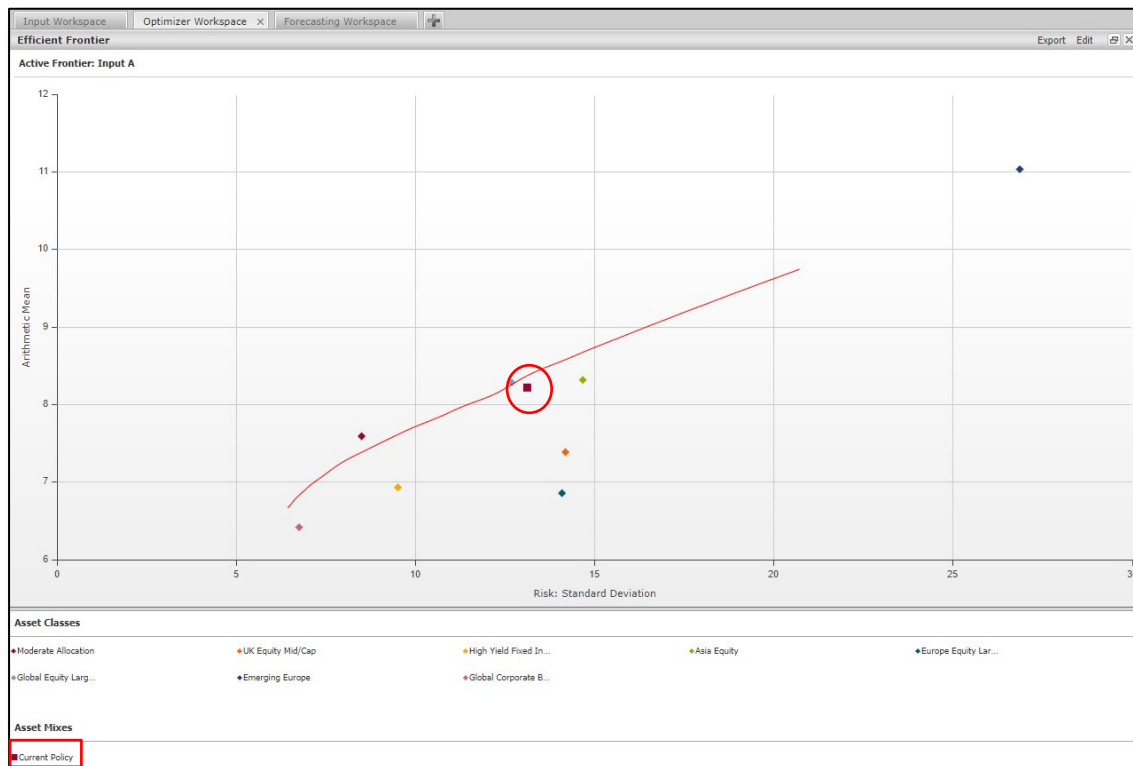
Our Policy appears below the Efficient Frontier line. This means there exists an Asset Mix on the Efficient Frontier with a higher return for the same level of risk.
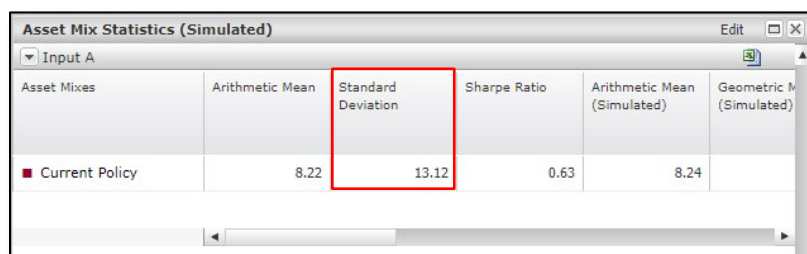
We will next learn to search for that asset mix and add it to the Efficient Frontier.

Morningstar Asset Allocation holds a **Search** function to find **Asset Mixes** that fit specific criteria.

To search for an **Asset Mix** with a high standard deviation, do the following:
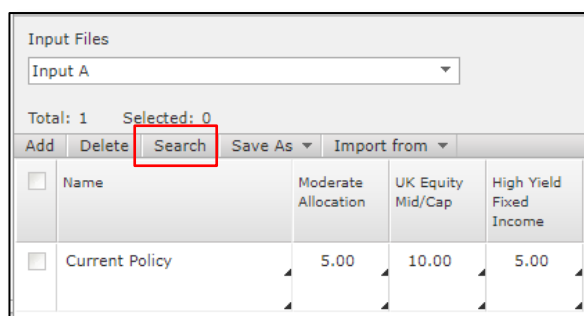
1. Under the **Asset Mix Statistics** table in the top-left of the **Morningstar Asset Allocation** window, check the **Standard Deviation** of your **Current Policy** asset mix.

Exercise 12: Searching for an Asset Mix with a similar risk level

Check the **Standard Deviation** of your asset mix

2. From the **Toolbar**, click **Asset Mixes**. The **Asset Mixes** dialogue box opens.
3. Click **Search**.

The **Asset Mix Search** dialogue box opens.

4. Select the **Search for One Asset Mix** radio button (default option).
5. Using the **Search for** drop-down menu, select **Standard Deviation**.
6. In the **of** field, enter the standard deviation value found under the **Asset Mix Statistics** table (12.77 in this instance).
7. In the **Name** field, type **Higher Return Asset Mix**.

See highlighted fields

8. Click **OK**.

The **Asset Mixes** table now contains our current policy, as well as an asset mix with similar risk but higher return.

	Name	Moderate Allocation	UK Equity Mid/Cap	High Yield Fixed Income	Asia Equity	Europe Equity Large Cap	Global Equity Large Cap	Emerging Europe	Global Corporate Bonds	Total
☐	Current Policy	5.00	10.00	5.00	15.00	20.00	5.00	25.00	15.00	100.00
☐	Higher Return Asset Mix	9.01	5.93	6.42	15.76	15.16	9.45	25.98	12.28	100.00

Asset Mixes — Input Files: Input A — Total: 2   Selected: 0 — Add   Delete   Search   Save As ▼   Import from ▼

9.   Click **OK**.

We notice several things:

- **Efficient Frontier**: the new Asset Mix displays on the Efficient Frontier itself.
- **Asset Mix Statistics**: "Higher Return Asset Mix" has a return of **8.36%** vs. **8.22%** for "Current Policy".
- **Composition**: the pie charts representing both asset mixes are displayed. Note the table showing the allocation numbers below the charts.
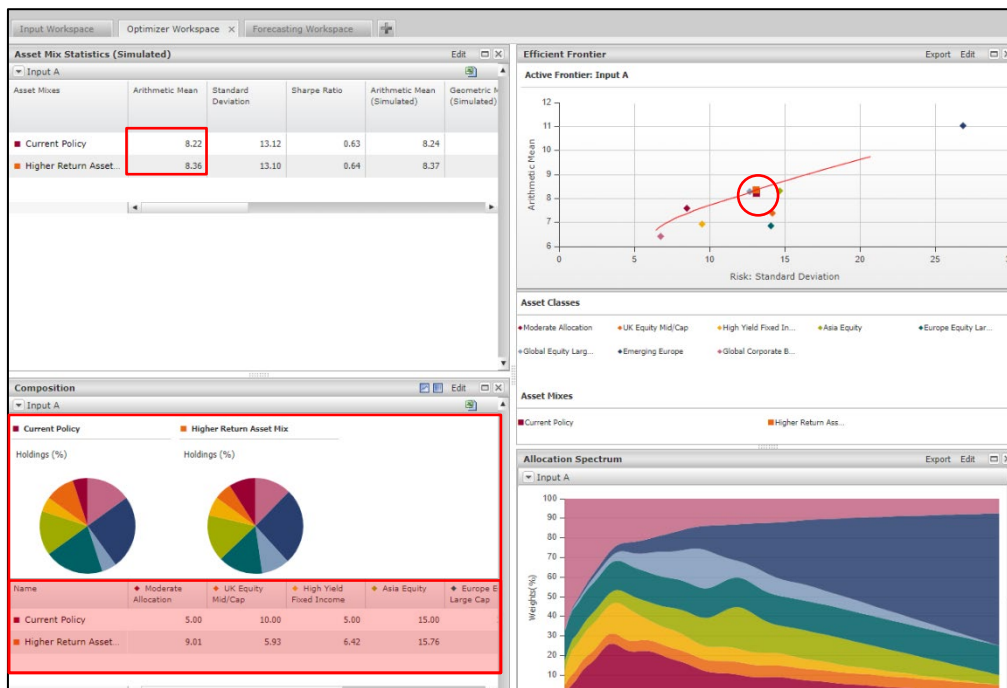
By increasing our allocation to Global Equity Large Cap and decreasing it in Europe Equity Large Cap, as well as some other minor changes in positions in the other asset classes, we can increase our policy return for the same level of risk.

Name	Moderate Allocation	UK Equity Mid/Cap	High Yield Fixed Income	Asia Equity	Europe Equity Large Cap	Global Equity Large Cap	Emerging Europe	Global Corporate Bonds
■ Current Policy	5.00	10.00	5.00	15.00	20.00	5.00	25.00	15.00
■ Higher Return Asset...	9.01	5.93	6.42	15.76	15.16	9.45	25.98	12.28

You can now save your **Asset Mix** as a **Custom Benchmark**, allowing further use in other modules of Morningstar Direct, such as Portfolio Analysis for Total Portfolio Attribution (macro attribution) or Presentation Studio.

Exercise 13: Saving an Asset Mix as a Custom Benchmark

To save the **Custom Benchmark**, do the following:

1.   From the **Toolbar**, click **Asset Mixes**.
2.   Select the checkbox to the left of the asset mix you want to save.
3.   Click **Save As > Save as Custom Benchmark**. The **Save as Custom Benchmark** dialogue box opens.
4.
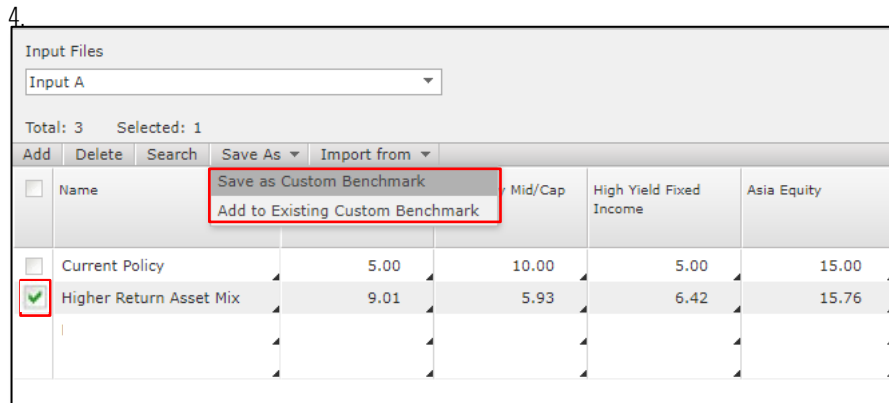
☞   **Note:** You can also decide to add this new asset mix to an existing Custom Benchmark to record a change in the benchmark composition.

5.   Select the **Currency** and **Portfolio Date** for your positions. We will assign 01/01/2004, which is the common start date for our asset classes.
6.   Under **Apply to**, select the checkbox to the left of your Asset Mix name.
7.   Click **Apply**.
8.   Click **OK**.

You will be prompted to confirm that the Custom Benchmark was saved successfully.

9.   Click the **Gear** icon and **Save** the **Inputs** and **Case** files.

You will find your saved Custom Benchmark under **Portfolio Management > Custom Benchmarks** and ready to use in other modules, such as Presentation Studio or Total Portfolio Attribution.
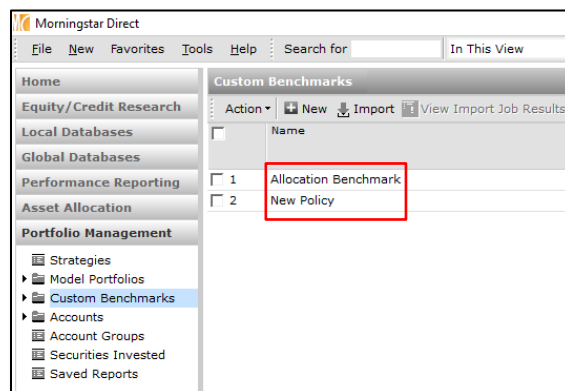
Your **Custom Benchmark** is saved and ready to use in Morningstar Direct

Presentation Studio hosts a variety of customisable templates to communicate your results effectively, including an **Asset Allocation** template.

Exercise 14: Communicating your Results

To use the Asset Allocation template, do the following:

1. In Morningstar Direct, click on **Presentation Studio** in the left navigation pane.
2. From the landing page, click **Asset Allocation**. The **Create New Report** dialogue box opens.
3. Select the **Morningstar Templates** radio button.
4. Select the **Asset Allocation Analysis** template.
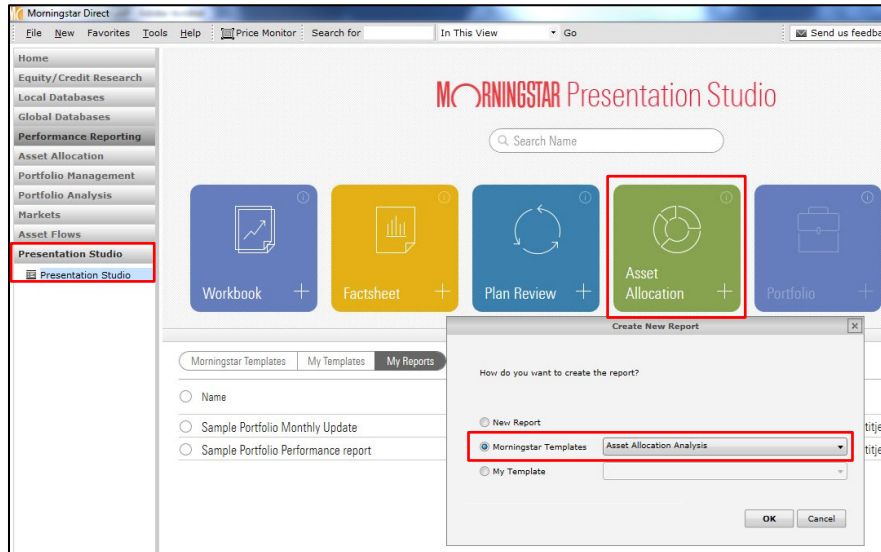
Use Presentation Studio's **Asset Allocation Analysis** template

5. Click **OK**. The **Find Asset Mixes** dialogue box opens.
6. Using the **Saved Case Files** drop-down menu, select your Asset Allocation case.
7. Deselect **Higher Return Asset Mix**.
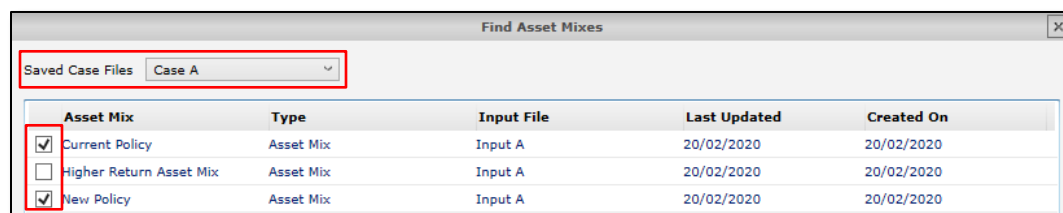
Select the relevant **Case file** and **Asset Mixes**

8. Click **OK**. **The Asset Mixes: Settings** dialogue box opens.
9. Choose your **Colour** and **Marker**.
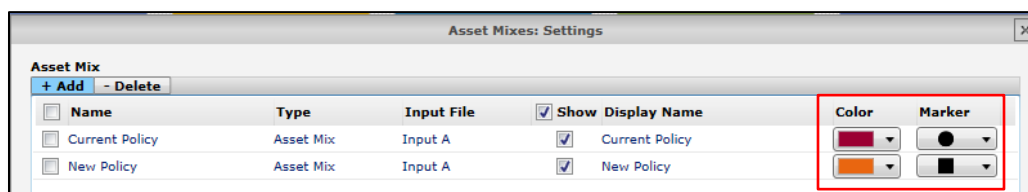
10. Click **OK**. The template opens.
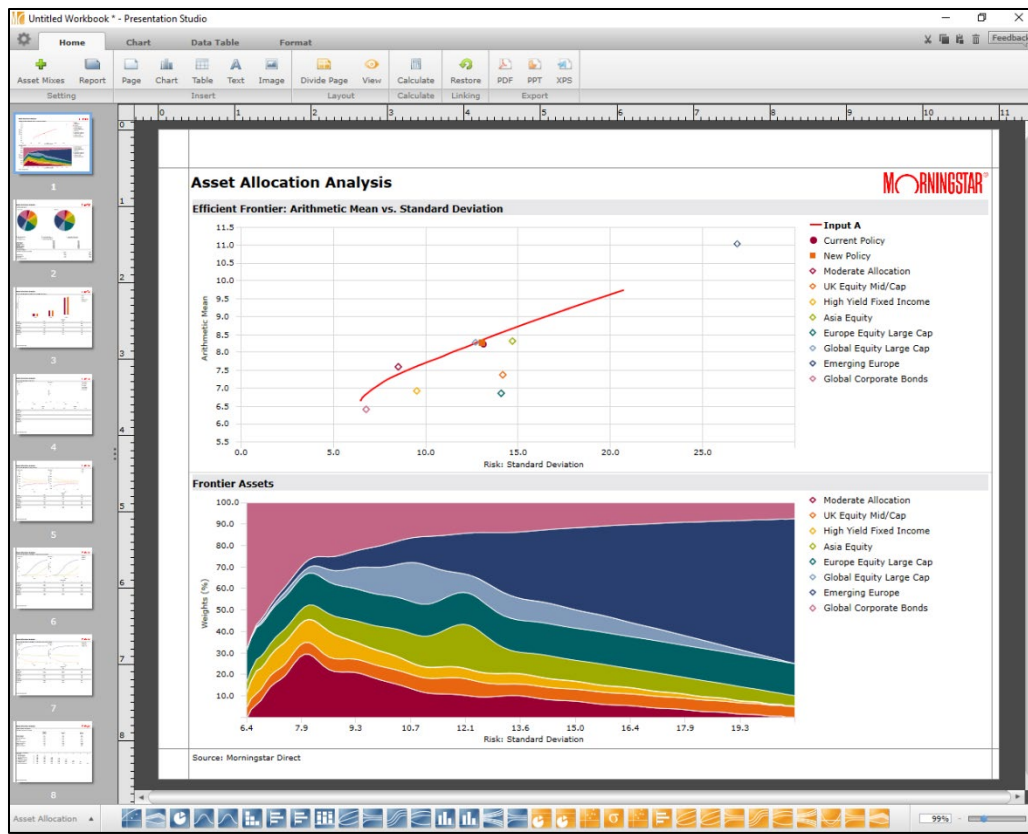
You can now modify this report to suit your needs.

1. From the **Home** tab, click **Report**.
2. From the **Data** tab, set the **Currency** to **Euro**.

Set the **Currency** to **Euro**

3. From the **Optimisation** tab, ensure that the checkbox for **Always use settings from case file** at the bottom of the dialogue box is selected.
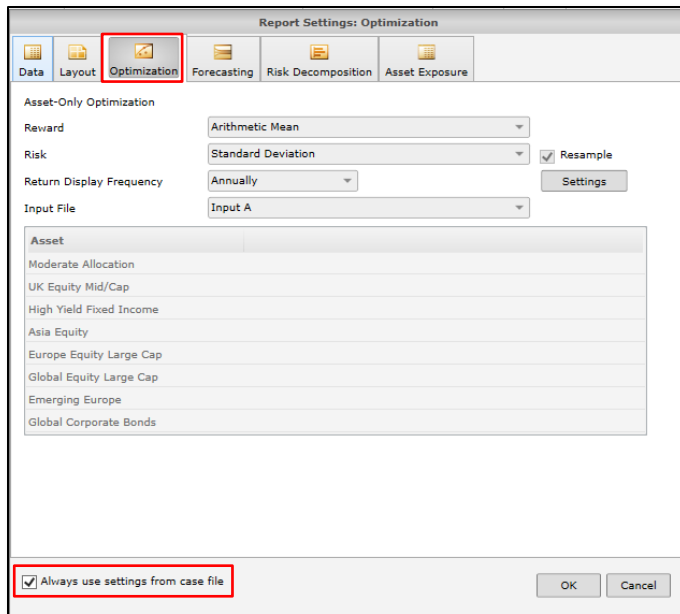
Ensure **Always use settings from case file** is selected

☞ **Note:** Deselecting this checkbox will remove the synchronisation between your Asset Allocation case file and the Presentation Studio report.

4. Click **OK** to return to the report.
5. Click **Calculate > Report** on the **Toolbar**.
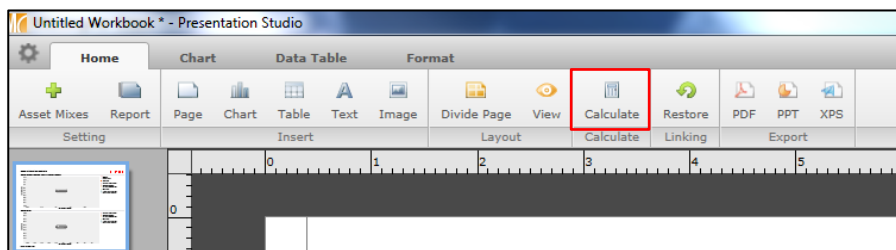
Click **Calculate**

6. Click the **Gear** icon in the top-left corner of the **Presentation Studio** window and click **Save As**. The Presentation Studio dialogue box opens.
7. Type **"Case A Analysis"** and click **Save**.
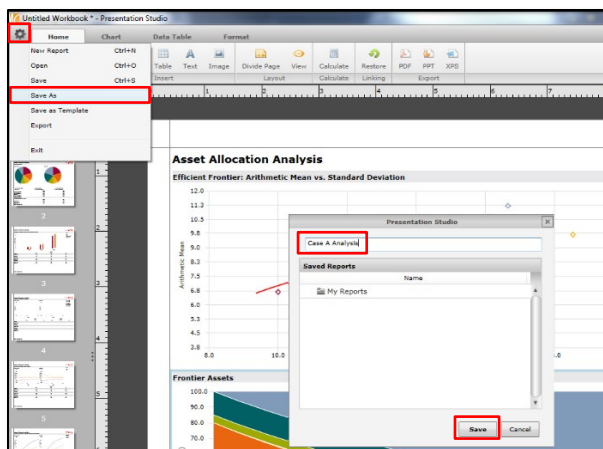
Save the report as **"Case A Analysis"**

Appendix

In this section, we will cover additional functions concerning Asset Allocation, such as:

- ► Capital Market Assumptions set up

- ► Adding another Input file on the Efficient Frontier

- ► Currency: Converting vs. Hedging

- ► Resampling

We have already seen how to create asset classes using an Investment List. You also have the option to add an asset class manually.

To add an asset class to an existing (or new) set, do the following:

1. From the **Morningstar Asset Allocation** window, click **Asset Class Setup**. The **Asset Class Setup** dialogue box opens.
2. From the **Asset Class Set** drop-down menu, select the desired set – **"*Indices list"** in this instance.

Appendix A: Capital Market Assumptions set up

Adding an Asset Class manually to an Asset Class set

Select your **Asset Class** set

The list of asset classes appears on screen.

3. Click **Add**. The **Add Asset Class** dialogue box opens.
4. In the **Asset Class Name** field, type **Emerging Europe Equity**.
5. In the **Proxy Index** field, type **MSCI EM NR EUR**
6. Click on the index name when it appears to select it.

Type the index name to select it

☞ **Note:** Alternatively, click the magnifying glass. The **Select Proxy** dialogue box opens, and you can access the **Market Indexes** database, as well as any **Custom Benchmark** you created.
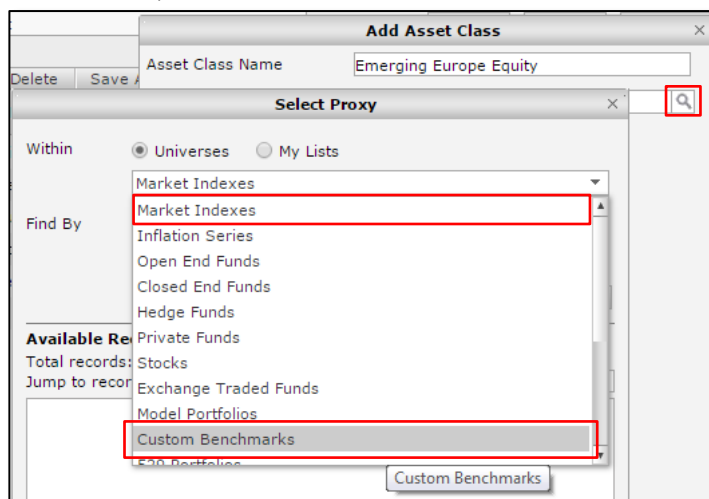
Select the index for your new asset class

7. Back in the **Add Asset Class** dialogue box, click **OK** to validate your selection.
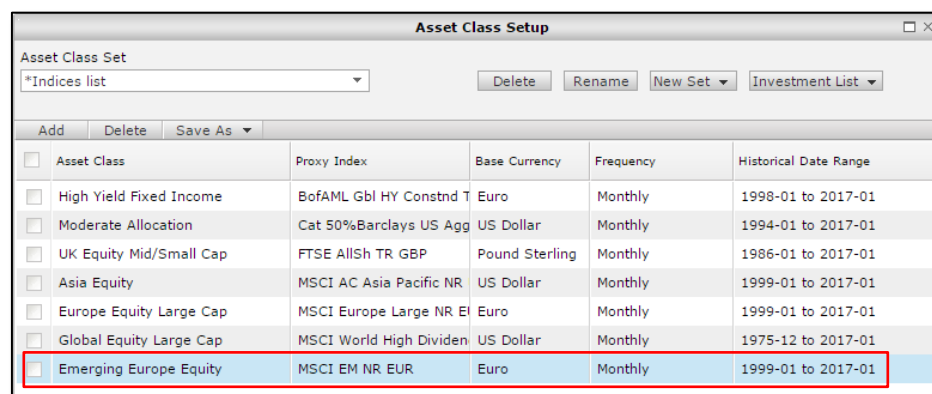
Emerging Europe Equity has now been added to our **Asset Class Set**.

8. Click **OK** to save and exit the **Asset Class Setup** dialogue box.

You can also add an asset class to an existing asset class set from within a Case file.

1. From your case file, click **Asset Classes** on the **Toolbar**.
2. Click **Add**. The **Add Asset Class** dialogue box opens.

Proceed as described above to add the new asset class.

Asset Allocation offers three different models. We will discover them all in turn.

Asset Allocation Models

> ► Log-Normal
> ► Johnson
> ► Bootstrap

The Log-Normal distribution is intuitive, well known, easy to calculate, and so results in less waiting in the software. Most people are familiar with the rule that 2/3 of the time, we get returns that are within one standard deviation off the mean; over 95% of the time, we are within 2 standard deviations off the mean and 99% of the time, we are 3 standard deviations off the mean.

Log-Normal Model

Log-Normal distributions are only described by two parameters: **Arithmetic Mean** and **Standard Deviation**.

This makes them limited in their flexibility. This limitation most commonly shows up in an under-prediction of extreme events. Most of the time when a Log-Normal distribution is fitted to historical data, there are returns in the historical data that occur outside of where the Log-Normal would predict any returns based on the number of historical observations we have.

The Log-Normal distribution is also almost symmetrical. There is no way to control the skewness or asymmetry of the distribution. For some asset classes this is an important property that can make them much more attractive or less attractive than other asset classes that have approximately the same Log-Normal distribution (same standard deviation and arithmetic mean). The Johnson model is a super set of the Log-Normal distribution. The Johnson model can be set to match the distribution that the Log-Normal model can create.

Through the addition of two extra parameters (skewness and kurtosis), the likelihood of extreme events and the ratio of the number of distributions above and below the mean can be controlled.

Johnson Model

These are the two areas where the Log-Normal distribution most commonly doesn't fit historical data well.

So the Johnson Distribution Model can model a wider range of asset class behaviour and thus produce more realistic results.

Why wouldn't I use the Johnson Model?

The Johnson model is not as well-known as the Log-Normal model.

This means that you may have to explain to the end client why you are using it, how it works, and the additional assumptions that you are making (what to set skewness and kurtosis to).

In many cases for traditional asset classes there are very few differences in terms of the efficient asset mixes that the Log-Normal and Johnson models predict.

It may not be worth the education effort to use the Johnson model when the Log-Normal model is an adequate approximation for your asset class set.

The Johnson model also takes additional calculation time.

The Bootstrapping model is the only model that can represent non-linear correlations.

Bootstrap Model

It is also the only model that can represent certain unusual patterns of returns.

For most asset classes, there is a return range that is very likely, and the likelihood of returns falls off from that range in both directions.

If an asset class has some gaps where returns just can't occur between two other areas where returns are likely then the Bootstrapping model is the only model that could account for this.

The Bootstrapping model also allows you to isolate individual economic scenarios or time periods and make your results based on those scenarios occurring again in proportions that you set.

For example, if you assume that your asset classes will behave like they have historical data but that high inflationary times are going to be more prevalent in the future than they were in the past you could isolate the high inflationary times in the historical data and give them a larger weight than they have in the historical data.

Users can change the data and methodologies used to calculate risk and return as well as correlation.

Expected Return Methodology

To make changes, do the following:

1. Within your Case file, click the **Input Workspace** tab.
2. Click **Estimates** on the **Toolbar**. The **Estimates** dialogue box opens.

Check Asset
Classes history

The different radio buttons in the Arithmetic Mean tab represent the different methods Morningstar Direct offers for calculating expected return of an asset class, such as **Black-Litterman**, **CAPM** and **Building Block**.

Black-Litterman is a method for determining the expected returns of Asset Classes. The first step is to compute the returns (called implied returns) that would be necessary for the portfolio of the Asset Classes according to the market capitalisation weights to be efficient. This puts every asset class on a common risk/reward trade-off which promotes diversification since no asset class has a level of return that is not commensurate with its risk. The second step of Black-Litterman is the ability to specify views on how the returns may differ from the implied returns either in absolute terms or in relative terms to another asset class. The big advantage here is that the views take into account the relationships between the asset classes and preserve the common risk/reward trade-off.

Black-Litterman

For instance, specifying that Europe Equity Large Cap will outperform the implied returns will probably also result in an increase in the return of UK Equity Mid/Small Cap as the two are positively correlated to some degree.

Building Blocks is a method for determining the expected returns of Asset Classes. The premise of Building Blocks is that the return of an asset class can be separated out into several factors and that these factors are more predictable that the asset classes themselves.

For Equity asset classes the factors are the risk-free rate, the return you should expect for investing in equity over bonds, and the return you should expect for investing in large cap over small cap.

For Fixed Income, the factors are the return you should expect for a risk-less asset with any maturity component removed, the return you should expect for investing for a given horizon and the return you should expect for investing in Corporate over Government bonds.

Building Blocks

CAPM is a method for determining the expected returns of Asset Classes based on a regression of a broad market index versus the series in question. CAPM provides a consistent risk/reward framework that promotes diversification in the optimisation results.

CAPM

The default calculation for risk and return is to use the most frequent historical time-series data provided by the proxy index as far as as data is available. For instance, arithmetic mean and standard deviation for an asset class using MSCI Europe Large NR EUR as a proxy index could use monthly returns starting in 1999 through the most recent month.

Different securities have different start and end dates, but you can select the start and end dates for historical calculation from the appropriate tab in Estimate.

To set a common time period, do the following:

1. From **Estimates > Arithmetic tab**, expand the **Historical** section at the bottom of the dialogue box.
2. Click **Common Time Period** on the **Toolbar**.

Select the index for your new asset class

3. Under the **Arithmetic** tab, click the **Baseline Settings** tab.

The **Baseline Settings** affect the various arithmetic mean methods. Refer to the screenshot below and the description of the arithmetic mean methods.

☞ **Note:** The same date changes can be applied for **Standard Deviation** and **Correlation**.

The **Correlation** tab also allows users to enter their own correlation matrix. Simply click on a table cell to edit, or copy and paste from Excel by clicking the top-left cell (1.00000) and pasting your Excel data into the **Correlation** table.

Morningstar Direct can also run asset-allocation simulations using users' own estimates for forward-looking risk and return. The **Input Summary** tab lets users enter their own **Arithmetic Mean** and **Standard Deviation** estimates for one or more asset classes. Similar to the **Correlation** table, you can also copy and paste data from Excel directly into the **Estimates** cells.

4. Click **OK** to validate or click the cross in the top-right corner of the **Estimates** dialogue box to cancel.

We want to compare the current Efficient Frontier with another one without constraints.

To remove constraints, do the following:

1. From the **Input Workspace** tab, click **Constraints** on the **Toolbar**.
2. Under **Min Holding**, set all values to **0**.
3. Under **Max Holding**, set all values to **100**.
4. Click **OK**.
5. Click the **Gear** icon in the top-left corner of the **Morningstar Asset Allocation** window.
6. Click **Save Inputs as**. The **Save Input File As** dialogue box opens.
7. In the **Name** field, type **Input B** and click **OK**.
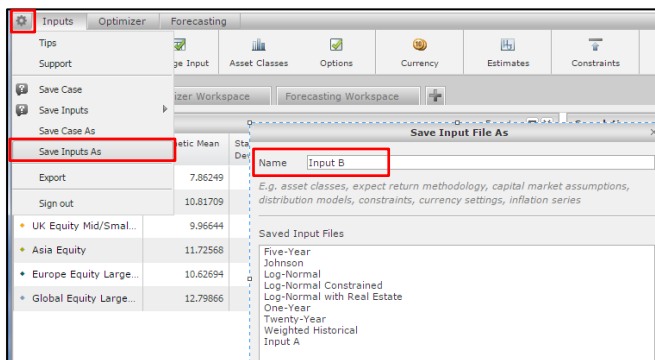
You will be prompted to save the case file to link the new input file to it.
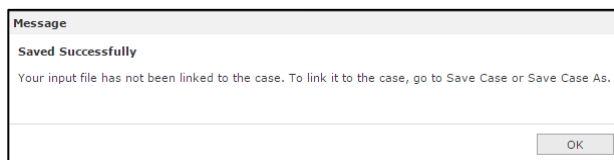
The next prompt asks whether you want to add the input file to the current case file > click **Yes**.
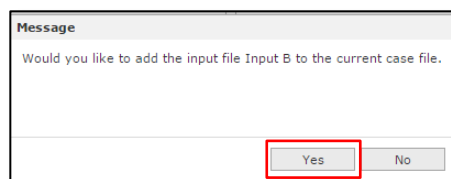
The new Input file has been added to the case file. To see Input B, do the following:

1. In the top-left corner of the **Morningstar Asset Allocation** window, select **Input B** from the **Active Input** drop-down menu.
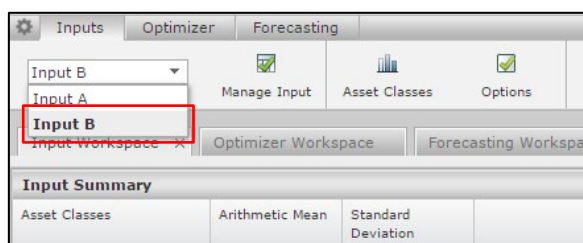
Select **Input B** from the menu

2. Click the **Optimiser** tab.
3. Click **Run Simulation** on the **Toolbar**.
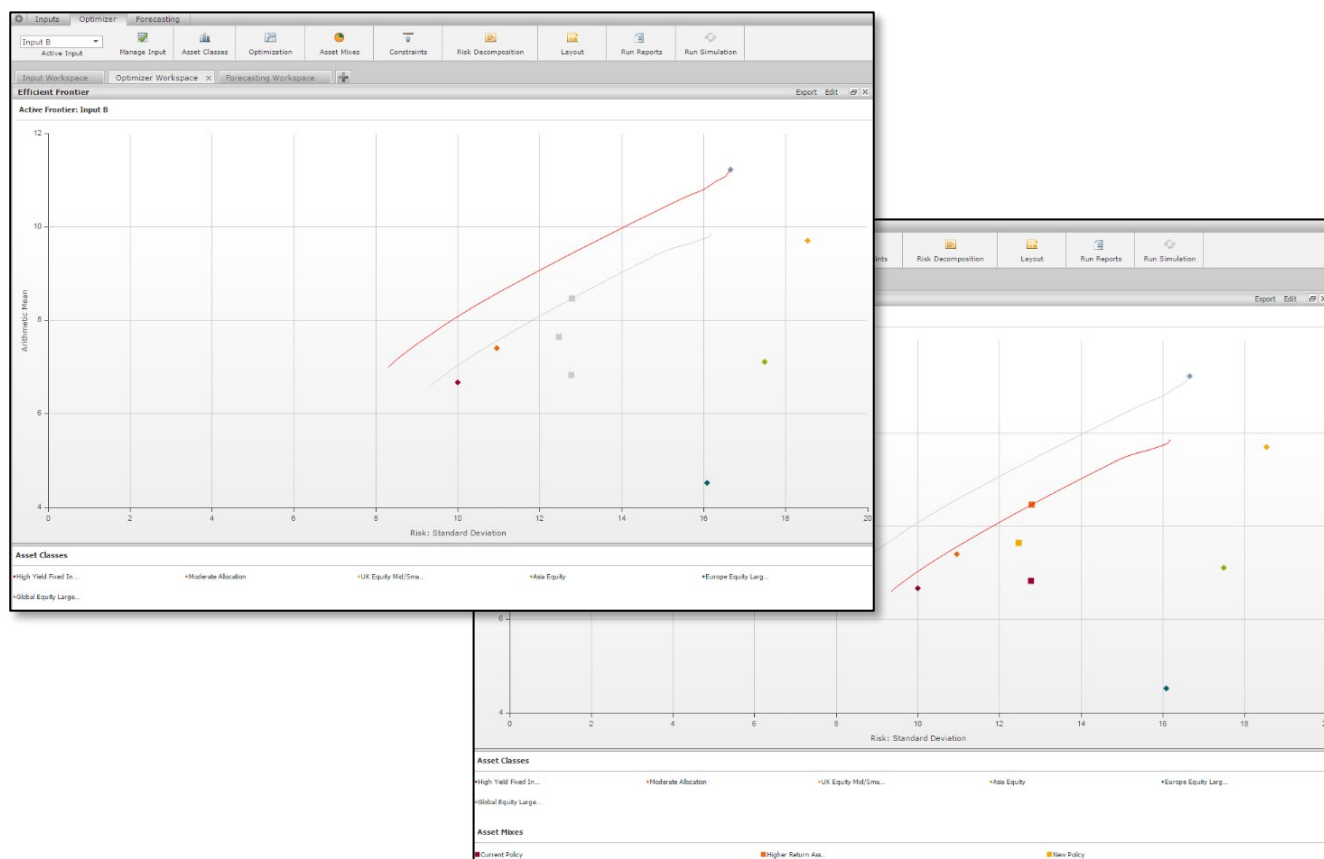
You can now toggle between both Efficient Frontiers, create various Asset Mixes and compare
the results.

Changing the currency of an asset class takes the return stream of the proxy and adds the currency risk of funding an investment in that proxy from another currency.

Appendix C: Currency: Converting vs. Hedging

For example, imagine as a European investor that you want to invest in a US Dollar-denominated series:

▶ You would have to first sell Euros to get US Dollars to invest.
▶ Then you would at some point sell out of the investment and trade the US Dollars to receive Euros.

Any change in the Spot rate between when you bought the investment and sold it would change your return in Euro terms.

By converting a US Dollar-denominated proxy series to Euros, you would be getting a more accurate reflection of the behaviour of that asset class for someone investing in it in Euros.

Another way to say this is that when you convert, you are converting the return stream into a different currency. This converted return stream will reflect the impact of the exchange rate fluctuation.

For instance, as a European-based investor, you would assume that the returns you achieve in a US Dollar-denominated asset will be adjusted for changes in the €/$ exchange rate. This is a simple, realistic scenario. This means you are not hedging; you are experiencing all the currency fluctuations.

Convert means you are not hedging, and you are experiencing all the currency fluctuations. You are converting the return stream into a different currency. This converted return stream will reflect the impact of the exchange rate fluctuation.

For instance, as a European-based investor, you would assume that the returns you achieve in a US Dollar-denominated asset will be adjusted for changes in the €/$ exchange rate. This is a simple, realistic scenario.

Hedge assumes you reduce your exposure to exchange rate fluctuations by hedging. This choice reflects historical prices of actual forward contracts in the currency markets that you could have used to mitigate exchange rate fluctuations. The higher the % chosen, the less exchange rate fluctuations you are experiencing.

Selecting **Hedge** and setting **hedge %** to **0** is the same thing as using **Convert**. The returns stream of those two methods should match exactly.

What problems does resampling address?   **Appending D: Resampling**

Resampling is a combination of the traditional Mean Variance Optimisation and Monte Carlo Simulations. It recognises that Capital Market Assumptions are forecasts and not a "sure thing". Traditional Mean Variance Optimisation produces results that can change wildly with small changes in the Capital Market Assumptions. It also tends to produce results that are not well diversified.

The resampled efficient frontier averages the optimal results under many different sets of Capital Market Assumptions that are similar to the original and thus produces more diversified and robust portfolios – hence, asset allocations that remain more stable over time.

How does resampling work?

Resampling runs a Monte Carlo simulation to produce a series of returns from the original input assumptions.

Because this series of returns is fairly short when the arithmetic mean, standard deviation and correlations are calculated from these returns, they don't exactly match the original assumption.

This set of similar asset class assumptions are then optimised with MVO. We do this a few hundred times and then take all the optimal asset mixes from these similar frontiers and plot them back on the original efficient frontier graph according to the original input assumption.

We then average all the asset mix weights over a small range of standard deviation to produce a resampled optimal asset mix.

These asset mixes are then joined through interpolation to create a frontier.

This averaging of asset mixes that come from a range of plausible future realised capital market assumptions produces asset mixes that do well on average across all the plausible outcomes. You can only use resampling with MVO.

Resampling produces more diversified and robust portfolios where it recognises that Capital Market Assumptions are forecasts and not a "sure thing". Therefore, there is no certainty to lead to highly concentrated portfolios. If you activate resampling from here, you will resample the efficient frontier without impacting the current and target allocations.