



Nested portfolios in FIA

Andrew Colin

Flametree Technologies

August 2024

INTRODUCTION

A subportfolio is defined as a portfolio that is held, in part or entirely, by a different portfolio.

Subportfolios can be used to model the following situations:

- A managed fund holds a fraction of a unit trust, and the manager needs an attribution report on the composite fund.
- A benchmark is made up of several sub-benchmarks.
- A small group of securities is to be split out from a main portfolio (a carveout) and monitored.
- A synthetic instrument is set up as a group of other instruments, but the manager wants to treat the synthetic instrument as a discrete entity in its own right.

All these cases can be modelled quickly and easily using FIA's subportfolio capabilities.

GETTING STARTED

To set up a nested portfolio, the following data is required in the weight and returns file:

- Weights and returns data for each portfolio. Each portfolio must include at least one placeholder record for the very first day in the calculation interval.
- Portfolio structure data, in which subportfolio holdings are shown as holdings in a top-level portfolio.

Structure holdings are treated in the same way as portfolio holdings, except that the security code is replaced by the name of another portfolio. This portfolio need not be defined in the security master file, but should refer to another portfolio in the holdings data. Further, the holdings must define a nested portfolio structure with a single root node.

This sounds more complex than it actually is, so here is an example.

EXAMPLE

Set up two portfolios, Subfund1 and Subfund2. The weights and returns files look as follows:

SUBFUND1

Date	Portfolio	Security	Weight	R_base	R_local
02-Aug-24	SUBFUND1	SecA			
31-Aug-24	SUBFUND1	SecA	1	0.1	0.1
31-Aug-24	SUBFUND1	SecB	1	0.1	0.1



The calculation interval runs from 2-Aug-24 to 31-Aug-24.

Subfund1 holds two securities with ID codes SecA and SecB, each with a weight of 50% and a return of 10%. The overall portfolio return is therefore 10%.

A weight (column 4), base return (column 5) and local return (column 6) are supplied for all securities at the end of each calculation interval.

To set the start date of the interval, a single additional record is required that contains the start date and the name of a security in the portfolio. For this record only, the weight and returns fields can be left blank. If any values are supplied in these fields, they will be ignored.

SUBFUND2

Date	Portfolio	Security	Weight	R_base	R_local
02-Aug-24	SUBFUND2	SecC			
31-Aug-24	SUBFUND2	SecC	0.5	0.2	0.2
31-Aug-24	SUBFUND2	SecD	0.5	0.2	0.2

Subfund 2 has the same structure as Subfund 1. Its overall return is 20%.

AGGREGATED PORTFOLIO

To analyse both portfolios at the same time, create a new file with the contents of both the above tables, and add the following four lines:

Date	Portfolio	Security	Weight	R_base	R_local
02-Aug-24	NESTED_FUND	SUBFUND1			
02-Aug-24	NESTED_FUND	SUBFUND2			
31-Aug-24	NESTED_FUND	SUBFUND1	0.5		
31-Aug-24	NESTED_FUND	SUBFUND2	0.5		

These holdings set up a new portfolio called NESTED_FUND, composed of 50% of Subfund1, and 50% of Subfund2. For these records, the value in the 'Security' column must be the name of another portfolio in the same file. In other words, each record represents a holding in a subportfolio, rather than in an individual security. The subportfolio does not have to be set up as a security in its own right in the security master file.

Relative holdings are shown in the 'Weight' column (4). Since these records are only used for relative weights, only the weight column is used, so the returns columns can be left blank.

In the same way as for portfolio data, an entry must be provided showing the beginning date for the calculation interval. This record must be specified for all subportfolios held, but weights and returns columns can be left blank.



The final file will look as follows¹:

Date	Portfolio	Security	Weight	R_base	R_local
02-Aug-04	SUBFUND1	SecA			
31-Aug-04	SUBFUND1	SecA	0.5	0.1	0.1
31-Aug-04	SUBFUND1	SecB	0.5	0.1	0.1
02-Aug-04	SUBFUND2	SecC			
31-Aug-04	SUBFUND2	SecC	0.5	0.2	0.2
31-Aug-04	SUBFUND2	SecD	0.5	0.2	0.2
02-Aug-04	NESTED_FUND	SUBFUND1			
02-Aug-04	NESTED_FUND	SUBFUND2			
31-Aug-04	NESTED_FUND	SUBFUND1	0.5		
31-Aug-04	NESTED_FUND	SUBFUND2	0.5		

A security master file is defined as follows:

Security ID	Security name	Sectors	Effective date	Pricing function	Risk functions	Credit rating	Effective exposure	Currency
SecA	SecA			FT_CASH				AUD
SecB	SecB			FT_CASH				AUD
SecC	SecC			FT_CASH				AUD
SecD	SecD			FT_CASH				AUD

The configuration settings are relatively simple. Assuming the returns file is called **nested_p.csv** and the security master file **nested_s.csv**, use

[FIA]

PortfolioFile=nested_p.csv

SecurityFile=nested_s.csv

XLReport=1

FileHeaders=1

DateFormat=%d-%b-%y

ReportSectors=Portfolio,Security| columns=AA,EE_W,R

ReportDirectory=.\

BatchID=0

¹ At present, there is no facility to generate this file by linking different portfolio files together at runtime, but we may introduce this option in future if there is sufficient user demand.



The only point to note here is the value of **ReportSectors**. Here the first sector selected is 'Portfolio'. By using this setting, we tell FIA to decompose the portfolio into its various subportfolios by name, as well as by any subsectors.

With these settings, FIA generates an interactive report that looks as follows:

Sectors	Weight	EE weight	Total return
PORTFOLIO/SECURITY	Portfolio	Portfolio	Portfolio
SecA	25.0000%	25.0000%	10.0000%
SecB	25.0000%	25.0000%	10.0000%
SUBFUND1/NESTED_FUND	50.0000%	50.0000%	10.0000%
SecC	25.0000%	25.0000%	20.0000%
SecD	25.0000%	25.0000%	20.0000%
SUBFUND2/NESTED_FUND	50.0000%	50.0000%	20.0000%
SUMMARY	100.0000%	100.0000%	15.0000%

The lines headed 'SUBFUND1/NESTED FUND' and 'SUBFUND2/NESTED FUND' contain the aggregated weights and returns for each subportfolio, as required.

If we omit PORTFOLIO from the ReportSettings string, the interactive report looks as follows:

Sectors	Weight	EE weight	Total return
SECURITY	Portfolio	Portfolio	Portfolio
SecA	25.0000%	25.0000%	10.0000%
SecB	25.0000%	25.0000%	10.0000%
SecC	25.0000%	25.0000%	20.0000%
SecD	25.0000%	25.0000%	20.0000%
SUMMARY	100.0000%	100.0000%	15.0000%

Here, there is no decomposition into subportfolios, and holdings still reflect the relative weights assigned to subportfolios and individual securities.

OVERLAPPING SECURITIES

Suppose the same security is present in two subportfolios. For instance, here we have replaced SecD by SecB in Subfund2.

If the main portfolio is decomposed by subportfolio, then SecB will appear in both subportfolios:

Sectors	Weight	EE weight	Total return
PORTFOLIO/SECURITY	Portfolio	Portfolio	Portfolio
SecA	25.0000%	25.0000%	10.0000%
SecB	25.0000%	25.0000%	10.0000%
SUBFUND1/NESTED_FUND	50.0000%	50.0000%	10.0000%
SecB	25.0000%	25.0000%	20.0000%



SecC	25.0000%	25.0000%	20.0000%
SUBFUND2/NESTED_FUND	50.0000%	50.0000%	20.0000%
SUMMARY	100.0000%	100.0000%	15.0000%

On the other hand, if no subportfolio level decomposition is performed, then all security holdings will be aggregated:

Sectors	Weight	EE weight	Total return
SECURITY	Portfolio	Portfolio	Portfolio
SecA	25.0000%	25.0000%	10.0000%
SecB	50.0000%	50.0000%	15.0000%
SecC	25.0000%	25.0000%	20.0000%
SUMMARY	100.0000%	100.0000%	15.0000%

GROUPING IN EXCEL

By default, FIA calculates pre-grouped reports in Excel.

When the interactive report is first opened, it looks as follows:

1	2	3	A	B	C	D
1			Interactive report			
2			Portfolio: NESTED_FUND			
3						
4			2-AUG-2004 to 31-AUG-2004			
5						
6			Sectors	Weight	EE weight	Total return
7			PORTFOLIO/SECURITY	Portfolio	Portfolio	Portfolio
14	+		SUMMARY	100.0000%	100.0000%	15.0000%
15						

The user can then use the '+' button at the left of the display, or the row of numbers at the upper left, to drill down into the report. For instance, pressing the plus or the '2' button drills down to the sub-portfolio level:

1	2	3	A	B	C	D
1			Interactive report			
2			Portfolio: NESTED_FUND			
3						
4			2-AUG-2004 to 31-AUG-2004			
5						
6			Sectors	Weight	EE weight	Total return
7			PORTFOLIO/SECURITY	Portfolio	Portfolio	Portfolio
10		+	SUBFUND1/NESTED_FUND	50.0000%	50.0000%	10.0000%
13		+	SUBFUND2/NESTED_FUND	50.0000%	50.0000%	20.0000%
14			SUMMARY	100.0000%	100.0000%	15.0000%
15						

This shows the aggregated weights and returns of each subportfolio in the main portfolio. To drill down to the individual security level, press the '3' button (to open all subportfolios) or the individual '+' buttons (to open individual portfolios):



1	2	3	A	B	C	D
1			Interactive report			
2			Portfolio: NESTED_FUND			
3						
4			2-AUG-2004 to 31-AUG-2004			
5						
6			Sectors	Weight	EE weight	Total return
7			PORTFOLIO/SECURITY	Portfolio	Portfolio	Portfolio
8			SecA	25.0000%	25.0000%	10.0000%
9			SecB	25.0000%	25.0000%	10.0000%
10			SUBFUND1/NESTED_FUND	50.0000%	50.0000%	10.0000%
11			SecC	25.0000%	25.0000%	20.0000%
12			SecD	25.0000%	25.0000%	20.0000%
13			SUBFUND2/NESTED_FUND	50.0000%	50.0000%	20.0000%
14			SUMMARY	100.0000%	100.0000%	15.0000%
15						

For more information, search Excel's documentation on grouping.

FURTHER INFORMATION ON NESTED PORTFOLIOS

This has covered the basics of how to set up a nested portfolio. For reasons of space, we have only shown weights and returns in the output, but all other quantities such as risks, market values and exposures, and contributions are aggregated at each summary level in the expected way.

PORTFOLIO TOPOLOGY

Portfolios can be nested in any way required, and FIA can model sub-portfolios of subportfolios. However, if you are using Excel to display results, note that Excel limits drill-down to 8 levels.

Fund topology can change over time, and entire subportfolios can leave or enter the main portfolio. Varying subportfolio holdings at different dates are also supported.

FIA enforces some constraints on how subportfolios are modelled:

- A portfolio can only have one root portfolio. In practice, this also means that all links in a portfolio must be matched; there can be no orphan portfolios.
- Circular links in the portfolio structure are not allowed. Portfolio A cannot own a part of portfolio B, which in turn owns part of portfolio A.

Both these conditions are verified at runtime, and FIA will close with an error if either is detected.

SUBPORTFOLIO WEIGHTS

Subportfolio weights do not have to lie between 0 and 1. Just as for portfolio weights, they can be assigned any value. However, weights will then be normalised as for single portfolios.