FIVE
ROBUST Index

Machine intelligence
for your portfolio

Innovating optimal portfolio allocation

1 | **Retirement savings goal:** wealth accumulation and preservation

2 | **Requirement:** a robust foundation for portfolio composition

3 | **Time to update:** current standard dates from the 1960s

4 | **Clarity:** advances in technology enable cutting-edge approaches with real practical usability

FIVE | The natural next step: **machine learning and financial network analytics in portfolio management**

WHAT are your benefits? FIVE ROBUST Multi Asset Index

Investment decisions based on a data-driven and systematic information process:

– **drop** assumptions

– **anticipate** risk

– **uncover** hidden relationships

Less vulnerable portfolios.

More tangible diversification benefits.

For further information please contact us for our research note "Towards robust portfolios" or go to **http://www.munichre.com/five**

WHY should you RE-think optimal portfolio allocation?

Allocation can make the difference

Let's take the case of equal weighting. This is often straightforward and suitable when applied within a single asset class. There, risk profiles and dependencies between the assets are rather similar and stable.

This changes in a multi asset context, as risk profiles and interdependencies can be more varied. In certain scenarios, fixed asset class weights can work out well, but is this enough to cope with potential regime shifts?
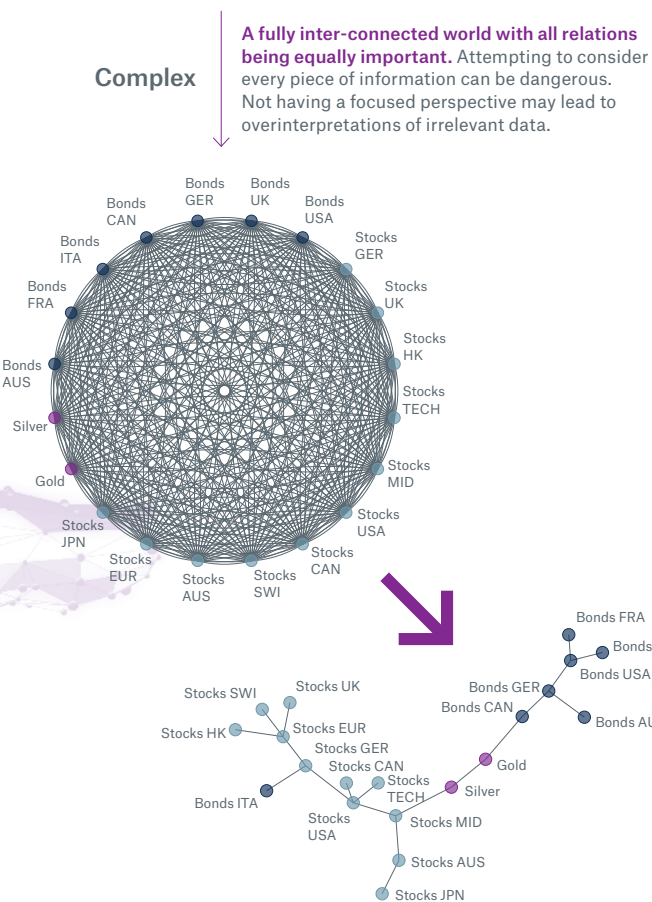
Robust and reliable

Estimating future risk profiles and asset inter-action is one important step of the allocation process. In current standard methods, small changes in the input estimates can have a significant impact on the resulting asset weights. Increased dynamic in financial markets may then lead to portfolio instability. This often occurs in the undesirable moments – when diversification is needed most. This can be costly for investors. FIVE ROBUST addresses this directly.

In the balanced sweet spot

Complex concepts such as minimum variance tend to generate unstable or unbalanced weights for selected assets, while simpler approaches often disregard asset interdependencies. Improved and more intuitive solutions can be achieved by incorporating machine learning and financial network analysis.

HOW can we reveal hidden information?

Financial market data is noisy, complex and has time-varying relationships. Modern methods allow to extract essential patterns.

Complex

A fully inter-connected world with all relations being equally important. Attempting to consider every piece of information can be dangerous. Not having a focused perspective may lead to overinterpretations of irrelevant data.

Filtering the relevant dependencies becomes possible with machine learning and graph theory. This approach allows for a better segmentation of assets into stable subsets, thus paving the way for a more robust allocation.

Focused

Foundation and rationale

The FIVE ROBUST approach strives to be more realistic

Financial markets are complex. Viewing them as a network of different parts that are highly inter-connected can be an important step towards more realistic representation and effective risk management.

The key point is incorporating a hierarchical structure. Hierarchy is a pervasive phenomenon in our world: elements are nested inside of subsystems which in turn form part of larger systems, and so on. An asset's position in the network and the degree of connectivity become relevant items.

How does new information spread in the asset uni-verse? What is the most likely path for shock waves? Which assets will be hurt most? While a crystal ball is yet to be found, answers to these questions become more resilient, realistic and explicable using machine learning and graph theory methods.
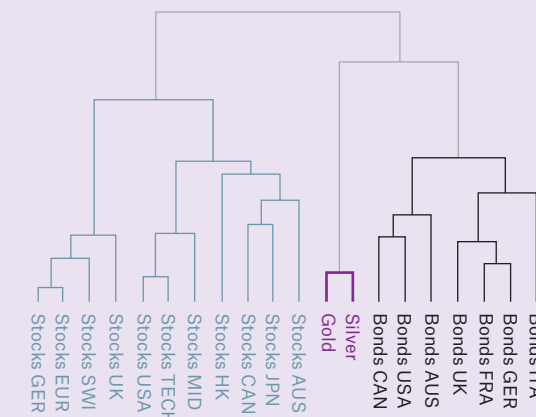
Hierarchies are everywhere

Each level is interconnected and interdependent with the others

Local	Social group	Sector
Business is part of a local economy	People of a social group	Stocks belong to an industry sector
National	Society	National
Which is part of a national economy	Social groups form societies	Which is part of a country's equities
Global	Humanity	World
Which in turn is part of a global economy	Societies form humanity	Which in turn belong to global equities
Economy	**Society**	**Equities**

Markets are and have always been a complex network of information flow.

Today, advanced data analytics can help to better understand this network and its effects.

ROBUST hierarchies for better-informed investment decisions

The above dendrogram ("tree structure") is the tool to visualize hierarchical clusters and derive asset weights. This and other methods are part of the monthly FIVE ROBUST rebalancing process, contributing to a solid investment decision.

"Hierarchy, I shall argue, is one of the central structural schemes that the architect of complexity uses."

Herbert A. Simon (pioneer in AI, information processing and complex systems. Nobel Prize in Economics, 1978)

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NOT IF, BUT HOW