

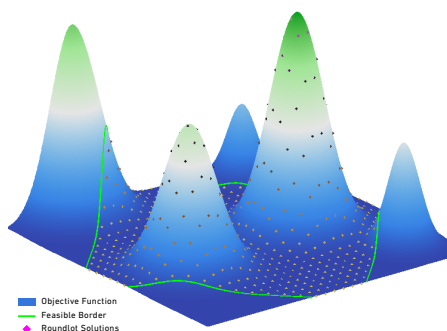
# MSCI Open Optimizer

▶ MSCI Open Optimizer is an open, flexible optimization library, specifically designed to help solve portfolio management challenges.

Its algorithms utilize multiple optimization engines from MSCI and 3rd parties to create index tracking portfolios, manage asset allocation, implement tax-aware strategies, and other objectives of portfolio managers.

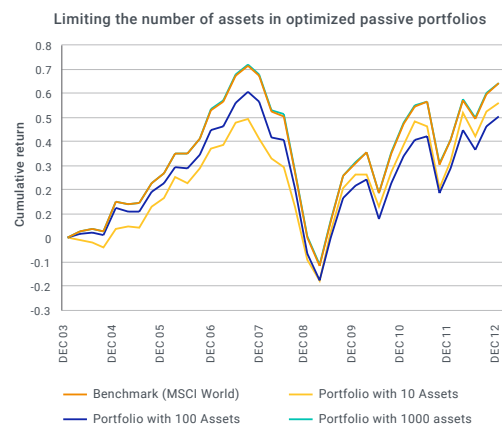
## Key benefits

- **Built for Portfolio Management** – The solver’s extensive feature set empower portfolio managers with economically meaningful results. It incorporates proprietary solvers developed by MSCI’s optimization research team and solvers created by leading optimization experts.
- **Continuous Innovation** – MSCI continues to support client needs as the investment landscape grows increasingly complex by delivering innovative white papers on optimization.
- **Flexible Integration** – An intuitive programming API, available in **C++, Java™, C#, and Python™**, provides easy integration with most libraries within statistical tools such as **MATLAB™, and R**. In addition, an **XML and Protobuf** interface allows flexible creation and management of optimization data and parameters regardless of programming language.
- **Investable Optimal Portfolios** – MSCI Open Optimizer moves beyond mean-variance optimization through support for advanced mandates and alternative portfolio construction techniques.



Constraint-aware roundlotting ensures the portfolio rules are satisfied while creating round lots and include threshold constraints. Other features include **risk parity portfolio construction** (also known as equal risk weighting) and **transaction cost control** through fixed costs, thresholds, and maximums on the number of names.

- **Transparency in Optimization** – By providing constraint shadow costs reports, solution introspection, and frontier analysis MSCI Open Optimizer provides users with more transparency and intuition around optimization results.
- **Industry Acceptance** – MSCI Optimizer engine powers Barra Aegis, BarraOne, and Barra PortfolioManager, which are used by a wide range of institutional investors. MSCI Open Optimizer features **direct and easy consumption of Models Direct files**, reducing onboarding and support costs. The MSCI Optimizer is used in the construction of many MSCI Indexes including the MSCI Global Minimum Volatility Indexes.



## Key features

- Comprehensive portfolio construction control for constraints and objectives
- **Risk parity** portfolio construction
- Minimize small trades or positions with precise control on **thresholds**
- **Set a maximum on the number of assets** help at portfolio or at a group level
- Enforce trades to round lots either during or after optimization
- Penalize the residual alpha in optimization to **correct alpha and risk factor misalignment**
- Limit the number of trades/longs/shorts/buys/sells
- **Apply fixed transaction** costs per trade in addition to piecewise-linear and non-linear transaction costs, specific to each asset
- **Enhance long/short optimization** with new leverage constraints, roundlotting, additional paring constraints, and non-convex risk constraints
- Add multiple risk terms to the objective function
- Prioritize soft bounds and constraints **to increase likelihood of feasibility**
- Control the optimality tolerance
- **Maximize the information ratio** and/or Sharpe ratio
- **Multiple-Period Optimization** to obtain a set of optimal portfolios for each of the specified periods
- **Multiple-Account Optimization** to simultaneously optimize several accounts and control not only the individual account constraints but also asset exposure, trade size and turnover of all accounts

## Long-Short Hedging Basket Creation

- Constraints on leverage for longs, shorts, and turnover that can be *defined independently by side*
- Lower bounds on long or short groups even when the problem becomes non-convex

## Tax-Aware Optimization

- Bounds on long- and short-term gross gains or losses for tax arbitrage
- Tax lotting, with FIFO, LIFO, and FIFO trading rules
- Multiple options for handling wash sales

## Asset Allocation

- Risk parity portfolio construction
- Includes futures, ETFs, currencies, and other alternative assets

## Technical Highlights

- APIs are available in C#, C++, Java™, and Python™
- Library can be incorporated into statistical packages of MATLAB™, and R with examples included
- XML and Protobuf interface for problem creation or maintenance
- Package is available for 64-bit machines running Microsoft Windows® and Linux® environments
- Multiple thread-safe for use in distributed grid computing
- Complete package includes programmers' references, tutorials, and working sample code for all supported development languages
- MSCI Open Optimizer has minimal baseline system requirements

## About MSCI

MSCI is a leading provider of critical decision support tools and services for the global investment community. With over 50 years of expertise in research, data and technology, we power better investment decisions by enabling clients to understand and analyze key drivers of risk and return and confidently build more effective portfolios. We create industry-leading research-enhanced solutions that clients use to gain insight into and improve transparency across the investment process.

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