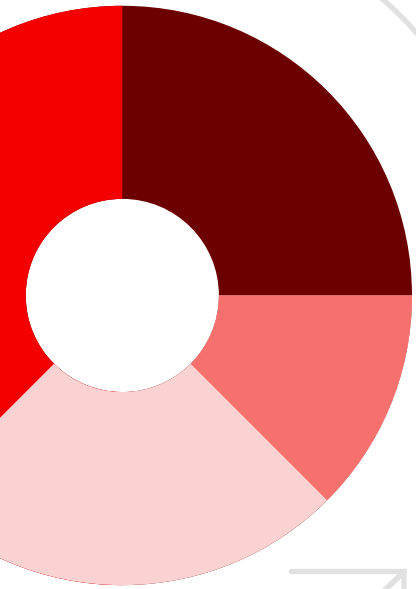
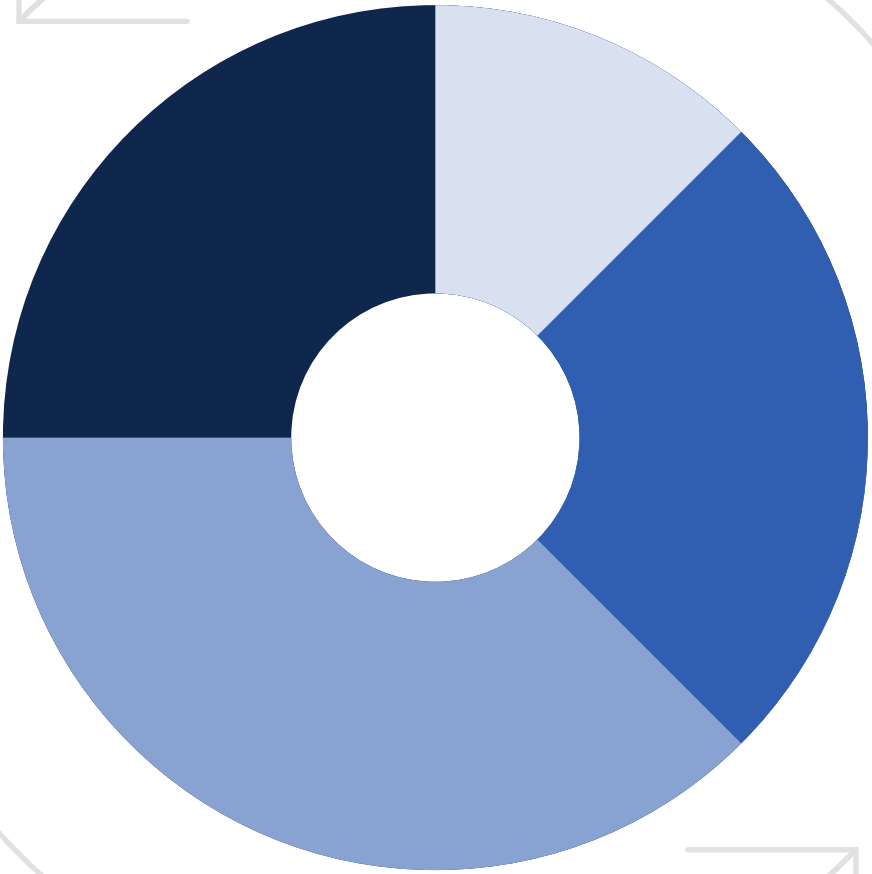
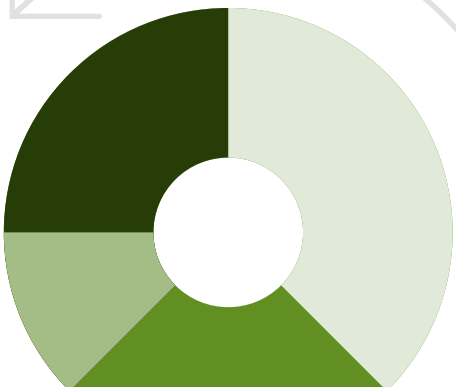
MORNINGSTAR®

Building and Backtesting Investment Models Efficiently with Analytics Lab







Cut Through the Noise

Predicting the future accurately is impossible, but identifying trends can help get you close. Precise model building and backtesting hold the power to transform asset management, and it can be done more easily than ever with Analytics Lab by Morningstar.

Data scientists face significant challenges, like:

- Accessing quality data
- Keeping models adaptive
- Ensuring thorough validation
- Leveraging insight strategically

Analytics Lab takes these challenges and transforms this process through its extensive financial data, integrated analytical tools, collaborative environment, and scalable infrastructure. Instead of slogging through data manually, Analytics Lab cuts through the noise by combining access to all Morningstar data and research with JupyterLab, allowing for rigorous investment analysis using Python. The result: enhanced, data-driven investment decisions.

The Crucial Role of Building and Backtesting Investment Models

Looking at the past can help decode the future. While a completely accurate prediction is practically impossible, seeing how specific choices played out in the past, and how a different choice could have gone differently, can help refine decision making. It just takes the right model built on the right data.

When done properly, building and backtesting investment models creates strategic benefits both internally and externally, including:

Evidence-Driven Decision Making: Backtesting on historical data enables data-driven decisions aligned to client risk appetite, market trends, and portfolio optimization needs. Firms can stress test strategies and assess performance under different conditions.

Risk Management and Compliance: Thoroughly validated models help firms manage risks effectively and comply with reporting regulations through scenario analysis, value-at-risk calculations, and performance measurement.

Client Customization: Granular testing allows asset managers to create personalized portfolios and wealth plans tailored to each investor's financial objectives, risk tolerance, and preferences.

Innovation and Competitiveness: Firms that continuously refine techniques and adopt new data types gain an edge. For instance, alternative data on consumer sentiment or supply chains can inform stock selection models.

Adaptability to Change: Recalibrating models by backtesting on recent data allows strategies to respond to shifting correlations, volatility, and market impacts of events. This ensures relevance amid fluid macro dynamics.

Addressing the Core Challenges with Analytics Lab

While crucial, building and validating models pose vexing hurdles in accessing accurate data, adapting to change, and infrastructure constraints. Analytics Lab simplifies the process:

Data Access and Quality

Analytics Lab, fueled by the morningstar_data Python package, is a dynamic platform that grants users near real-time access to an extensive collection of financial datasets, spanning funds, equities, alternatives, ESG, Thematic, and more. This unique feature empowers data scientists and quantitative analysts to utilize wide-ranging and multifaceted datasets for model creation and verification.

You have access to an extensive collection of data, and now you simply have to use it. But that also means reviewing the datasets you need for accuracy before using it to construct your model, more time spent planning over executing. At least, it used to. The advantage of accessing data through Analytics Lab is that there's less emphasis on evaluating the data required. Because Analytics Lab is built on top Morningstar's data quality control system, you can go straight to building the model.

Adapting Models to Market Changes

Staying agile in changing markets is another challenge Analytics Lab works to solve. By scrutinizing historical data and adjusting their models accordingly, data scientists can ensure that investment strategies remain pertinent and effective even in the face of fluctuating market landscapes. Analytics Lab, with its extensive and reliable financial datasets, facilitates this process. It provides a platform where data scientists can seamlessly build and backtest their models, enabling them to stay responsive to ever-changing market conditions.

Scalability Constraints

Addressing scalability constraints, Analytics Lab provides a robust cloud infrastructure designed to manage extensive data volumes and complex simulations. The platform's scalability ensures that even the most intricate machine learning models and quantitative analyses can be executed efficiently, without the limitations often encountered in traditional computing environments.

Ready to dive into Analytics Lab?
Claim your free trial here.

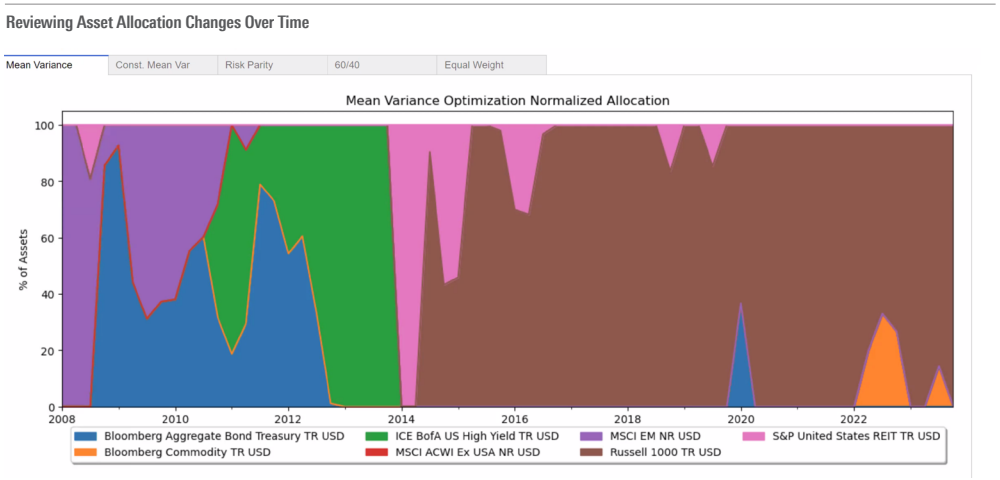
This flexibility is crucial for data scientists and quants who require the agility to scale their computational resources up or down based on the complexity of their projects. Whether it's deploying advanced machine learning algorithms or handling large-scale data sets for comprehensive backtesting, Analytics Lab's infrastructure is built to support the most demanding analytical tasks, ensuring seamless and uninterrupted workflow for its users.

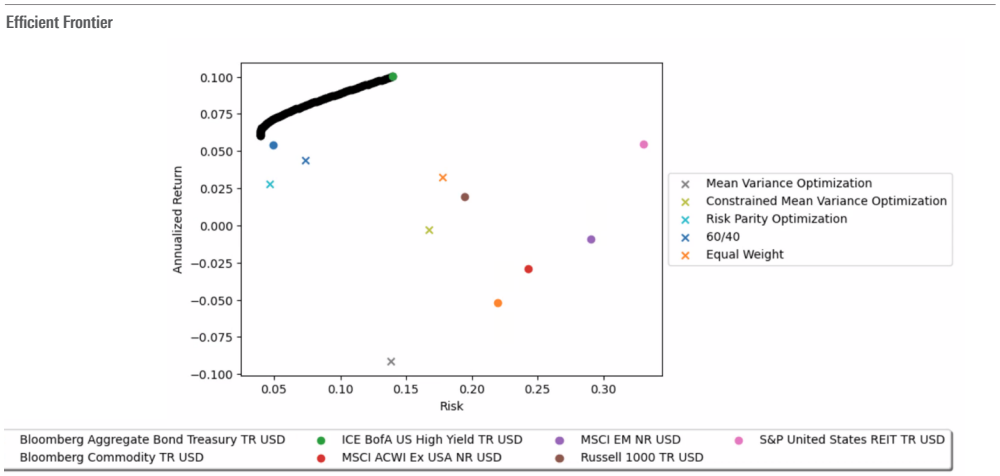
Building and Backtesting Models in Analytics Lab: 5 Critical Use-Cases

1. Portfolio Optimization and Asset Allocation

Advanced Techniques and Tools: Analytics Lab excels in portfolio optimization, facilitating advanced algorithms such as Black-Litterman models or custom optimization solutions. Analytics Lab allows for the exploration of varying levels of risk tolerance and target returns, factoring in real-world constraints like transaction costs or liquidity considerations. Users can leverage Python's vast ecosystem, including libraries like plotly for interactive charting and altair for declarative statistical visualization, to gain granular insights into portfolio structures.

Interactive Visualizations: The platform enables the creation of interactive visualizations like 3D efficient frontier plots and asset allocation pie charts. These visualizations aid in identifying the optimal asset mix, providing a clear visual representation of risk versus return trade-offs.





Portfolio Optimization

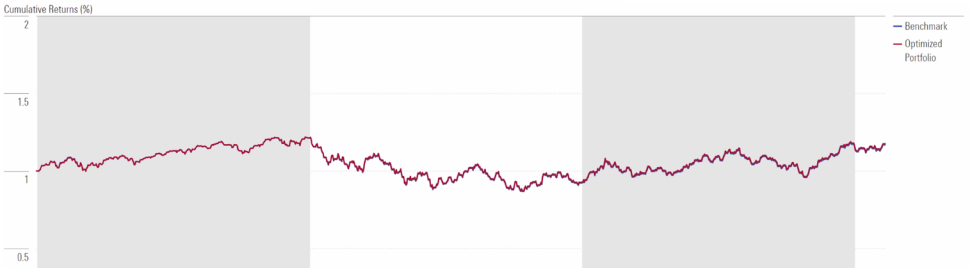
Quick glance at the optimization outcomes and characteristics of the portfolio generated at each rebalance date

Date	Tracking Error ex-ante (%)	Tracking Error ex-post (%)	Turnover (%)	Turnover Parent (%)	Max Sector Deviation (%)	Portfolio Size	Market-Cap Coverage Eligible (%)	Risk Model Miscoverage by Count (%)	Risk Model Miscoverage by Market Value (%)	Running Time (seconds)
2023-12-31	0	0	31.8	31.8	0.0	200	100	0	0	1.85
2023-09-30	0	0	0.7	0.7	0.0	195	100	0	0	1.68
2023-06-30	0	0	1.7	1.7	0.0	195	100	0	0	1.57
2023-03-31	0	0	1.2	1.2	0.0	198	100	0	0	1.84
2022-12-31	0	0	39.0	39.0	0.0	199	100	0	0	1.88
2022-09-30	0	0.03	2.2	2.2	0.0	196	100	0.51	0	1.75
2022-06-30	0	0.07	3.0	3.0	0.0	197	100	0.51	0	1.93
2022-03-31	0	0.12	1.5	1.4	0.0	198	100	0.5	0	1.82
2021-12-31	0	0.42	49.0	49.3	0.0	198	99	1	0	1.69
2021-09-30	0	0	2.6	2.6	0.0	192	100	0	0	1.62

Page 1 of 2 Prev Next Viewing 1 to 10 of 13 Show 10

Daily Cumulative Return

Performance comparison between the chosen index and the optimized portfolio



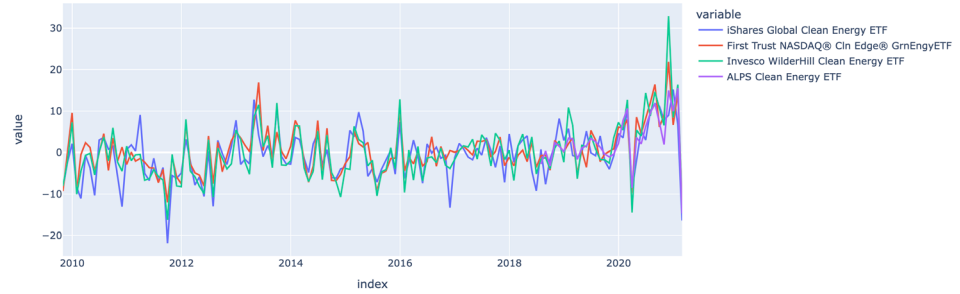
2. Risk-adjusted Performance Measurement

Comprehensive Metric Analysis: Analytics Lab offers a detailed examination of risk-adjusted performance metrics. Users can calculate and analyze Sharpe, Sortino, and information ratios over various timeframes and under different market conditions, providing a nuanced understanding of a portfolio's performance.

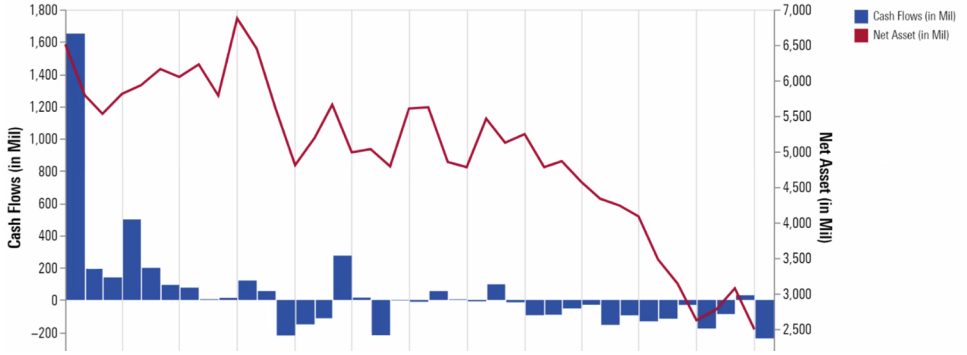
Dynamic Benchmarking: The platform supports dynamic benchmarking, allowing users to compare portfolio performance against a range of indices or custom benchmarks. This feature is particularly valuable for understanding how different investment strategies perform relative to market standards.

Risk-adjusted Performance Measurement

```
import plotly.express as px

us_mkt_index={'TR':'XIUSA0010V',
'PR':'XIUSA0010F',
'NR':'F000010SCA'}

dfExcessReturns=md.direct.get_excess_returns(investments=etfs_with_data['SecId'].tolist()
                                             , benchmark_sec_id=us_mkt_index['NR']
                                             , start_date= '2009-10-31'
                                             , end_date= '2021-02-28'
                                             , freq='monthly'
                                             , currency='USD')

fig = px.line(dfExcessReturns, x=dfExcessReturns.index, y=dfExcessReturns.columns.tolist())
fig.show()
```



Strategy Share Class Assets and Flows



3. Systemic/Quant Investment Strategies

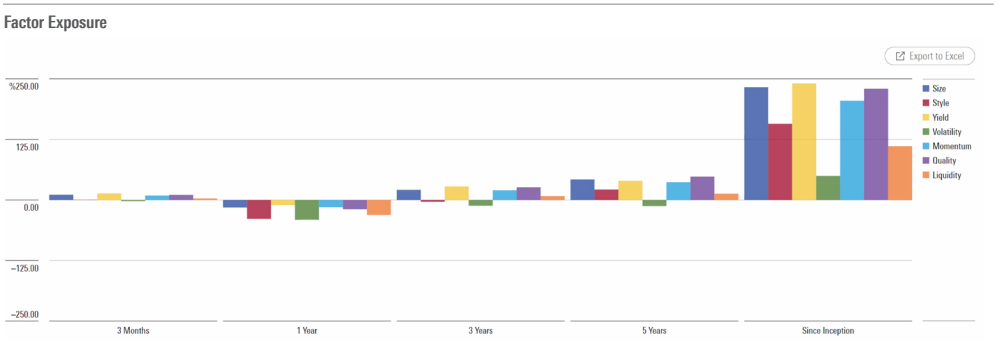
Statistical Model Development: The platform supports the creation of quantitative portfolio models based on statistical and mathematical principles, perfect for identifying and exploiting market inefficiencies or patterns.

Comprehensive Backtesting Capabilities: Analytics Lab offers advanced backtesting tools that allow for testing these trading strategies across different market conditions, thereby validating their effectiveness and adaptability.

4. Factor Analysis and Alpha Generation

Factor Exploration: The platform provides tools for in-depth factor analysis, allowing users to identify and exploit key drivers of returns. Users can examine factors like market capitalization, value, growth, and momentum, using Python libraries for sophisticated statistical analysis.

Custom Model Development: With Analytics Lab, users can develop custom models for alpha generation, testing different factor combinations and investment hypotheses.
The platform's flexibility enables the incorporation of alternative data sources for a more comprehensive market analysis.



Factor Exposure Correlation

6 Months

Export to Excel

Factors	Size	Style	Yield	Volatility	Momentum	Quality	Liquidity
Size	1.00	-0.27	-0.16	0.37	-0.34	-0.30	0.08
Style	-0.27	1.00	-0.32	0.06	-0.01	0.13	0.02
Yield	-0.16	-0.32	1.00	-0.26	0.16	0.17	-0.00
Volatility	0.37	0.06	-0.26	1.00	-0.56	-0.36	0.44
Momentum	-0.34	-0.01	0.16	-0.56	1.00	0.33	-0.25
Quality	-0.30	0.13	0.17	-0.36	0.33	1.00	-0.17
Liquidity	0.08	0.02	-0.00	0.44	-0.25	-0.17	1.00

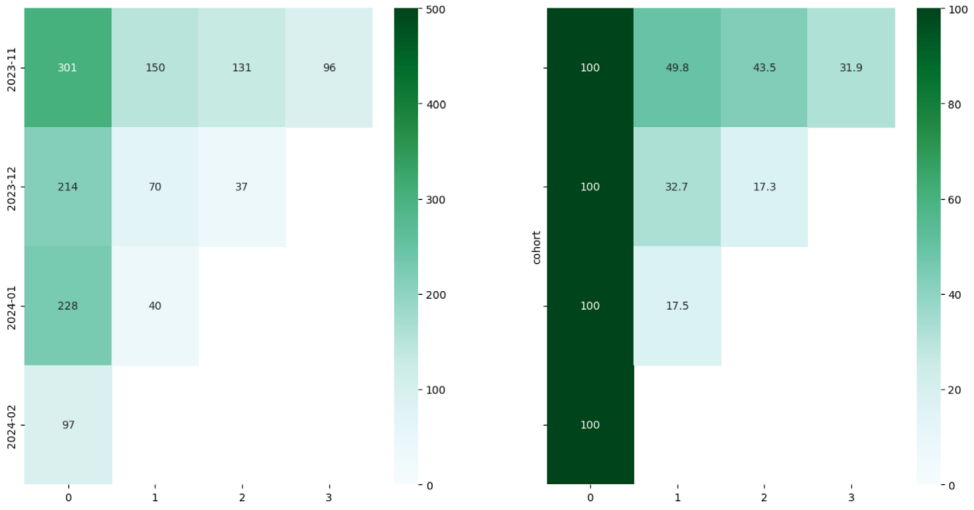
Ready to dive into Analytics Lab?
Claim your free trial here.

5. Multi-Asset Class Modeling

Correlation Analysis: Analytics Lab facilitates advanced correlation analysis between different asset classes. Users can generate correlation matrices and conduct principal component analysis to understand how different asset classes move in relation to each other, crucial for diversification strategies.

Scenario Analysis: The platform supports the creation of complex scenario analyses, simulating how multi-asset portfolios would perform under various market conditions. This feature is essential for stress-testing diversified portfolios and ensuring resilience against market volatility.

Multi-Asset Class Modeling



What's Next?

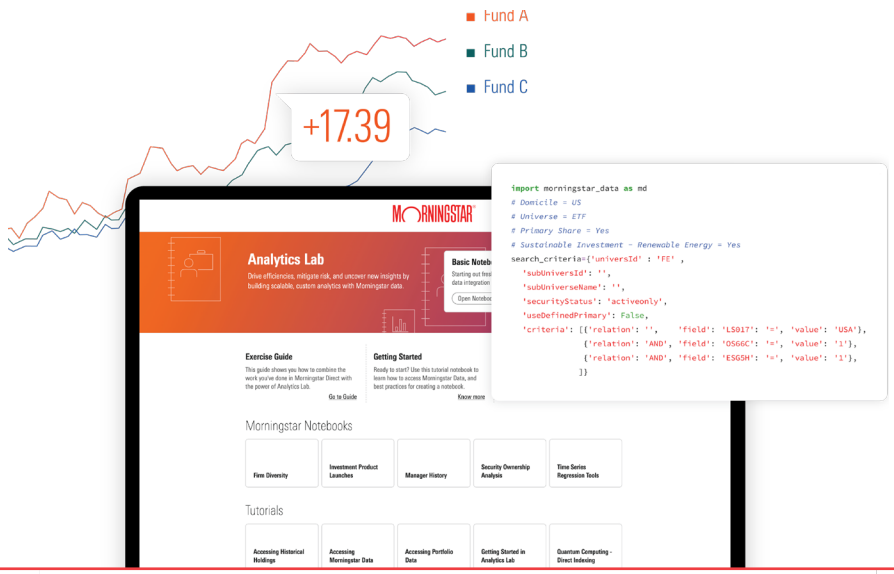
Meeting demands and exceeding expectations in a changing environment is a difficult task, but Analytics Lab can help you make informed decisions for your next move. With a strong platform backed by quality, independent data, you can be prepared for whatever tomorrow brings, one Python script at a time.

Here's what you should do next:

1. Identify your specific challenges—although data scientists generally face challenges of the same categories, no two are same. Make sure you can name your specific challenges.

2. Audit your systems—Look at where there are gaps in your systems or areas of opportunity for improvement.

3. Explore more about Analytics Lab—Talk with us more about how Analytics Lab can meet your needs and take on your challenges.



See how Analytics Lab can help you build custom analytics using Morningstar data. Sign up for a free trial.