

NEEDS-BASED ALLOCATION: A NEW PLATFORM FOR PORTFOLIO CONSTRUCTION – ONE YEAR LATER

Martin Tarlie

GMO

AGENDA

1. Conceptual overview
2. Needs-Based Allocation: the basic concept
3. NEBO: the platform

**Our vision is to help people achieve financial well-being
by helping financial advisors build better portfolios for all their clients.**

MAIN TAKEAWAYS

NEBO is an asset management platform that redefines risk

1. NEBO melds financial planning and asset management.
2. NEBO enhances human intelligence.
3. NEBO generates better portfolios for your clients.

“What do you need, and when do you need it?”

WHY WE ARE SO OPTIMISTIC ABOUT NEBO

Many of our users are “always questioning their portfolios ...”

*... having **better-designed client portfolios** are their own reward.*

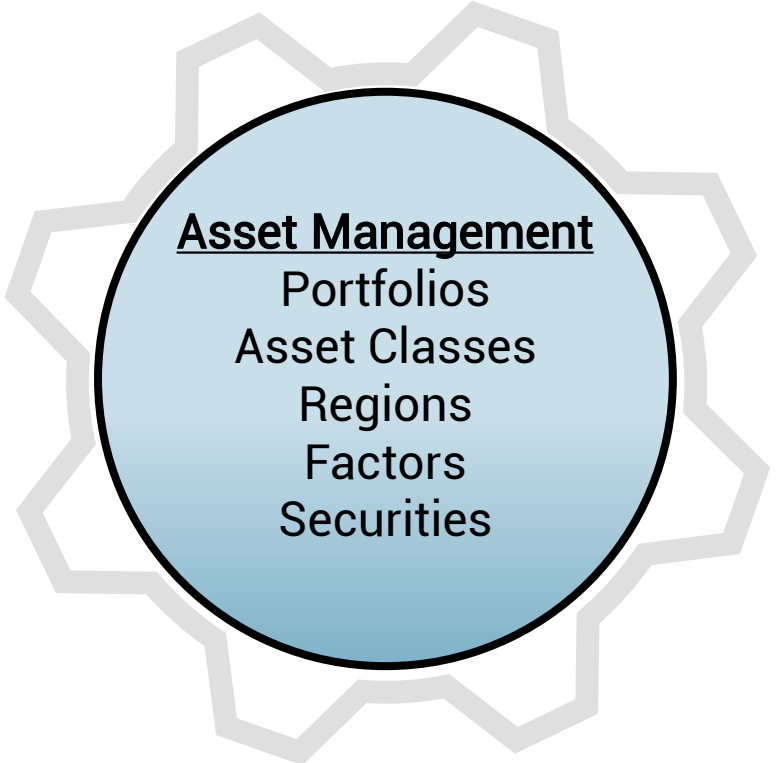
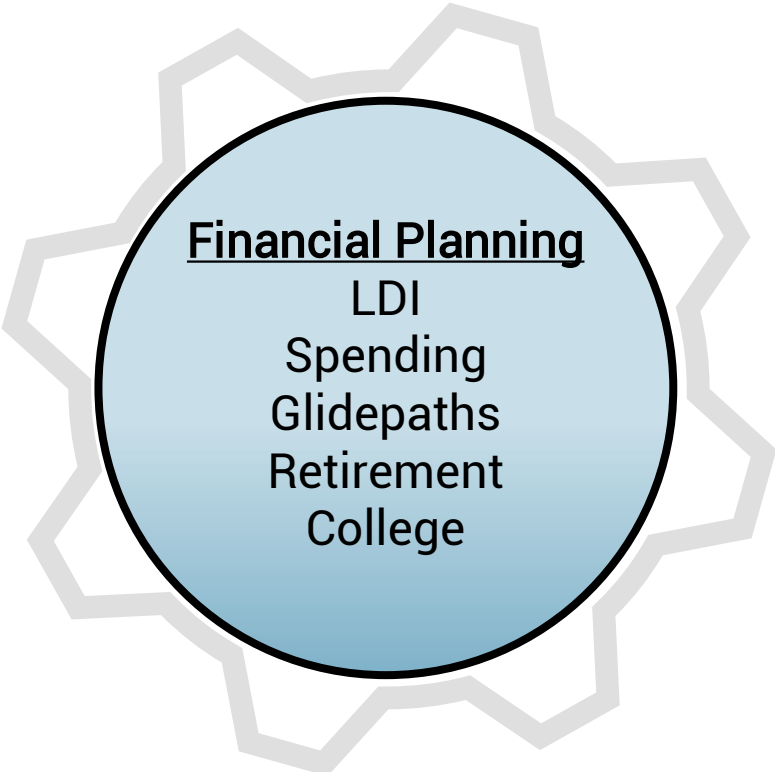
*... Knowing that NEBO is ... **calculating the allocation that seems most likely to succeed**, makes them feel a lot more **confident** that they are doing the right thing for clients.*

*... **It's hard to overstate how valuable that is to the advisor.***

CONCEPTUAL OVERVIEW

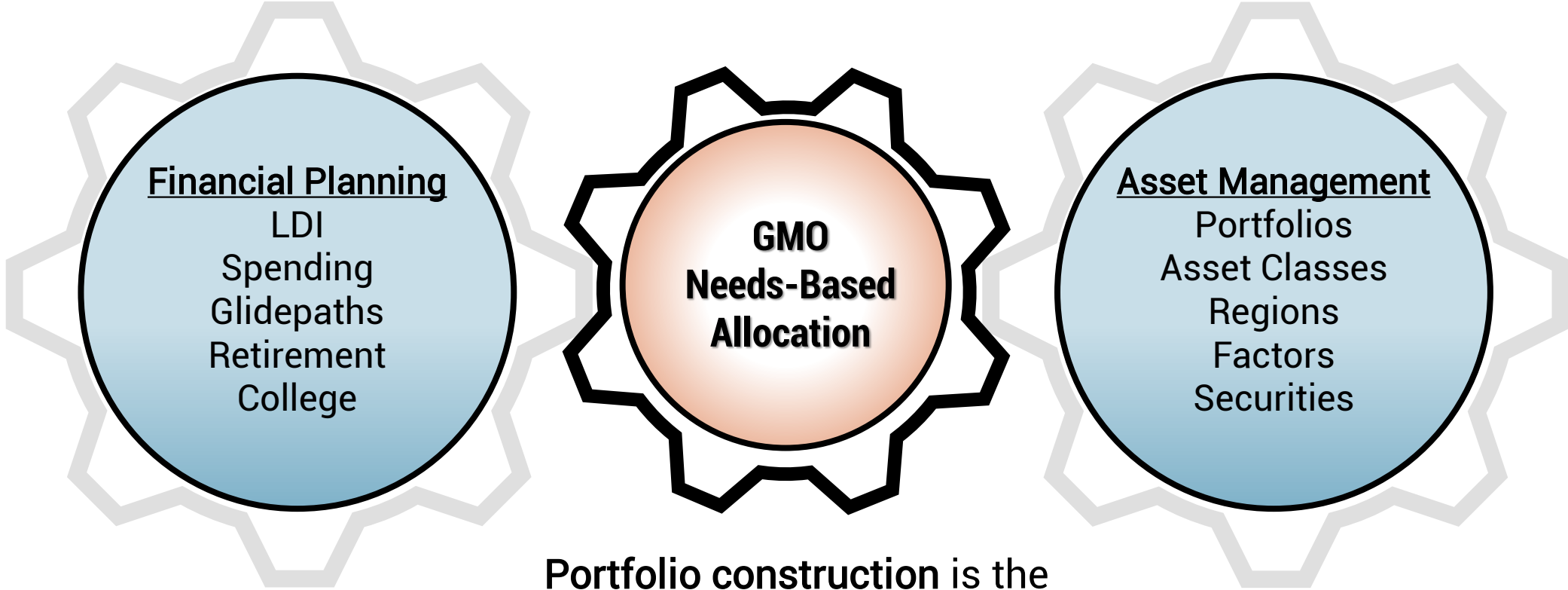
FINANCIAL PLANNING & ASSET MANAGEMENT

Currently...the left hand doesn't talk to the right hand



FINANCIAL PLANNING & ASSET MANAGEMENT

Needs-Based Allocation melds financial planning and asset management



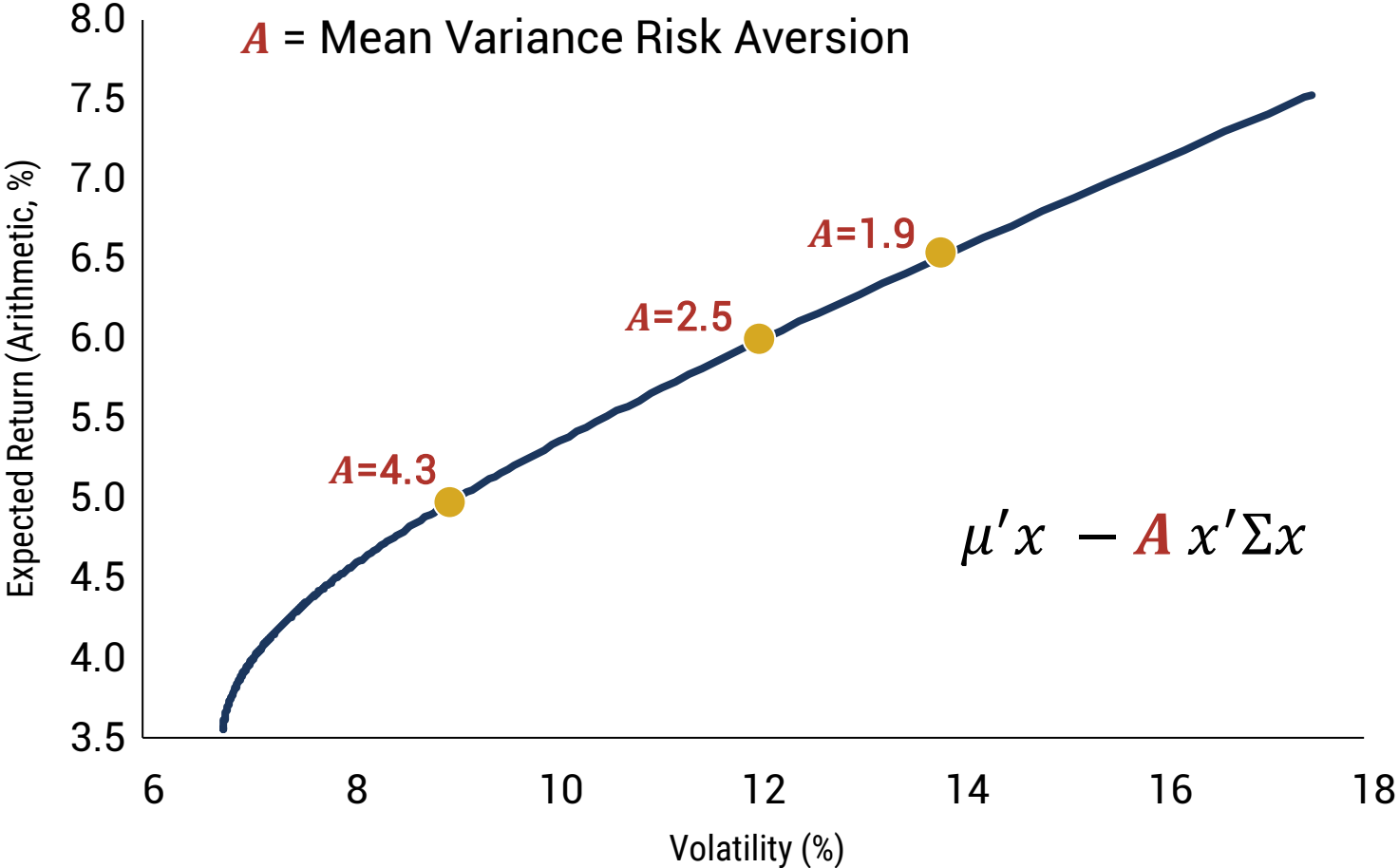
Portfolio construction is the “crucial moment of action.”

If you don't get it right, then nothing else matters.

NEEDS-BASED ALLOCATION: THE BASIC CONCEPT

THE EFFICIENT FRONTIER REVISITED

Horizon and TCR define the appropriate location on the frontier – NOT your risk aversion*



*TCR = "Target Compounding Rate" is the rate at which you need to compound your wealth over the investment horizon
 Efficient frontier generated by a stock-bond portfolio. Expected real returns on stocks and bonds are 6% and 2.5%, and volatilities are 17.5% and 7.8%, with zero correlation. Expected returns are not mean reverting.

NEEDS-BASED ALLOCATION

Redefining risk

Risk = not having what you need, when you need it

1. Risk \neq volatility.
2. Care more about shortfall than surplus.
3. Horizon matters
 - e.g., aging is a continuous life event!

A Case Study in Multiperiod Portfolio Optimization:
A Classic Problem Revisited

Martin B. Tarlie*

Investment Horizon and Portfolio Selection

Martin B. Tarlie*

GMO

WHITE PAPER

April 2014

Investing for Retirement:
The Defined Contribution Challenge

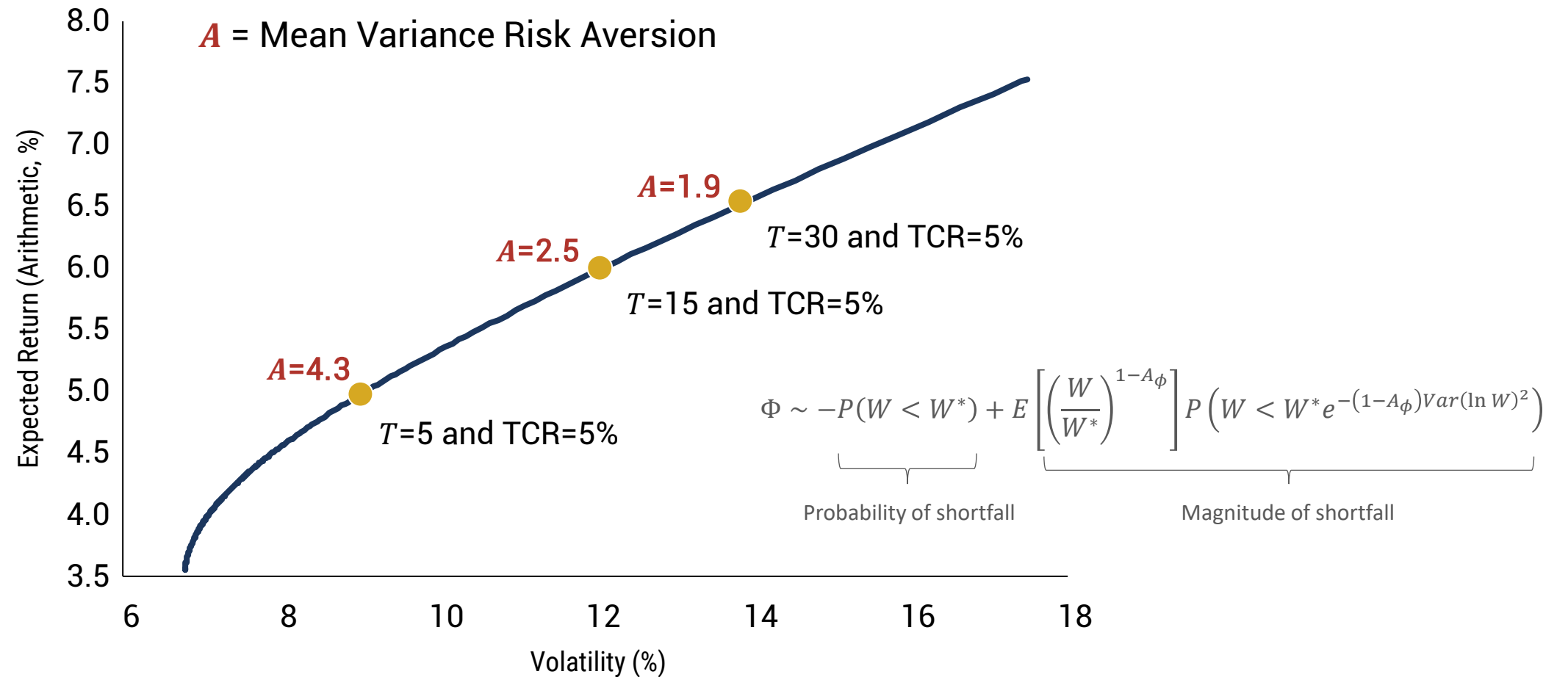
Ben Inker and Martin Tarlie



The retirement landscape has changed. Defined benefit plans, the historical workhorse of the retirement system, had the advantage of access to corporate profitability. In the event that financial asset returns fell short of design expectations, this access mitigated the impact on workers' retirement. But, as defined benefit plans have given way to defined contribution (DC) plans, the burden being placed on financial returns in satisfying retirement needs has increased.

THE EFFICIENT FRONTIER REVISITED

Horizon and TCR define the appropriate location on the frontier – NOT your risk aversion*



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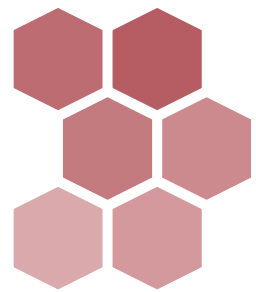
NEBO: THE PRODUCT OF USER-LED DEVELOPMENT

BEFORE NEBO

A common process

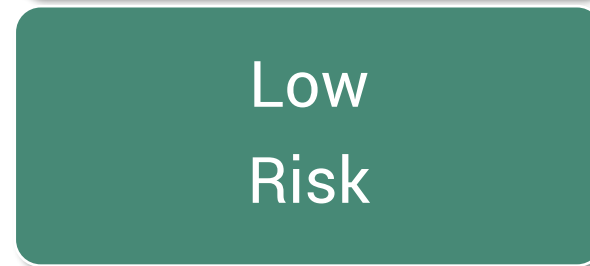
Securities

(Funds, ETFs, stocks...)



Model Portfolios

(Multi-Asset Class)



Risk = portfolio volatility

Clients

Portfolios based on "risk" category



AFTER NEBO

The NEBO process

Securities

(Funds, ETFs, stocks...)



Firm-Specific Model Portfolios

(Single-Asset Class)



Clients

Portfolios customized based on "what you need, when you need it"



Risk = falling short of your needs

THE POWER OF SINGLE ASSET CLASS BUILDING BLOCKS

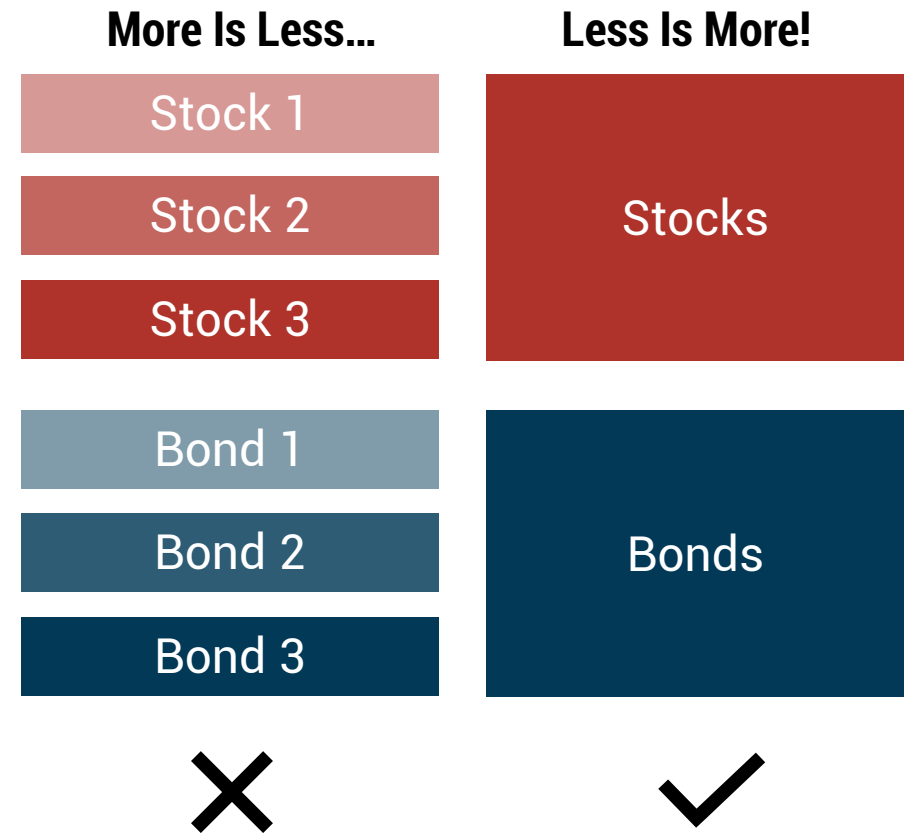
Solves a hard financial engineering problem

Simplify and clarify portfolio structure

- Helps you see the forest through the trees
- Layers the decision-making process

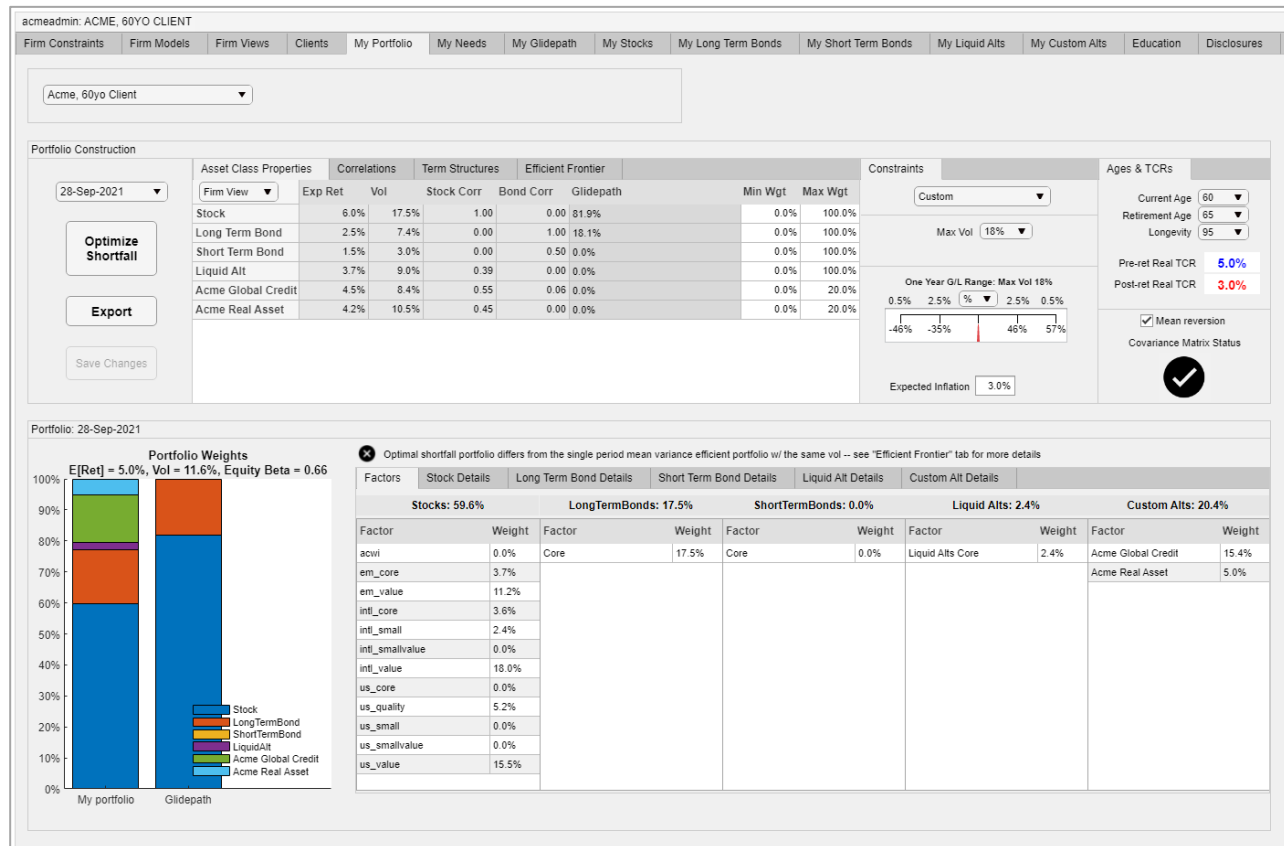
Optimizers are bad at choosing between similar assets

- More robust optimization
- Tend to rely less on constraints



PORTFOLIO CONSTRUCTION

Multi-period shortfall optimization is where the rubber meets the road



- NEBO is not a “black box”
- NEBO is designed to answer this question:
 - *“what do I need to believe in order to own this portfolio?”*
 - *About the markets*
 - *About the client*
- NEBO helps you find the right balance between the art and science of portfolio management

The result is better portfolios for your client

EFFICIENT PORTFOLIO MANAGEMENT

Retire your spreadsheets!

Excel

| Asset Class | Benchmark | Fund | Ticker | Aggressive - 100 | Moderate - 65 | Conservative - 30 |
|-----------------------------------|------------------------------|-----------------------------|--------|------------------|---------------|-------------------|
| STB | BBGBarc Us Govt/Credit 1-5Yr | Aome Short-Term Bond | AAAAA | 0.00% | 17.50% | 35.00% |
| ILTB | BBGBarc US Agg Bond | Aome Short-Term High Yield | AAAAAB | 0.00% | 17.50% | 35.00% |
| Equity | MSCI ACWI | Aome Short-Term High Yield | AAAAAB | 100.00% | 65.00% | 30.00% |
| Expected Return | | | | 6.00% | 4.60% | 3.20% |
| Asset Class | Benchmark | Fund | Ticker | Aggressive - 100 | Moderate - 65 | Conservative - 30 |
| Short-Term Corp/Gove Bonds | BBGBarc Us Govt/Credit 1-5Yr | Aome Short-Term Bond | AAAAA | 0.00% | 8.75% | 17.50% |
| Short-Term Multisector/High Yield | ML BofA 0-2Y Duration BB-B I | Aome Short-Term High Yield | AAAAAB | 0.00% | 8.75% | 17.50% |
| Intermediate-Term Credit | BBGBarc US Govt/Credit TR | Aome Intermediate Credit | AAAAC | 0.00% | 8.75% | 17.50% |
| Multisector Credit | BBGBarc US Universal | Aome Multisector Credit | AAAAD | 0.00% | 8.75% | 17.50% |
| Domestic Large Core | Russell 1000 | Aome Domestic Large Core | AAAAE | 24.00% | 15.60% | 7.20% |
| Domestic Mid Core | Russell Mid Cap | Aome Domestic Mid Core | AAAAF | 23.00% | 14.95% | 6.90% |
| Domestic Small Core | Russell 1000 | Aome Domestic Small Core | AAAAG | 23.00% | 14.95% | 6.90% |
| Foreign Large Core | MSCI ACWI Ex: US | Aome Foreign Large Core | AAAAH | 10.00% | 6.50% | 3.00% |
| Foreign Small/Mid Core | MSCI ACWI Ex: USA Small | Aome Foreign Small/Mid Core | AAAAI | 10.00% | 6.50% | 3.00% |
| Emerging Markets | MSCI Emerging Markets | Aome Emerging Markets | AAAAK | 10.00% | 6.50% | 3.00% |
| | | | | 100.00% | 100.00% | 100.00% |
| | | | | 24.00% | 24.00% | 24.00% |
| | | | | 23.00% | 23.00% | 23.00% |
| | | | | 23.00% | 23.00% | 23.00% |
| | | | | 10.00% | 10.00% | 10.00% |
| | | | | 10.00% | 10.00% | 10.00% |
| | | | | 10.00% | 10.00% | 10.00% |
| | | | | 10.00% | 10.00% | 10.00% |
| | | | | 100.00% | 65% | 30% |
| | | | | 0% | 18% | 35% |
| | | | | 0% | 18% | 35% |

VS.

NEBO

afinnegan: FINN_PAPA

Firm Constraints Firm Models Firm Views Clients My Portfolio My Needs My Glidepath My Stocks My Long Term Bonds My Short Term Bonds My Liquid Alts My Custom Alts Education Disclos

Strategies Save Cash Sweep 0.25%

Implementations for GMO STOCK MODEL - US ONLY Default

Aggressive New

Default Delete...

Asset Class Default Weight

GMO Stock Model - US Only Stock 0.00%

Portfolio Construction

Asset Class Properties Correlations Term Structures Efficient Frontier Constraints Ages & TCRs

06-Oct-2021

Optimize Shortfall Export Save Changes

| Asset Class | Exp Ret | Vol | Stock Corr | Bond Corr | Glidepath | Min Wgt | Max Wgt |
|--------------------|---------|-------|------------|-----------|-----------|---------|---------|
| Stock | 0.9% | 17.5% | 1.00 | 0.00 | 74.3% | 0.0% | 100.0% |
| Long Term Bond | -3.5% | 7.4% | 0.00 | 1.00 | 23.9% | 0.0% | 100.0% |
| Short Term Bond | -2.7% | 3.0% | 0.00 | 0.50 | 0.0% | 0.0% | 100.0% |
| Liquid Alt | 0.3% | 8.0% | 0.43 | 0.00 | 1.8% | 0.0% | 20.0% |
| GMO Benchmark Free | 5.0% | 10.9% | 0.96 | 0.27 | 0.0% | 0.0% | 20.0% |

Max Vol 18%

One Year G/L Range: Max Vol 18%

0.5% 2.5% % 2.5% 0.5%

Expected Inflation 2.9%

Current Age 62 Retirement Age 65 Longevity 95

Pre-ret Real TCR 5.0 Post-ret Real TCR 3.0

Mean reversion Covariance Matrix Stat

Portfolio: 06-Oct-2021

Optimal shortfall portfolio matches the single period mean variance efficient portfolio w/ the same vol -- see "Efficient Frontier" tab for more details

E[Ret] = 1.6%, Vol = 13.4%, Equity Beta = 0.76

| Factor | Weight | Factor | Weight | Factor | Weight | Factor | Weight | Factor | Weight |
|------------|--------|--------|--------|--------|--------|--------|--------|--------------------|--------|
| acwi | 0.0% | Core | 0.0% | Core | 0.0% | Core | 20.0% | GMO Benchmark Free | 20.0% |
| em_core | 2.9% | | | | | | | | |
| em_growth | 0.0% | | | | | | | | |
| em_value | 8.6% | | | | | | | | |
| int_core | 3.2% | | | | | | | | |
| int_growth | 0.0% | | | | | | | | |
| int_small | 2.1% | | | | | | | | |
| int_value | 16.0% | | | | | | | | |

INVESTMENT SCHEMA – ONBOARDING HAS TREMENDOUS VALUE

Our best thinking, customized to your firm's investment philosophy

The screenshot displays a web-based interface for configuring investment strategies. The top navigation bar includes tabs for Firm Constraints, Firm Models, Firm Views, Clients, My Portfolio, My Needs, My Glidepath, My Stocks, My Long Term Bonds, My Short Term Bonds, My Liquid Alts, My Custom Alts, Education, and Disclosures. The main content area is divided into several sections:

- Strategies:** A table listing strategies with their asset classes and default weights. A 'Cash Sweep' field is set to 0.50%.
- Implementations for GMO STOCK MODEL - GEAF:** A table showing the 'Default' implementation is selected.
- Factors for GMO STOCK MODEL - GEAF | DEFAULT:** A table listing factors and their weights as of 27-Sep-2021.
- STOCK Groups:** A table showing the 'Default' group is selected.
- Strategy Weight:** A table showing the 'GMO Stock Model - GEAF' strategy is set to 100.0% weight.

| Strategy | Asset Class | Default Weight |
|---------------------------|-----------------|----------------|
| GMO Stock Model - GEAF | Stock | 100.0% |
| GMO Basic Long Term Bond | Long Term Bond | 100.0% |
| GMO Basic Short Term Bond | Short Term Bond | 100.0% |
| Acme Hedge Funds | Liquid Alt | 100.0% |
| Acme Global Credit | Custom Alt | 100.0% |
| Acme Real Asset | Custom Alt | 100.0% |

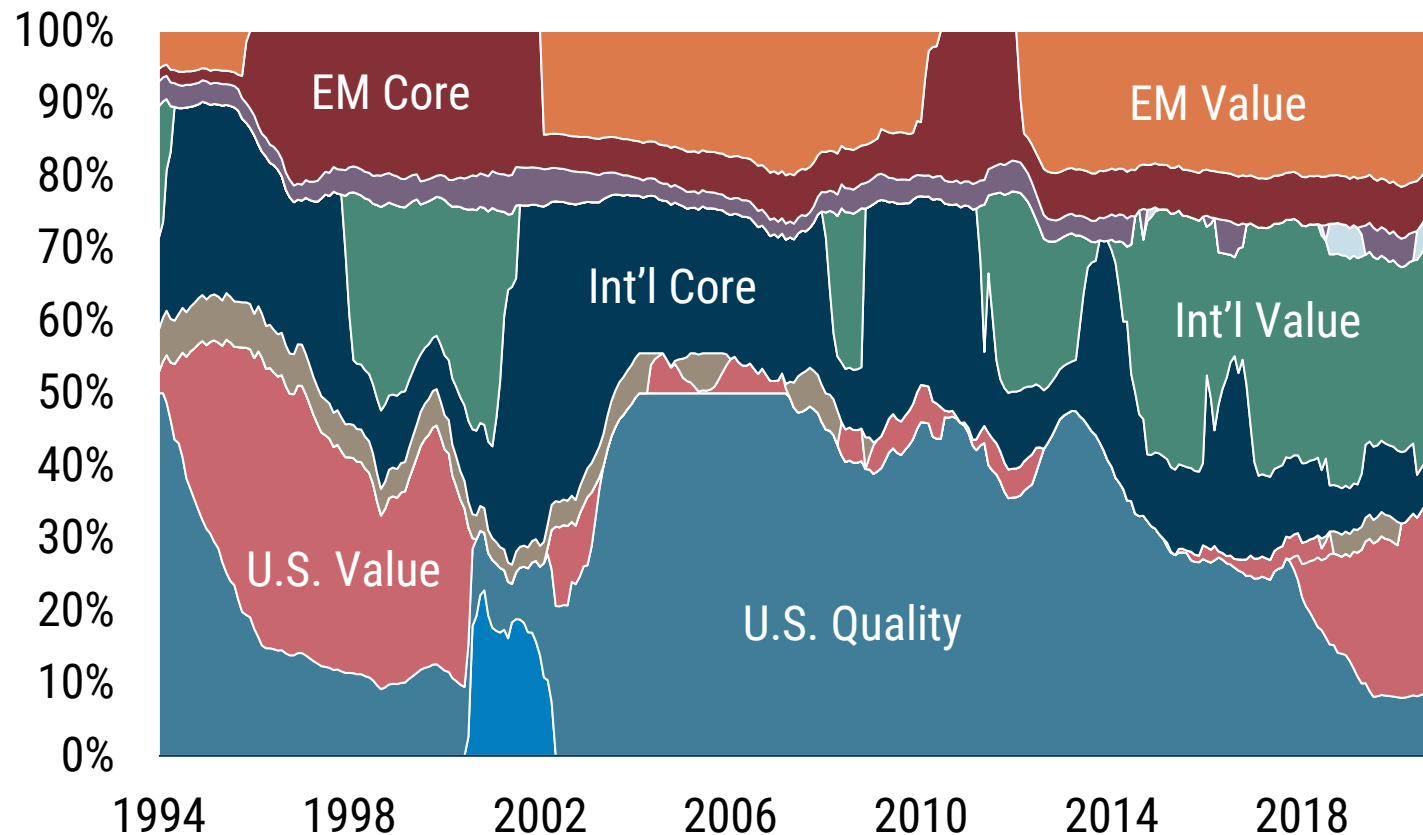
| Factor | Wgt (As of 27-Sep-2021) | ACWI |
|-----------------|-------------------------|------|
| acwi | 0.0% | |
| us_core | 0.0% | |
| us_quality | 8.7% | |
| us_value | 26.1% | |
| us_small | 0.0% | |
| us_smallvalue | 0.0% | |
| intl_core | 6.0% | |
| intl_value | 30.2% | |
| intl_small | 4.0% | |
| intl_smallvalue | 0.0% | |
| em_core | 6.2% | |
| em_value | 18.7% | |

- Open architecture
- Reflects your investment philosophy
- Suite of customizable, single-asset class strategies ("building blocks")
 - Global equity
 - Unconstrained equity
 - Regional equity factor strategies
 - Global credit (e.g., High Yield, BB, EMBIG)
 - Real assets: (e.g., REITS, TIPS, Infra, Resources, Comm)
- NEBO can handle privates & illiquids

HYPOTHETICAL EQUITY ALLOCATION STRATEGY

An example of dynamic regional and factor allocations

EQUITY ALLOCATION STRATEGY



- Builds on our 30-year history of managing global equity strategies
- Customizable to your constraints
- Dynamic regional and factor weights

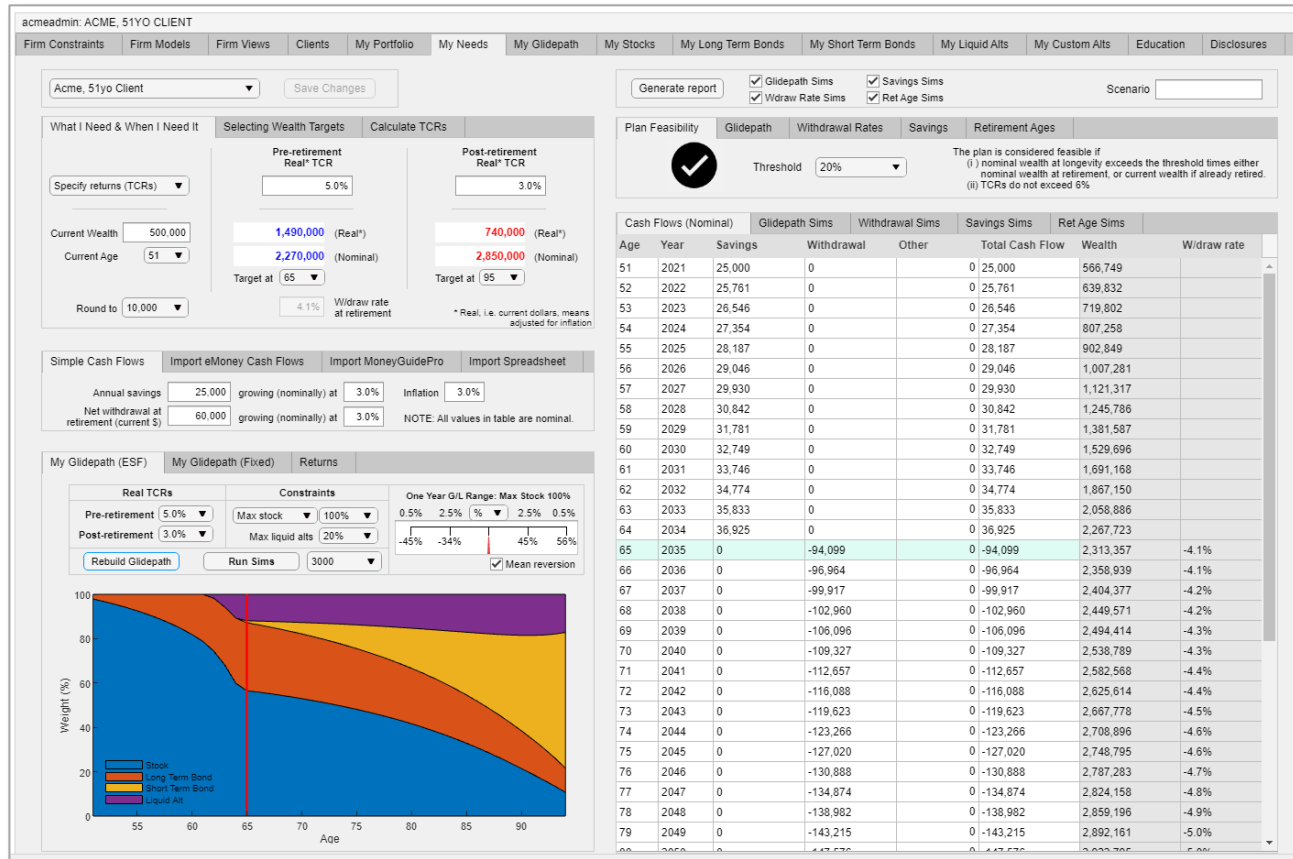
| | |
|-------------------|-------|
| Avg Alpha | 0.91% |
| Tracking Error | 3.5% |
| Information Ratio | 0.26 |

As of 10/21 | Source: GMO

Past performance, whether hypothetical or actual is not predictive of future returns. Please see disclosures at the end of this presentation.

CUTTING-EDGE FINANCIAL PLANNING

Simple to use and packs a lot of firepower



Flexible parameters

- Needs can be wealth, spending, or possibilities
- Plan feasibility
- Bequest

Integrated with eMoney and MoneyGuidePro

Custom glidepaths that account for market conditions

Extensive array of Monte Carlo simulations

- Mean reversion
- Historically consistent volatility profile of stocks and bonds

Next-generation sensitivity analyses

- Withdrawal rates vs. probability of success
- Savings
- Retirement age

FROM THE ASSET MANAGEMENT ANGLE

Enhanced Human Intelligence

... having **better-designed client portfolios** are their own reward.

... Knowing that NEBO is ... **calculating the allocation that seems most likely to succeed**, makes them feel a lot more **confident** that they are doing the right thing for clients.

... **It's hard to overstate how valuable that is** to the advisor.

FROM THE FINANCIAL PLANNING ANGLE

Enhanced Human Intelligence

... for most clients with portfolio sustainability issues, the **problem is one with their lifestyle expenses.**

... NEBO shows how in tough environments like this, **decreasing withdrawals is more meaningful than shifting your AA and taking more risk.**

... tendency is to focus on the investment part. We'd like to **focus on the most impactful things:** like decreasing spending and focusing on the cash flows.

BETTER PORTFOLIOS FOR YOUR CLIENTS

Almost a decade of deep research to solve the portfolio construction problem

1. Asking the right question cuts your probability of ruin in half

+ 100 bps

2. Moving your assets cuts your probability of ruin by another third

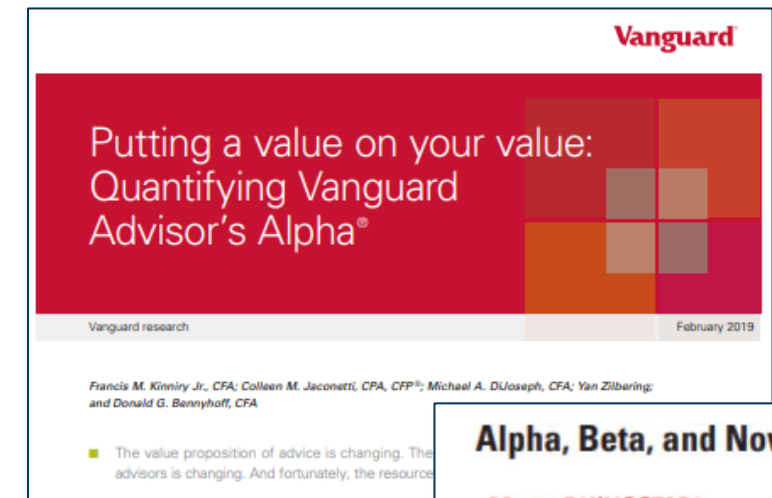
+ 50 bps

3. Dynamic asset/factor allocation

+ 50 – 100 bps

Total estimated “alpha”

+ 150 – 250 bps*



* Our research is consistent with numerous studies estimating the economic benefits of (portfolio-related) financial advice: Morningstar Gamma, Vanguard Advisor Alpha, Investnet Capital Sigma

MAIN TAKEAWAYS

NEBO is an asset management platform that redefines risk

1. NEBO melds financial planning and asset management.
2. NEBO enhances human intelligence.
3. NEBO generates **better portfolios** for your clients.

“What do you need, and when do you need it?”

WHERE ARE WE GOING NEXT?

1. We are looking for a handful of new partners to join us
2. If this piques your interest, please reach out!

The industry is waking up to this approach ...

APPENDIX

WHAT'S WRONG WITH THE CURRENT PARADIGM?

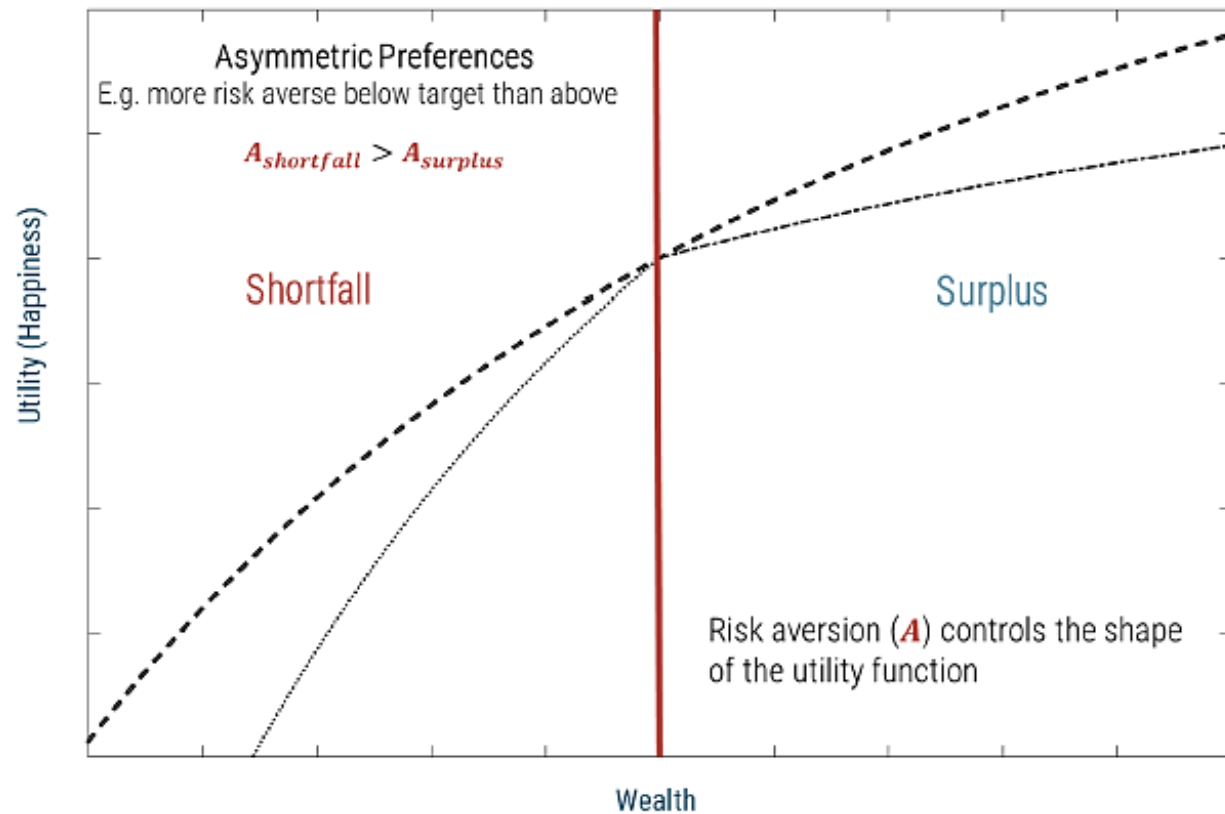
If it's broken, fix it!

| <i>The Current Problems</i> | <i>Why It Matters</i> | <i>The NEBO Solutions</i> |
|---|--|---|
| Financial planning and asset management are disconnected | Slippage between financial plan and optimal client portfolio | NEBO melds financial planning and asset management |
| Risk = volatility | But risk \neq volatility | Risk = not having what you need when you need it |
| Portfolios are the result of a "hand waving" process that focuses on volatility and combines mean-variance optimization with Monte Carlo simulation | Volatility matters but is related to fear of short-term losses. It should not be the force driving the portfolio | Portfolios optimize shortfall with constraints for short term loss aversion |
| MVO is single period – but people's lives are not! | MVO is not solving the investor's fundamental problem – running out of money | Shortfall optimization is multi-period and focuses on minimizing shortfall and the risk of ruin |
| Monte Carlo simulations overstate long term stock risk and understate long term bond risk | Historically, real stock volatility rises more slowly with horizon than real bond volatility | Monte Carlo simulations – and optimizations – reflect historical patterns of long-term volatility of stocks and bonds |

PORTFOLIO CONSTRUCTION

*Risk = not have what you need when you need it**

ASYMMETRIC PREFERENCES



How much do you care about falling short?

- Risk is falling short of target, not volatility.
- Both probability and magnitude matter.
- Expected shortfall incorporates investment horizons, whereas mean variance is myopic.**

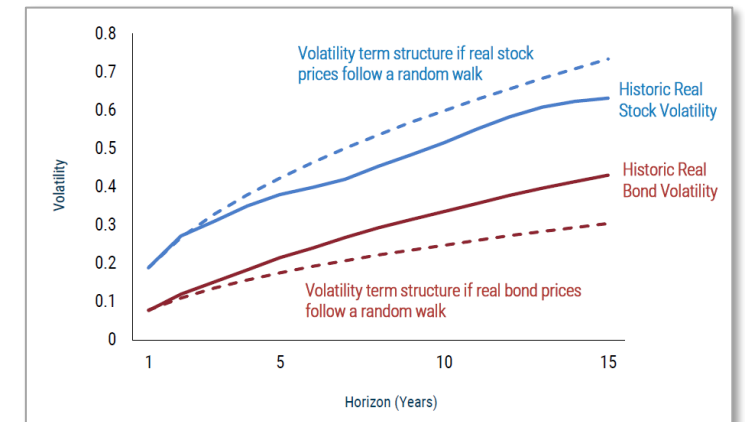
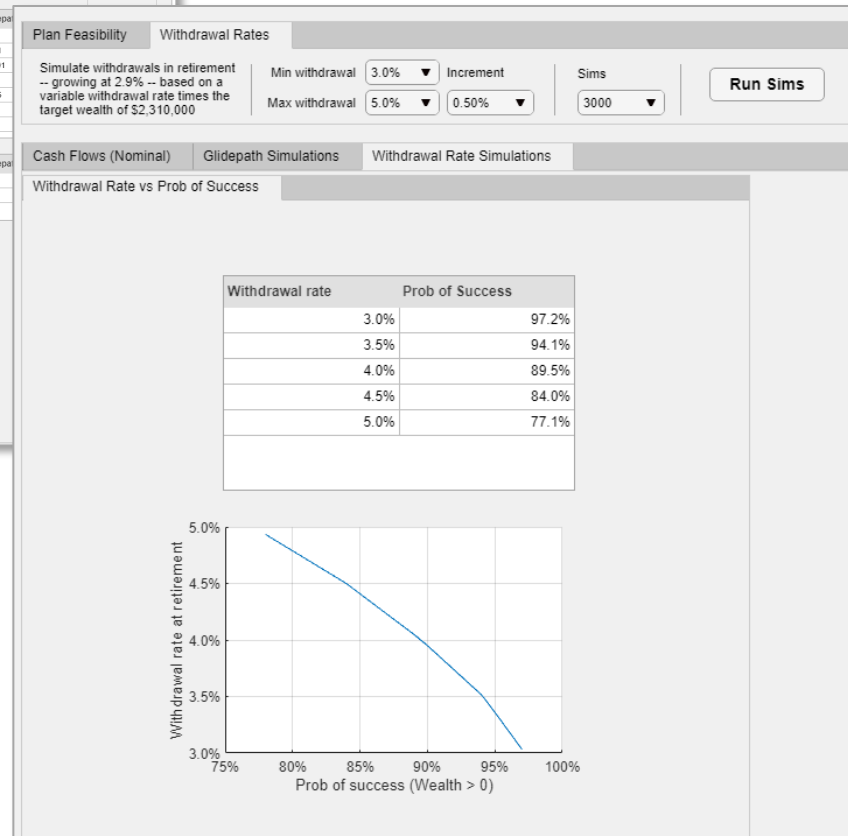
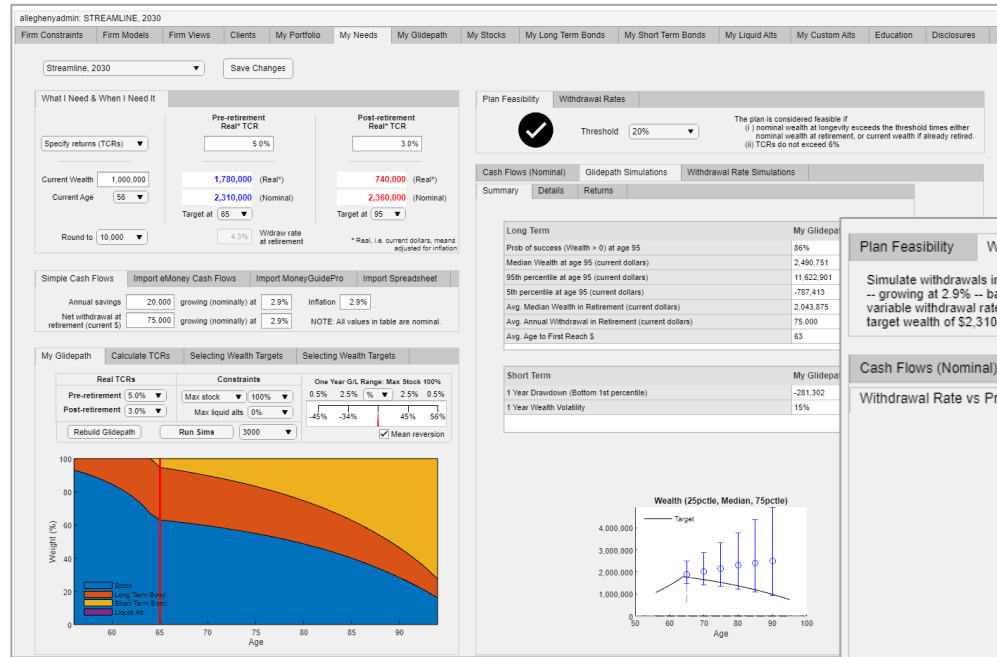
*For further details, see Tarlie (2017), "Investment Horizon and Portfolio Selection", https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2854336

** For further details, see Tarlie (2020), "A Case Study in Portfolio Optimization: A Classic Problem Revisited", https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3697948

FEATURES THAT CLIENTS AND PROSPECTS LOVE

State-of-the-art Monte Carlo simulations, withdrawal rate simulator, etc.*

- Create customized output to share with clients



*** Conventional Monte Carlo simulations do not account for the fact that stocks get relatively less volatile, and bonds relatively more volatile with horizon**

IMPROVED DECISION-MAKING THROUGH REVERSE ENGINEERING

Enhancing CIO/PM decision-making by asking the right questions

How to use NEBO to drive consistency between question (inputs/beliefs) and answer (portfolio)

- Start with a candidate portfolio (answer).
- Figure out what question that portfolio answers: what do I need to believe to own this portfolio?
 - a) For portfolios this is highly non-trivial because the question has both financial planning and asset management elements.
 - b) It is very easy to lose track of things – NEBO helps you stay focused on the key inputs/beliefs.
- Are those inputs/beliefs reasonable?
 - a) If not, modify them and then look at the new answer.
 - b) Does the new answer make sense? If not, go back and alter your inputs/beliefs until you arrive at consistency between your question and your answer.

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Hypothetical performance is developed with the benefit of hindsight and has inherent limitations. Specifically, hypothetical results do not reflect actual trading or the effect of material economic and market factors on the decision-making process. Since trades have not actually been executed, results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity, and may not reflect the impact that certain economic or market factors may have had on the decision-making process. Actual performance may differ significantly from hypothetical performance.

Hypothetical results are adjusted to reflect the reinvestment of dividends and other income and, except where otherwise indicated, are presented gross-of fees and include the effect of hypothetical transaction costs, but not management fees, performance fees or expenses, if any. Actual fees are disclosed in Part 2 of GMO's Form ADV.

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