

Constructing Specialized Portfolios

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Presentation goals

- Provide instruction on how to create a couple popular types of specialized portfolios
 - Minimum Variance
 - Maximum Diversification
 - Risk Parity
 - Factor Mimicking
- Expand client optimizer “vocabulary” by working through new examples
- Point out some lesser-used optimizer features

Minimum Variance Portfolios

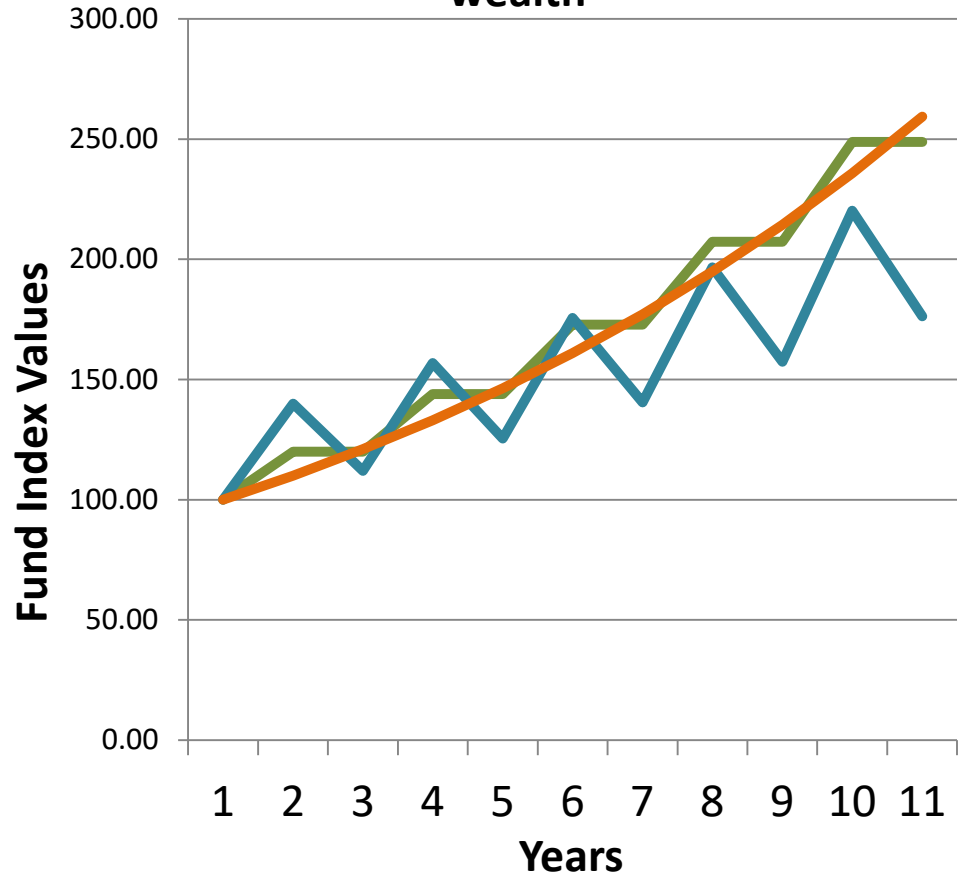
- General theory:
 - CAPM theory is *single period*
 - Since the real world has multiple periods, the best strategy for a fully-invested is to have the portfolio with the least total risk to take advantage of the difference between arithmetic returns (maximized in CAPM) and geometric returns (maximized with minimum variance)
 - With no expectations of returns, we should want to hold the portfolio with the least risk possible.
- Optimizer setup:
 - Just use a cash benchmark

Minimum Variance Portfolios

Year	Fund 1 0/20 Fund Return	Fund 2 40/-20 Fund Return	Fund 3 10 Fund Return
0	0	0	0
1	20	40	10
2	0	-20	10
3	20	40	10
4	0	-20	10
5	20	40	10
6	0	-20	10
7	20	40	10
8	0	-20	10
9	20	40	10
10	0	-20	10

Average Return	10.00	10.00	10.00
Variance of Returns	111.11	1000.00	0.00
Total return	148.83	76.23	159.37
Equivalent compound return	9.545	5.830	10.000

Variance drain destroys long term wealth



Minimum Variance Portfolios

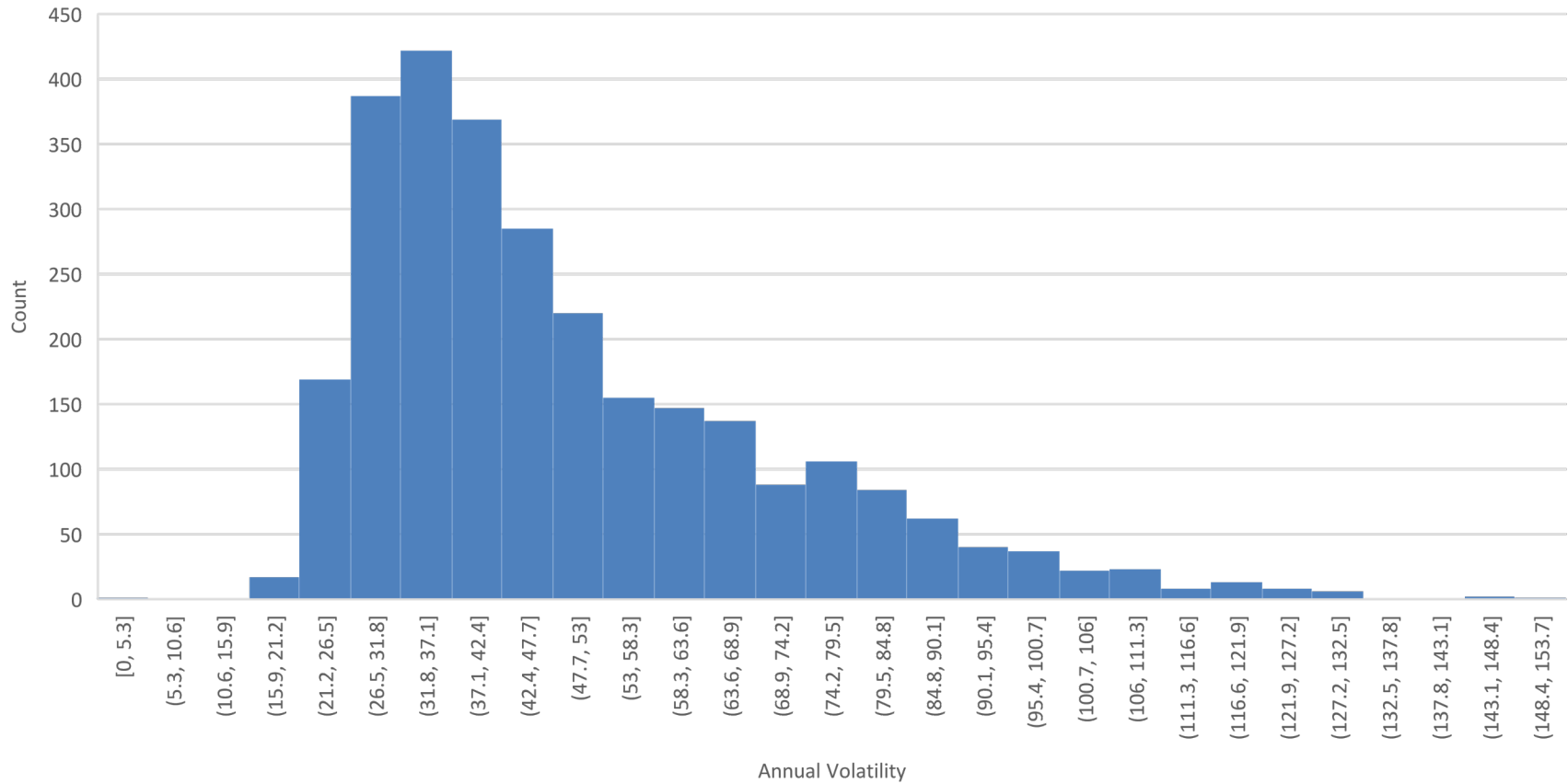
- Two previous research webinars on the topic of minimum variance portfolios:
 - Dan diBartolomeo: “A Detailed Examination of Minimum Variance and Low Volatility Equity Strategies.” July 2011. <https://www.northinfo.com/documents/467.pdf>
 - Jason McQueen & Daniel Mostovoy: “Risk Model Testing, or Horses for Courses Part 2 - Minimum Variance Portfolios.” February 28, 2017. <https://www.northinfo.com/documents/737.pdf>

Minimum Variance Portfolios

- [Optimizer example – Minimum Variance.fnd]

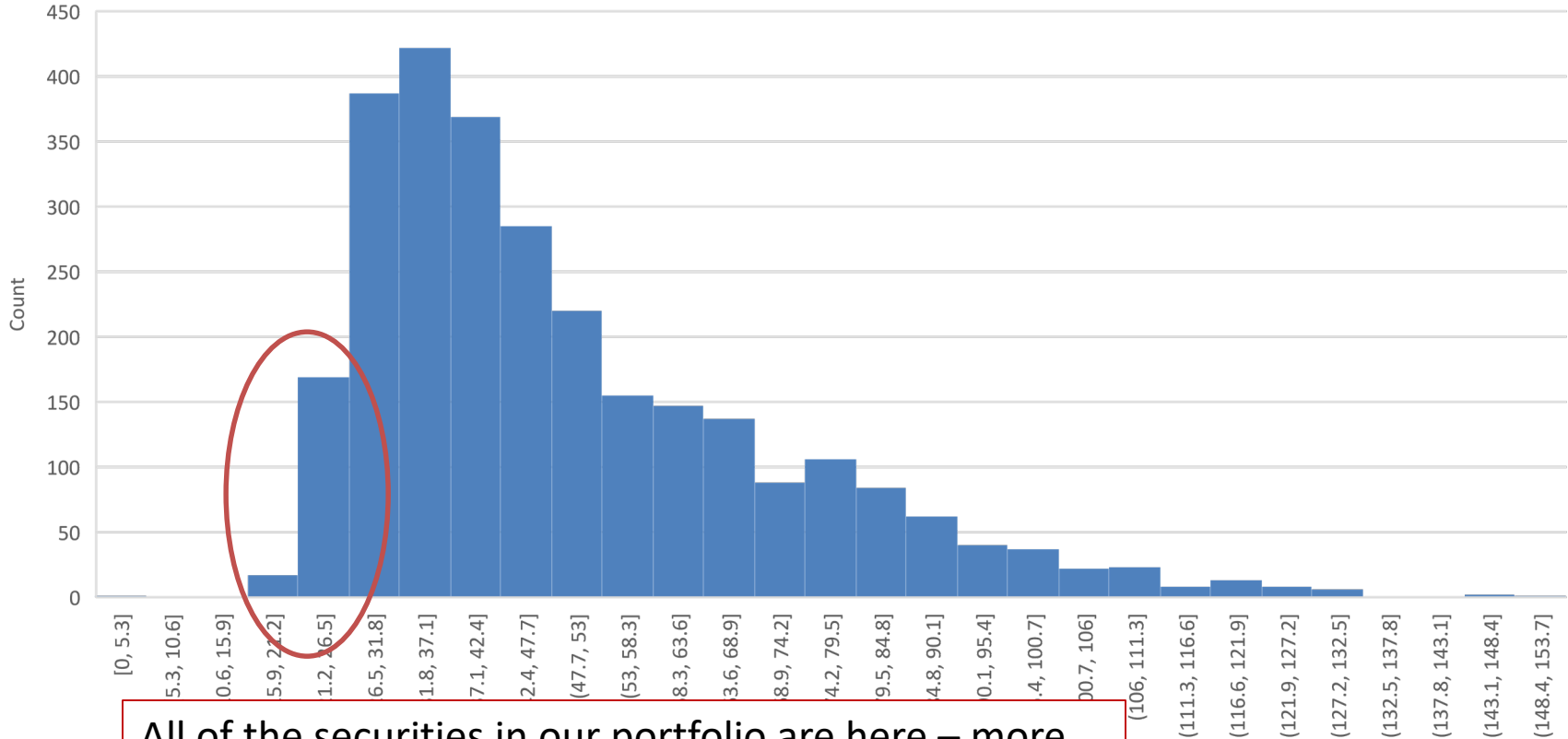
Minimum Variance Portfolios

Distribution of Forecasted Total Volatility of Stocks in Russell 3000



Minimum Variance Portfolios

Distribution of Forecasted Total Volatility of Stocks in Russell 3000



All of the securities in our portfolio are here – more likely to be underestimating risk than overestimating

Minimum Variance Portfolios

- Use the “Blend Covariance” feature when estimation error is important. This feature blends the original covariance matrix with “duller” versions of itself
 - **Single Index:** Stocks are correlated only through the market portfolio. Each stock’s total variance is unchanged.
 - **Constant Correlation:** Stocks share the same pairwise correlation, which is, the average correlation within the market portfolio. Each stock’s total variance is unchanged.
 - **Constant Covariance:** Variance and correlation for all assets is the same based on the market portfolio. Stock’s variance is changed.

Ledoit & Wolf. “Improved Estimation of the Covariance Matrix of Stock Returns with an Application to Portfolio Selection.” Journal of Empirical Finance, Dec v10(5):603-621. (available <http://www.ledoit.net/ole2.pdf>)

Anish Shah, CFA. “Mitigating Estimation Error in Optimization.” June 4, 2010. <https://www.northinfo.com/documents/370.pdf>

Mike Knezevich. “Estimation Error Adjustment-Covariance Blend.” March 2010. <https://www.northinfo.com/docs/tech032010.pdf>

Maximum Diversification Portfolios

- Conceptually simple: Maximum stock specific risk, minimum factor risk
- Use large value for UnsysRAP, use a small value for SysRAP.
 - Feasible values are 1-200. 6x desired tracking error is a good starting point for UnsysRAP, 1 for SysRAP.

$$\bullet \quad U = \underbrace{\alpha}_{\text{Return}} - \underbrace{\left(\frac{\sigma_s^2}{\text{RAP}_{\text{sys}}} + \frac{\sigma_u^2}{\text{RAP}_{\text{unsys}}} \right)}_{\text{Risk Component}} - \underbrace{((C + T) * A)}_{\text{Implementation Cost}}$$

Factor Risk
Stock Specific Risk

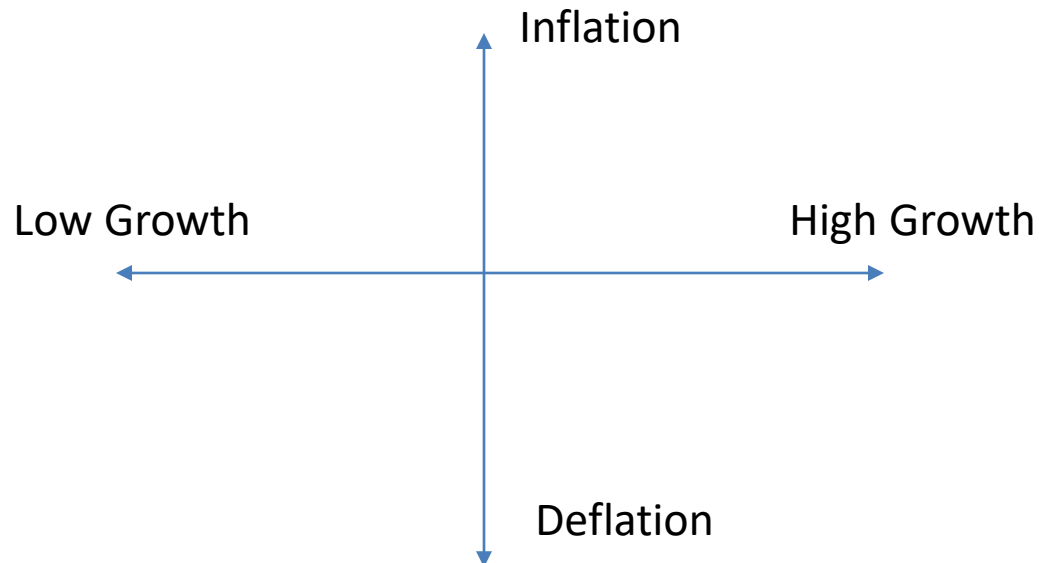
- α = the "certainty equivalent" expected portfolio return
- σ_s^2 = portfolio variance risk due to common factors (correlation across securities)
- σ_u^2 = portfolio variance risk due to stock specific risks
- RAP = risk tolerance
- C = transaction costs for the optimization
- T = capital gain taxes for the optimization
- A = amortization constant

Maximum Diversification Portfolios

- [Optimizer example – Maximum Diversification.fnd]

Risk Parity Portfolios

- General theory:
 - We don't have expectations for asset returns or market conditions
 - We want a portfolio that is generally fine in all market conditions
 - Popularized by Ray Dalio and Bridgewater



Risk Parity Portfolios

- Working backwards
 - If we have information about expected returns and expected risk, you just get a traditional optimization.
 - If we have no information about expected returns or expected risk, use an equal weighted portfolio. No security is better than another.
 - If we have information about expected risk, but no information about returns, we use a minimum variance portfolio.
 - If we have no information about expected returns, but partial information about risk, we can construct a frontier from the equal weight portfolio to the minimum variance portfolio.

See Edward Qian, "The Myths and Facts of Risk Parity." June 2011.

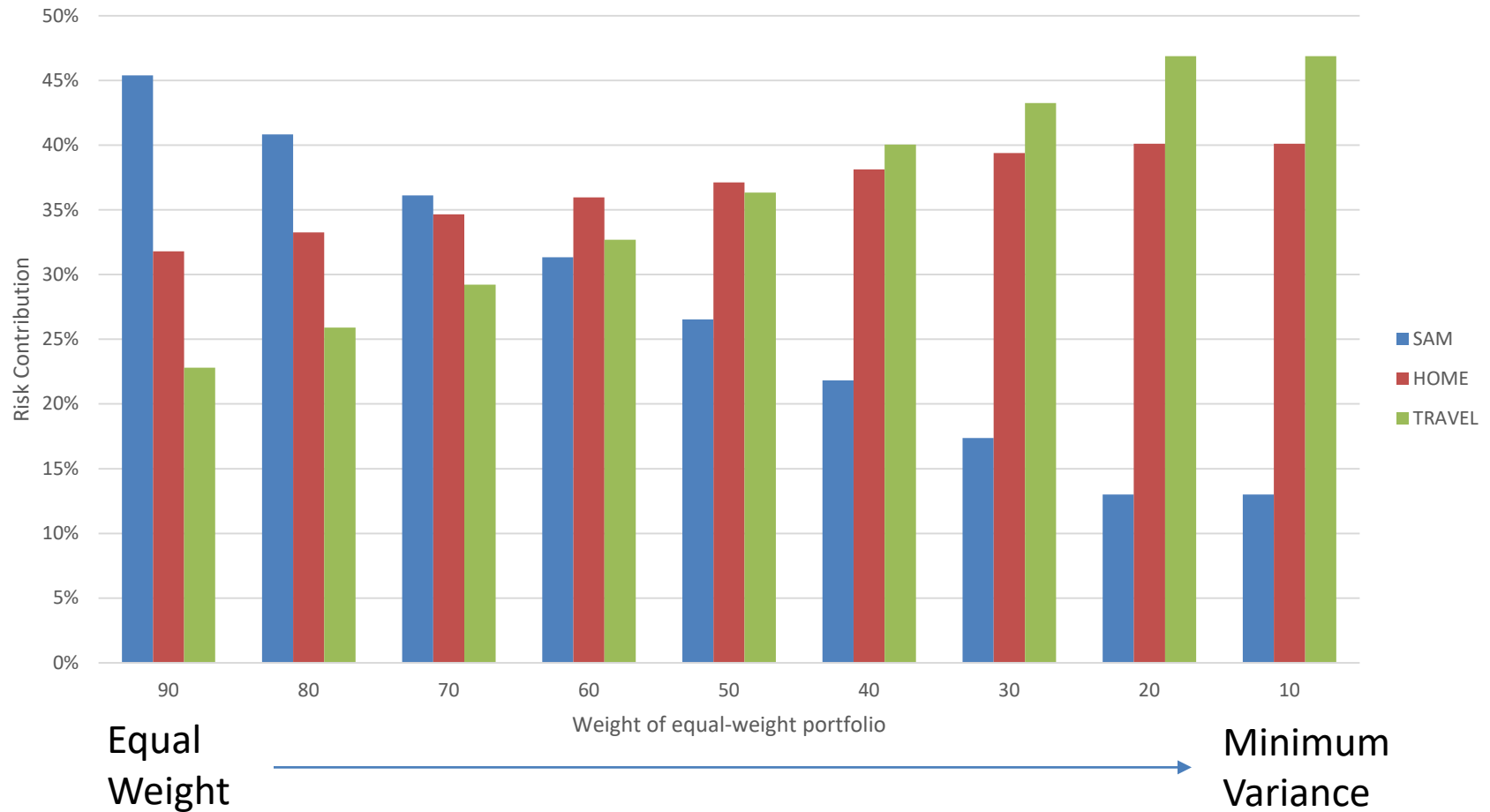
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Risk Parity Portfolios

- [Optimizer example – Risk Parity.ee]

Risk Parity Portfolio

% Risk Contribution By Asset



Factor Mimicking Portfolio

- For our last example, we are just telling the optimizer what **exposures** we want instead of what benchmark we want. Think of it as a shortcut.
- Set it up like any other project, but just use a synthetic asset.
- Can be extended to any set of exposures to replicate assets you don't or can't own with assets you do own.

For more on this topic, please see Jason MacQueen, et al. "Rules-Based Style Rotation: Dynamic Switching Between Smart Portfolios." February 2016.

<https://www.northinfo.com/documents/689.pdf>

Factor Mimicking Portfolio

- [Optimizer example – Factor Mimicking.apt; Factor Mimicking_oil.apt]