MBA SIMFUND 2023-24

Arizona State University

Semi-annual report

Dec 2023

MBA SIMFUND Team

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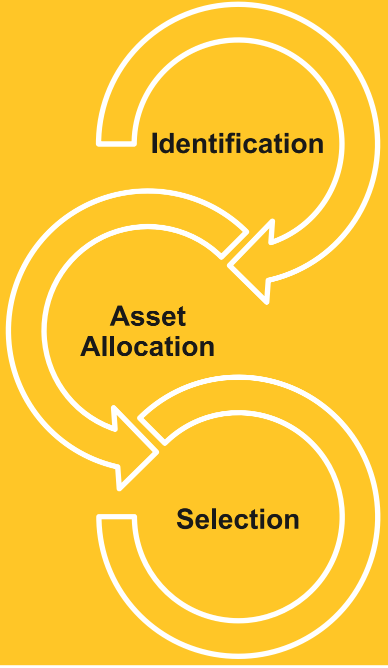
Agenda

1. Introduction
2. Approach & Learning Goals
3. Asset Allocation
4. Selection
5. Final Portfolio

Approach

- ✔ Pre-constructed Portfolio
- ✔ Black-Litterman Model
- ✔ Valuation
- ✔ Constraints



Learning Goals

Personal Investment	Asset Allocation	Asset Selection	Performance Evaluation

Asset Allocation

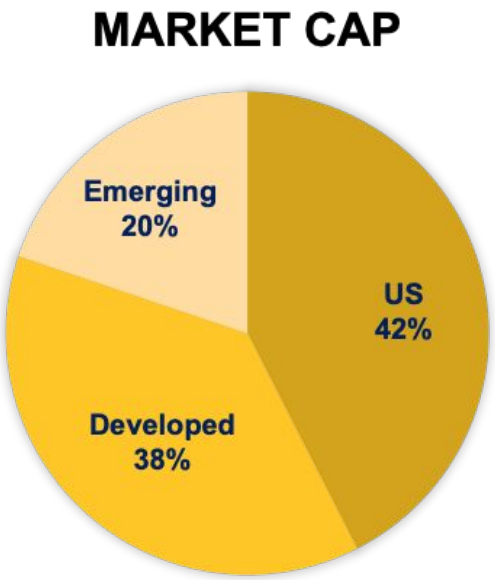
- Investor views
  - Value vs Growth
  - Emerging vs Developed
  - Treasury vs Corporate
- Charter Limitations
- Current International Scenario's
- Future Projections
- Active vs Passive

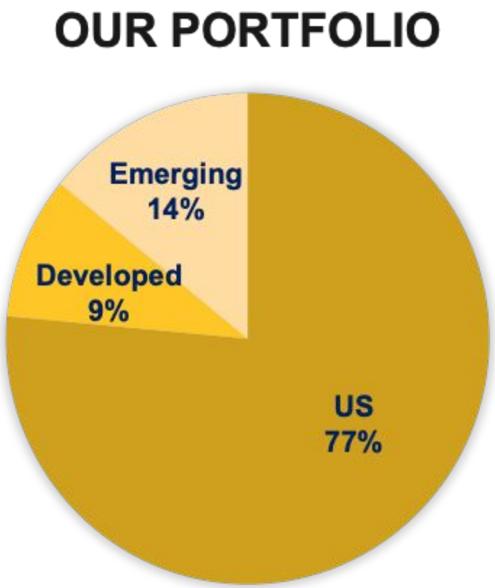
U.S. Fixed Income 15%

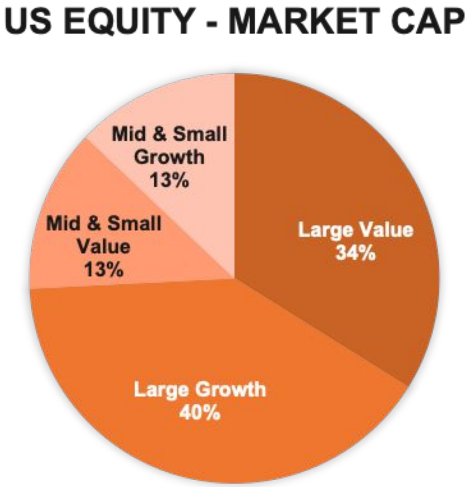
U.S. Equity 65%

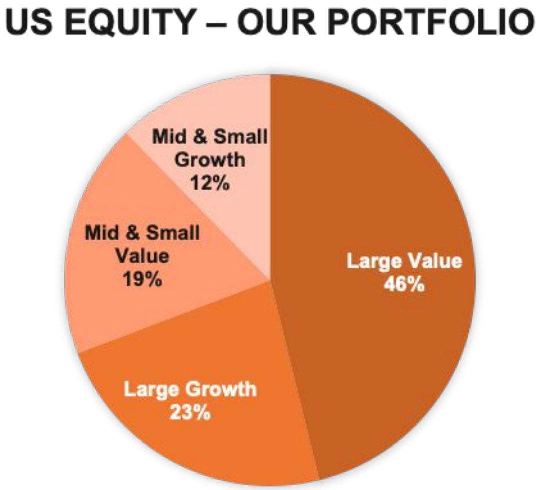
International Equity 20%

Asset Allocation

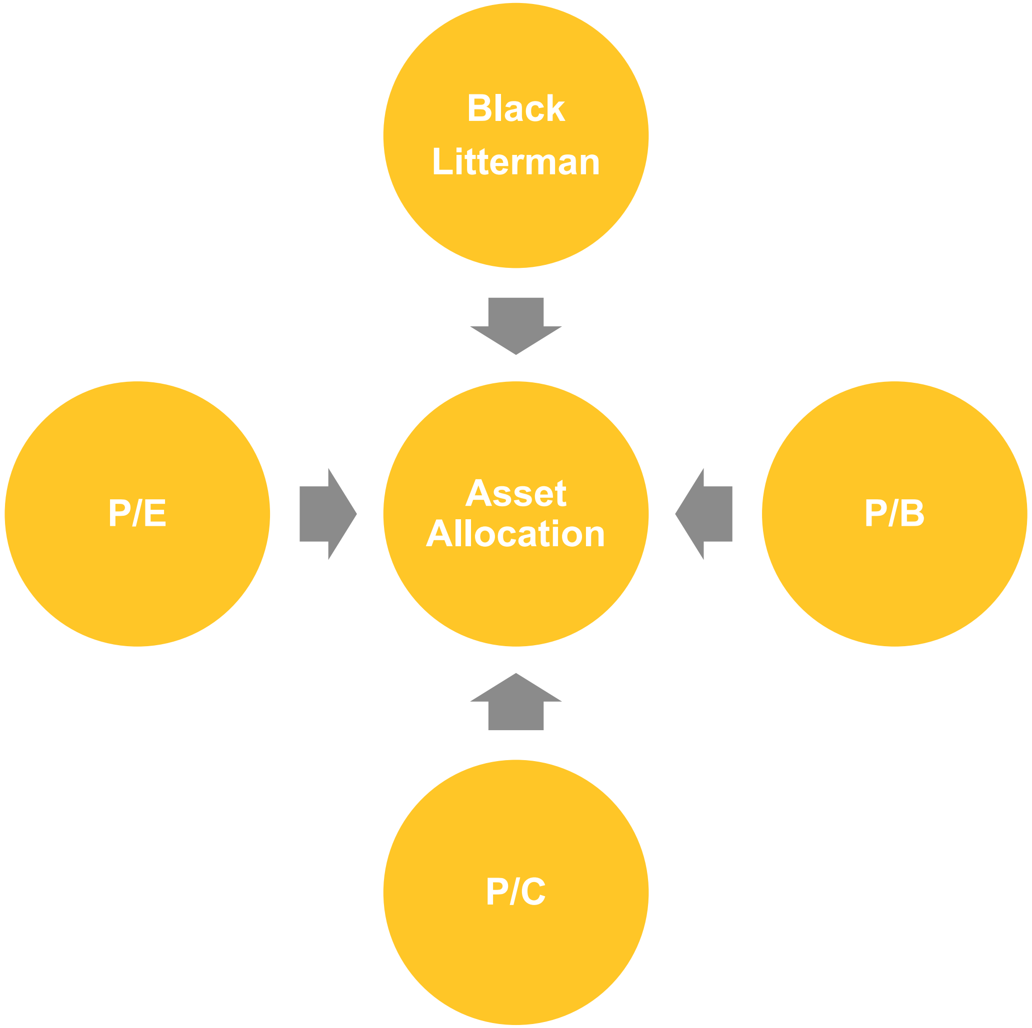






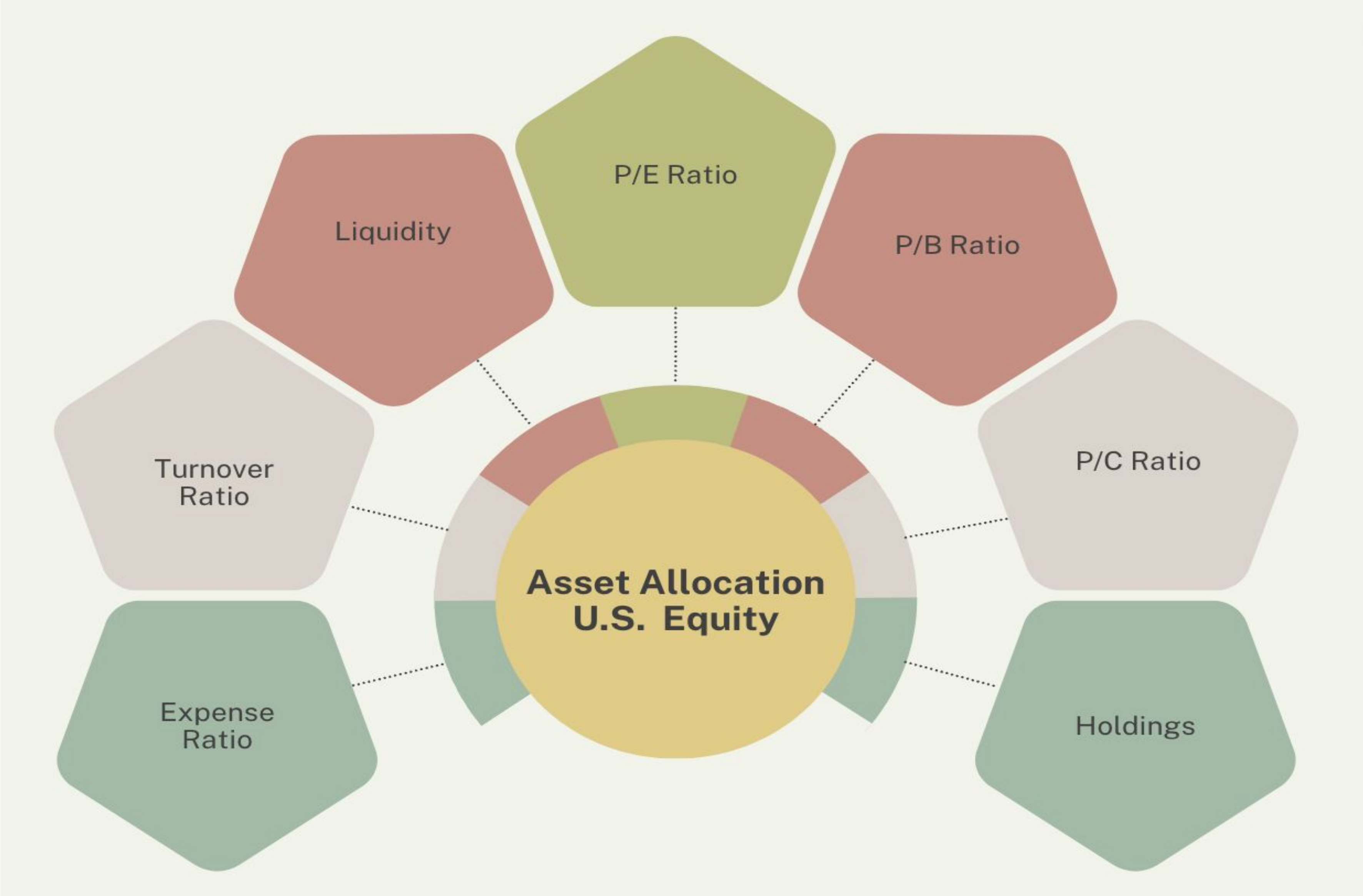


Asset Allocation – Why tilt from MCap?



	P/E		P/B		P/C	
	Value	Growth	Value	Growth	Value	Growth
US Large Cap	12	36.4	2.6	10.1	7.6	23
US Mid Cap	15.4	25.1	2	4.7	9.5	17.5
US Small Cap	7.7	23.1	1.3	3.5	4.3	14.9
Emerging	12.4		1.5		7.9	
Developed	13		1.5		8.8	

Security Selection – U.S. Equity



Security Selection – U.S. Large Cap

U.S. Large Capital - Value

ETF	Expense Ratio	Turnover Ratio %	Avg Daily Volume (3 Mo)	P/E Ratio	P/B Ratio	P/C Ratio	Holdings
Vanguard Value ETF	**0.04**	**5.00**	**2,456,634.00**	**15.49**	**2.40**	**10.72**	**342**
Avantis US Large Cap Value ETF	0.15	23.00	174,238.50	11.76	2.51	7.61	268
Schwab US Large-Cap Value ETF™	0.04	7.00	396,891.85	15.43	2.37	11.09	508
Vanguard Russell 1000 Value ETF	0.08	14.00	529,897.27	15.21	2.14	10.76	847

U.S. Large Capital - Growth

ETF	Expense Ratio	Turnover Ratio %	Avg Daily Volume (3 Mo)	P/E Ratio	P/B Ratio	P/C Ratio	Holdings
Schwab US Large-Cap Growth ETF™	**0.04**	**9.00**	**1,114,281.36**	**29.08**	**7.02**	**19.94**	**253**
SPDR® Portfolio S&P 500 Growth ETF	0.05	33.00	1,690,934.21	23.99	6.42	17.17	238
Vanguard Growth ETF	0.04	5.00	837,070.09	32.87	8.28	22.25	221
Vanguard Russell 1000 Growth ETF	0.08	13.00	846,794.88	30.69	10.01	20.70	446

Security Selection – U.S. Small Cap

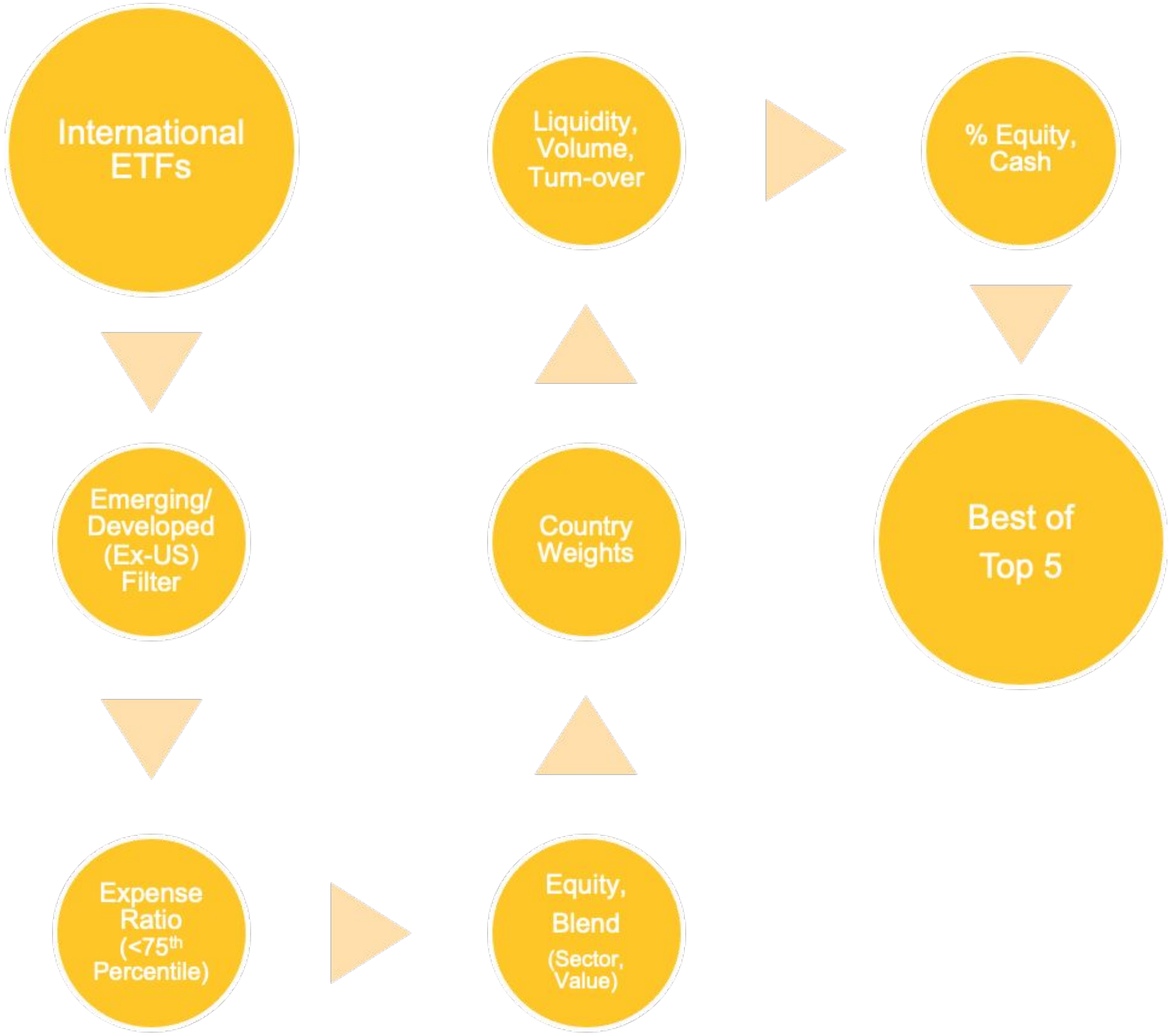
U.S. Small Capital - Value

ETF	Expense Ratio	Turnover Ratio	Avg. Daily Volume(3 Mo)	P/E Ratio	P/B Ratio	P/C Ratio	Holdings
Avantis US Small Cap Value ETF	**0.25**	**24%**	**497000**	**7.31**	**1.16**	**3.98**	**737**
SPDR® S&P 600 Small Cap Value ETF	0.15	46%	257300	11.17	1.13	6.10	465
iShares Morningstar Small-Cap Value ETF	0.06	41%	17800	9.55	1.26	5.88	1,145
Vanguard Small-Cap Value ETF	0.07	13%	490000	10.82	1.58	7.23	843
First Trust Small Cap Val AlphaDEX ETF	0.73	110%	12500	8.34	0.95	4.71	263

U.S. Small Capital - Growth

ETF	Expense Ratio	Turnover Ratio	Avg. Daily Volume(3 Mo)	P/E Ratio	P/B Ratio	P/C Ratio	Holdings
iShares Morningstar Small-Cap Growth ETF	**0.06**	**52%**	**55000**	**18.81**	**2.75**	**12.92**	**1,077**
First Trust Small Cap Gr AlphaDEX ETF	0.71	140%	318000	15.23	2.46	8.40	265
Vanguard Small-Cap Growth ETF	0.07	24%	257500	23.11	3.46	14.93	647
Motley Fool Small-Cap Growth ETF	0.85	62%	14000	19.32	2.93	17.75	39
SPDR® S&P 600 Small Cap Growth ETF	0.15	48%	165600	12.85	1.99	9.39	346

Security Selection – International Markets



Security Selection – International Markets

International Emerging Markets

ETF	Ticker	Expense Ratio	Turn Over Ratio (%)	Volume (#)	Top 5 Country Weights
iShares Core MSCI Emerging Markets ETF	**IEMG**	**0.10**	**7**	**11292935**	**23% China, 17% India, 15% Taiwan, 13% S Korea, 5.5% Brazil**
Vanguard FTSE Emerging Markets ETF	VWO	0.08	7	9743953	27% China, 19% India, 15% Taiwan, 6% Brazil, 4.2% Saudi A
Schwab Emerging Markets Equity ETF	SCHE	0.11	13	1562583	29% China, 19% India, 16% Taiwan, 6.6% Brazil, 4% Saudi A
SPDR® Portfolio Emerging Markets ETF	SPEM	0.11	8	1854223	27% China, 20% India, 17% Taiwan, 6% Brazil, 4% Saudi A
Avantis Emerging Markets Equity ETF	AVEM	0.33	3	333435	22% China, 18% India, 17.7% Taiwan, 14% S Korea, 6% Brazil

Developed Ex-US Markets

ETF	Ticker	Expense Ratio	Turn Over Ratio (%)	Volume (#)	Top 5 Country Weights
iShares Core MSCI Intl Dev Mkts ETF	**IDEV**	**0.04**	**2**	**634335**	**21.6% Japan, 12% UK, 10% Canada, 9.6% France, 8% Switzerland**
SPDR Portfolio Developed Wld ex-US ETF	SPDW	0.04	3	3781004	21.8% Japan, 11% UK, 9.5% Canada, 8.8% France, 8% Switzerland
Vanguard FTSE Developed Markets ETF	VEA	0.05	4	11122582	21.3% Japan, 11.8% UK, 9% Canada, 9% France, 8% Switzerland
Hartford Multifactor Dev Mkts (exUS) ETF	RODM	0.29	33	148553	19% Japan, 13% Canada, 11% UK, % Australia, 7.4% Switzerland
Invesco FTSE RAFI Dev Mkts ex-US ETF	PXF	0.45	16	92676	21% Japan, 14.6% UK, 9.6% France, 9% Germany, 8.8% Canada

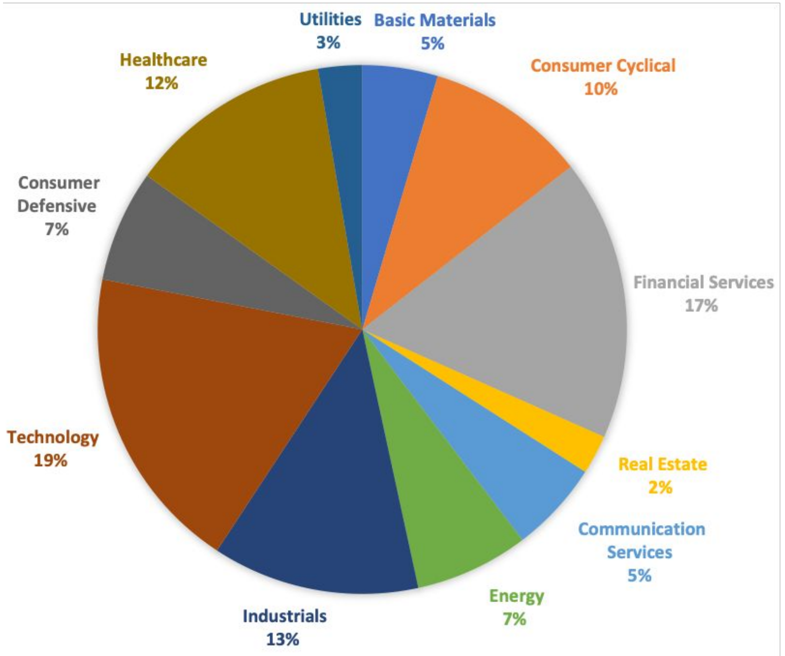
Security Selection – US Fixed Income

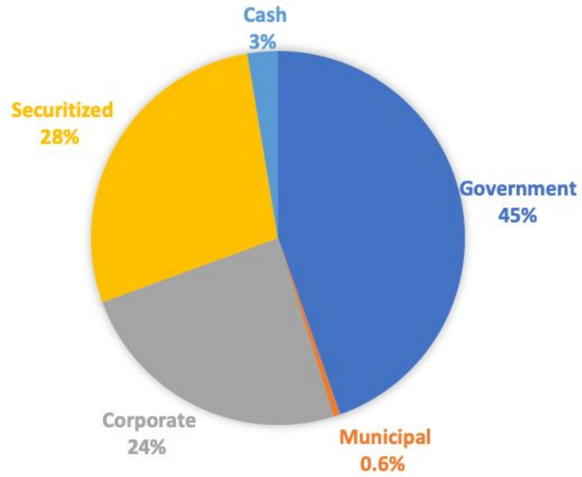
- Selected Funds with underlying Securities rated BBB or higher
- Average Maturity <10 years
- Expense Ratios on the lower side = More passive
- Average Credit quality AA or Higher
- Price & Diversification

Top Choices: (Benchmark Index: LBUFTRUU)

Fund Name	Fund Ticker	Expense Ratio (%)	90 Day Avg Agg Vol	Spread	Market Cap	Rebalancing Frequency	NAV (11/17/2023)	Maturity <10 years	Maturity >10 years	Active/Passive
Schwab US Aggregate Bond ETF	SCHZ	0.03	856.3K	0.010	USD 7.03B	Monthly	USD 44.77	54.86 %	42.78%	Passive
Vanguard Total Bond Market ETF	BND US	0.03	6.6 M	0.010	USD 98.52B	Monthly	USD 70.57	59.68%	39.22%	Passive
iShares 0-5 Year TIPS Bond ETF	STIP US	0.03	877.3K	0.010	USD 8.95B	Monthly	USD 97.26	93.77%	0	Passive

Final Portfolio (as seeded on Nov 17th, 2023)





ETF	Ticker	Capital (USD)	% Allocation
Schwab US Aggregate Bond ETF	SCHZ	180,098	14.9%
Vanguard Value ETF	VTV	360,197	29.9%
Schwab U.S. Large-Cap Growth ETF	SCHG	180,098	14.9%
Avantis US Small Cap Value ETF	AVUV	144,079	11.9%
iShares Morningstar Small-Cap Growth ETF	ISCG	96,052	8.0%
iShares Core MSCI Intl Dev Mkts ETF	IDEV	96,052	8.0%
iShares Core MSCI Emerging Markets ETF	IEMG	144,079	11.9%
Cash	-	5,374	0.4%

Thank you!

“Every journey has a first step”

Appendix 1

Black- Litterman Model

- Developed 1990 by Fischer Black & Robert Litterman
- Mathematical Model for portfolio Selection
- Markowitz Mean-Variance approach Limitations
- User does not require estimates of expected returns
  - Only requires user defined assumptions differing from market and users confidence in the assumption
- Black-Litterman can be used to solve the constrained optimization problem

$$E(R) = [(\tau\Sigma)^{-1} + P^T\Omega^{-1}P]^{-1}[(\tau\Sigma)^{-1}\Pi + P^T\Omega^{-1}Q]$$

- $E(R)$ is a Nx1 vector of expected returns, where N is the number of assets.
- Q is a Kx1 vector of views.
- P is the KxN **picking matrix** which maps views to the universe of assets. Essentially, it tells the model which view corresponds to which asset(s).
- Ω is the KxK **uncertainty matrix** of views.
- Π is the Nx1 vector of prior expected returns.
- Σ is the NxN covariance matrix of asset returns (as always)
- τ is a scalar tuning constant.

$$\delta = \frac{R - R_f}{\sigma^2}$$

$$\hat{\Sigma} = \Sigma + [(\tau\Sigma)^{-1} + P^T\Omega^{-1}P]^{-1}$$

$$\Pi = \delta\Sigma w_{mkt} \qquad \Omega = \tau * P\Sigma P^T$$

Appendix 1(a)

PORTFOLIO VISUALIZER   Examples   Docs

Step 1/3: Benchmark Portfolio

Model Configuration

Portfolio Type: Asset Classes

Covariance Period: Full History

Expected Return: 7.0 %

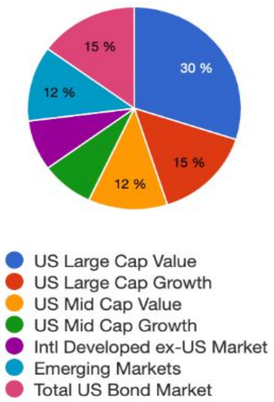
Asset Allocation	Asset Class	Allocation
Asset 1	US Large Cap Value	30 %
Asset 2	US Large Cap Growth	15 %
Asset 3	US Mid Cap Value	12 %
Asset 4	US Mid Cap Growth	8 %
Asset 5	Intl Developed ex-US Market	8 %
Asset 6	Emerging Markets	12 %
Asset 7	Total US Bond Market	15 %
Asset 8	Select asset class...	%
Asset 9	Select asset class...	%
Asset 10 (More)	Select asset class...	%
Total		100 %

Appendix 1(b)

Benchmark Portfolio with Equilibrium Returns

Asset Class	Equilibrium Return	Allocation
US Large Cap Value	7.56%	30.00%
US Large Cap Growth	7.88%	15.00%
US Mid Cap Value	8.14%	12.00%
US Mid Cap Growth	9.05%	8.00%
Intl Developed ex-US Market	7.82%	8.00%
Emerging Markets	9.82%	12.00%
Total US Bond Market	0.30%	15.00%

Equilibrium returns are based on the expected annual return of 7.00%. Covariance matrix is based on monthly asset returns from Jan 1995 to Oct 2023.

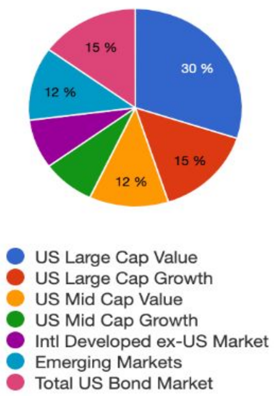


Optimized Portfolio

Optimization Type Constrained

Asset Class	Adjusted Return	Allocation
US Large Cap Value	7.56%	30.00%
US Large Cap Growth	7.88%	15.00%
US Mid Cap Value	8.14%	12.00%
US Mid Cap Growth	9.05%	8.00%
Intl Developed ex-US Market	7.82%	8.00%
Emerging Markets	9.82%	12.00%
Total US Bond Market	0.30%	15.00%

Adjusted returns are equilibrium returns adjusted for the given views. The optimized portfolio has expected return of 7.00% with annualized standard deviation of 13.65% and total allocation of 100.00%.



Save portfolio »

Appendix 2

Developed Ex-US Markets

ETF	Ticker	Expense Ratio	Turn Over Ratio (%)	Volume (#)	Equity %	Top 5 Country Weights
iShares Core MSCI Intl Dev Mkts ETF	**IDEV**	**0.04**	**2**	**634335**	**99.3%**	**21.6% Japan, 12% UK, 10% Canada, 9.6% France, 8% Switzerland**
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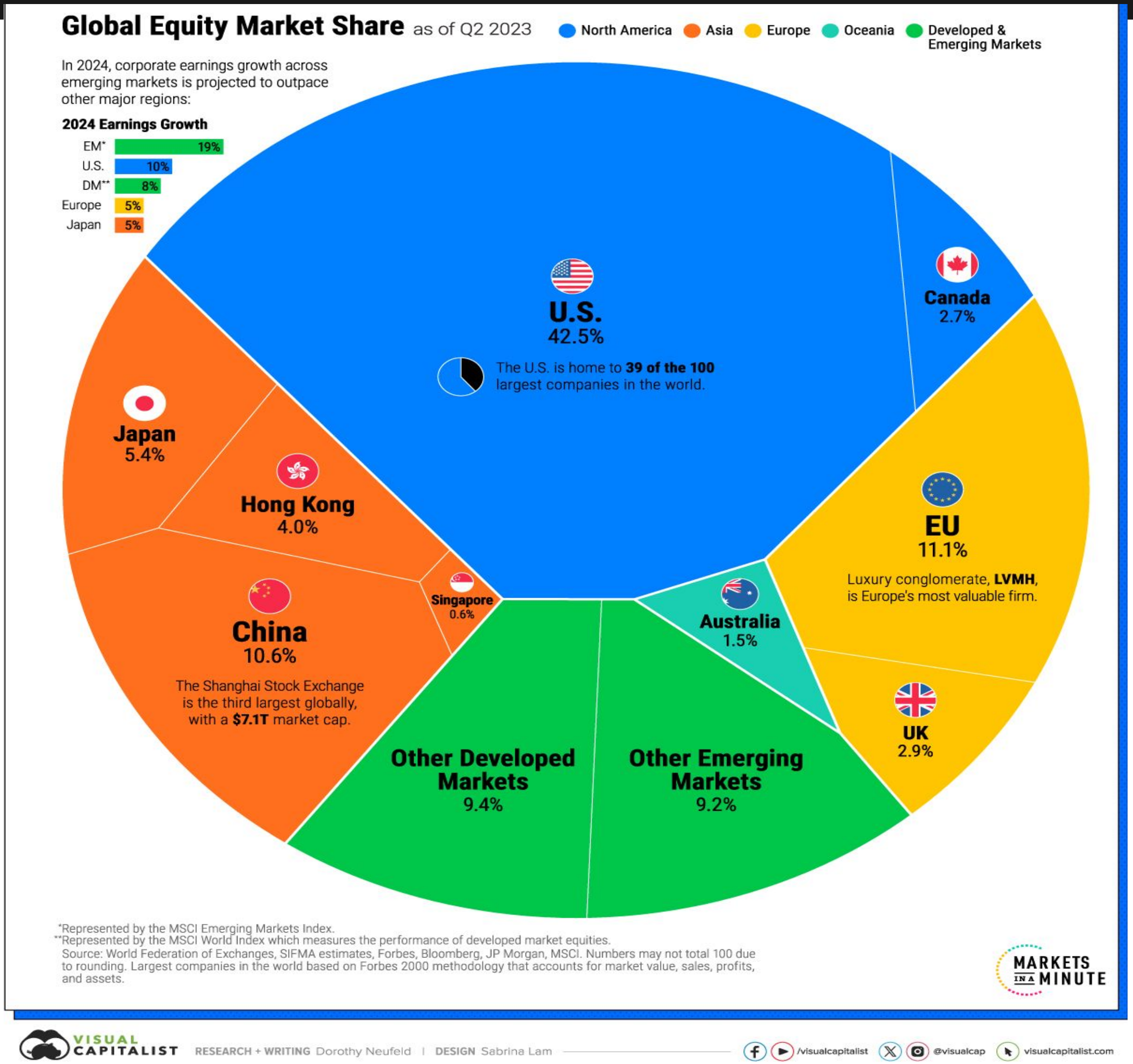
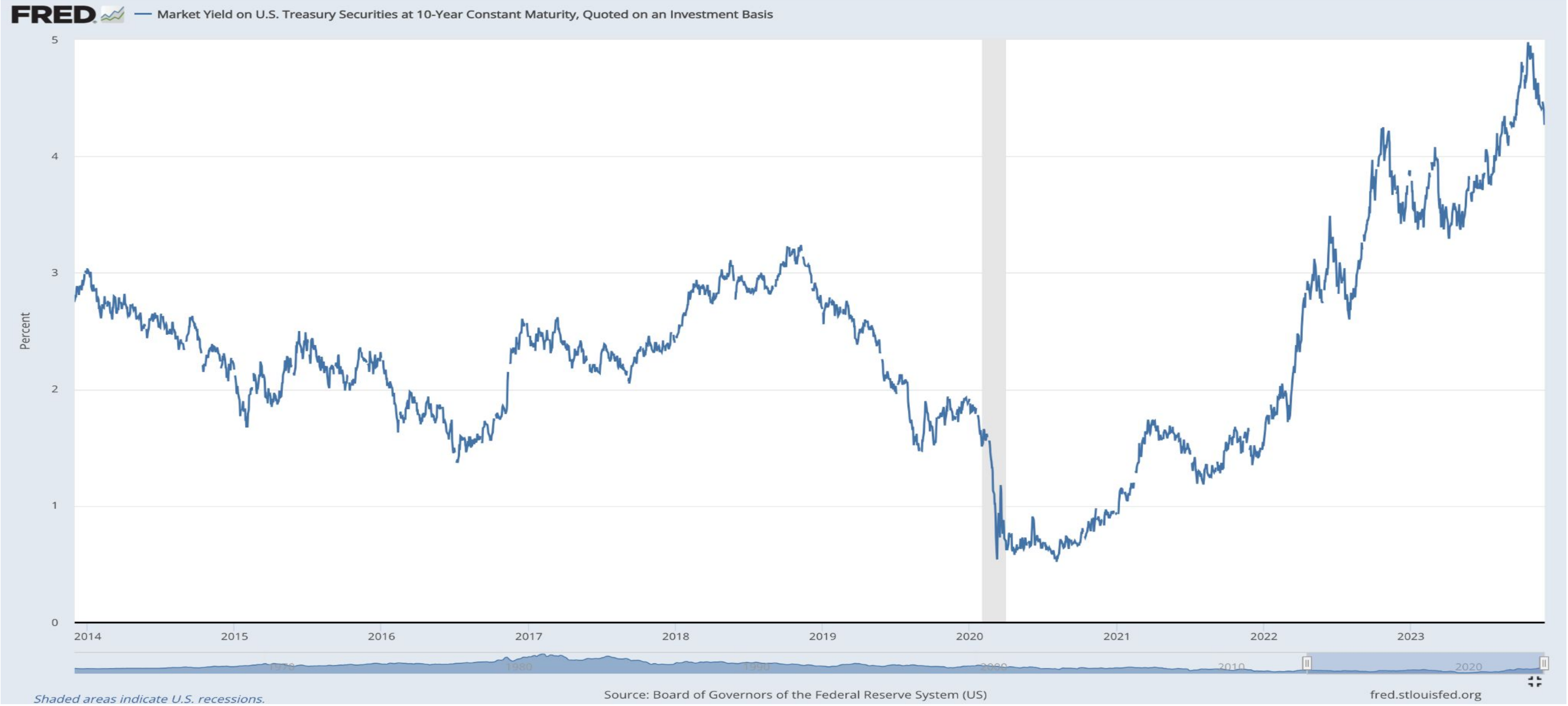
Appendix 3



Global Equity Market Share as of Q2 2023
North America
Asia
Europe
Oceania
Developed & Emerging Markets
In 2024, corporate earnings growth across emerging markets is projected to outpace other major regions:
2024 Earnings Growth
EM* 19%
U.S. 10%
DM** 8%
Europe 5%
Japan 5%
U.S.
42.5%
The U.S. is home to 39 of the 100 largest companies in the world.
Canada
2.7%
Japan
5.4%
Hong Kong
4.0%
Singapore
0.6%
China
10.6%
The Shanghai Stock Exchange is the third largest globally, with a $7.1T market cap.
EU
11.1%
Luxury conglomerate, LVMH, is Europe's most valuable firm.
Australia
1.5%
UK
2.9%
Other Developed Markets
9.4%
Other Emerging Markets
9.2%
*Represented by the MSCI Emerging Markets Index.
**Represented by the MSCI World Index which measures the performance of developed market equities.
Source: World Federation of Exchanges, SIFMA estimates, Forbes, Bloomberg, JP Morgan, MSCI. Numbers may not total 100 due to rounding. Largest companies in the world based on Forbes 2000 methodology that accounts for market value, sales, profits, and assets.
MARKETS IN A MINUTE
VISUAL CAPITALIST
RESEARCH + WRITING Dorothy Neufeld | DESIGN Sabrina Lam
/visualcapitalist
@visualcap
visualcapitalist.com

Appendix 4 - Yield Curve (10Y Mat.)



Appendix 5 - Russell 3000 Sector Breakdown

iShares Russell 3000 ETF

Fact Sheet | Prospectus | Financial and Legal Documents | Data Download

Overview | Performance & Distributions | Fund Facts | Sustainability Characteristics | Fees | Holdings | Literature

Sector

as of Nov 29, 2023

Type	Fund
Information Technology	27.37
Financials	13.44
Health Care	12.48
Consumer Discretionary	10.77
Industrials	9.63
Communication	8.11
Consumer Staples	5.80
Energy	4.21
Real Estate	2.88
Materials	2.69
Utilities	2.33
Cash and/or Derivatives	0.29