



Approved Prep
Provider



CFA Institute

Level III – Alternative Investments

Asset Allocation to Alternative Investments

www.ift.world

*Graphs, charts, tables, examples, and figures are copyright 2019, CFA Institute.
Reproduced and republished with permission from CFA Institute. All rights reserved.*

www.ift.world

Mahakavi Book Center
99204111558 / 99200665601
www.mahakavibooks.com

Contents and Introduction

1. Introduction
2. The Role of Alternative Investments in a Multi-Asset Portfolio
3. Diversifying Equity Risk
4. Perspectives on the Investment Opportunity Set
5. Investment Considerations Relevant to the Decision to Invest in Alternatives
6. Suitability Considerations
7. Asset Allocation Approaches
8. Liquidity Planning
9. Monitoring the Investment Program

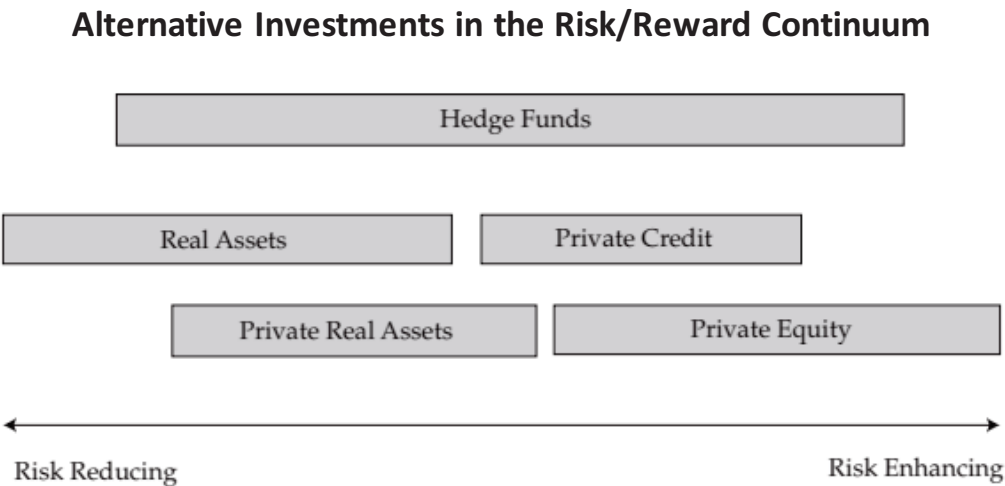
No universal definition of alternative investments but for this reading alternatives include:

- Private equity
- Hedge funds
- Real assets
- Commercial real estate
- Private credit

2. The Role of Alternative Investments in a Multi-Asset Portfolio

Higher risk-adjusted returns through higher returns and/or risk reduction benefit

Asset classes in a portfolio can have different functional roles



		Role			
		Diversifying			
Asset Class		Capital Growth	Income	Public Equities	Safety
Fixed Income and Credit	Governments		M	H	H
	Inflation-Linked		M	H	H/M
	Inv.-Grade Credit		M	H	M
	High-Yield Credit		H	M	
	Private Credit		H	M	
Equities	Public Equity	H	M		
	Private Equity	H	M	M	
Real Estate	Public Real Estate	M	H	M	
	Private Real Estate	M	H	M	
Real Assets	Public Real Assets (Energy, Metal, etc.)			H	
	Private Real Assets (Timber, etc.)	H	H	H	
Hedge Funds	Absolute Return		M	H	
	Equity Long/Short			M	

Notes: H = high/strong potential to fulfill the indicated role; M = moderate potential to fulfill the indicated role.

Role of Different Types of Alternative Investments (1/3)

2.1 The Role of Private Equity in a Multi-Asset Portfolio

- Return enhancer; illiquidity risk
- Limited diversification benefit
- Volatility estimated using public equity proxy

2.2 The Role of Hedge Funds in a Multi-Asset Portfolio

- Hedge fund strategies span the spectrum from risk reducers to return enhancers
- Long/short equity strategies deliver equity-like returns but with lower exposure to equity premium
- Short-biased equity strategies attempt to generate alpha by shorting overpriced securities
- Arbitrage and event-driven strategies provide equity-like returns with little to no correlation with traditional asset classes

Role of Different Types of Alternative Investments (2/3)

2.3 The Role of Real Assets in a Multi-Asset Portfolio

- Category includes timber, commodities, farmland, energy and infrastructure assets
- Timber investments provide both growth and inflation-hedging properties
- Commodities (e.g., metals, energy, livestock, and agricultural commodities) serve as a hedge against inflation and provide a differentiated source of alpha; certain commodity investments serve as safe havens in times of crisis
- Farmland investing may have a commodity-like profile or a commercial real estate-like profile
- Energy investments are generally considered a real asset as the investor owns the mineral rights to commodities that are correlated with inflation factors.
- Infrastructure investments tend to generate stable/modestly growing income and tend to have high correlation with overall inflation.

Role of Different Types of Alternative Investments (3/3)

2.4 The Role of Commercial Real Estate in a Multi-Asset Portfolio

- Core strategies: collect rent from fully occupied properties
- Opportunistic strategies: develop properties and sell; purchase distressed properties and rehabilitate
- Protection against unanticipated inflation
 - Rent
 - Property value

2.5 The Role of Private Credit in a Multi-Asset Portfolio

- Distressed investment and direct lending
- Direct lending assets are income-producing; asset owner assumes default and recovery risks
- Distressed investments have an equity-like profile
 - Idiosyncratic risk dominates all other risks
- Both strategies have high illiquidity risk

3. Diversifying Equity Risk

Are alternative assets better risk mitigators than government bonds?

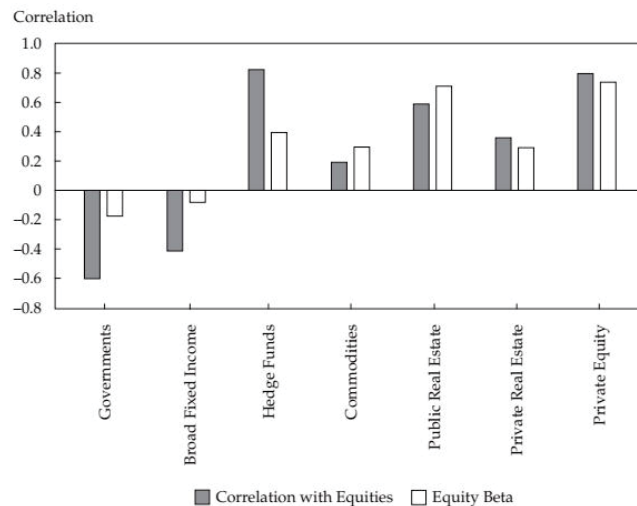
1. Volatility Reduction over the Short Time Horizon
2. Risk of Not Meeting the Investment Goals over the Long Time Horizon

3.1 Volatility Reduction over the Short Time Horizon

Reported volatility and correlation numbers for alternative assets are understated because

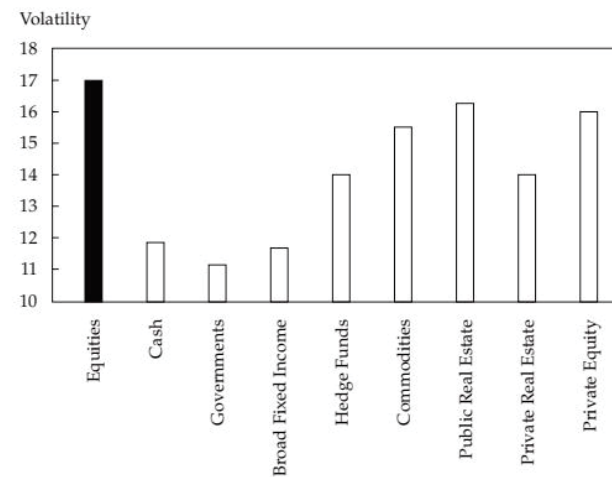
- Reported returns are often based on appraisals and estimates
- Survivorship bias
- Indexes (such as hedge fund indexes) might already reflect a diversification benefit

Exhibit 6 Fixed-Income's and Alternative's Equity Beta and Correlation with Equities



Sources: Bloomberg and authors' own data and calculations.

Exhibit 7 Volatility of Portfolios Comprised of 70% Equities and 30% Other Asset Class



Sources: Bloomberg and authors' own data and calculations.

If inflation is low and there is negative correlation between bond returns and equity returns, government bonds do better than various alternative assets in reducing the volatility of an equity-based portfolio.

3.2 Risk of Not Meeting the Investment Goals over the Long Time Horizon

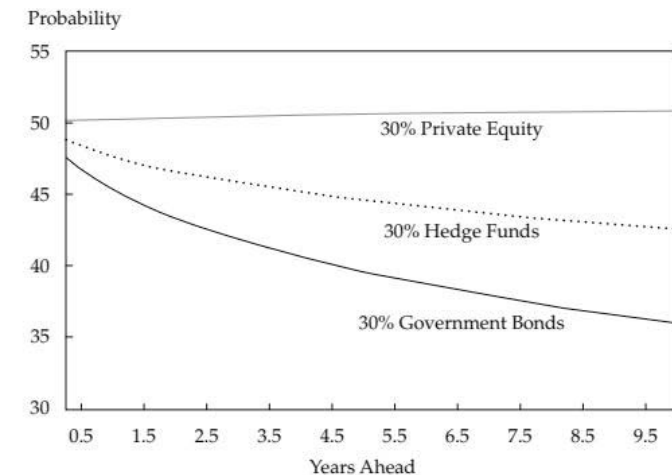
Volatility is not always the most relevant risk measure
Consider probability of meeting investment objective

As time horizon increases return accumulation becomes more important

- Return accumulates proportionally with time
- Volatility scales with the square root of time

Risk of severe and sustained drawdown needs to be considered

Exhibit 9 The Probability of Achieving Investment Objectives over the Longer Time Horizon



Note: Portfolios comprised of 70% equities and 30% other asset classes.
Source: Authors' calculations.

Example 1: Mitigating Equity Risk by Allocating to Hedge Funds or Bonds

The investment committee of a major foundation is concerned about high equity valuations and would like to increase the allocation either to hedge funds or to high-grade, fixed-income assets to diversify equity risk. As the risk manager of this foundation:

- 1 Discuss the justifications and the limitations of using bonds to mitigate equity risk.
- 2 Discuss the justifications and the limitations of using hedge funds to mitigate equity risk.

Solution to 1:

- Supporting argument: Bonds have exhibited negative correlation and beta to equities in a low inflation environment, so as long as inflation stays at or below average historical levels, this negative equity–bond correlation should lead to the highest reduction in portfolio volatility.
- Limitations: The negative stock/bond correlation may be temporary, and amid high inflation the stock/bond correlation could turn positive. Furthermore, if bonds' expected return is low, a heavy allocation to bonds may reduce the probability of achieving the foundation's long-term return objectives.

Solution to 2:

- Supporting argument: With a net equity beta of around 0.3–0.4 (see Exhibit 5), hedge funds would reduce an equity-dominated portfolio's overall beta. With higher expected returns than bonds, an allocation to hedge funds would make achieving the long-term return target more feasible.
- Limitations: Although a well-constructed hedge fund portfolio may reduce portfolio volatility and beta, hedge funds are often highly actively managed, levered investment strategies, and individual hedge funds may suffer significant and permanent losses during turbulent times.

4. Perspectives on the Investment Opportunity Set

1. Traditional Approaches to Asset Classification
2. Risk-Based Approaches to Asset Classification
3. Comparing Risk-Based and Traditional Approaches

4.1 Traditional Approaches to Asset Classification

Liquidity-Based Approach to Defining the Opportunity Set

- Initial asset allocation using only broad, liquid asset classes
- Second iteration incorporates liquidity profile

	Equity & Equity-Like	Fixed Income & Fixed Income-Like	Real Estate
Marketable/Liquid	Public Equity Long/Short Equity Hedge Funds	Fixed Income Cash	Public Real Estate Commodities
Private/Illiquid	Private Equity	Private Credit	Private Real Estate Private Real Assets

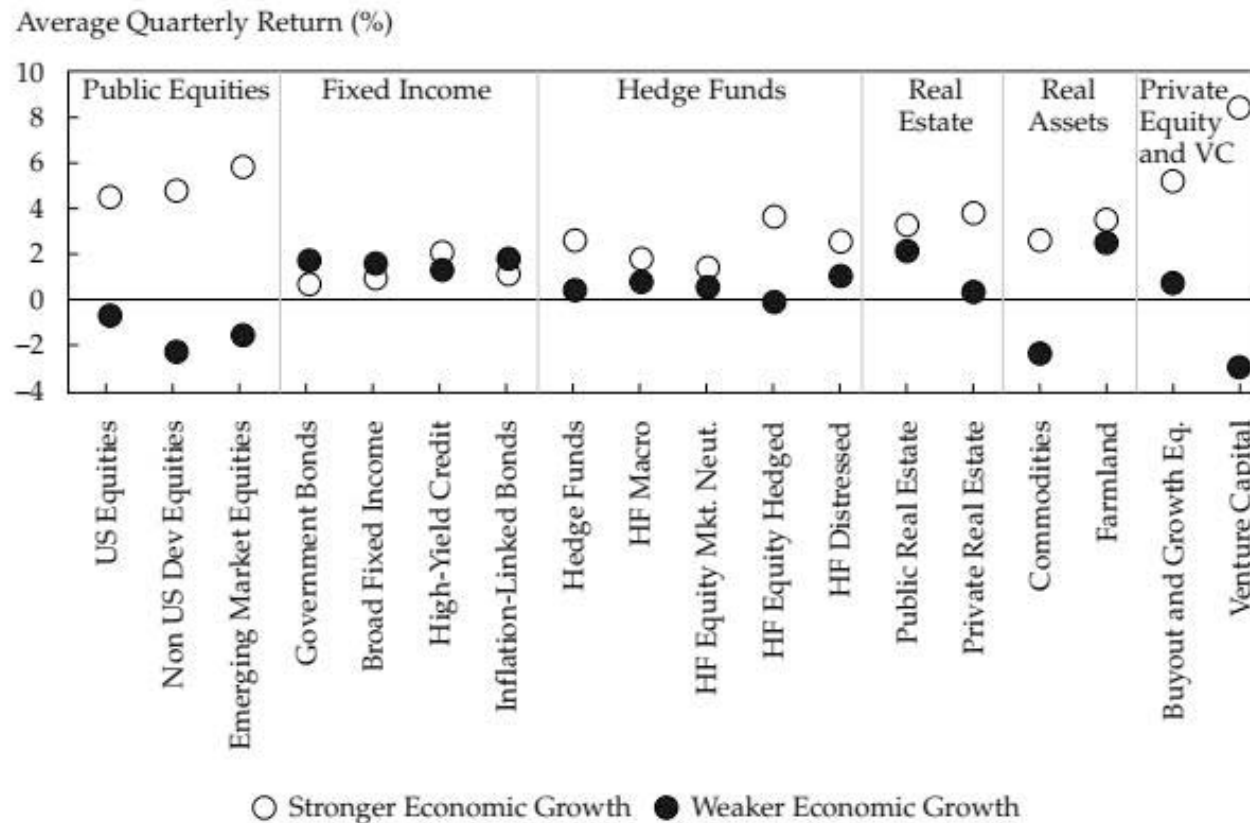
Approach Based on Expected Performance Under Distinct Macroeconomic Regimes

- Capital growth assets
- Inflation-hedging assets
- Deflation-hedging assets

		Inflation Environment		
		Deflation	Moderate Inflation	High Inflation
Economic Environment	High Growth		Public Equity Private Equity High-Yield Bonds Private Credit	Real Estate Commodities
	Low Growth/ Recession	Government Bonds		Inflation-Linked Bonds Gold

Source: Authors' data.

Historical Asset Class Performance under Stronger and Weaker Economic Growth Periods (1997–2017)



4.2 Risk-Based Approaches to Asset Classification

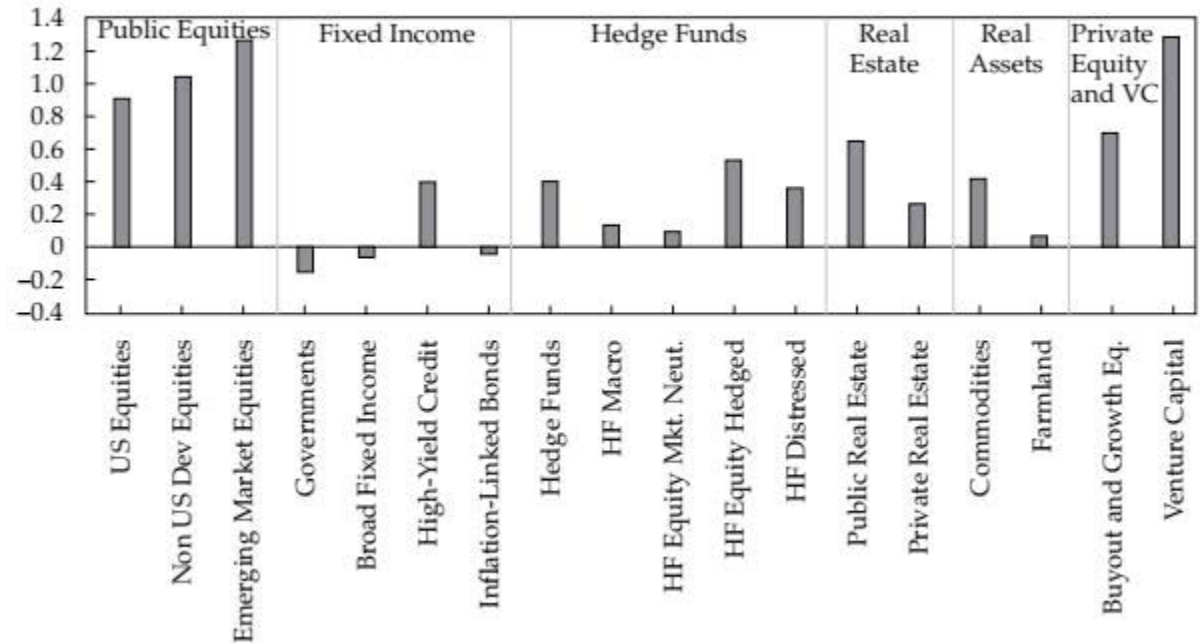
Many traditional and alternative asset classes share similar characteristics that can result in high correlations

Asset allocation can be done based on risk factor sensitivity

Risk factors

- *Equity market return*
- *Size*
- *Value*
- *Liquidity*
- *Duration*
- *Inflation*
- *Credit spread*
- *Currency*

Global Equity Beta



Sources: Authors' calculations; index data sources are the same as those in Exhibit 12.

Factor Sensitivity Estimates across Various Asset Classes

Asset Classes	Equity	Size	Value	Liquidity	Nominal Duration	Inflation	Credit Spread	Currency	R-squared
US Equities	1.0								1.00
Non-US Dev Equities	0.9							0.7	0.86
Emerging Mkt Equities	1.1	0.5						0.5	0.66
Government Bonds					4.8				0.96
Broad Fixed Income					4.2		0.6		0.89
High-Yield Credit					4.1		4.2		0.95
Inflation-Linked Bonds					6.6	7.0			0.82
HF Macro	0.2	0.2			1.9	3.1	-0.9	0.1	0.28
HF Equity Mkt. Neut.	0.1								0.14
HF Equity Hedged	0.5								0.72
HF Distressed	0.1	0.2					1.8		0.72
Commodities						18.0		0.8	0.36
Public Real Estate	0.9				4.6	0.9			0.38
Private Real Estate	0.2			0.1		2.4			0.20
Buyout & Growth Equities	0.6	0.2	-0.3	0.1					0.70

Example 2: Applying Risk Factors for Inflation Hedging

- 1 The CIO (chief investment officer) of the United Retired Workers Plan would like to reduce inflation risk in the portfolio. Based on the data displayed in Exhibit 14, which asset classes would you recommend as potential inflation-hedging tools?
- 2 The CIO is not only concerned about inflation but also rising interest rates. Which alternative asset classes would you recommend for consideration?

Solution to 1:

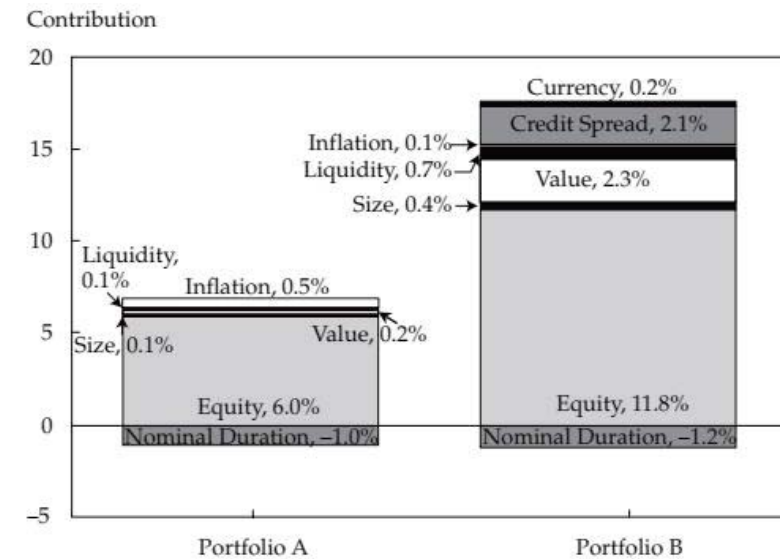
Commodities and inflation-linked bonds have the highest factor sensitivity to inflation, so they are the most obvious candidates. Real estate (both public and private) also has some potential to protect against inflation. Based on the data presented, macro hedge fund strategies also exhibited a positive inflation beta, but given their active nature, further analysis may be needed before choosing them as inflation-hedging vehicles.

Solution to 2:

Commodities and private real estate would be the likely asset classes to hedge against rising interest rates, given their zero-factor sensitivity to nominal duration. Some of the hedge fund strategies also show zero-factor sensitivity to duration, but the relationship may not hold true in the future given the actively managed nature of hedge funds. Although Exhibit 14 indicates equity strategies (both public and private) also show little to no sensitivity to rising interest rates (duration) bonds and equities have been more highly correlated in the past.

Illustration: Asset Allocation and Risk-Based Approaches

Broad Asset Classes	Asset Allocation		Underlying Investments		% Contribution to Risk	
	Portfolio A	Portfolio B	Portfolio A	Portfolio B	Portfolio A	Portfolio B
Fixed Income	20%	20%	Government Bonds	High-Yield Bonds	-6.5%	7.6%
Public Equities	20%	20%	US Equities	Non-US Developed Equities	51.4%	18.2%
Hedge Funds	20%	20%	Equity Market Neutral	Long/Short Equity	5.4%	11.1%
Real Assets	20%	20%	Inflation-linked bonds	REITs	0.7%	13.2%
Private Equity	20%	20%	Buyout	Venture Capital	48.9%	49.8%
Total	100%	100%				
			Expected Return		5.3%	8.8%
			Volatility		5.9%	16.5%
			Equity Beta		0.30	0.79



4.3 Comparing Risk-Based and Traditional Approaches

Traditional Approaches	Risk-Based Approaches
Strengths: Easy to communicate Relevance for liquidity management and operational considerations	Strengths: Common risk factor identification Integrated risk framework
Limitations: Over-estimation of portfolio diversification Obscured primary drivers of risk	Limitations: Sensitivity to the historical look-back period Implementation hurdles

5. Investment Considerations Relevant to the Decision to Invest in Alternatives

1. Risk Considerations
2. Return Expectations
3. Investment Vehicle
4. Liquidity
5. Fees and Expenses
6. Tax Considerations
7. Other Considerations

5.1 Risk Considerations

- Standard deviation and illiquid assets
- Actual asset allocation versus modeled asset allocation
- Different strategies have their unique risk and return profiles which are not easy to model
 - Short-only strategy
 - Option payouts

5.2 Return Expectations

- Limited return history
- Idiosyncratic risk
- Building block approach

5.3 Investment Vehicle

Direct investment in private (limited) partnership

- Commonly used vehicle
- High idiosyncratic risk
- Little or no involvement in fund operation

Funds of funds (FOFs)

- Pools capital from multiple investors
- Diversification
- Higher fees

SMAs, funds of one

- Favorable investment terms
- Customizable
- GP and investor interests might not be aligned

Mutual funds, UCITS, publicly traded funds

- Undertakings for collective investment in transferable securities
- Replicate alternative investment strategies, especially hedge funds
- Smaller investors get access to otherwise inaccessible asset classes
- Regulatory restrictions

5.4 Liquidity (1/3)

Liquidity Risks Associated with the Investment Vehicle

	Subscription	Redemption	Lock-Up
Hedge Funds	<ul style="list-style-type: none"> Typically accept capital on a monthly or quarterly basis. 	<ul style="list-style-type: none"> Quarterly or annual redemptions with 30 to 90 days' notice required. May be subject to a gate limiting the amount of fund or investor assets that can be redeemed at any one redemption date. 10% holdback of the redemption amount pending completion of the annual audit. 	<ul style="list-style-type: none"> Typically one year in the US; shorter in Europe. Redemptions prior to the lock-up period may be permitted but are subject to a penalty, typically 10%.
Private Equity, Private Credit, Real Estate, and Real Asset Funds	<ul style="list-style-type: none"> Funds typically have multiple "closes." The final close for new investors is usually one year after the first close. Committed capital is called for investment in stages over a 3-year investment period. 	<ul style="list-style-type: none"> No redemption provisions. Fund interests may be sold on the secondary market, subject to GP approval. Distributions paid as investments are realized over the life of the fund. Unrealized assets may be distributed in kind to the LP at fund termination. 	<ul style="list-style-type: none"> Typical 10-year life, with GP option to extend fund term 1 to 2 years.

Secondary Markets

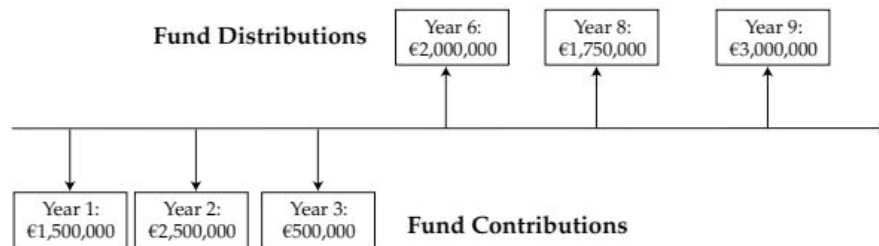
5.4 Liquidity (2/3)

Liquidity Risks Associated with the Investment Vehicle

Understanding a drawdown structure

The Chan Family Partnership commits €5,000,000 to Uptown Real Estate LP. The fund has a three-year investment period. When fully invested, Uptown expects to hold 12 to 15 properties. The capital call schedule for Uptown may look something like this:

- Year 1: €1,500,000 of the €5,000,000 committed is called, covering three investments
- Year 2: €2,500,000 is called, covering six investments
- Year 3: €500,000 is called, covering two investments
- Year 6: €2,000,000 is distributed by Uptown Real Estate
- More distributions in subsequent years



5.4 Liquidity (3/3)

Liquidity Risks Associated with the Underlying Investments

Potential mismatch between fund terms and liquidity profile of instruments held by fund

- Equity-oriented hedge funds
- Event-driven hedge funds
- Relative value hedge funds
- Leverage

5.5 Fees and Expenses

Significant gap between gross return and net of fee return

- AUM fee and incentive fee
- Many funds pass through normal fund expenses
- Fees could be charged on committed capital, not invested capital

5.6 Tax Considerations

Taxes can have an impact on relative attractiveness

- Some strategies generate more short-term gains relative to long-term gains
- Some investment vehicles help mitigate potential tax consequences
- Tax codes can favor certain industries and investments
- Some tax-exempt organizations might generate “unrelated business income” which is taxable

5.7 Other Considerations

- Access to top-tier managers
- Effective due diligence
- Skills to evaluate and monitor (build vs. buy)
 - Cost
 - In-house team
 - Consultants
 - Degree of control or influence

Example 3: Considerations in Allocating to Alternative Investments

The investment committee (IC) for a small endowment has decided to invest in private equity for the first time and has agreed upon a 10% strategic target. The internal investment team comprises the CIO (chief investment officer) and two analysts. The IC asks the CIO to recommend an implementation plan at the next meeting.

- 1 What are the options the CIO should include in her report as it relates to vehicles, and what factors might influence the recommendation?
- 2 The IC provided no guidance as to expectations for when the investment program should reach its 10% target weight. What additional information should the CIO gather before presenting her plan of action?

Solution to 1:

The primary considerations for the CIO include the size of the private equity allocation, the team's expertise with private equity, and the available resources. Because this is a small endowment, it may be difficult to commit enough capital to achieve an adequate level of diversification. The size of the fund's investment team is also likely to be a concern. Unless there are financial resources to add a private equity specialist and/or employ an outside consultant, the fund-of-funds route would likely be the optimal vehicle(s) to implement a diversified private equity program.

Solution to 2:

The CIO should factor in the cash flows and anticipated liquidity profile of the overall endowment in considering the speed with which they would commit to a significant PE program. If, for example, the foundation is embarking on a capital campaign and anticipated distributions are small over the next few years, then commitments may be accelerated after factoring in an appropriate vintage year diversification. (Because private investment returns are very sensitive to the fund's vintage year, it is common for investors to build up to a full allocation over a period of years, called vintage year diversification.) However, if the rest of the investment program is heavily exposed to illiquid investments (e.g., real estate, certain hedge fund strategies) and anticipated distributions to fund operating expenses are high, the CIO may want to commit at a slower pace.

Example 4: Considerations in Allocating to Alternative Investments

A \$100 million client of a family office firm has requested that all public securities investments meet certain ESG criteria. The ESG ratings will be provided by an independent third-party firm that provides a rating for most public equities and some fixed-income issuers. Moreover, the family would like to dedicate a percentage of assets to support an “environmental sustainability” impact theme.

- 1 Which alternative investment strategies may not be suitable for this client given the ESG requirements?
- 2 What additional information might the family office firm require from the client in order to meet the environmental sustainability threshold?

Solution to 1:

Because the ESG criteria apply to all public securities, most hedge fund strategies would be precluded because they are typically owned in a commingled vehicle, such as a limited partnership or a mutual fund where transparency of holdings is limited and the investor has no influence over the composition of the underlying portfolio. Separate account strategies are available for certain large portfolios, but it is unlikely that a \$100 million client would be eligible for a custom portfolio that would be allocating only a small asset base to any particular fund.

Solution to 2:

The client and the manager would need to agree on a clear definition of environmental sustainability and the types of investments that might qualify for this theme. It is unlikely that most hedge funds, private credit, energy, or infrastructure strategies would be considered to positively impact environmental sustainability. The most likely candidates for consideration could be timber, sustainable farmland, and clean-tech funds under the venture capital category.

6. Suitability Considerations

6.1 Investment Horizon

- In general alternative investments are suitable for investors with relatively long investment horizons
- Appropriate investment horizon depends on strategy
- For private real estate, private real assets and private equity, 15 years or more is recommended

6.2 Expertise

- Investors should understand the factors which drive success or failure of different strategies
 - Investment expertise
 - Information asymmetry
- Investment philosophy should be consistent with principles of alternative investments

6.3 Governance

- The long- and short-term objectives of the investment program are clearly articulated.
- Decision rights and responsibilities are allocated to those individuals with the knowledge, capacity, and time required to critically evaluate possible courses of action.
- A formal investment policy has been adopted to govern the day-to-day operations of the investment program.
- A reporting framework is in place to monitor the program's progress toward the agreed-on goals and objectives.

6.4 Transparency

- Less than 100% transparency
 - Blind pool
 - Risk exposures
 - Questionable actions by GP
- Hedge fund reporting
- Private equity reporting
- Calculation of fund NAV and LPs' NAV
- High-quality alternative investment managers engage independent and respected accounting firms to perform an annual audit

Example 5: Suitability Considerations in Allocating to Alternative Investments

The Christian family office is concerned with investor or manager fraud and so will invest only in separately managed accounts (SMAs).

- 1 What are the benefits and drawbacks to the use of SMAs?
- 2 The 75-year-old patriarch of the Christian family would like to consider a significant private equity allocation in a trust that he oversees on behalf of his youngest daughter. This would be the first alternative investment commitment made with any of the family's assets. The daughter is 40 years old. She will receive one-half of the assets outright upon his death. The remainder of the assets will be held in trust subject to the terms of the trust agreement. List some of the reasons why private equity may or may not be appropriate for this trust.

Solution to 1:

Although an SMA allows for greater transparency and control of capital flows (the manager does not generally have the authority to distribute capital from the client account), it has several potential disadvantages: 1) SMAs are not available or appropriate for many alternative strategies; thus, the requirement to invest via an SMA may limit the ability to develop an optimal alternative investment program. 2) A manager cannot invest alongside the client in the client's SMA. This may reduce the alignment of interest between the manager and the client and may give rise to conflicts of interest as trades are allocated between the SMA and the manager's other funds.

Solution to 2:

- Successful private equity investment requires a long time horizon. Given the patriarch's age, it is likely that half of the trust's assets will be distributed before the private equity program has had time to mature. This may lead to an unintended doubling in the size of the private equity allocation.
- The patriarch has no experience investing in alternative assets. Unless he is willing to commit the time, money, and effort and engage an outside adviser with the relevant expertise and access to top-tier funds, the likelihood of a successful private equity investment program would be low.
- Because the beneficiary of the trust is relatively young, the time horizon of the investment likely matches the profile of the underlying investor. It may be appropriate for the trust to invest in long-dated private equity assets, provided the investment is sized appropriately and the necessary expertise has been retained.

7. Asset Allocation Approaches

1. Statistical Properties and Challenges of Asset Returns
2. Monte Carlo Simulation
3. Portfolio Optimization
4. Risk Factor-Based Optimization

7.1 Statistical Properties and Challenges of Asset Returns

Appraisal-based valuation

Stale pricing

Artificially smoothed returns

Serial correlation

Unsmoothing

Quarterly Data Dec. 1997–Sept. 2017	Serial Correlation	Volatility (reported returns)	Volatility (unsmoothed)
US Equities	0.03	17.0%	17.7%
Hedge Funds—Aggregate	0.15	8.1%	9.5%
HF Macro	0.08	5.4%	5.9%
HF Equity Market Neutral	0.17	3.5%	4.1%
HF Equity Hedged	0.19	10.7%	13.1%
HF Distressed	0.36	8.9%	13.0%

Skewness + excess kurtosis → fat tails

Impact of fat tails can be addressed using advanced mathematical and statistical models: time varying volatility models, regime switching models, extreme value theory

Unsmoothed Quarterly Data Dec. 1997–Sept. 2017	Skewness	Excess Kurtosis	95% CVaR (Normal Distribution)	95% CVaR (Observed)	99% CVaR (Normal Distribution)	99% CVaR (Observed)
High-Yield Credit	0.18	6.14	−7.9%	−9.8%	−10.8%	−19.7%
Inflation-Linked Bonds	−0.32	1.08	−4.2%	−4.2%	−5.8%	−8.1%
Hedge Funds	−0.17	1.69	−7.6%	−8.6%	−10.3%	−9.7%
HF Macro	0.36	0.85	−4.3%	−4.1%	−6.0%	−5.1%
HF Equity Market Neutral	−1.17	3.55	−2.9%	−3.9%	−4.1%	−5.4%
HF Equity Hedged	0.08	2.24	−10.8%	−10.6%	−14.5%	−12.7%
HF Distressed	−1.25	3.52	−10.8%	−11.1%	−14.5%	−16.9%

Asset allocation process:

1. Adjust returns by unsmoothing
2. If returns are normally distributed use MVO
3. If returns have fat tails use appropriate optimization technique

7.2 Monte Carlo Simulation

Monte Carlo model construction process

1. Identify variables
2. Establish quantitative framework to generate realistic random scenarios
3. If using risk factor approach convert risk factors to asset returns
4. Translate asset class return scenarios to meaningful indicators

Monte Carlo simulations can be used to

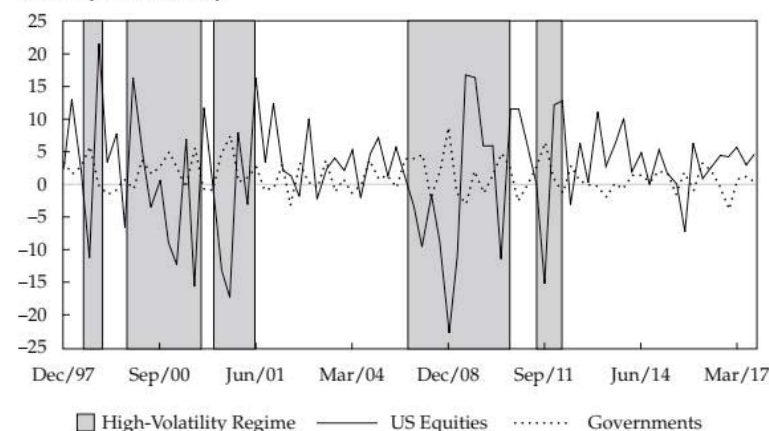
- Generate return scenarios even if underlying data is not normally distributed
- Illustrate simulation-based risk and return characteristics over a long investment horizon

Simulating Skewed and Fat-Tailed Financial Variables

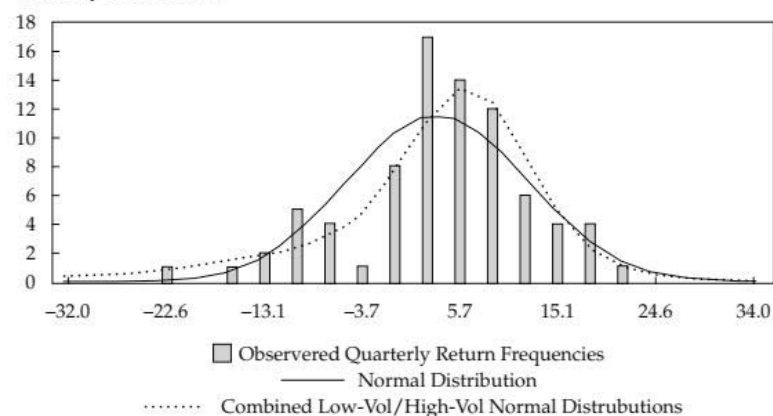
Estimate behavior of factors and/or assets in low-volatility regimes and high-volatility regimes

Generate scenarios using the different means and covariances estimated under the different regimes

Quarterly Factor History



Quarterly Factor Return

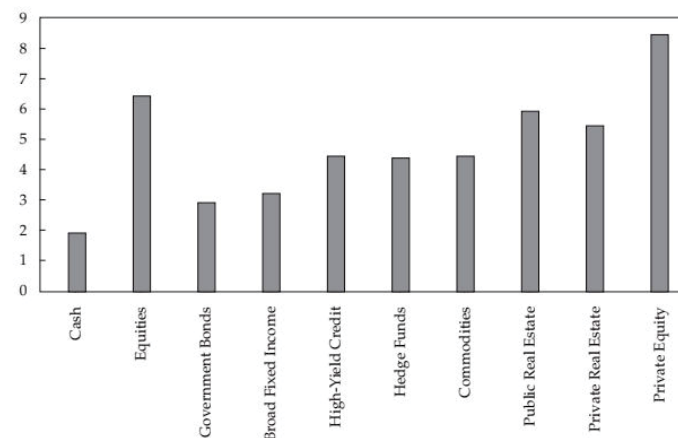


	Equities	Government Bonds
Quarterly Average Return	2.1%	1.2%
Quarterly Return Volatility	8.5%	4.5%
Skewness	-0.5	0.6
Kurtosis	0.4	0.4
Average Return in Regime 1	5.1%	0.5%
Average Return in Regime 2	-3.1%	2.4%
Volatility in Regime 1	5.5%	1.9%
Volatility in Regime 2	13.7%	3.8%
Correlation in Regime 1		0.0
Correlation in Regime 2		-0.6

Simulation for Long-Term Horizon Risk Assessment

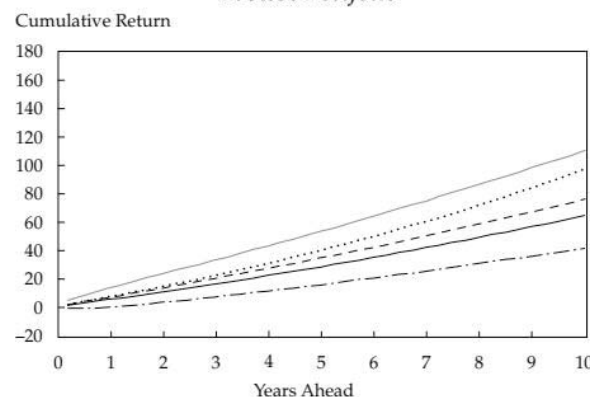
Simulating portfolio outcomes (± 1 standard deviation) to estimate the likelihood of falling short of the investment objectives.

Asset Class Expected Returns

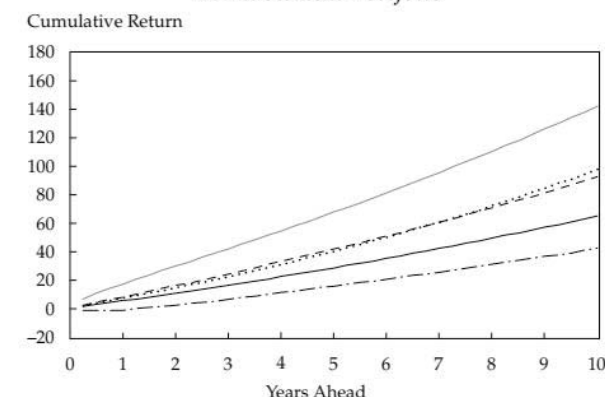


	Government Bond Portfolio	50/50 Portfolio	Endowment Portfolio
Expected Geometric Return over 10 Years	2.3%	5.6%	7.0%
Annual Total Return Volatility	4.2%	6.6%	11.2%
95% VaR over Q/Q (quarter over quarter)	-3.1%	-2.9%	-4.6%
95% VaR over 1 Year	-5.2%	-4.2%	-9.1%
95% CVaR over Q/Q	-4.0%	-3.9%	-6.4%
95% CVaR over 1 Year	-6.9%	-6.6%	-13.1%

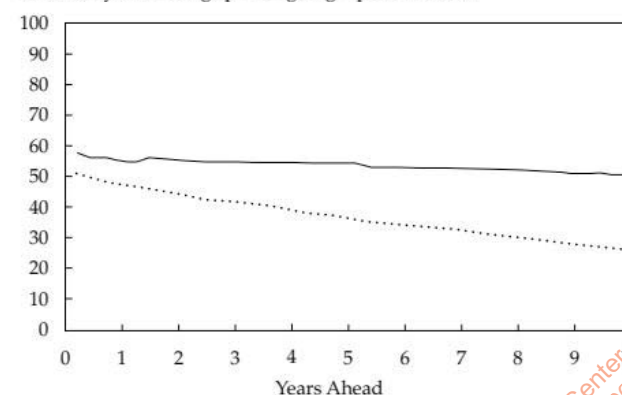
A. 50/50 Portfolio



B. Endowment Portfolio



Probability of meeting spending target plus inflation



— Endowment Portfolio 50/50 Portfolio

7.3 Portfolio Optimization

Mean-Variance Optimization without and with Constraints

- Unconstrained MVO
 - Over-allocate illiquid alternative asset classes
 - High-risk portfolios dominated by private equity
 - Low-risk portfolios dominated by cash and fixed income
- One work-around is to impose minimum and maximum constraints to different asset classes

Mean-CVaR Optimization

- Minimize CVaR subject to an expected return target
- Appropriate if down-side risk is of particular concern
- If asset classes have negative skewness and long tails, asset allocation will be very different from what MVO will produce

Example 6: Asset Allocation Recommendation

The CIO (chief investment officer) of the International University Endowment Fund (the Fund) is preparing for the upcoming investment committee (IC) meeting. The Fund's annual asset allocation review is on the agenda, and the CIO plans to propose a new strategic asset allocation for the Fund. Subject to prudent risk-taking, the recommended asset allocation should offer

- the highest expected return and
- the highest probability of achieving the long-term 5% real return target.

The inflation assumption is 2%. In addition, the risk in the Fund is one factor that is considered when lenders assign a risk rating to the university. The university's primary lender has proposed a loan covenant that would trigger a re-evaluation of the university's creditworthiness if the Fund incurs a loss greater than 20% over any 1-year period. The investment staff produced the following tables to help the CIO prepare for the meeting:

Which asset allocation is *most likely* to meet the committee's objective and constraints?

Alternative	Asset Allocation					
	Cash	Public Equity	Govt	Credit	Hedge Fund	Real Estate
A	5.0%	60.0%	30.0%	5.0%	0.0%	0.0%
B	4.0%	50.0%	16.0%	5.0%	10.0%	5.0%
C	2.0%	40.0%	8.0%	5.0%	18.0%	7.0%
D	1.0%	30.0%	5.0%	4.0%	20.0%	10.0%
E	2.0%	40.0%	3.0%	3.0%	15.0%	7.0%
F	2.0%	50.0%	3.0%	0.0%	10.0%	5.0%
G	1.0%	56.0%	3.0%	0.0%	10.0%	0.0%

Alternative	Expected Return	Volatility	10-Year Horizon:				
			1-Year 99% VaR	1-Year 99% CVaR	5th Percentile Return	95th Percentile Return	Probability of Meeting 5% Real Return
A	6.0%	9.0%	-12.4%	-15.0%	1.6%	10.5%	37.0%
B	6.7%	10.3%	-14.6%	-17.3%	2.0%	11.4%	46.1%
C	7.1%	11.1%	-15.8%	-18.8%	2.2%	12.2%	52.1%
D	7.4%	11.5%	-16.3%	-19.4%	2.4%	12.6%	56.1%
E	7.7%	12.3%	-17.4%	-20.6%	2.4%	13.2%	58.8%
F	7.8%	13.0%	-18.5%	-21.8%	2.2%	13.7%	60.8%
G	7.9%	13.5%	-19.3%	-22.7%	2.1%	14.1%	61.0%

7.4 Risk Factor-Based Optimization (1/2)

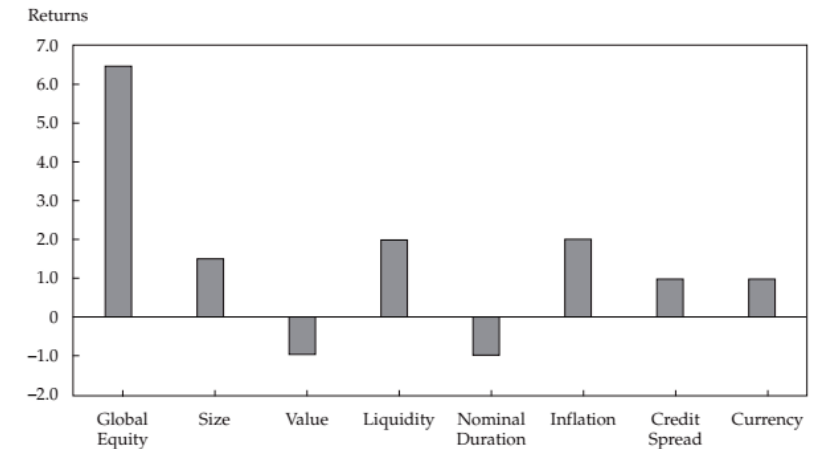
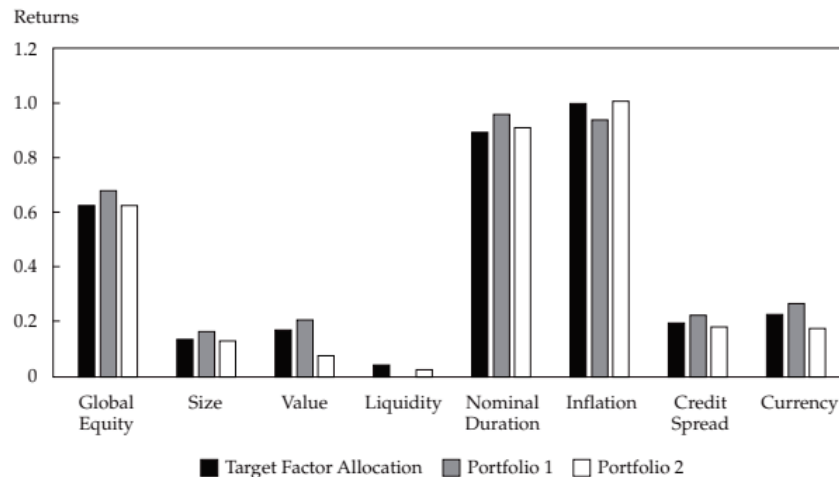
Optimize allocation to risk factors rather than asset classes

Allocations must be implemented using asset classes

Portfolios with similar factor exposures can have very different asset allocations

Asset allocation using risk factors

- We are given expected factor returns and want to minimize factor-implied risk subject to a total return target of 6.5%
- Duration and equity factors have a correlation of -0.6
- Value and equity factors have a correlation of -0.3



	Portfolio 1	Portfolio 2
Domestic Equities; <i>Value Tilt</i>	21.0%	13.0%
Non-Domestic Developed Market Equities; <i>Value Tilt</i>	21.0%	13.0%
Foreign Emerging Market Equities	21.0%	12.0%
Government Bonds	0.0%	5.0%
Broad Fixed Income	10.0%	0.0%
High-Yield Credit	2.0%	3.0%
Inflation-Linked Bonds	7.0%	0.0%
Hedge Funds	15.0%	10.0%
Commodities	3.0%	4.0%
Public Real Estate	0.0%	12.0%
Private Real Estate	0.0%	13.0%
Private Equity	0.0%	15.0%
Total	100.0%	100.0%
Expected Return	6.2%	6.9%
Volatility	13.5%	13.2%

7.4 Risk Factor-Based Optimization (2/2)

Caveats associated with risk factor-driven approach:

1. Investors might have different definitions of risk factors
2. Correlations between risk factors may shift under changing market conditions
3. Some factor sensitivities are very unstable

Example 7: Selecting an Asset Allocation Approach

- 1 You have a new client who has unexpectedly inherited a substantial sum of money. The client is in his early 30s and newly married. He has no children and no other investible assets. What asset allocation approach is most suitable for this client?

Solution to 1:

Mean–variance optimization with Monte Carlo simulation is most appropriate for this client. He has limited investment expertise, so your first responsibility is to educate him with respect to such basic investment concepts as risk, return, and diversification. A simple MVO approach supplemented with Monte Carlo simulation to illustrate potential upside and downside of an asset allocation choice is mostly likely to serve the asset allocation and investment education needs.

- 2 Your client is a tax-exempt foundation that recently received a bequest doubling its assets to €200 million. There is an outside investment adviser but no dedicated investment staff; however, the six members of the investment committee (IC) are all wealthy, sophisticated investors in their own right. The IC conducts an asset allocation study every three years and reviews the asset allocation at its annual meeting. The current asset allocation is 30% equities, 20% fixed income, 25% private equity, and 25% real estate. Three percent of assets are paid out annually in grants; this expenditure is covered by an annuity purchased some years ago. The foundation's primary investment objective is to maximize returns subject to a maximum level of volatility. A secondary consideration is the desire to avoid a permanent loss of capital. What asset allocation approach is most suitable for this client?

Solution to 2:

Given the sophistication and investment objectives of the IC members, using a mean–CVaR optimization approach is appropriate to determine the asset allocation. This client has a more sophisticated understanding of risk and will appreciate the more nuanced view of risk offered by mean–CVaR optimization. Given the portfolio's exposure to alternative investments, the asset allocation decision will be enhanced by the more detailed picture of left-tail risk offered by CVaR optimization (the risk of permanent loss) relative to mean–variance optimization. The lack of permanent staff and a once-per-year meeting schedule suggest that a risk factor-based approach may not be appropriate.

8. Liquidity Planning

Need to ensure that we have liquidity to meet obligations or goals

Liquidity challenges should be considered before allocating funds to alternative investment program

1. Achieving and Maintaining the Strategic Asset Allocation
2. Managing the Capital Calls
3. Preparing for the Unexpected

8.1 Achieving and Maintaining the Strategic Asset Allocation

Determine necessary annual commitments in order to reach and maintain long-term target asset allocation

Example: Committed capital is 100 million. Contract term is 12 years. 25% is contributed in the first year and 50% of the remaining commitments are contributed in each of the subsequent years.

Capital Contribution = Rate of Contribution \times (Capital Commitment – Paid-in-Capital)

The fund does not distribute any money in Year 1 or Year 2 but distributes 10% of the prevailing net asset value in Year 3, 20% in Year 4, 30% in Year 5, and 50% of the remaining balance in each of the remaining years. The growth rate is 13%.

Distributions = Rate of Distribution at time $t \times [\text{NAV} \times (1 + \text{Growth Rate})]$

NAV at time 1 = prior NAV $\times (1 + \text{Growth Rate}) + \text{Capital Contribution} - \text{Distributions}$

Lower distribution rates in earlier years allows NAV to grow higher

Exhibit 39 Assumed Annual Distribution Rates (RD_t)

Year	1	2	3	4	5	6	7	8	9	10	11	12
Rate of Distribution	0%	1%	3%	6%	11%	18%	26%	36%	49%	63%	80%	100%

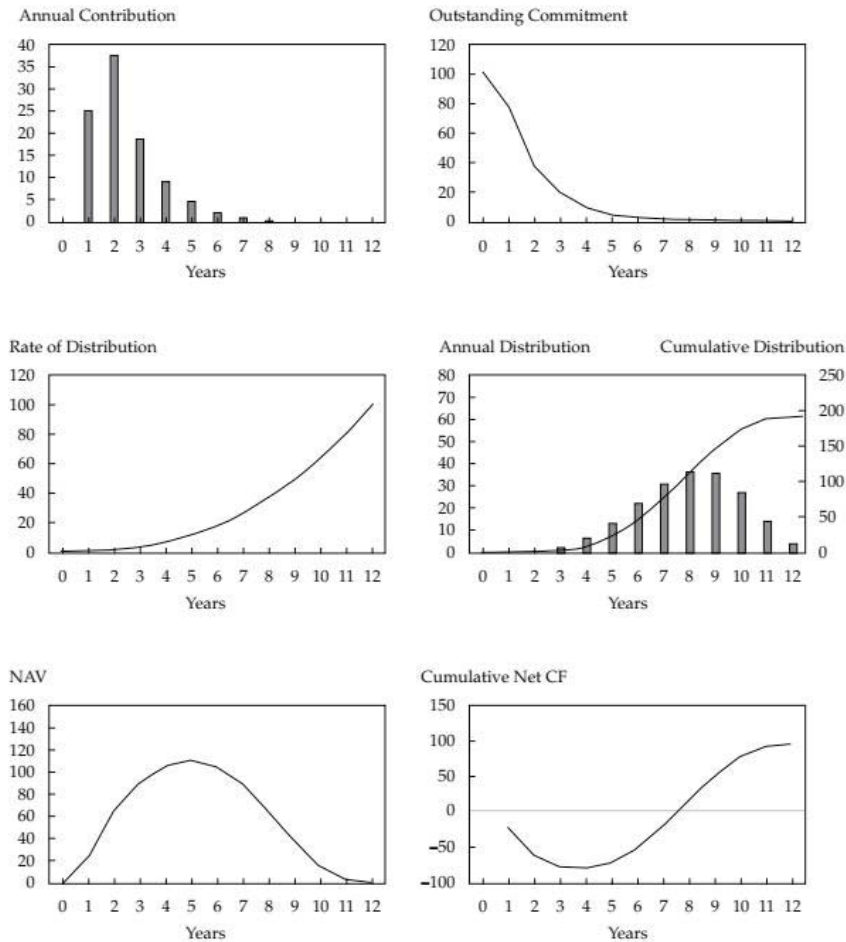
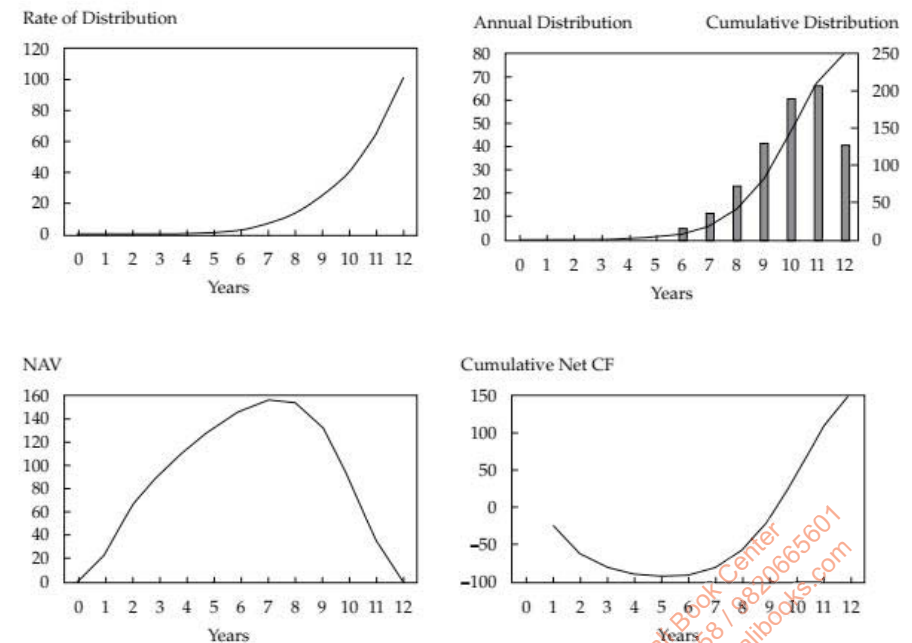


Exhibit 40 Alternative Assumed Annual Distribution Rates (RD_t)

Year	1	2	3	4	5	6	7	8	9	10	11	12
Rate of Distribution	0%	0%	0%	0%	1%	3%	7%	13%	24%	40%	65%	100%



Example 8: Liquidity Planning for Private Investments

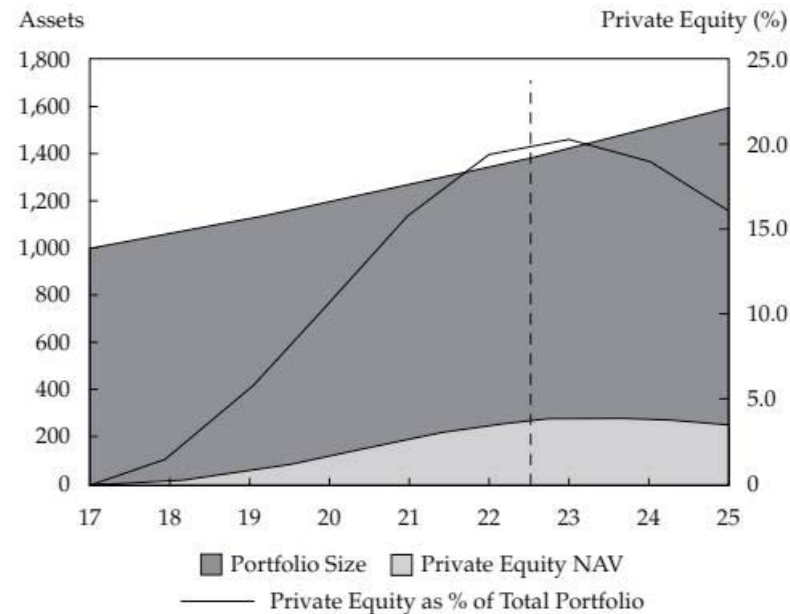
The NAV of an investor's share in a private renewable energy fund was €30 million at the end of 2020. All capital has been called. The investor expects a 20% distribution to be paid at the end of 2021. The expected growth rate is 12%. What is the expected NAV at year-end 2022?

Commitment Pacing

Cash flow and commitment-pacing models enable investors to

- Manage portfolio liquidity
- Set realistic annual commitment targets to reach desired asset allocation

Commitment Pacing:
Private Equity NAV as %
of the Total Portfolio



8.2 Managing the Capital Calls

Investors should have a strategy for maintaining asset allocation while waiting for fund to become fully invested

- Public equities for private equity
- High-yield bonds for private credit investments
- REITs for real estate investments

8.3 Preparing for the Unexpected

Estimates of cash inflows and outflows are heavily dependent on assumptions

- In bear markets GPs may call capital at a higher pace and make distributions at a lower pace than expected
- GP could exercise option to extend fund life

In addition to base case, other scenarios should be modeled

Example 9: Private Investments, Asset Allocation, and Liquidity Planning

The Endowment Fund of the University of Guitan (the Fund) has \$750 million in assets. The investment committee (IC) adopted the following strategic asset allocation four years ago. Private investments are at the lower end of the permitted range. To reach the target allocation among private investments, the investment team has made several new commitments recently, and they expect capital calls over the coming year equal to approximately about 20% of the current private asset net asset value.

	Strategic Asset Allocation Target	Permitted Range	Current Asset Allocation	
			(%)	(\$mil)
Cash	2%	0 to 5%	3%	22.5
Public Equities (including long/ short equity)	35%	30 to 40%	35%	262.5
Government Bonds	5%	4 to 10%	7%	52.5
High-Yield Credit	3%	2 to 5%	5%	37.5
Hedge Funds (excluding long/ short equity)	20%	17 to 23%	23%	172.5
Private Real Estate	10%	7 to 13%	8%	60.0
Private Real Assets	5%	3 to 7%	4%	30.0
Private Equity	20%	15 to 22%	15%	112.5
Total				\$750 mil
Expected Return	7.1%			
Expected Volatility	11.1%			
99% CVaR	-18.8%			
Assumed Inflation Rate	2%			

- 1 Identify and discuss the liquidity factors that the CIO should consider as she develops her portfolio positioning strategy for the next 12 to 24 months.
- 2 Recommend and justify a tactical asset allocation strategy for the Fund.



The strategic asset allocation has a 52% probability of meeting the 5% real return target (4% spend rate, 1% principal growth, and 2% inflation).

At its last meeting, the endowment committee of the board approved a temporary increase in the spending rate, raising it from 4% to 5% for the next five years to support the university's efforts to reposition itself in the face of declining enrollments. The spending rate is calculated as a percentage of the Fund's trailing 5-year average value.

The CIO (chief investment officer) has produced a capital market outlook that will guide the fund's tactical asset allocation strategy for the next several quarters. Key elements of the outlook are:

- accommodative central bank policies are ending;
- equity valuation metrics have recently set new highs;
- the economic cycle is at or near its peak (i.e., there is a meaningful probability of rising inflation and a weaker economic environment over the next several quarters); and
- returns will quite likely be lower than what has been experienced over the past five years.

She also developed the following stress scenario based on her capital market outlook:

Return Stress Scenario	
Cash	2%
Public Equities (including l/s equity)	-30%
Government Bonds	-3%
High-Yield Credit	-10%
Hedge Funds (excluding l/s equity)	-8%
Private Real Estate	0%
Private Real Assets	10%
Private Equity	-10%

- Given the market outlook, it is reasonable to assume cash flows into the fund from existing private investments will be negligible.
- The fund has next-12-month liabilities as follows:
 - Approximately \$37.5 million to the university (\$750 million x 5%). This is a high (conservative) estimate based on an assumption that the trailing 5-year average Fund value is less than the current \$750 million.
 - Approximately \$40.5 million in capital calls from private investment commitments (equally allocated across private real estate, private real assets, and private equity

$$[(\$60m + \$30m + \$112.5m) \times 20\%]$$

- Total liabilities next 12 months = \$78 million
- Sources of immediate liquidity:
 - Cash = \$22.5 million
 - Government bonds = \$52.5 million
 - \$73.9 million in total (less than the \$78 million liability)
- Other liquidity:
 - Public equities are at the midpoint of the permitted range. The allocation could be reduced from 35% to 30% and remain within the permitted range. This would free up \$37.5 million (\$750 million x 5%) for reinvestment in more-defensive asset classes or to meet anticipated liquidity needs. However, if the return scenario is realized (equities down 30%), then the equity allocation will fall below the 30% minimum and additional rebalancing will be required.
 - High-yield credit is at the upper end of the allowed range. The allocation could be reduced from the current 5% to 2% or 3%, freeing up an additional \$15 to \$22.5 million. The limited liquidity in high-yield bond markets may make this challenging.
 - The hedge fund allocation is at the upper end of the allowed range. The allocation could be reduced from the current 23% to something in the range of 17% to 20% (between the lower end of the band and the target allocation). However, given the required redemption notice

(generally 60 to 90 days in advance of the redemption date), if the market weakens the hedge funds might invoke any gates allowed for in their documents.

- Longer term, a temporary increase in the spending rate reduces the probability that the fund will meet its real return target. This objective would be further threatened if the inflation rate does rise as the CIO fears. The liquidity profile of the Fund's investments should prepare for the possibility that, in a bad year, they may be called upon to dip into capital to fund the spending obligation.

- The Fund should target the upper end of the ranges for cash and government bonds in light of the current high equity valuations, weakening economic outlook, and threat of rising inflation. Given rising inflation and interest rate concerns, she may also consider shortening the duration of the government bond portfolio.
- The higher cash and bond allocation will also provide the liquidity buffer needed to meet the Fund's liabilities. Additional cash might be justified to fund the known payouts.
- A high allocation to real estate could also be considered a defensive positioning, but the current 8% allocation may rise toward its 13% maximum, even without additional allocations, given the expected decline in the balance of the portfolio. In addition, tactical tilts in private asset classes are difficult to implement because it would take an extended time period to make new commitments and invest the additional capital.
- The allocations to public equities and hedge funds could be reduced to fund the increases in cash and government bonds.

The following table summarizes the proposed allocation and looks at the likely end-of-year allocations if events unfold as forecast.

	Allowed Ranges		Current Allocation	Proposed Allocation		Expected Return Next 12 Months	Allocation 12 Months Forward	
	Lower Limit	Upper Limit		%	\$ (mil)		%	\$ (mil)
Cash	0%	5%	3%	10%	75	2%		0*
Public Equities	30%	40%	35%	30%	225	−30%	25%	157.50
Government Bonds	4%	10%	7%	10%	75	−3%	12%	72.75
High-Yield Credit	2%	5%	5%	5%	37.5	−10%	5%	33.75
Hedge Funds	17%	23%	23%	17%	127.5	−8%	19%	117.30
Private Real Estate	7%	13%	8%	8%	60	0%	12%	72.00
Private Real Assets	3%	7%	4%	5%	37.5	10%	8%	48.75

9. Monitoring the Investment Program

Monitoring of an alternative investments program is time and labor intensive

- Data is difficult to obtain
- Data is not comparable across managers and asset classes

1. Overall Investment Program Monitoring
2. Performance Evaluation
3. Monitoring the Firm and the Investment Process

9.1 Overall Investment Program Monitoring

Alternative investments program should be monitored relative to goals

- Goals and objectives could change
- Market conditions could change
- Investment manager strategy could change

9.2 Performance Evaluation

Two common benchmarking approaches

- Custom index proxies
- Peer group comparisons

Both approaches have limitations

Some funds report IRR which is sensitive to timing of cash flows

Pricing issues can distort reported risk and return measures

Strategy	Provider	3-Year Annualized Return (%)	5-Year Annualized Return (%)
		ending December 31, 2017	
Equity Hedge	HFRI	5.7	6.6
	Credit Suisse	4.3	7.1
	Eurekahedge	6.5	7.8
Event-Driven	HFRI	3.8	5.9
	Credit Suisse	0.8	3.7
	Eurekahedge	6.8	7.2

Ideally investor should develop qualitative understanding of underlying assets.

9.3 Monitoring the Firm and the Investment Process

Not easy to terminate manager and transfer assets to another manager/firm

Some areas to monitor include

- Key person risk
- Alignment of interests
- Style drift
- Risk management
- Client/asset turnover
- Client profile
- Service providers

Example 10: Monitoring Alternative Investment Programs

- 1 The O'Hara family office determined that the illiquidity risk inherent in private investments is a risk that the family is ill-suited to bear. As a result, they decided several years ago to unwind their private equity program. There are still a few remaining assets in the portfolio. The CIO (chief investment officer) notices that the private equity portfolio has delivered outstanding performance lately, especially relative to other asset classes. He presents the data to his research staff and wants to revisit their decision to stop making new private equity investments. Explain why the investment results that prompted the CIO's comments should not be relied upon.

Solution to 1:

With small, residual holdings, even a modest change in valuation can result in outsized returns; for example, a \$2,000 investment that gets revalued to \$3,000 would report a nominal return of 50%. The 50% return is not representative of private equity investment as a whole but is merely an artifact of the unwinding process. A more accurate picture of performance must consider the development of the fund IRR over time and consider other performance measures, such as the MOIC.

- 2 The ZeeZaw family office has been invested in the Warriors Fund, a relatively small distressed debt strategy, which has performed very well for a number of years. In a recent conversation with the portfolio manager, the CIO for ZeeZaw discovered that the Warriors fund will be receiving a significant investment from a large institution within the next few weeks. What are some of the risks that might develop with the Warriors Fund as a result of this new client? What are some other issues that the CIO might want to probe with the Warriors Fund?

Solution to 2:

The CIO should investigate whether the fund manager is able to appropriately deploy this new capital consistent with the investment process and types of investments that contributed to the Warriors Fund success. Because the fund was relatively small, a very large influx of capital might force the portfolio manager to make larger investments than is optimal or more investments than they did before. Either change without the appropriate resources could undermine future success. Finally, a large influx of cash could dilute near-term performance, especially if the funds remain undeployed for a significant period of time.

Summary

- Roles of alternative investments in portfolios
- Alternative investments versus bonds as risk mitigators
- Traditional versus risk-based approaches to defining investment opportunity set
- Investment considerations
- Suitability considerations
- Approaches to asset allocation
- Liquidity planning
- Monitoring alternative investment programs