Macro-Level Real Estate Investment Analysis

Welcome to an exploration of macro-level real estate investment analysis. We'll examine how real estate fits into the broader investment landscape and portfolio strategy.

This presentation covers strategic policy formulation, tactical policy implementation, and the critical role real estate plays in diversified investment portfolios.

Micro vs. Macro Investment Analysis

Micro-Level Analysis

Focuses on individual properties and deals

- Property-specific metrics
- Deal structure evaluation
- Individual asset performance

Macro-Level Analysis

Examines aggregates of properties and portfolio considerations

- Portfolio-wide allocation decisions
- Mixed-asset portfolio management
- Interface between real estate and other asset classes

Evolution of Macro-Level Analysis

Traditional Era

Real estate investment was primarily a micro-level endeavor focused on individual properties

Last Third of 20th Century

Macro-level analysis emerged as a distinct discipline in real estate

Late 20th Century

Rapid growth connecting Wall Street to Main Street in real estate investment

Present Day

Macro-level analysis drives modern real estate career paths and investment strategies

Three Major Decision Arenas

Strategic Policy

Defines broad allocations and long-run objectives

- Modern Portfolio Theory (MPT)
- Long-term allocation targets

Tactical Policy

Seeks to profit from shorter-term opportunities

- Market timing
- Econometric forecasting

Implementation

Carries out strategic and tactical policies effectively

- Manager performance evaluation
- Incentive structure alignment

Modern Portfolio Theory (MPT)

MPT is the cornerstone of strategic investment allocation, focusing on optimizing risk and return at the portfolio level.

Comprehensive Approach

Treats risk and return together in an integrated manner

Quantifiable Framework

Provides measurable implications of risk and return decisions

Portfolio-Level Focus

Addresses allocation at the level of the investor's overall wealth

Nobel Prize-Winning

Developed by Harry Markowitz, who won the 1990 Nobel Prize in Economics

Investor Preferences and Risk Tolerance

Conservative Investor

More risk-averse with steeply curved indifference curves

Requires significant additional return to accept more risk

Aggressive Investor

More risk-tolerant with less steeply curved indifference curves

Willing to accept more risk for moderate increases in return

Portfolio Dominance Concept

Dominant Portfolio

Provides more return with equal or less risk, or less risk with equal or more return compared to another portfolio

Dominated Portfolio

Any portfolio that could be improved by moving to a dominant portfolio position

MPT's Primary Goal

Help investors avoid holding dominated portfolios by moving "northwesterly" in the risk/return diagram

The Power of Diversification

Traditional Wisdom

"Don't put all your eggs in one basket"

Quantified Benefit

MPT quantifies diversification benefits in terms of risk and return

Optimal Allocation

Provides guidance on how many "eggs" should go in which "baskets"

Diversification may be one of the rare "free lunches" in economics, allowing investors to improve return without increasing risk, or reduce risk without reducing return.

Correlation: The Key to Diversification

High Correlation

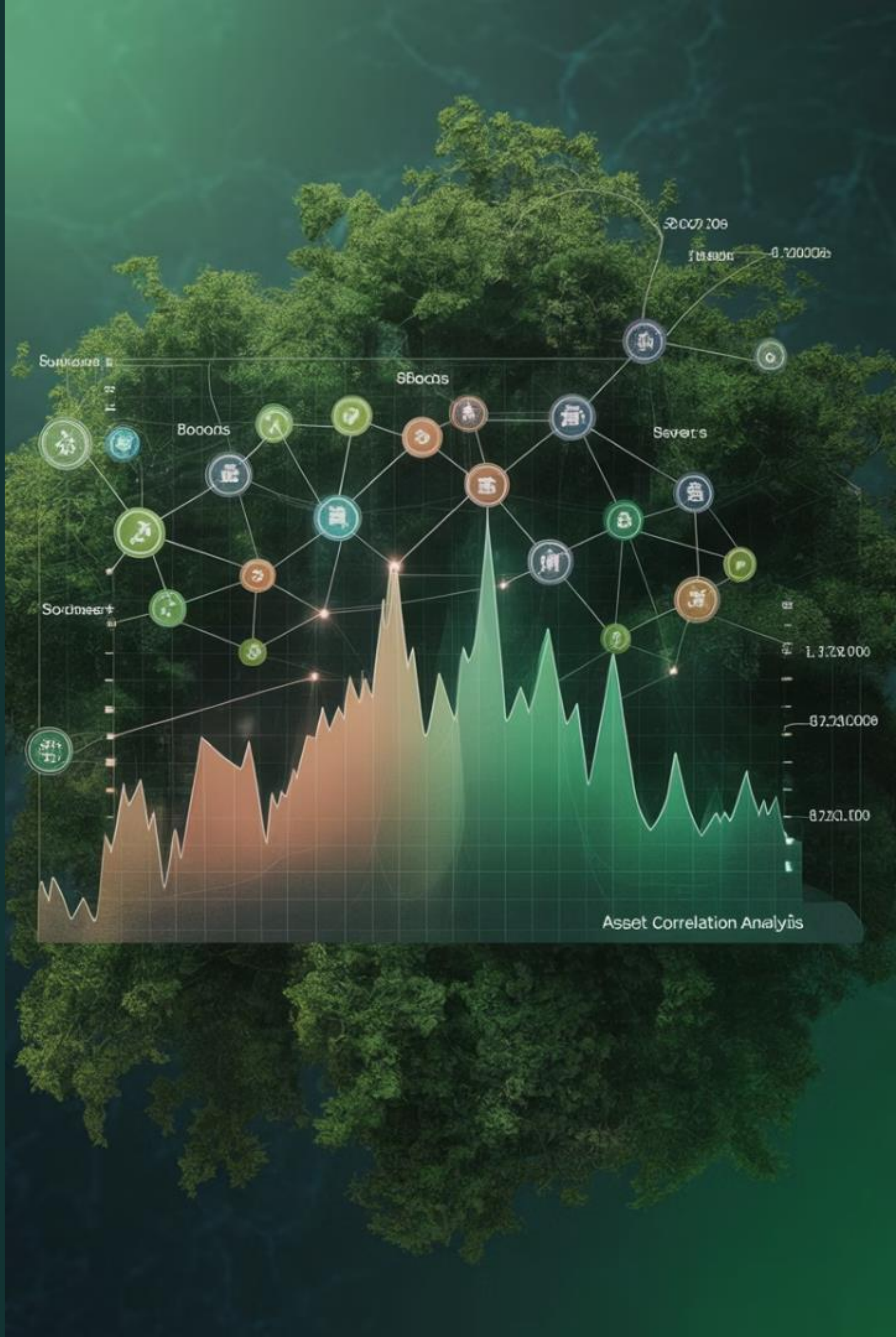
Assets that move together provide less diversification benefit

Low Correlation

Assets that don't move together provide greater diversification benefit. Assets with negative return correlations are hard to find but stabilize returns.

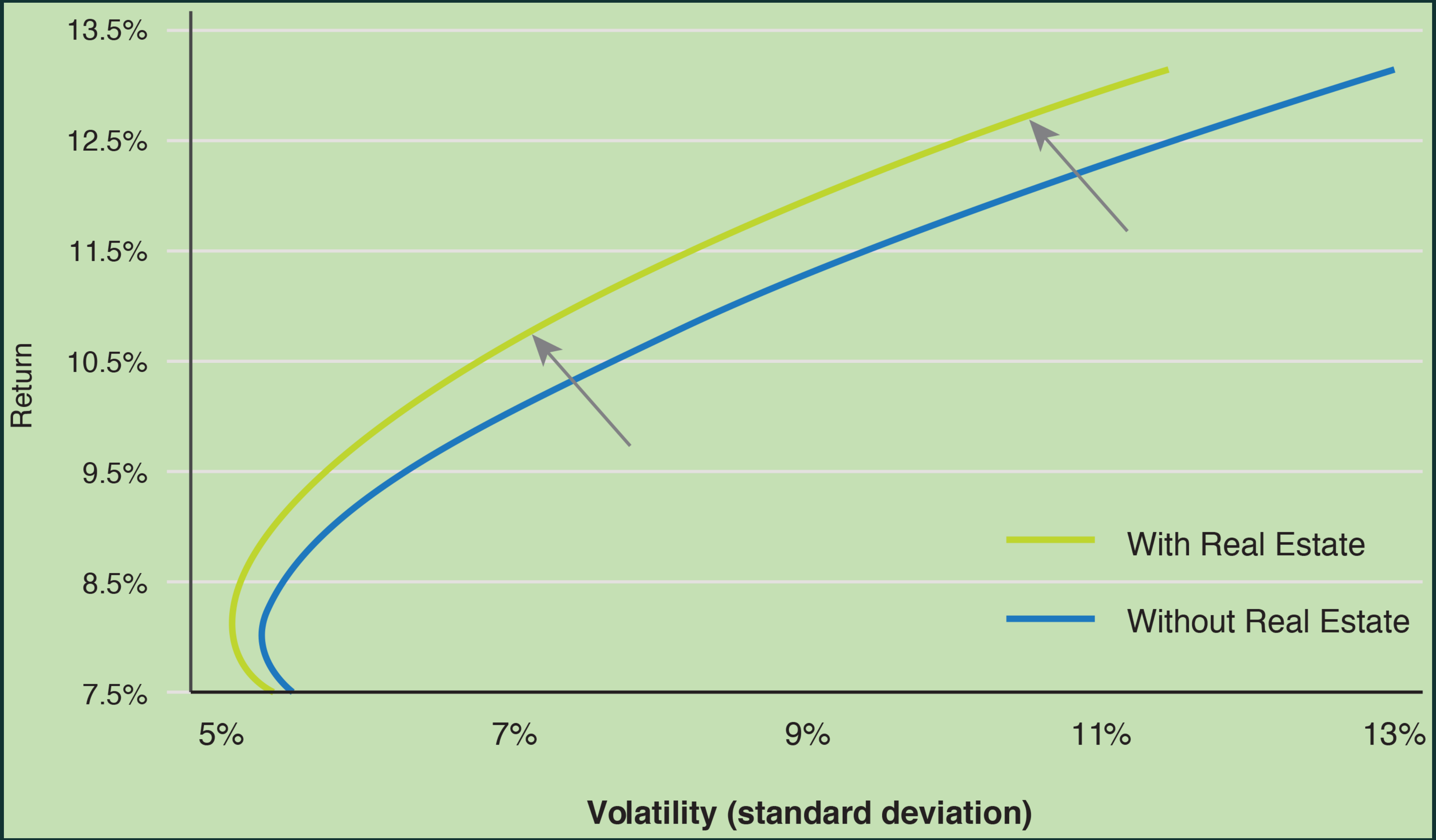
Real Estate Advantage

Direct property investments typically have lower correlation with stocks and bonds



The Efficient Frontier

The efficient frontier represents the set of portfolios that offer the highest expected return for a given level of risk. Here the blue line represents stocks and bonds and the green line Represents the impact of including real estate.



Real Estate in the Mixed-Asset Portfolio

33%	1/3	3rd
Optimal Allocation	**Market Value**	**Asset Class**
Typical real estate allocation in conservative to moderate portfolios	Real estate represents represents about one-third of investable capital market value	Real estate is the third major asset class after stocks and bonds

Portfolio theory provides an underlying explanation for why real estate should occupy a prominent role in the average investment portfolio.

Another Role for Real Estate: Inflation Hedge

Liability Protection

Helps pension funds meet inflation-adjusted benefit obligations

COLA Coverage

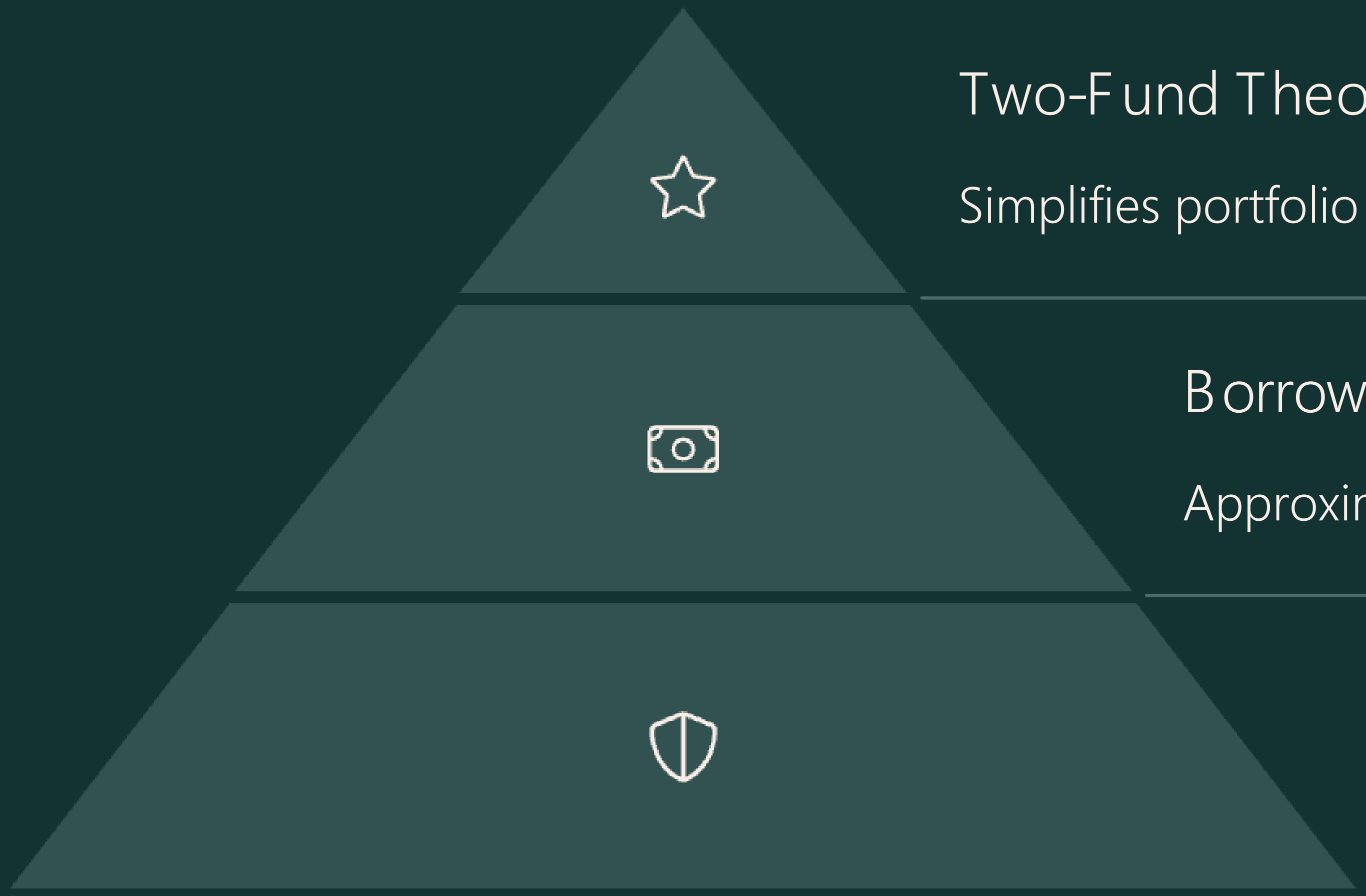
Addresses cost-of-living adjustments in pension benefits

Real Asset Value

Based on physical product with intrinsic value that tends to rise with inflation

While real estate's primary role on the asset side is as a diversifier, its value on the liability side is often as an inflation hedge asset.

The Riskless Asset Construct



Two-Fund Theorem

Simplifies portfolio allocation decisions

Borrowing & Lending

Approximates debt financing and cash positions

Risk-Free Rate

Usually represented by Treasury bills

The riskless asset construct extends MPT by allowing investors to combine risk-free investments with risky portfolios. This creates a straight line on the risk-return diagram rather than a curved efficient frontier.

The Sharpe Ratio

$$Sharpe\ Ratio = \frac{r_P - r_f}{S_P}$$

Where:

rP

Expected return of the portfolio

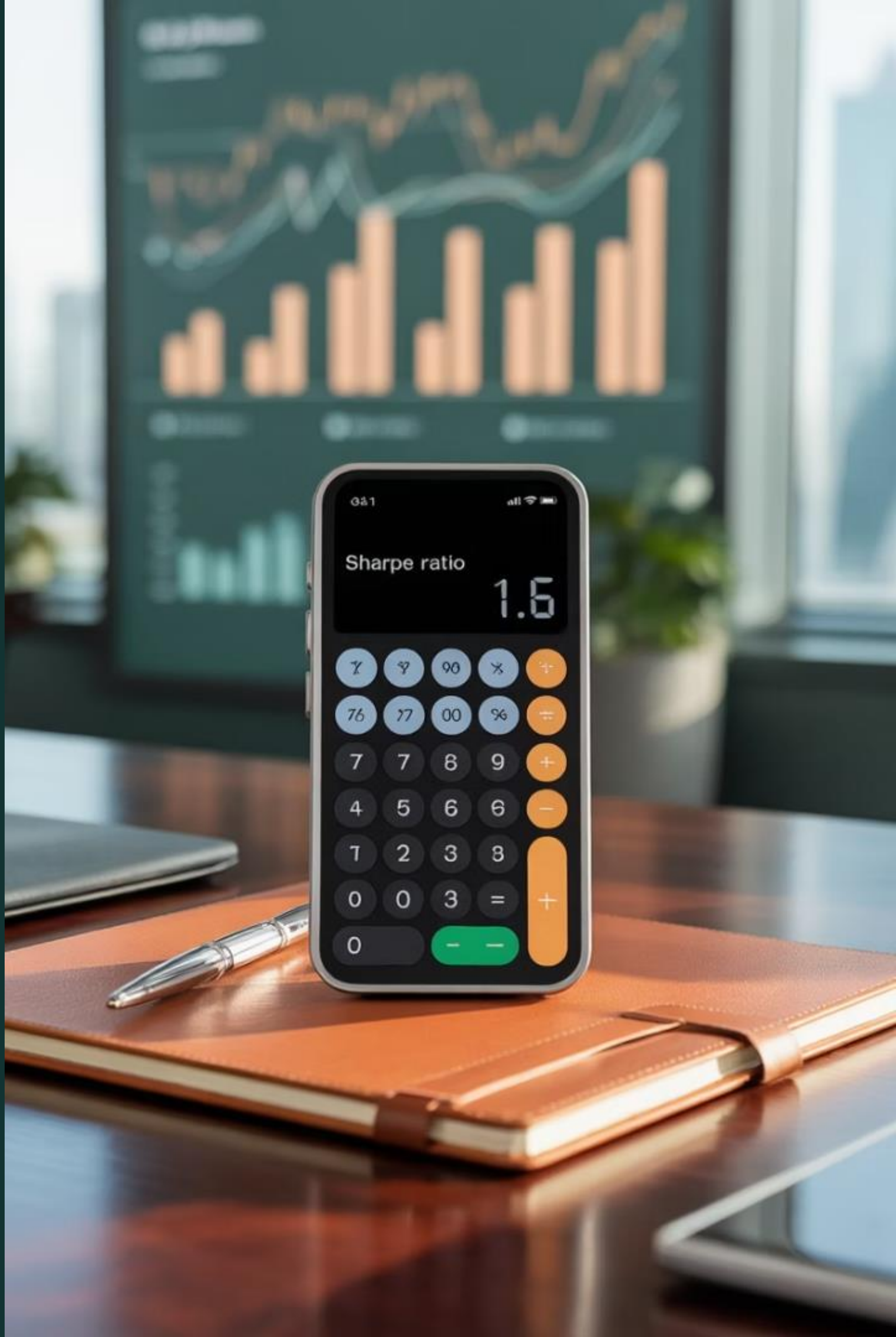
rf

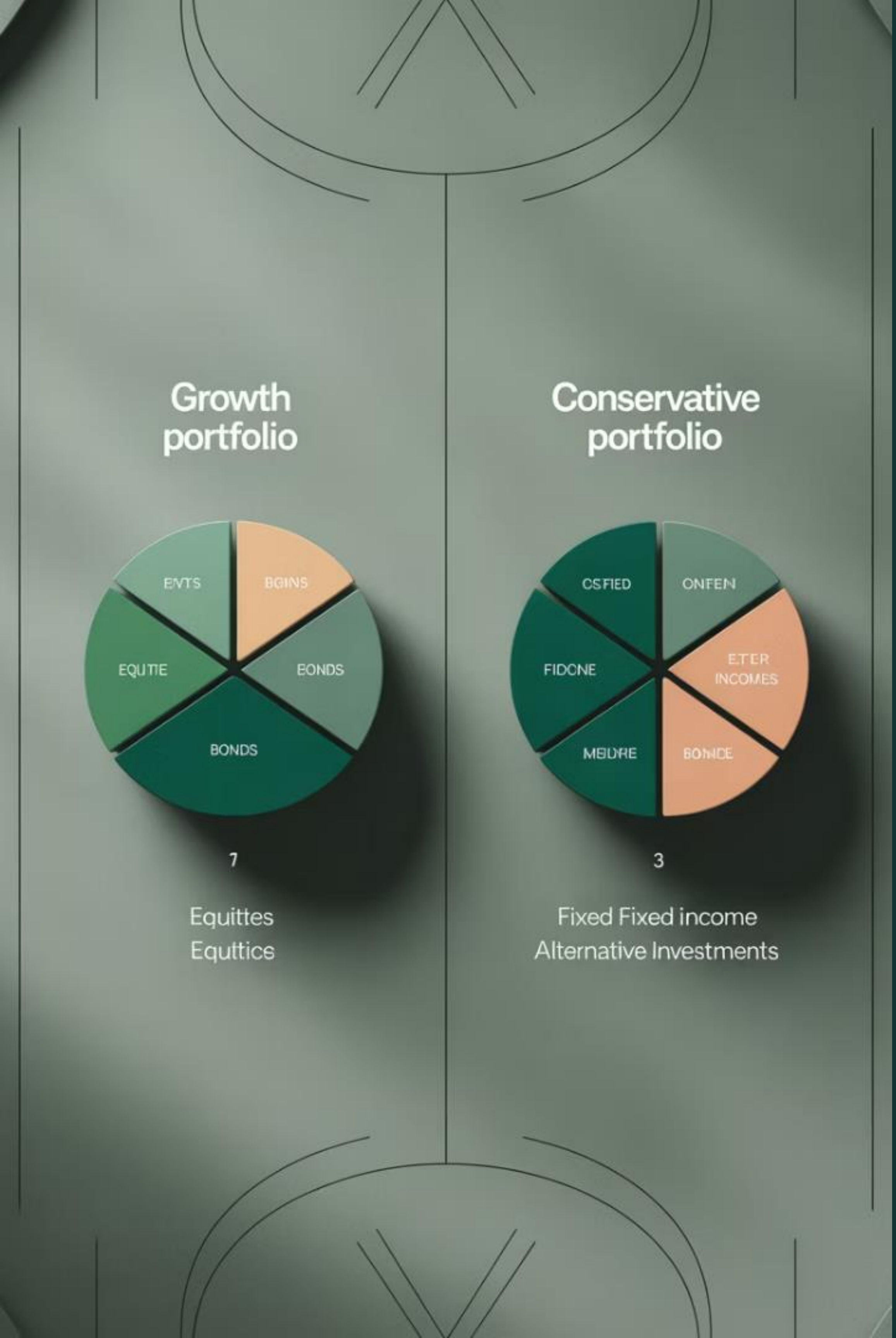
Risk-free rate (short term government bonds)

SP

Standard deviation (volatility) of the portfolio

The Sharpe ratio measures risk-adjusted return by dividing the risk premium by volatility. The optimal combination of risky assets is the one with the highest ratio.





Sharpe-Maximizing vs. Variance-Minimizing

Portfolio Approach	Stocks	Bonds	Real Estate	Cash
Variance-Minimizing (7% target)	16%	48%	36%	0%
Sharpe-Maximizing (7% target)	25%	33%	32%	10%

The Sharpe-maximizing approach typically allocates more to higher-return assets like stocks compared to the variance-minimizing approach for conservative investors.

Risk Parity Portfolio (RPP)

Equal Risk Contribution

Each asset class contributes the same amount to portfolio volatility

Uncertainty Protection

Less sensitive to errors in expected return forecasts

Practical Simplicity

One specific portfolio point rather than a curve of possibilities

Passive Allocation Approach

Market-Based Allocation

"The market knows best" philosophy matches portfolio to market value shares

Benchmark Matching

Reduces risk of deviating from established performance benchmarks

Simplified Implementation

Requires less research and fewer resources than optimization approaches

Based on U.S. investable capital market shares, passive allocation might suggest real estate allocation of approximately 10-36% depending on whether all real estate or just commercial real estate equity is considered.

Risk vs. Uncertainty in Portfolio Allocation

Risk (Known Unknowns)

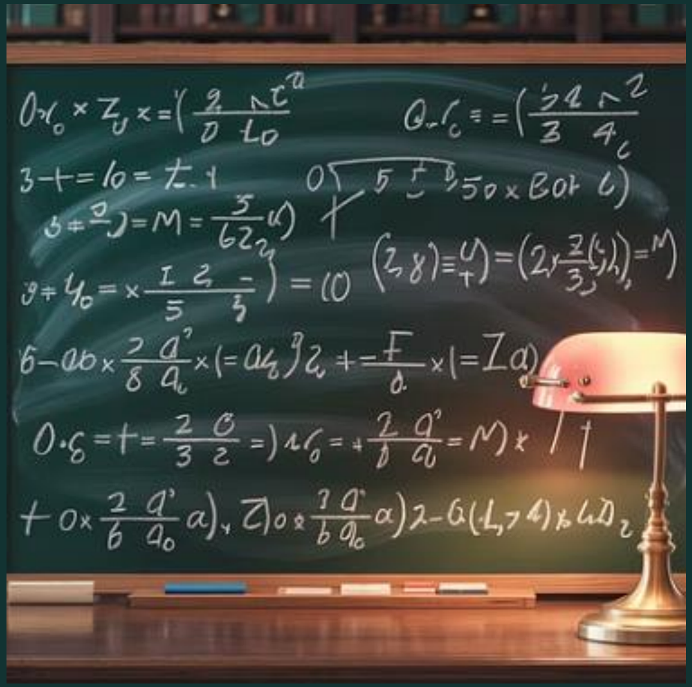
- Quantifiable probabilities
- Measurable volatility
- Historical data available
- Can be modeled mathematically

Uncertainty (Unknown Unknowns) aka Black Swans

- Unquantifiable probabilities
- Future expectations unclear
- No reliable historical precedent
- Cannot be modeled effectively

The distinction between risk and uncertainty helps explain why some investors prefer simpler allocation approaches like Risk Parity over complex optimization models.

Is MPT Economics?


MPT earned Harry Markowitz (left above) a Nobel Prize in economics, yet it has unique characteristics in the world of economic theory. Unlike most economic theories based on market equilibrium, opportunity cost, or wealth maximization, focuses on risk-return optimization.

When defending his PhD thesis, economist Milton Friedman (right above) reportedly commented that MPT was "a great theory, but it was finance or engineering, not economics." Whether economics or not, MPT remains a powerful tool for investment strategy. After Harry won the Nobel prize in economics, he asked Harry: “Now is it economics?”

Key Takeaways

Strategic Importance

Macro-level analysis is essential for optimal real estate investment allocation

Significant Allocation

All portfolio approaches suggest real estate deserves substantial allocation

Multiple Approaches

MPT, Risk Parity, and Passive Allocation each offer valuable perspectives

Dual Benefits

Real estate serves as both a portfolio diversifier and inflation hedge

Appendix on the mathematics of the Efficient Frontier

Making the analysis more formal & rigorous…

AT THE HEART OF PORTFOLIO THEORY ARE TWO BASIC MATHEMATICAL FACTS:

1) PORTFOLIO RETURN IS A LINEAR FUNCTION OF THE ASSET WEIGHTS (w, allocation, share of portfolio):

$$r_P = \sum_{n=1}^{N} w_n r_n$$

IN PARTICULAR, THE PORTFOLIO EXPECTED RETURN IS A WEIGHTED AVERAGE OF THE EXPECTED RETURNS TO THE INDIVIDUAL ASSETS. E.G., WITH TWO ASSETS ("i" & "j"):

$$r_p = \omega r_i + (1-\omega) r_j$$

WHERE ω_i IS THE SHARE OF PORTFOLIO TOTAL VALUE INVESTED IN ASSET i.

e.g., If Asset A has $E[r_A]$=5% and Asset B has $E[r_B]$=10%, then a 50/50 Portfolio (50% A + 50% B) will have $E[r_P]$=7.5%.

THE 2ND FACT:

2) PORTFOLIO VOLATILITY IS A NON-LINEAR FUNCTION OF THE ASSET WEIGHTS:

$$VAR_P = \sum_{I=1}^{N} \sum_{J=1}^{N} w_i w_j COV_{ij}$$

SUCH THAT THE PORTFOLIO VOLATILITY IS LESS THAN A WEIGHTED AVERAGE OF THE VOLATILITIES OF THE INDIVIDUAL ASSETS. E.G., WITH TWO ASSETS:

$$s_P = SQRT[\, w^2(s_i)^2 + (1-w)^2(s_j)^2 + 2w(1-w)s_i s_j C_{ij} \,]$$

$$< ws_i + (1-w)s_j, \quad \text{where: } s = \text{StDev}, C = \text{correl}$$

WHERE S_i IS THE RISK (MEASURED BY STD.DEV.) OF ASSET i.

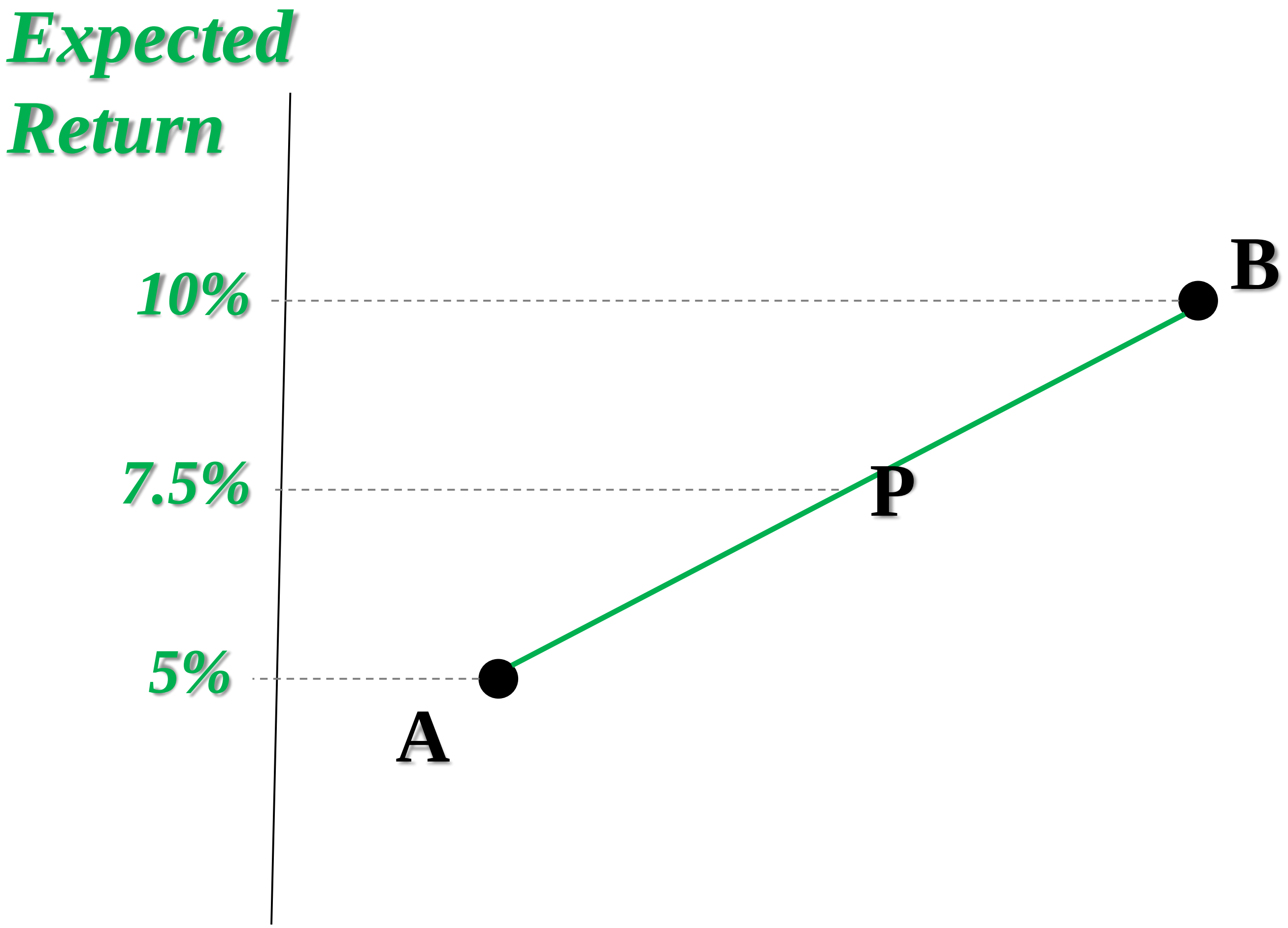
e.g., If Asset A has StdDev[r_A]=5% and Asset B has StdDev[r_B]=10%, then a 50/50 Portfolio (50% A + 50% B) will have StdDev[r_P] < 7.5% (conceivably even < 5%).

➔ This is the beauty of Diversification. It is at the core of Portfolio Theory. It is perhaps the only place in economics where you get a "free lunch": In this case, less risk without necessarily reducing your expected return!

Here's a picture of the first mathematical fact:

e.g., where P is { (1/2)A & (1/2)B }…

$$r_P = \sum_{n=1}^{N} w_n r_n$$

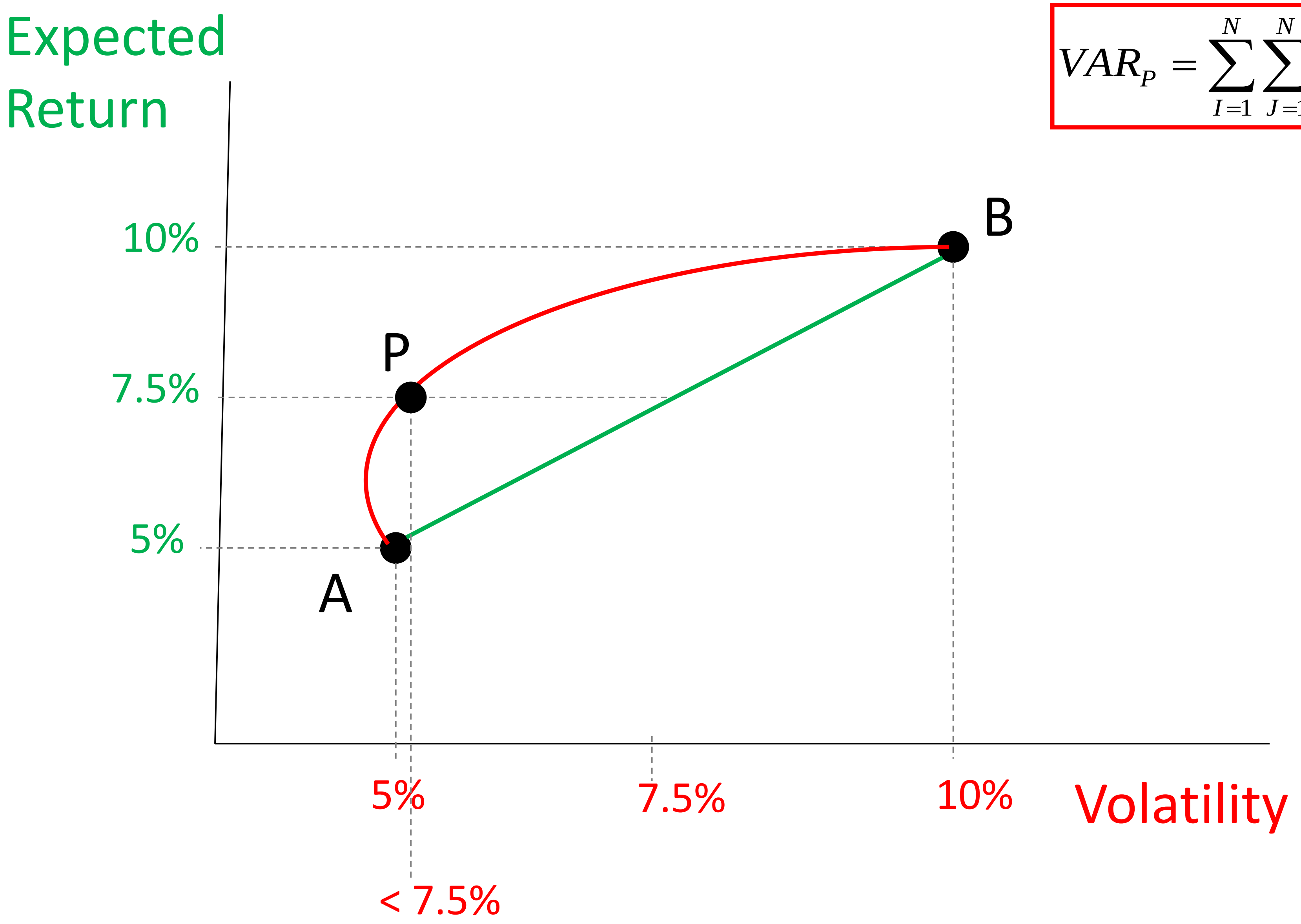


Here's a picture of both the two mathematical facts:

e.g., where P is { (1/2)A & (1/2)B }...

$$r_P = \sum_{n=1}^{N} w_n r_n$$

$$VAR_P = \sum_{I=1}^{N} \sum_{J=1}^{N} w_i w_j COV_{ij}$$



The red line is the complete picture, both return and risk.

KEY POINT:

If

- **Risk that matters to investor is risk in *<u>overall wealth</u>*** *(this is really a threshold point in the theory, a starting point)*,

Then *(this is just straightforward math)*:

- **Risk that matters in investments (assets) is *<u>covariance</u>* with overall wealth (contribution to overall wealth volatility);**
- **Not the asset's own volatility (Std.Dev)** *(This was not the traditional view and is not so intuitive)*

(e.g., if investor portfolio primarily stocks & bonds, & if Real Estate has low correlation with stocks & bonds, then R.E. volatility may not matter to investor; because it may not contribute much to investor's wealth volatility.)

$$VAR_P = \sum_{I=1}^{N} \sum_{J=1}^{N} w_i w_j COV_{ij}$$

Covariance(i,j) = Stdev(i)*Stdev(j)*Correl(i,j)

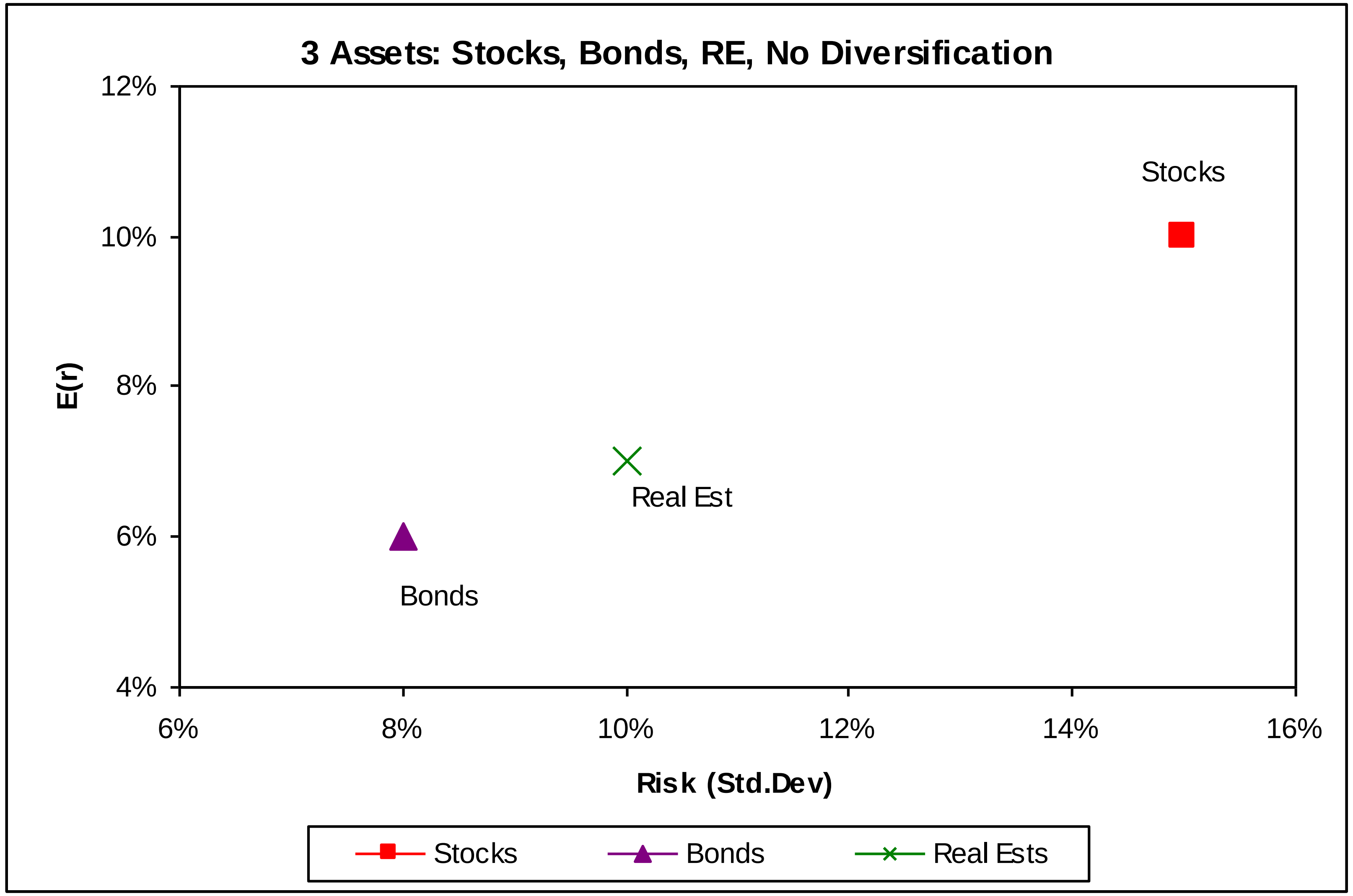
22.2.4 STEP 1: FINDING THE "EFFICIENT FRONTIER"

SUPPOSE WE HAVE THE FOLLOWING RISK & RETURN EXPECTATIONS…

	Stocks	Bonds	RE
Mean	10.00%	6.00%	7.00%
STD	15.00%	8.00%	10.00%
Corr			
Stocks	100.00%	30.00%	25.00%
Bonds		100.00%	15.00%
RE			100.00%

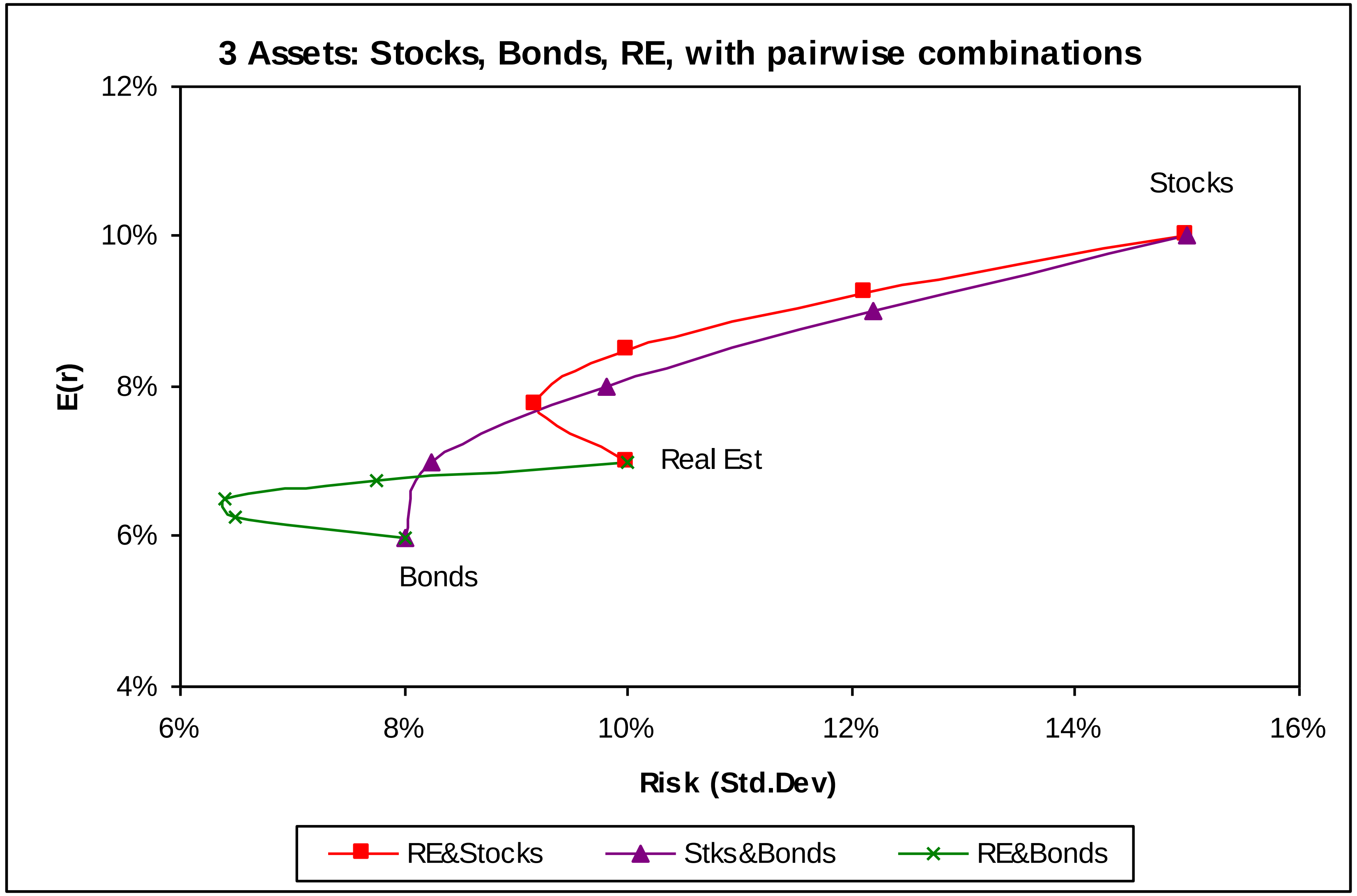
INVESTING IN ANY ONE OF THE THREE ASSET CLASSES WITHOUT DIVERSIFICATION ALLOWS THE INVESTOR TO ACHIEVE ONLY ONE OF THREE POSSIBLE RISK/RETURN POINTS…

INVESTING IN ANY ONE OF THE THREE ASSET CLASSES WITHOUT DIVERSIFICATION ALLOWS THE INVESTOR TO ACHIEVE ONLY ONE OF THE THREE POSSIBLE RISK/RETURN POINTS DEPICTED IN THE GRAPH BELOW…

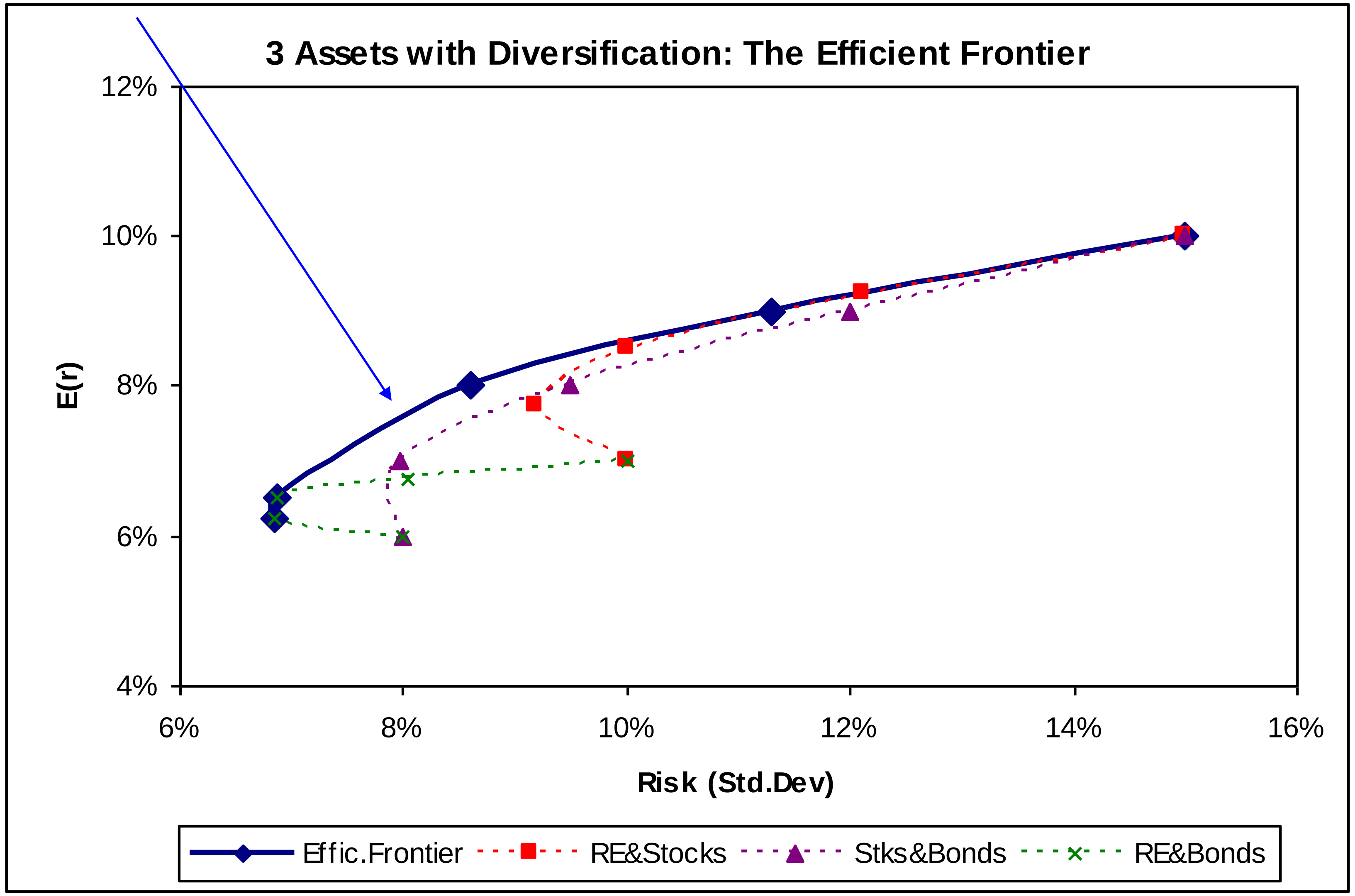


IN A RISK/RETURN CHART LIKE THIS, ONE WANTS TO BE ABLE TO GET AS MANY RISK/RETURN COMBINATIONS AS POSSIBLE, AS FAR TO THE "NORTH" AND "WEST" AS POSSIBLE (more return, less risk).

ALLOWING PAIRWISE COMBINATIONS INCREASES THE RISK/RETURN POSSIBILITIES TO THESE…



FINALLY, IF WE ALLOW UNLIMITED DIVERSIFICATION AMONG ALL THREE ASSET CLASSES, WE ENABLE AN INFINITE NUMBER OF COMBINATIONS, THE “BEST” (I.E., MOST “NORTH” AND “WEST”) OF WHICH ARE SHOWN BY THE OUTSIDE (ENVELOPING) CURVE.



THIS IS THE “EFFICIENT FRONTIER” (IN THIS CASE OF THREE ASSET CLASSES).

"EFFICIENT FRONTIER" CONSISTS OF ALL ASSET COMBINATIONS (PORTFOLIOS) WHICH MAXIMIZE RETURN AND MINIMIZE RISK.

EFFICIENT FRONTIER IS AS FAR "NORTH" AND "WEST" AS YOU CAN POSSIBLY GET IN THE RISK/RETURN GRAPH.

A PORTFOLIO IS SAID TO BE "EFFICIENT" (i.e., represents one point on the efficient frontier) IF IT HAS THE MINIMUM POSSIBLE VOLATILITY FOR A GIVEN EXPECTED RETURN, AND/OR THE MAXIMUM EXPECTED RETURN FOR A GIVEN LEVEL OF VOLATILITY.

(Terminology note: This is a different definition of "efficiency" than the concept of informational efficiency applied to asset markets and asset prices.)

SUMMARY UP TO HERE:

DIVERSIFICATION AMONG RISKY ASSETS ALLOWS:

- GREATER EXPECTED RETURN TO BE OBTAINED

  FOR ANY GIVEN RISK EXPOSURE, &/OR;

- LESS RISK TO BE INCURRED

  FOR ANY GIVEN EXPECTED RETURN TARGET.

(This is called getting on the "efficient frontier".)

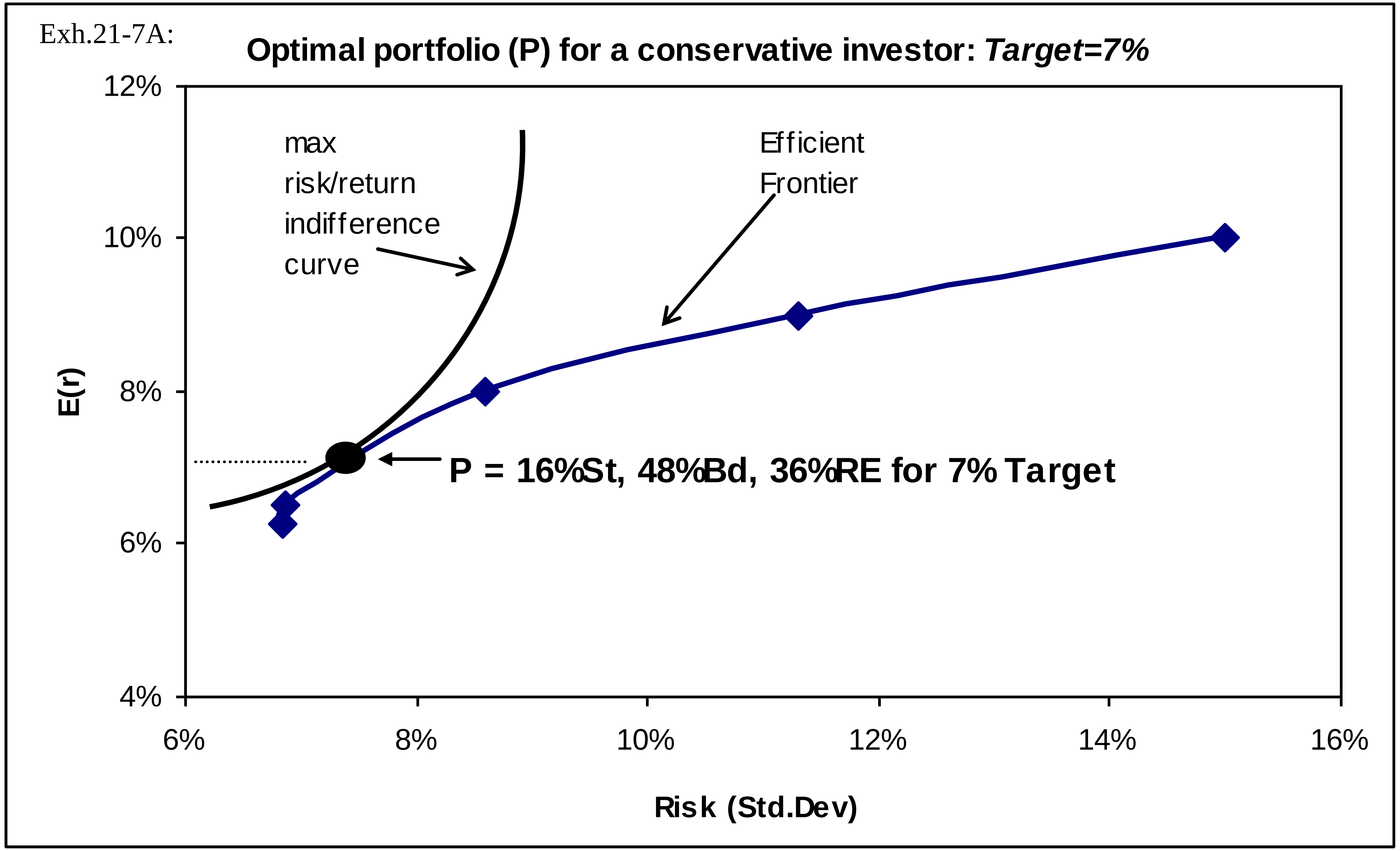
PORTFOLIO THEORY ALLOWS US TO:

- <u>QUANTIFY</u> THIS EFFECT OF DIVERSIFICATION
- IDENTIFY THE "<u>OPTIMAL</u>" (BEST) MIXTURE OF RISKY ASSETS

(It also allows to quantify how much it matters.)

POINTS ON FRONTIER ARE NON-DOMINATED, SO MPT LET'S INVESTOR PICK ANY ONE OF THEM. SO, SET YOUR TARGET RETURN TO REFLECT YOUR RISK PREFERENCE.

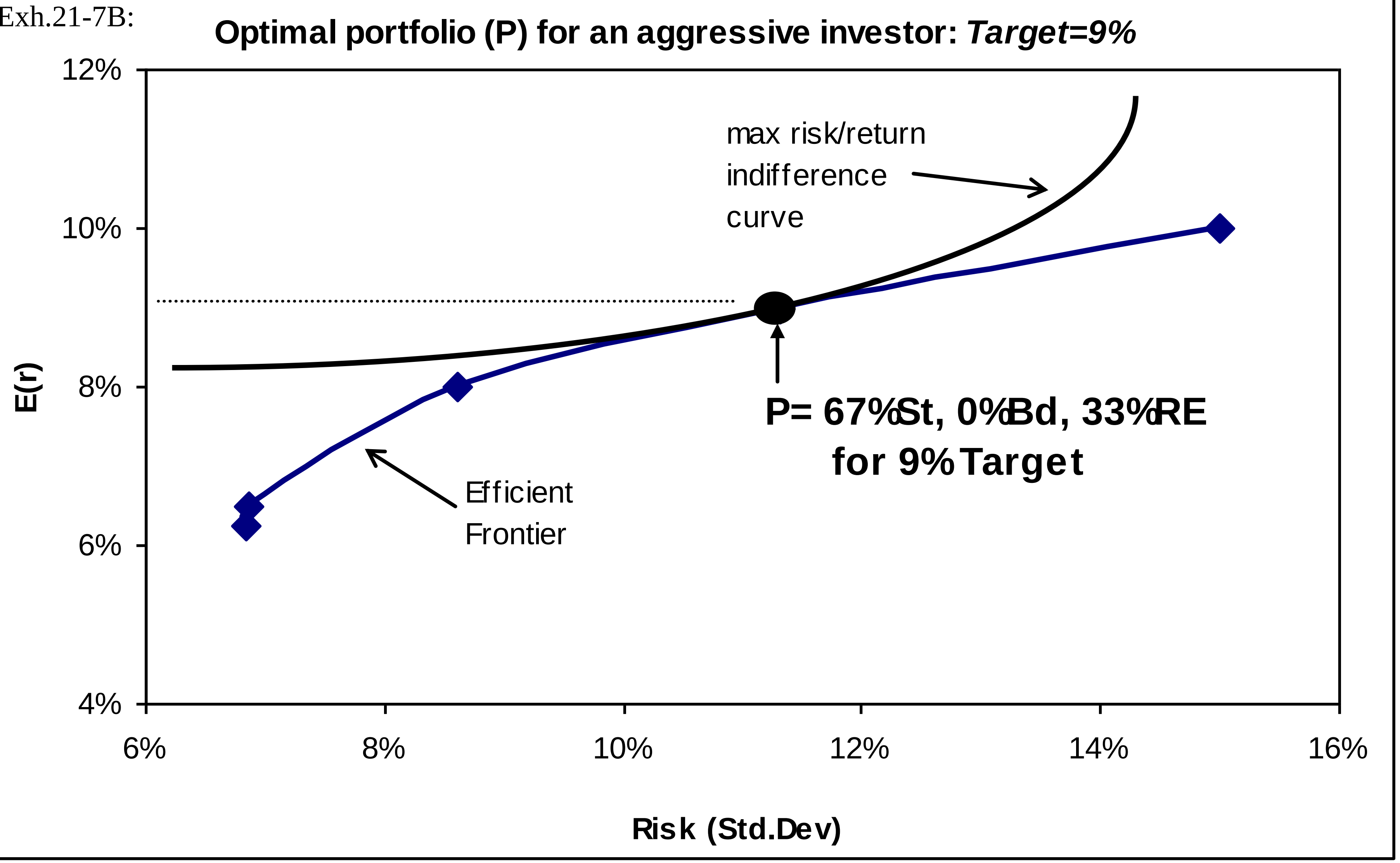
E.G., ARE YOU HERE (7%)?...



POINTS ON FRONTIER ARE NON-DOMINATED, SO MPT LET'S INVESTOR PICK ANY ONE OF THEM. SO, SET YOUR TARGET RETURN TO REFLECT YOUR RISK PREFERENCE.

OR ARE YOU HERE (9%)?...

Exh.21-7B:



Now, how do we implement such a portfolio analysis in practice? (Two steps…)

Step 1: FIND THE EFFICIENT FRONTIER. MATHEMATICALLY, PORTFOLIO ALLOCATION IS A "CONSTRAINED OPTIMIZATION" PROBLEM

==> Algebraic solution using calculus

==> Numerical solution using computer and "quadratic programming". Spreadsheets such as Excel include "Solvers" that can find optimal portfolios this way (via numerical search algorithms).

==> We have distributed an Excel optimizer file (& one comes in the CD at the back of the textbook).

Remember: Milton Friedman told Harry Markowitz in 1956 (HM defending his PhD dissertation): *"This is not economics."* What is it?...
"Optimal control", a branch of Operations Research (OR) or "Engineering Systems" (MIT term).

Example: Given following expectations:

See the Excel mechanics example in 13-minute video linked here.

	Stocks	Bonds	RE
Mean	10.00%	6.00%	7.00%
STD	15.00%	8.00%	10.00%
Corr			
Stocks	100.00%	30.00%	25.00%
Bonds		100.00%	15.00%
RE			100.00%

Assuming weights: (1/2)Stocks, (1/3)Bonds, (1/6)RE,

Portf mean (expected) return is:

$$r_P = w_{ST} r_{ST} + w_{BD} r_{BD} + w_{RE} r_{RE} = \tfrac{1}{2}10\% + \tfrac{1}{3}6\% + \tfrac{1}{6}7\% = 8.17\%$$

Weighted Covariance Matrix gives the portfolio variance**:**

Portf variance is the sum across the 9 cells, each cell is: $(w_i)(w_j)(SD_i)(SD_j)(CORR_{ij})$

(1/2)(1/2)(.15)(.15)(1.00)	(1/2)(1/3)(.15)(.08)(0.30)	(1/2)(1/6)(.15)(.10)(0.25)
(1/2)(1/3)(.15)(.08)(0.30)	(1/3)(1/3)(.08)(.08)(1.00)	(1/3)(1/6)(.08)(.10)(0.15)
(1/2)(1/6)(.15)(.10)(0.25)	(1/3)(1/6)(.08)(.10)(0.15)	(1/6)(1/6)(.10)(.10)(1.00)

SUM

0.0056	**0.0006**	**0.0003**
0.0006	**0.0007**	**0.0001**
0.0003	**0.0001**	**0.0003**

= 0.0086

SQRT(0.0086) = 9.26% = Portf Volatility

HOW THE STEP 1 PROBLEM IS SOLVED IN EXCEL…

Set the problem up in Excel® as on the earlier slide.

Invoke the Excel <u>Solver</u> so as to:

Find the weights ($w_{ST,}$ $w_{BD,}$ w_{RE}) such that they:

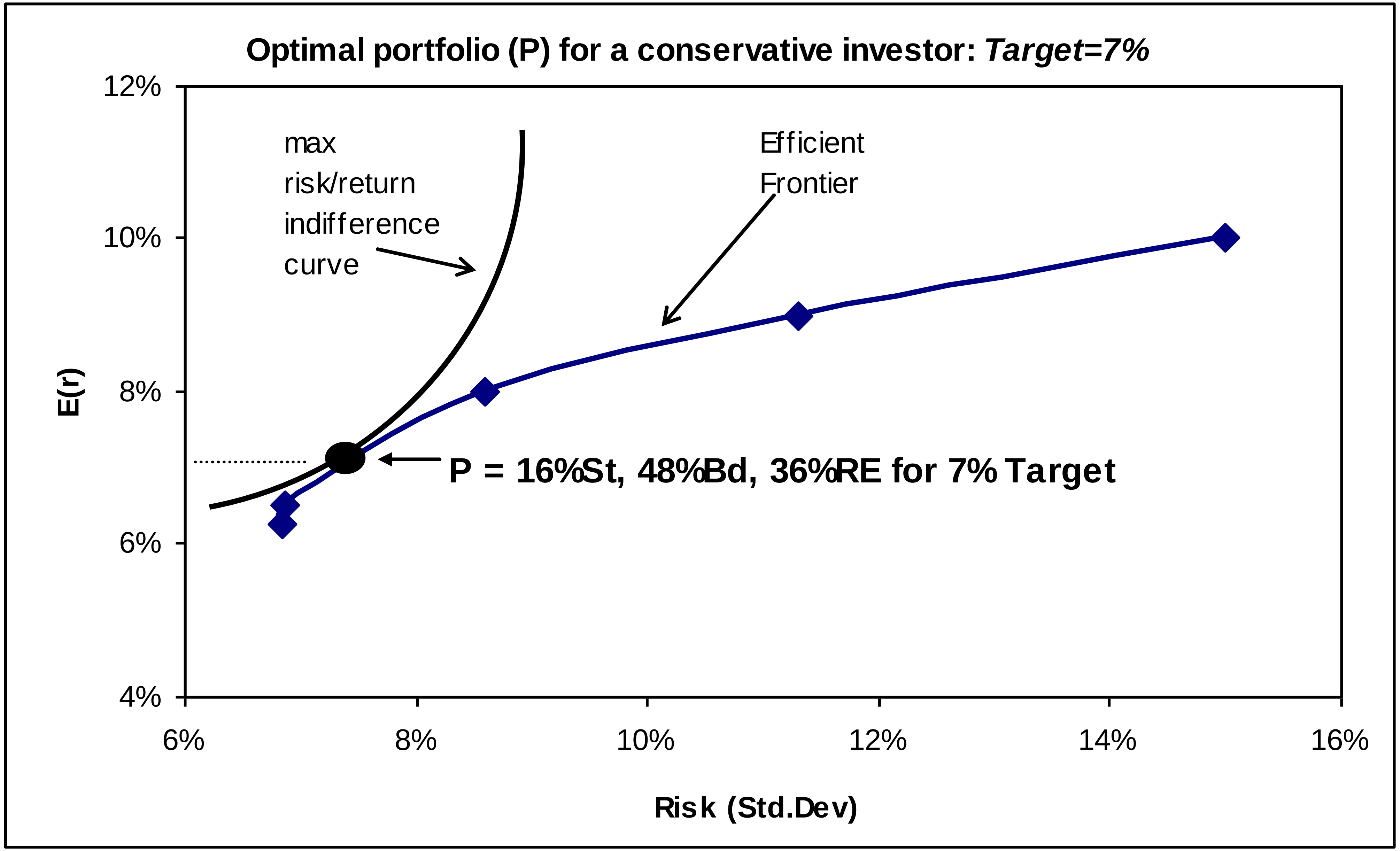
- **Are all positive,**
- **Sum to 1,**
- **Produce portf mean return r_P = target return, and**
- **They minimize the portfolio volatility (or variance).**

Repeat for various different target return points to

Trace out the efficient frontier.

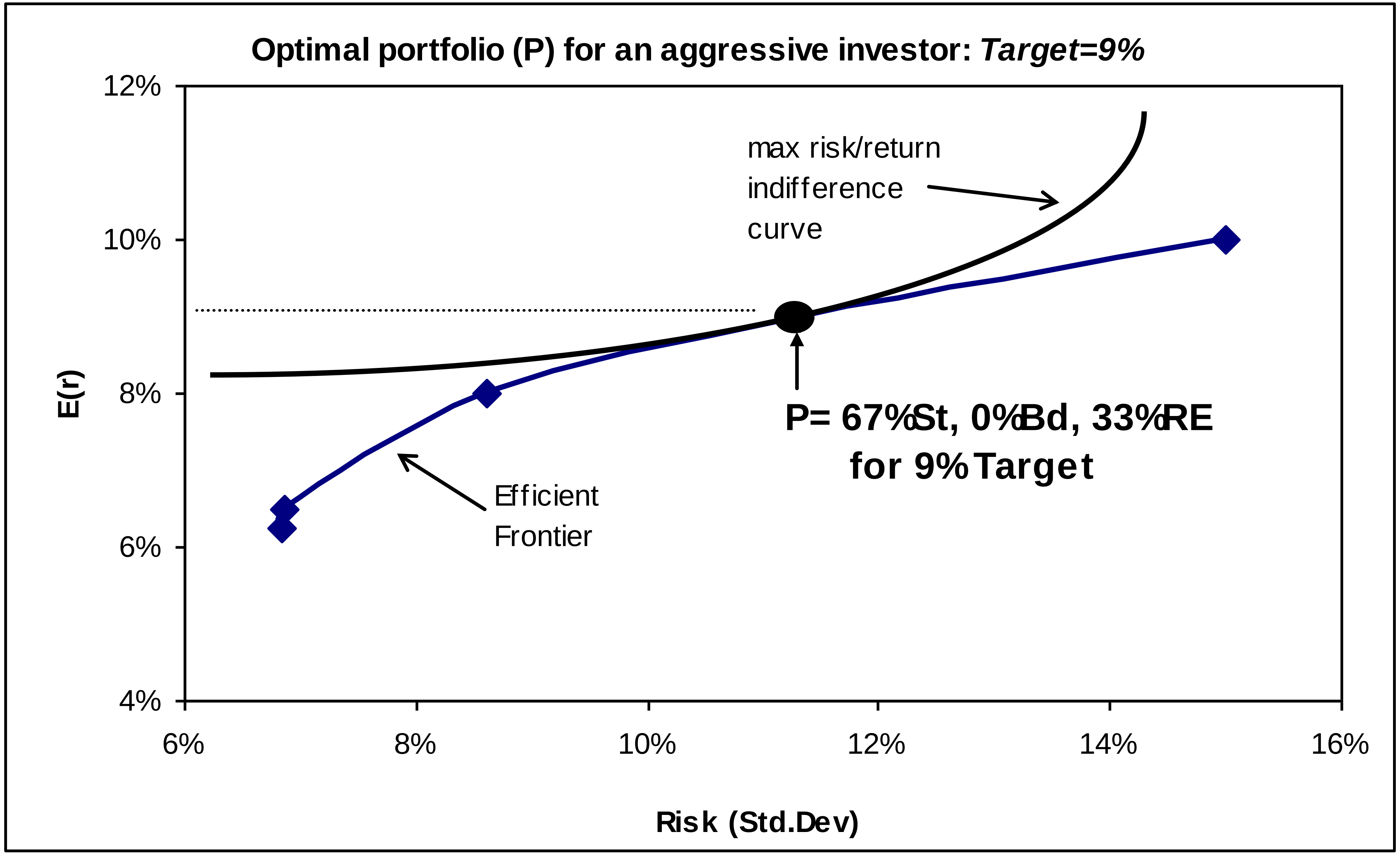
22.2.5. STEP 2: *PICK A RETURN TARGET FOR YOUR OVERALL WEALTH THAT REFLECTS YOUR RISK PREFERENCES...*

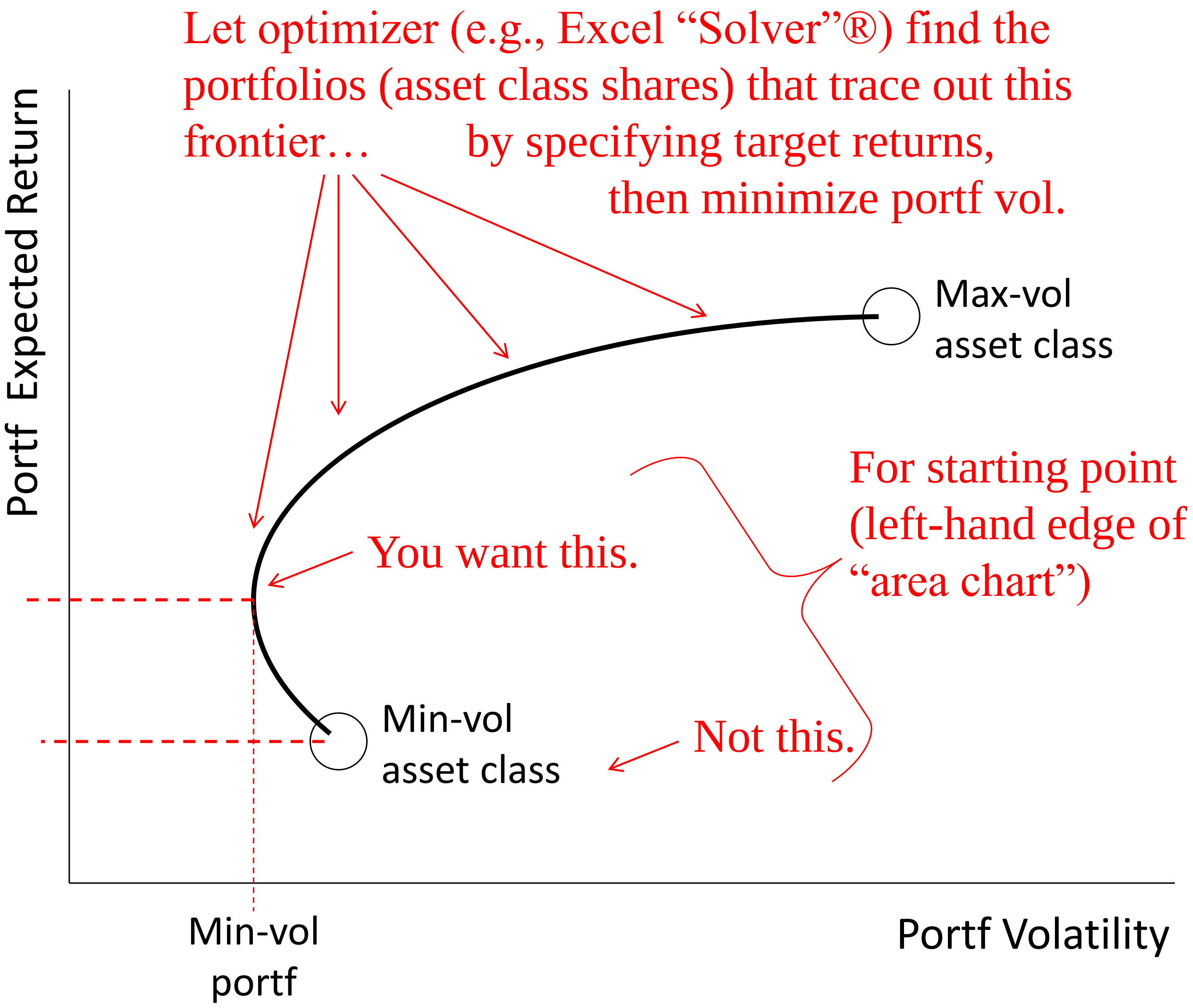
E.G., ARE YOU HERE (7%)?...



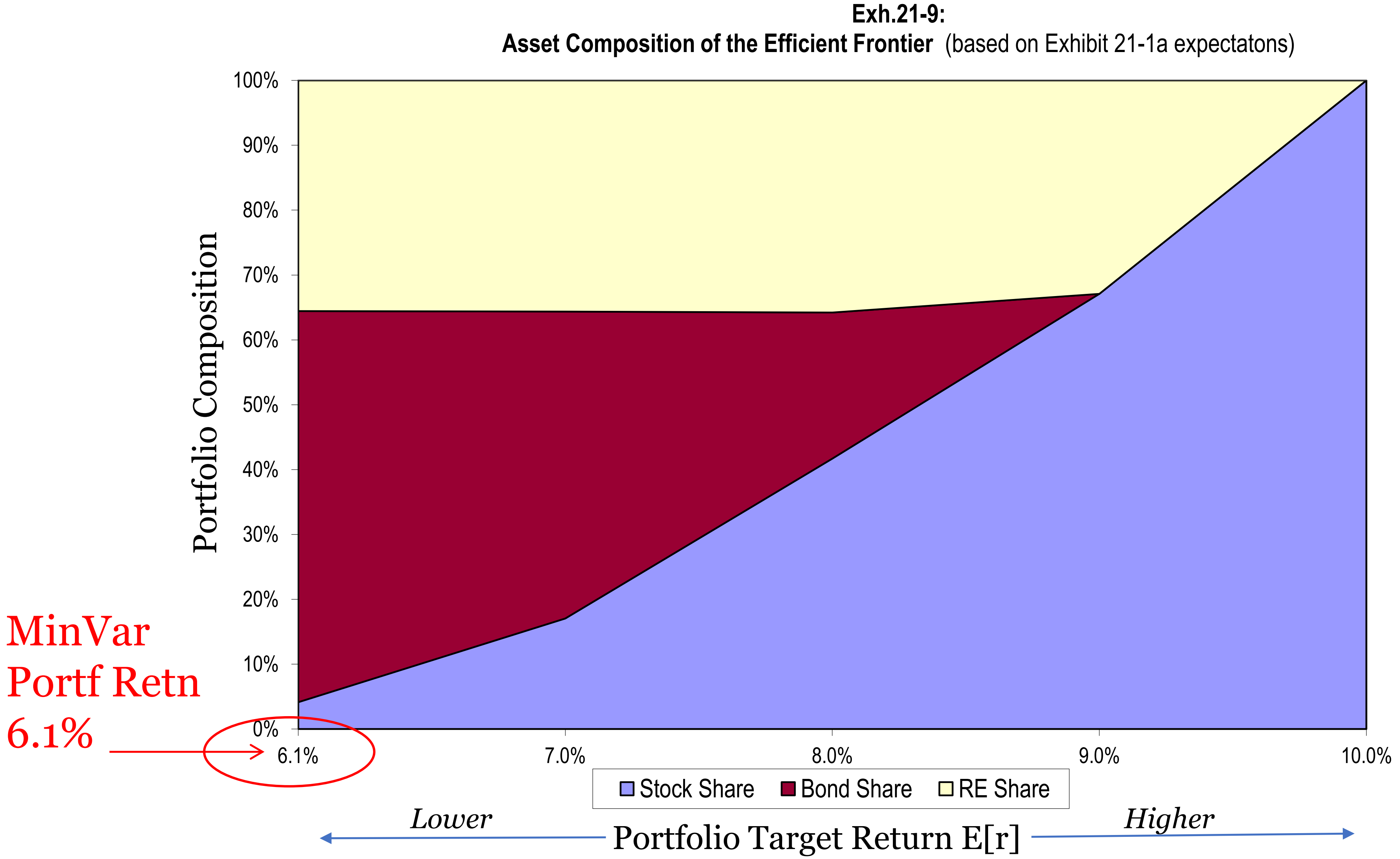
22.2.5. STEP 2: *PICK A RETURN TARGET FOR YOUR OVERALL WEALTH THAT REFLECTS YOUR RISK PREFERENCES...*

OR ARE YOU HERE (9%)?...




Let optimizer (e.g., Excel "Solver"®) find the portfolios (asset class shares) that trace out this frontier… by specifying target returns, then minimize portf vol.
Portf Expected Return
Max-vol asset class
For starting point (left-hand edge of "area chart")
You want this.
Min-vol asset class
Not this.
Min-vol portf
Portf Volatility

22.2.6
Major Implications of Portfolio Theory for Real Estate Investment



Core real estate assets typically make up a large share of efficient (non-dominated) portfolios for conservative to moderate return targets.