Tashkent State University of Economics

Household finance

Lecture 3: Household portfolio decisions.

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PORTFOLIO THEORY AND RISK

Note that only a selection of these slides will be dealt with in detail, in the lecture

All other slides are there to guide you towards the key points in Cuthbertson/Nitzsche "Investments" and in the end of chapter questions

Revise your elementary stats before the lecture

TOPICS

- Basic Ideas
- Efficient Frontier
- Transformation Line, Capital Market Line
- and the Market Portfolio
- Practical Issues in Portfolio Allocation
- Self-Study Slides

READING

- Investments:Spot and Derivative Markets,
- K.Cuthbertson and D.Nitzsche

- <u>CHAPTER 10:</u>
- Section 10.1: Overview
- Section 10.2: Portfolio Theory

- Note:
- Chapter 18 also contains much useful material
- for those who wish to learn more !

PORTFOLIO THEORY

- Portfolio theory works out the ‘best combination’ of
- stocks to hold in your portfolio of risky assets.

- You like return but dislike ‘risk’

- We assume the investor is trying to ‘mix’ or combine
- stocks to get the <u>best return</u> relative to the <u>overall</u>
- <u>riskiness</u> of the chosen portfolio.

- As we shall see ‘Best’ has a very specific meaning.

PORTFOLIO THEORY

Question 1

- What proportions of your own $100 should you put in
- two different stocks
- (e.g. ‘weights’ = 25%, 75% which implies $25, $75)

- Different ‘weights’ give rise to different ‘risk-return’
- combinations and this is the ‘efficient frontier’

- Question 2
- We now allow you to borrow or lend (from the bank),
- How does this alter your choice of ‘weights’ and the
- amount you actually choose to borrow or lend?
- Latter depends on your ‘love of risk’

Statistics: Some Definitions

- Expected Return of Portfolio
- $E(R_P) = w_1 ER_1 + w_2 ER_2$

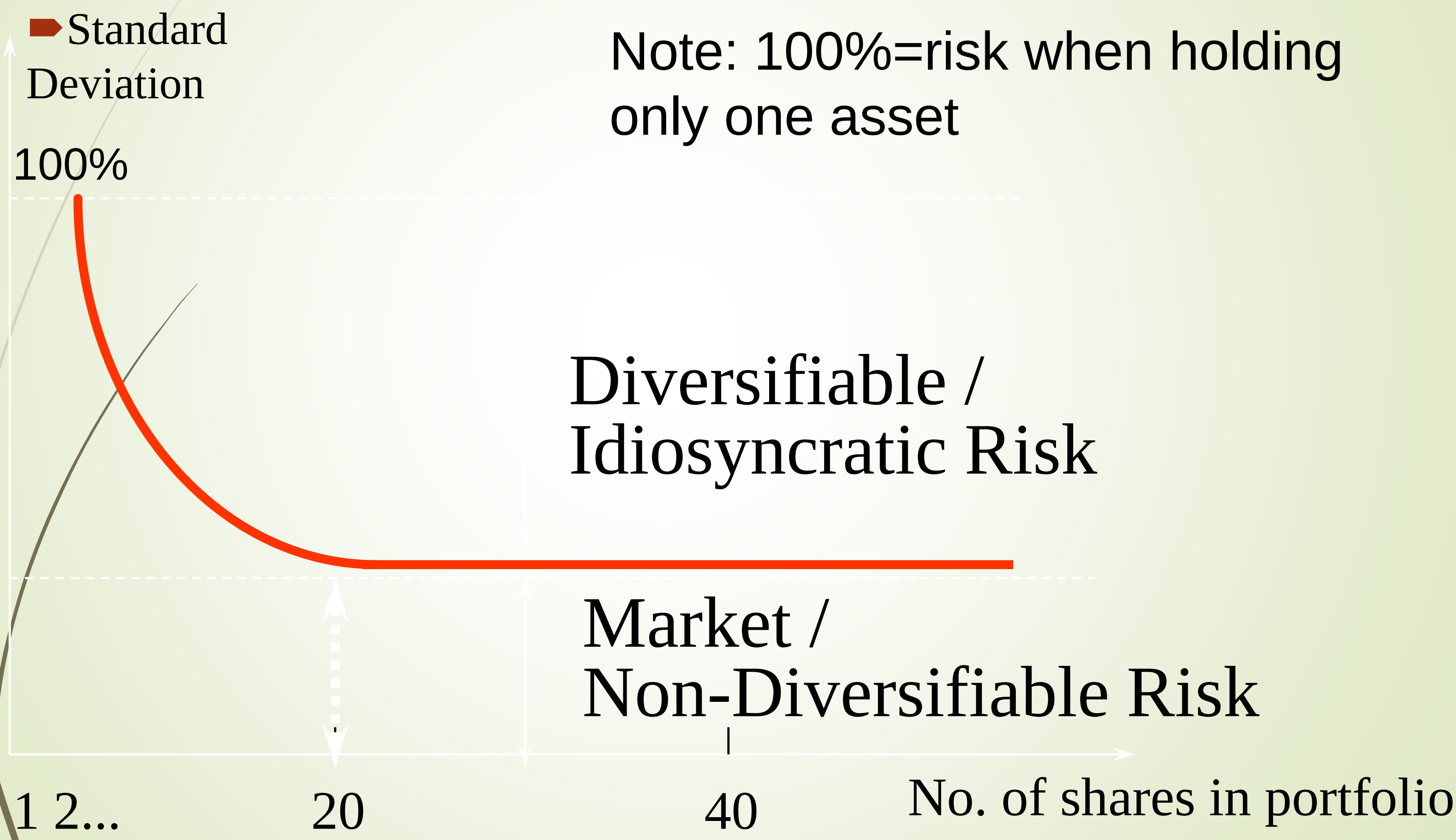
- Variance of Portfolio
- $\sigma^2_P = w^2_1 \sigma^2_1 + w^2_2 \sigma^2_2 + 2 w_1 w_2 \sigma_{12}$
- $\sigma^2_P = w^2_1 \sigma^2_1 + w^2_2 \sigma^2_2 + 2 w_1 w_2 (\rho \sigma_1 \sigma_2)$
-
- Also, 'proportions' are: $w_1 + w_2 = 1$.
- Note $\sigma_{12} = \rho \sigma_1 \sigma_2$ - from statistics

Some Intuition: Domestic Assets

- Risk of a single asset is the variance (SD = σ_1) of its return
- (eg. Man.Utd share)
- Risk of a portfolio of shares depends crucially on covariance (correlation) between the returns.
- (Eg. Man Utd and Arsenal)

Random selection of shares

Increasing the size (=n) of the portfolio
(each asset has 'weight' $w_i = 1/n$)

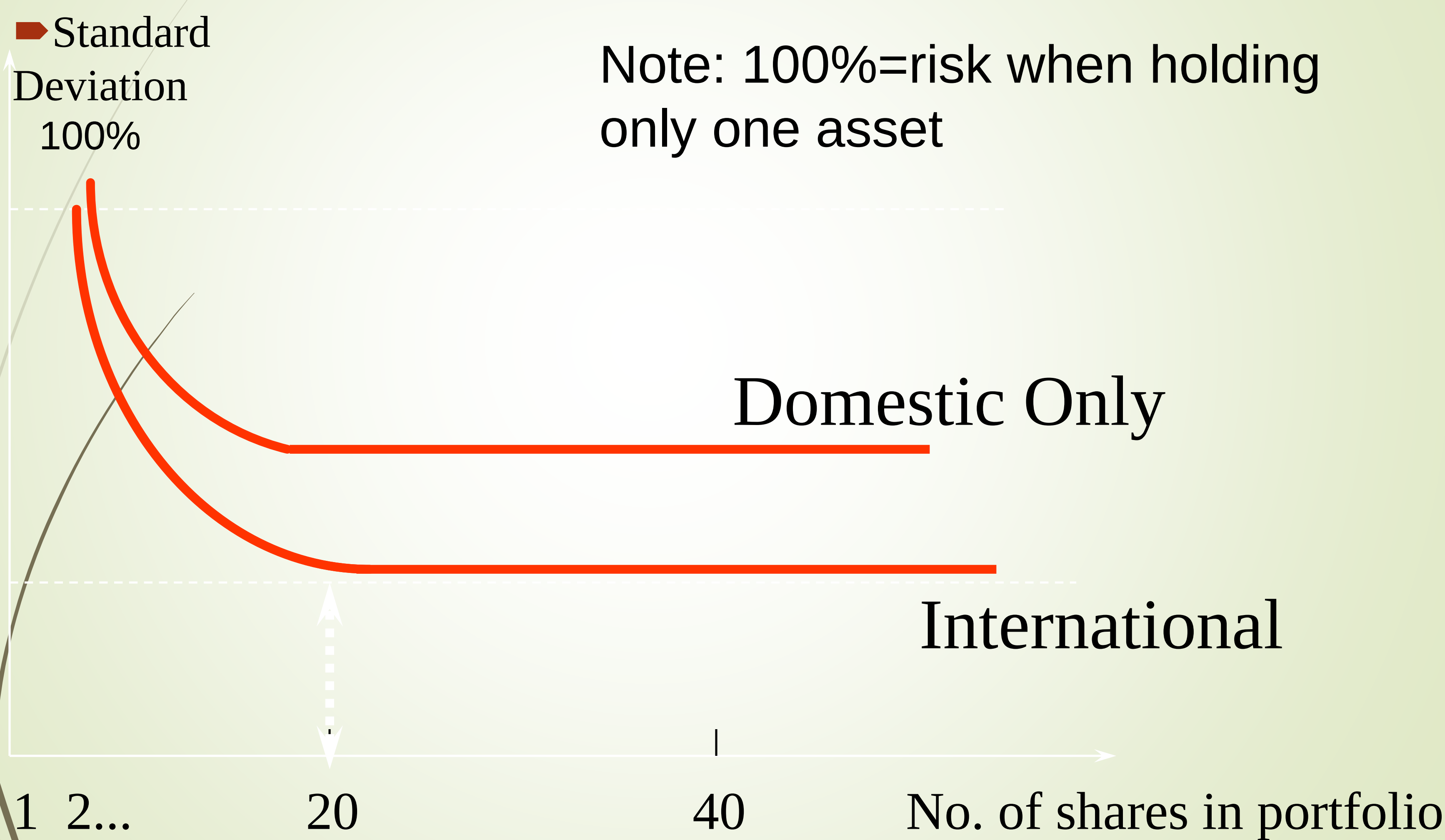


Some Intuition: International Diversification

- US resident invests $100 in UK Stock index (FTSE100)
- Suppose whenever FTSE100 goes up by 1% the sterling exchange rate always goes down by 1% - perfect negative correlation between the two returns
- Then the US resident has zero US dollar risk
- Hence negative correlations (strictly any $\rho < +1$) reduces risk
- (True, she also has zero expected USD return but seeing as she is holding zero risk, that seems OK. 'It's the 1st rule of finance, stupid!')

Random Selection: International Portfolio

Note: 100%=risk when holding only one asset

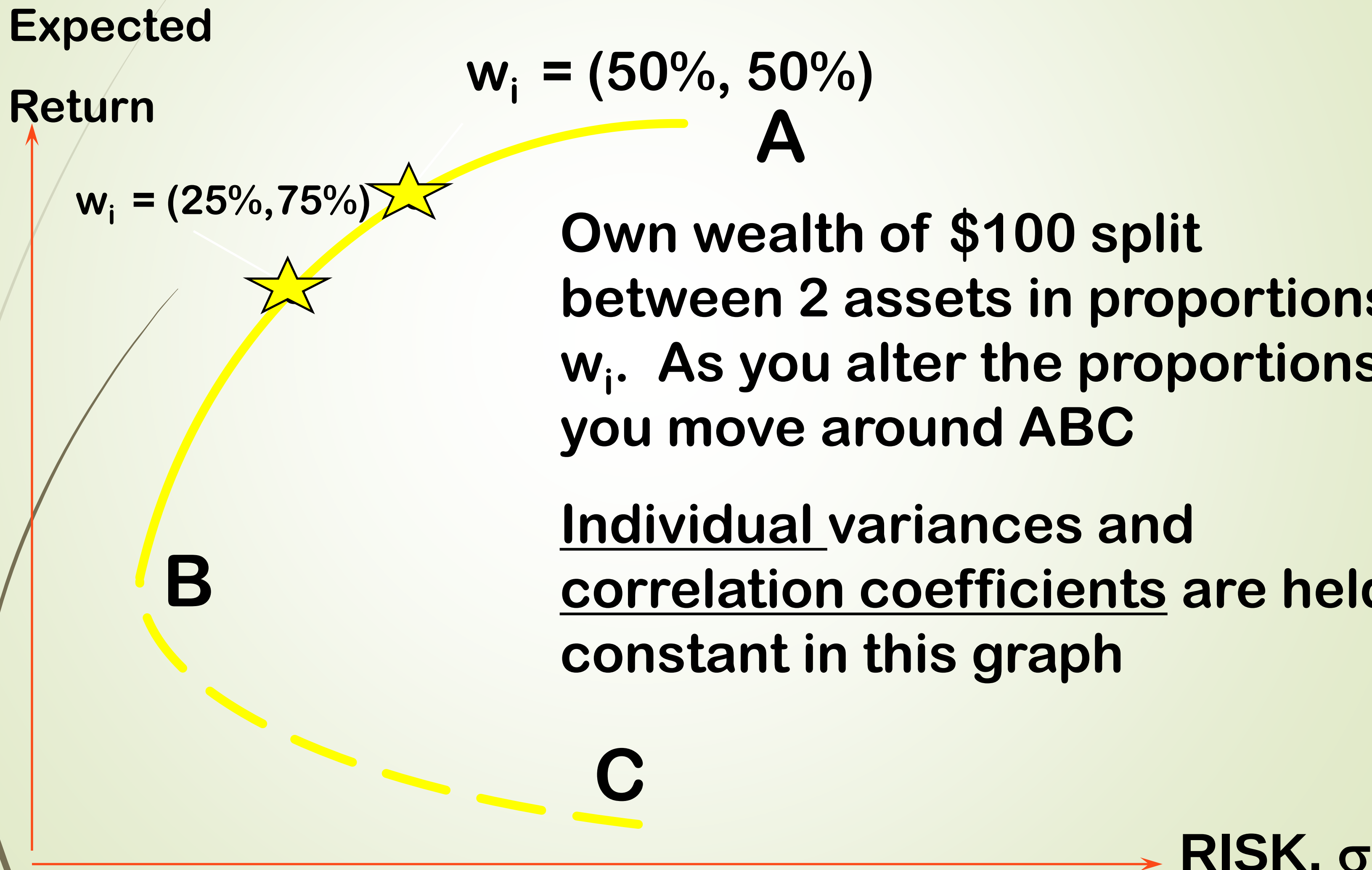


Can we do better than "random selection"?

Consider 'Return' together with 'Risk'

- Assumptions
- You like return and dislike portfolio risk (variance/ SD).
- Assume everyone has the same view of future returns ER_i and correlations σ_{12} , ρ_{12} .
- 2-Stage Decision Process
- STAGE 1
- Use only "own wealth" of $100 and work out the risk-return combinations which are open to you by distributing this $100 in different combinations (proportions, w_i) in the available stocks. This gives the "efficient frontier"

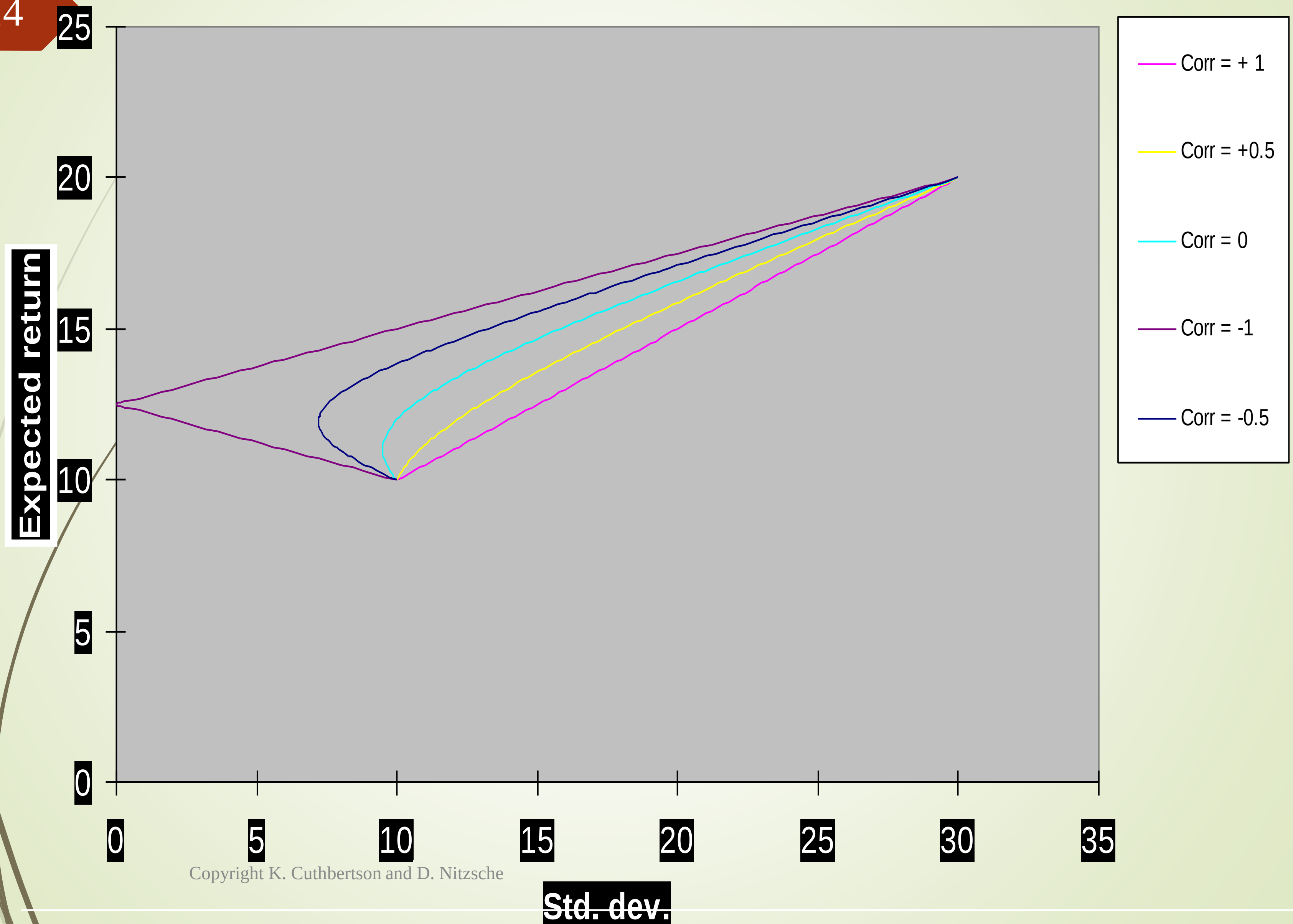
Efficient Frontier: Diversification



Own wealth of $100 split between 2 assets in proportions w_i. As you alter the proportions you move around ABC

<u>Individual</u> variances and <u>correlation coefficients</u> are held constant in this graph

Figure 10.4 : Risk Reduction Through Diversification



- Transformation Line
- the
- Capital Market Line CML
- and the
- Market Porfolio

Borrowing and Lending, 'safe rate'= r

STAGE 2

- You are now allowed to borrow and lend at risk free
- rate, r while still investing in any SINGLE 'risky bundle'
- on the efficient frontier .

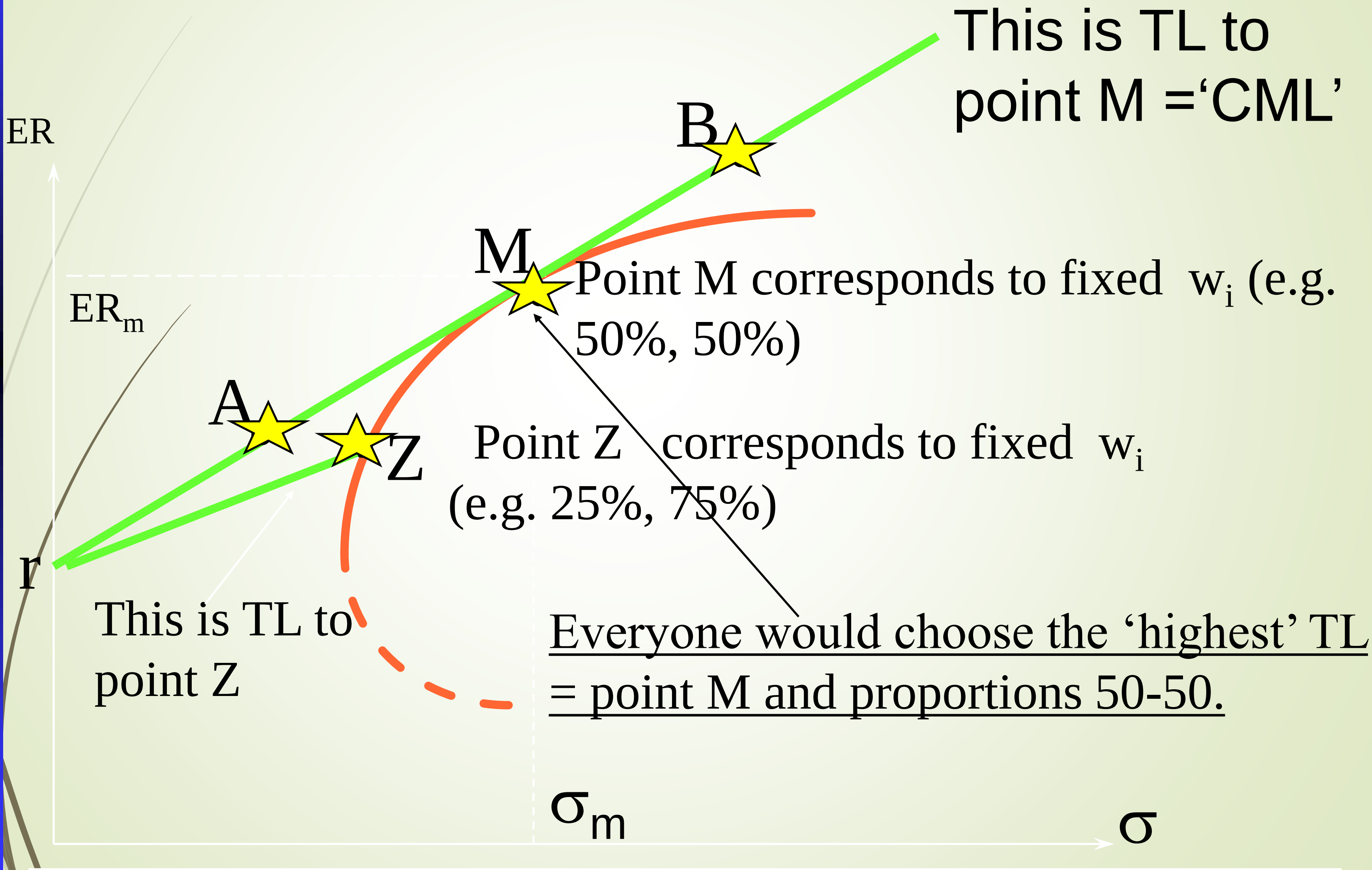
- For each SINGLE risky bundle, this gives a new set of
- risk-return combinations ="transformation line, TL"
- ~ which is a 'straight line'

- Each risky asset bundle has its 'own' TL

- You can move along this TL by altering your borrowing/lending

Transformation Line(s) TL

TL = Combination of ANY SINGLE 'risky bundle' and the safe asset



CML: Some Properties

- NO BORROWING OR LENDING (ONLY USE OWN $100)
- You are then at point M

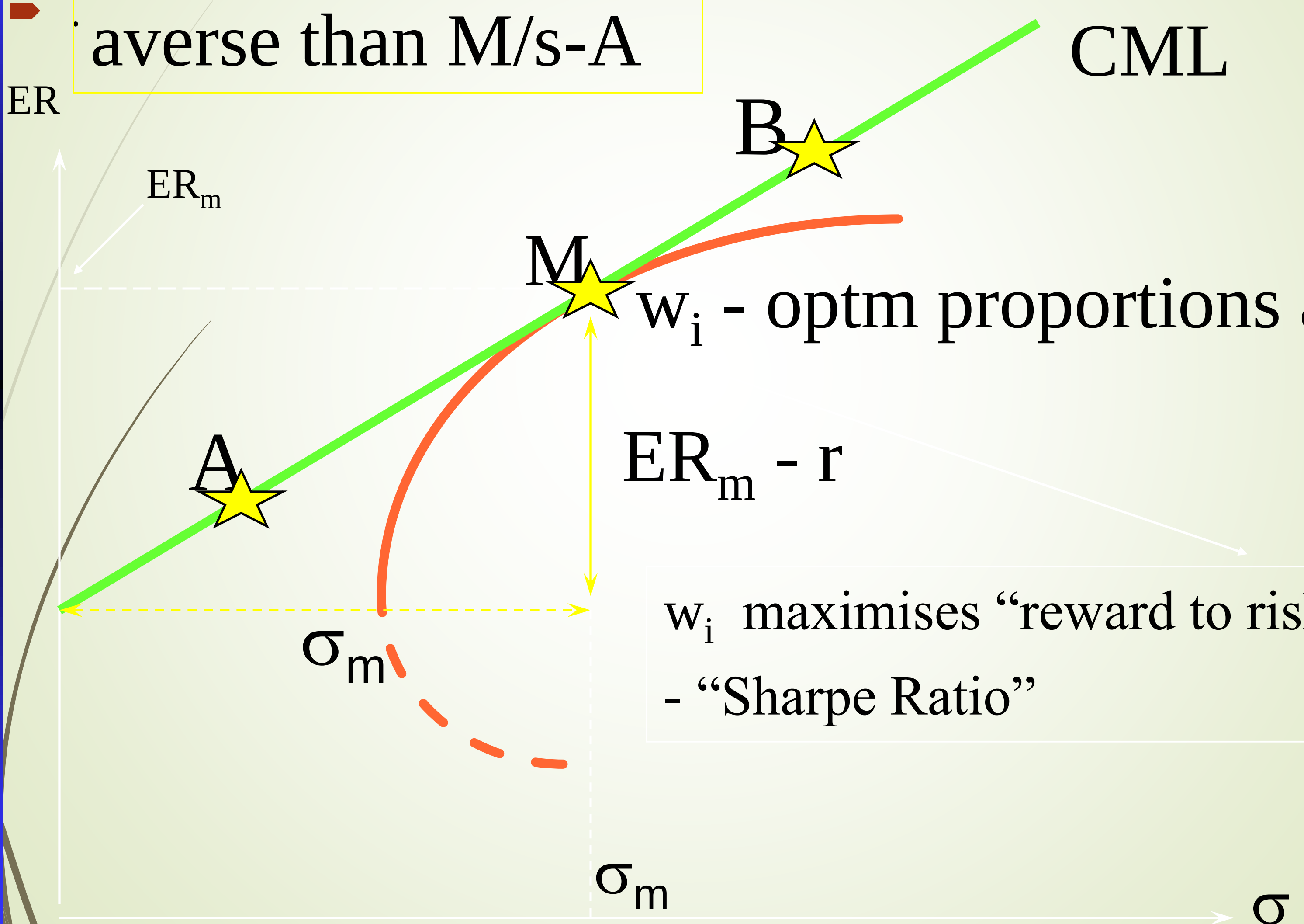
- LEND SOME OF $100 (e.g lend $90 at r and $10 in risky bundle)
- You are then at point like A

- BORROW (say $50) and put all $150 in risky assets
- You are then at point like B

- Surprisingly the <u>proportions</u> at A and B are the same as at M
- (I.e. 50%,50%) - but the $ amounts are NOT the same! (Tricky !)

CML and Market Portfolio (M)

M/s-B **less** risk averse than M/s-A



w_i maximises "reward to risk ratio"

- "Sharpe Ratio"

Market Portfolio = Passive Investment Strategy

- Optimal w_i maximises "reward to risk ratio" - "Sharpe Ratio".
- At the time you choose your optimal proportions you expect to obtain a 'reward to risk ratio' of
-
- $$S = (ER_m - r) / \sigma_m$$
- Note that both M/s-A and M/s-B have the same Sharpe ratio
- Of course the 'out-turn' for the Sharpe ratio could be very different to what you envisaged (because your forecasts turned out to be poor).
- Ball park estimate for Sharpe ratio for S&P500 (annual)
- = 0.4 [= (12-4)/20]