Tashkent State University of Economics

Household finance

Lecture 4: Households risk preferences.

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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

‘Active’ versus ‘Passive’ Strategy

- Sharpe Ratio for any portfolio-k
- $S_k = (ER_k - r) / \sigma_k$

- Active portfolio managers must try and beat the Sharpe ratio of the ‘passive’ investment strategy (I.e. holding the market portfolio, month in-month-out).

- ER_k = average of ‘out-turn’ values for monthly portfolio returns (net of transactions costs) over say 3 years, for any portfolio-k and any ‘strategy’ (e.g. trying to pick winners)
- σ_κ = sample SD of these monthly returns (over 3 years)

- Compare investment strategies:
- The investor with the highest value of S_k is the ‘winner’

Practical Issues

1) Suppose all investors do not have the same views about expected returns and covariances.

- ~ we can still use our methodology to work out optimal proportions/weights for for each individual investor.

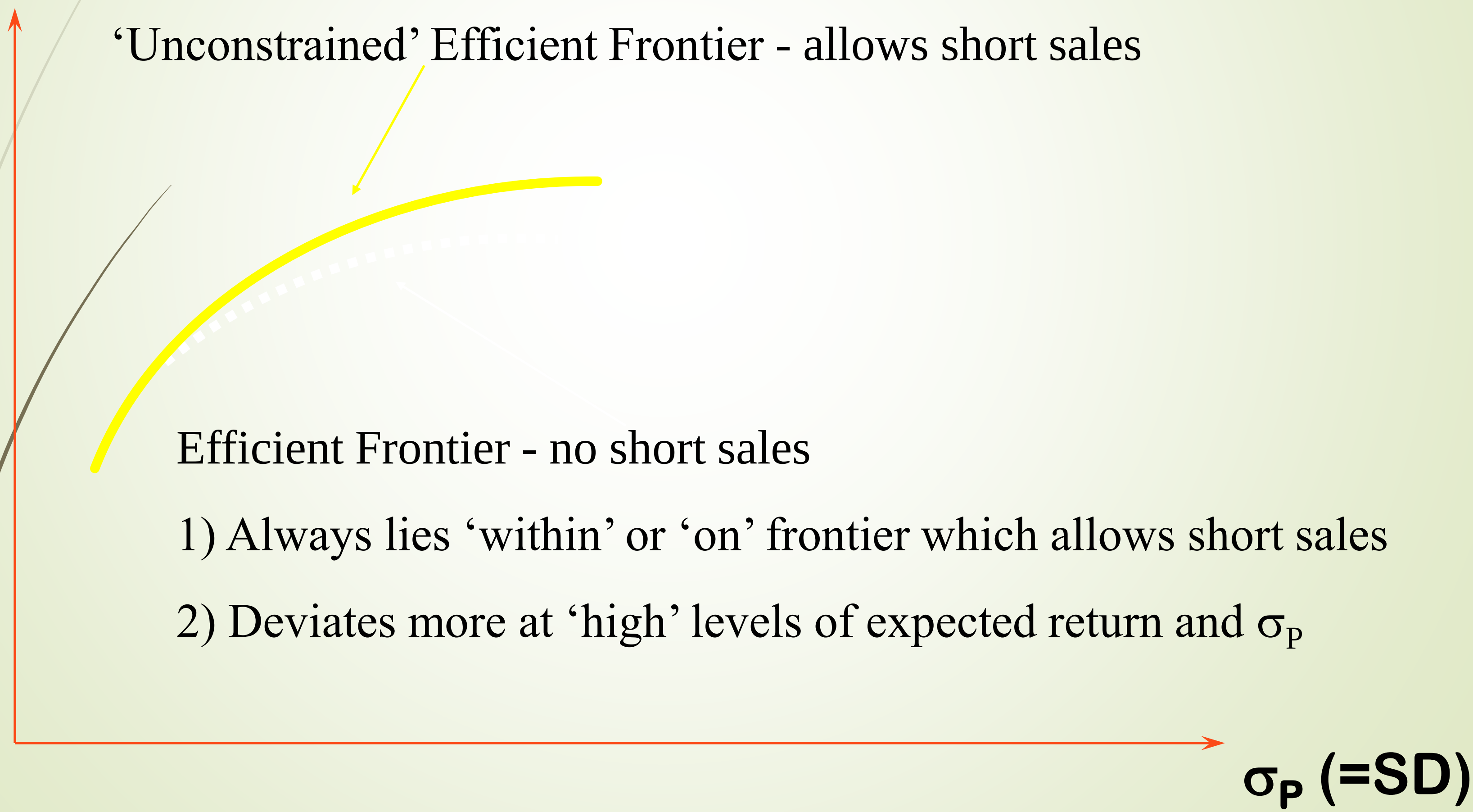
- 2) The optimal weights will change as forecasts of returns and correlations change - the 'passive' portfolio needs 'some rebalancing' - 'Tracking Error'

- 3)The method can be easily adopted to include transactions costs of buying and selling, and investing "new" flows of money.

- 4) Lots of weights might be negative, which implies short-selling, possibly on a large scale. If this is 'impractical' you can re-calculate, where all the weights are forced to be positive.

No-Short Sales Allowed

(ie. All ‘weights’ > 0)



1) Always lies ‘within’ or ‘on’ frontier which allows short sales

2) Deviates more at ‘high’ levels of expected return and σ_P

Practical Issues

- 5) The optimal weights depend on estimate/forecasts of expected returns and covariances.

- If these forecasts are incorrect, the actual risk-return outcome may be very different from that envisaged when you started out

- Put another way a small change in expected returns can radically alter the optimal weights - ie. Extreme sensitivity to the" inputs".

- The optimal weights are relatively insensitive to errors in forecasts of correlations and variances - hence some investors choose weights to min. SD only.

International Diversification

- Within a particular country, either portfolio theory will be used to guide proportions in each industrial sector, or they will try just 'track' the respective domestic indices (e.g. the S&P500, FTSE 100).

- There is some evidence that INVESTMENT COMMITTEES are moving towards choosing industrial sector weights, subject to limits on the resulting country proportions. This is to 'gain' from the disparate business cycles between industries (e.g. world car industry has different cycle to world chemicals)

- This is because 'country indices' are beginning to have 'high correlations' (e.g. US and UK aggregate business cycles are now more highly correlated.

International Diversification

- TACTICAL ASSET ALLOCATION

- Use part of funds for market timing' the business cycle'
- (e.g. switch 10% of speculative funds out of US and into SE Asia)

- -might use a macro-economic model for forecasts

- -does not easily 'fit' into portfolio theory because usually little or no formal estimate of risk is made

SELF STUDY SLIDES

The following slides provide a simple numerical example to construct the efficient frontier,the capital market line and the market portfolio

These slides will NOT be covered in the lectures

STATISTICS REVISION: 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**
- **The above are used to derive the EFFICIENT FRONTIER by (arbitrarily) altering the w's**

STAGE 1: 2 Risky Assets:
Real world data (statistician)

	Risky Assets	
	Equity-1	**Equity-2**
Mean, ER_i	8.75	21.25
σ_i(SD) .	10.83	19.80

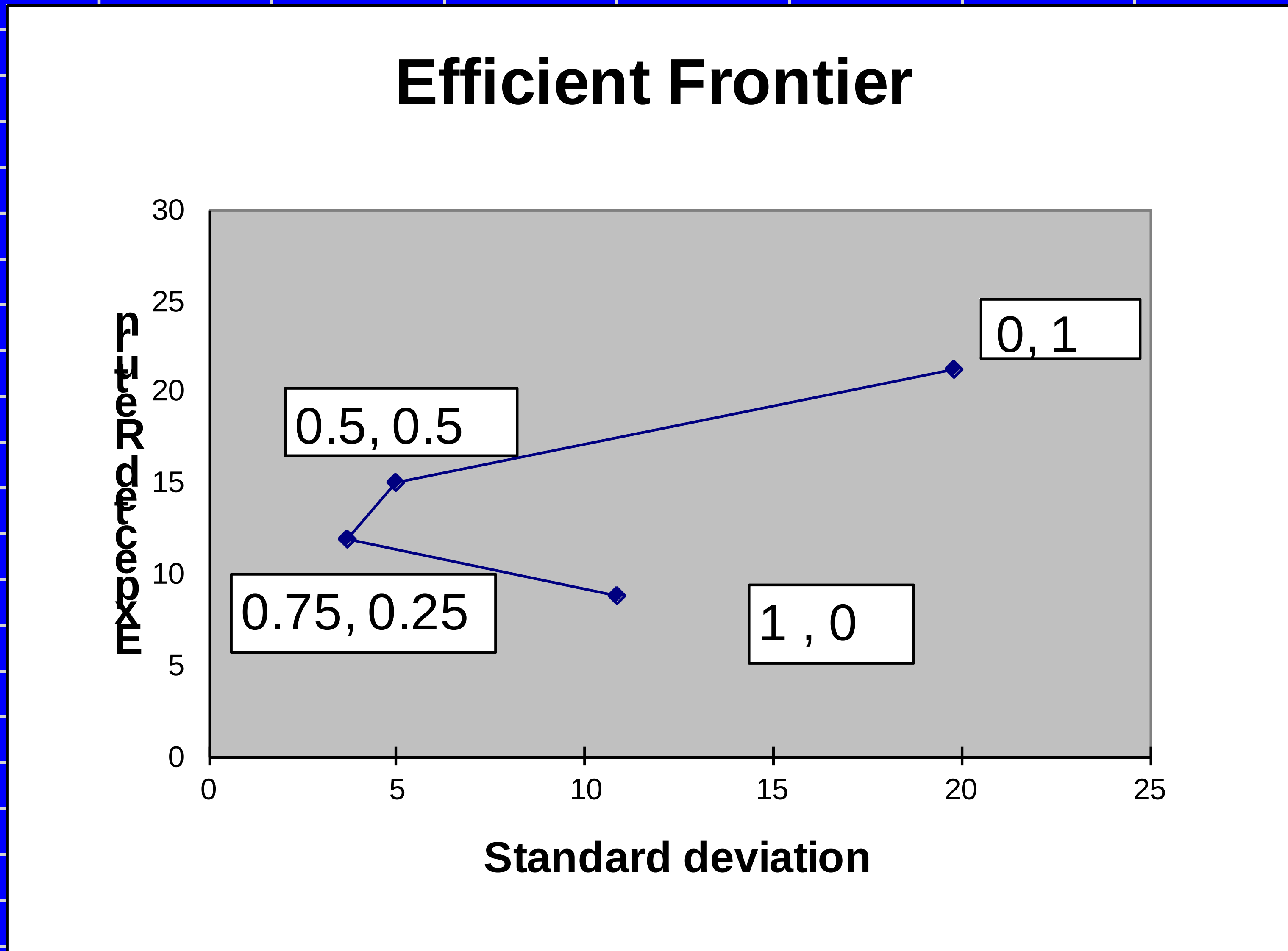
Correlation (Equity-1, Equity-2): - 0.9549
Cov(Equity-1, Equity-2) : -204.688

STAGE 1: Construct Efficient Frontier

Choose different w's and calculate ER_p and σ_p combinations**)**

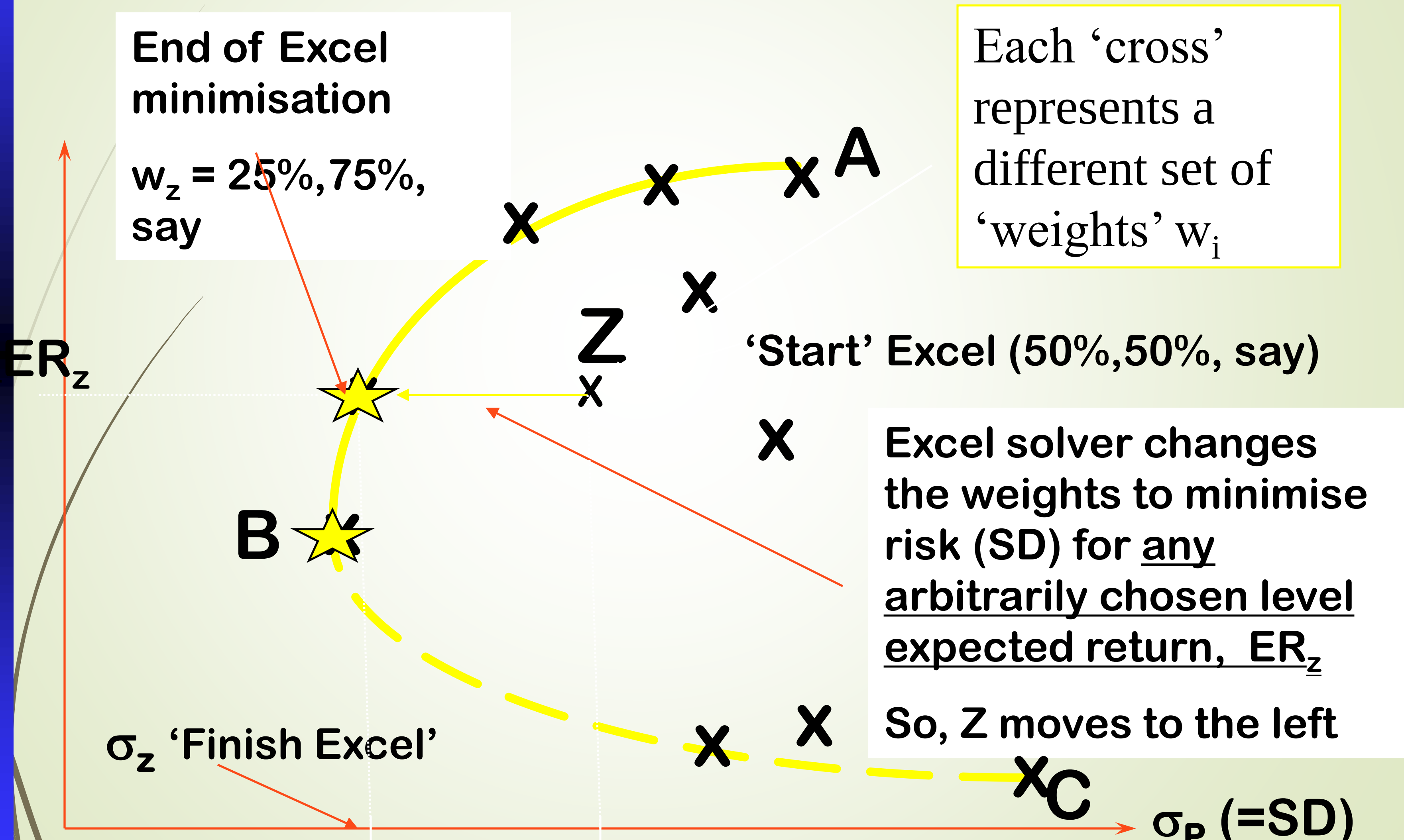
State	Shares of		Portfolio	
	Equity-1 w_1	**Equity-2** w_2	ER_p	σ_p
1	1	0	8.75	10.83
2	0.75	0.25	11.88	3.70
3	0.5	0.5	15	5
4	0	1	21.25	19.80

Now plot values of ER_p and σ_p and construct the Efficient Frontier


Efficient Frontier
0, 1
0.5, 0.5
0.75, 0.25
1 , 0
Expected Return
Standard deviation
0
5
10
15
20
25
30

Efficient Frontier with ‘n’ - Risky Assets

You require EXCEL ‘SOLVER’ to ‘draw’ the
EFFICIENT FRONTIER (=A-B)



STAGE 2: Transformation Line

- We have 'constructed' the efficient frontier
- Now introduce a "safe asset"
- What does the risk-return "trade-off" look like when we
- allow borrowing or lending at the safe rate
- and
- we combine this with any '<u>single bundle'</u> of risky assets?
- 'New Portfolio'=1-safe asset + 1 "bundle of risky assets"
-
- Answer = Straight Line relationship between ER and σ

STAGE 2: Transformation Line

- What is a 'Risky Asset bundle' ?:

- Keep (arbitrary) fixed weights in risky assets
- eg. 20% in asset-1, 80% in asset-2
- So, if you have W_0 = $100 you will hold $20 in
- asset-1 and $80 in asset-2

- Assume this gives rise to a fixed "bundle" of risky
- assets" called "q" with ER_q=22.5% and s_q= 24.8%

- Now combine 'fixed risky bundle' with the safe asset
- by borrowing/lending different $ amounts of safe asset

Construct 'One' Transformation Line

Data

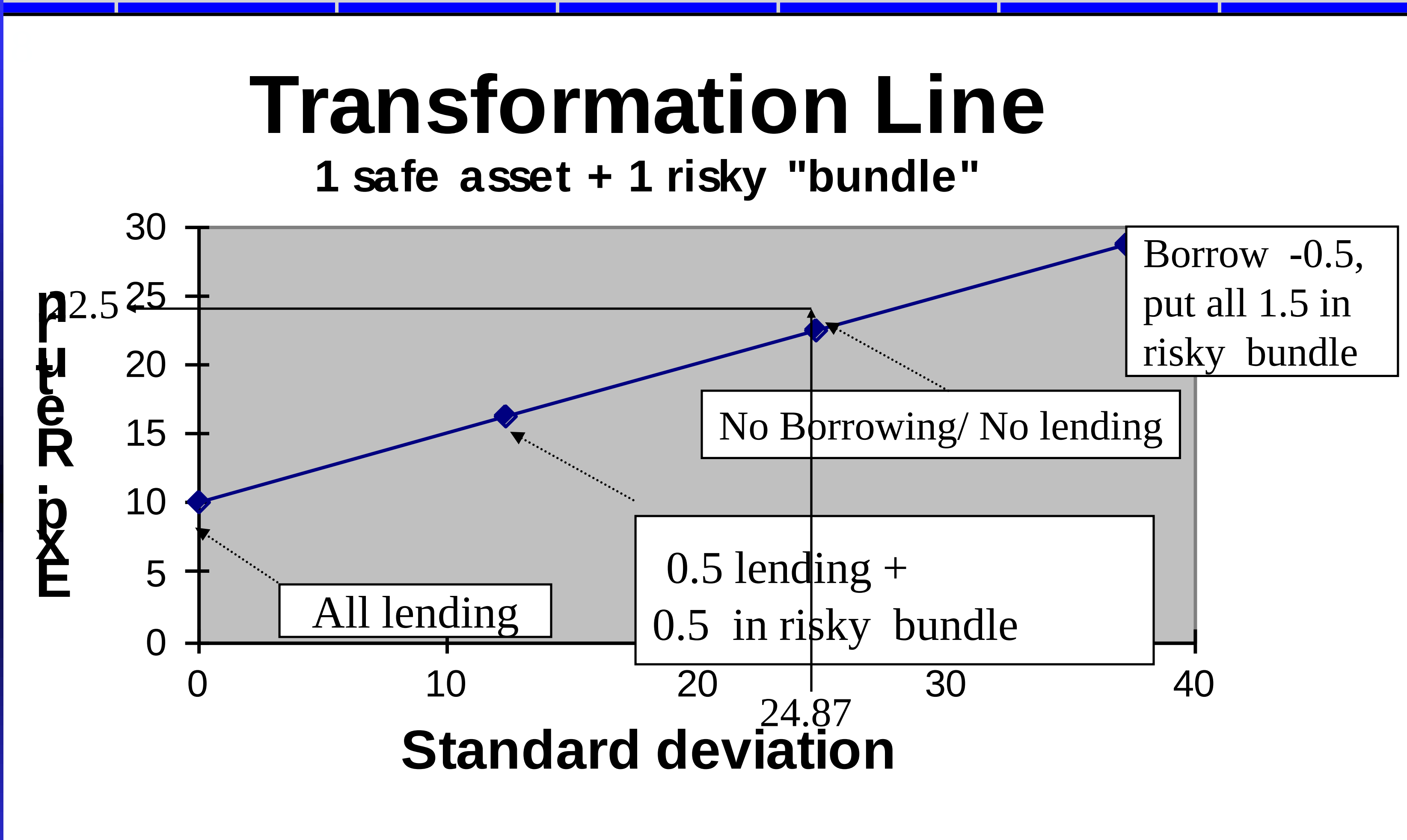
	Return	
	T-bill (safe)	Equity (Risky)
Mean	$r = 10$	$R_q = 22.5$
Std. Dev.	0	$\sigma_q = 24.87$

FORMULAE FOR EXPECTED RETURN AND SD OF 'NEW' PORTFOLIO

N= "new" portfolio of: 'safe + risky 'bundle'
σ_q^2 = variance of the risky 'bundle'
x = proportion held in 'risky asset'
(1-x) = proportion held in safe asset(with $\sigma = 0$)

Expected Return: $E(R_N) = (1- x) . r + x \ ER_q$

THEN: Variance (SD) of NEW PORTFOLIO of " 1-safe + 1 risky asset"
$\sigma_N^2 = x^2 \sigma_q^2$ or $\sigma_N = x \sigma_q$



Note: At "no borrow/lend" position, ER and σ of "new" portfolio equals that for the risky asset alone (not surprisingly)

Transformation Lines

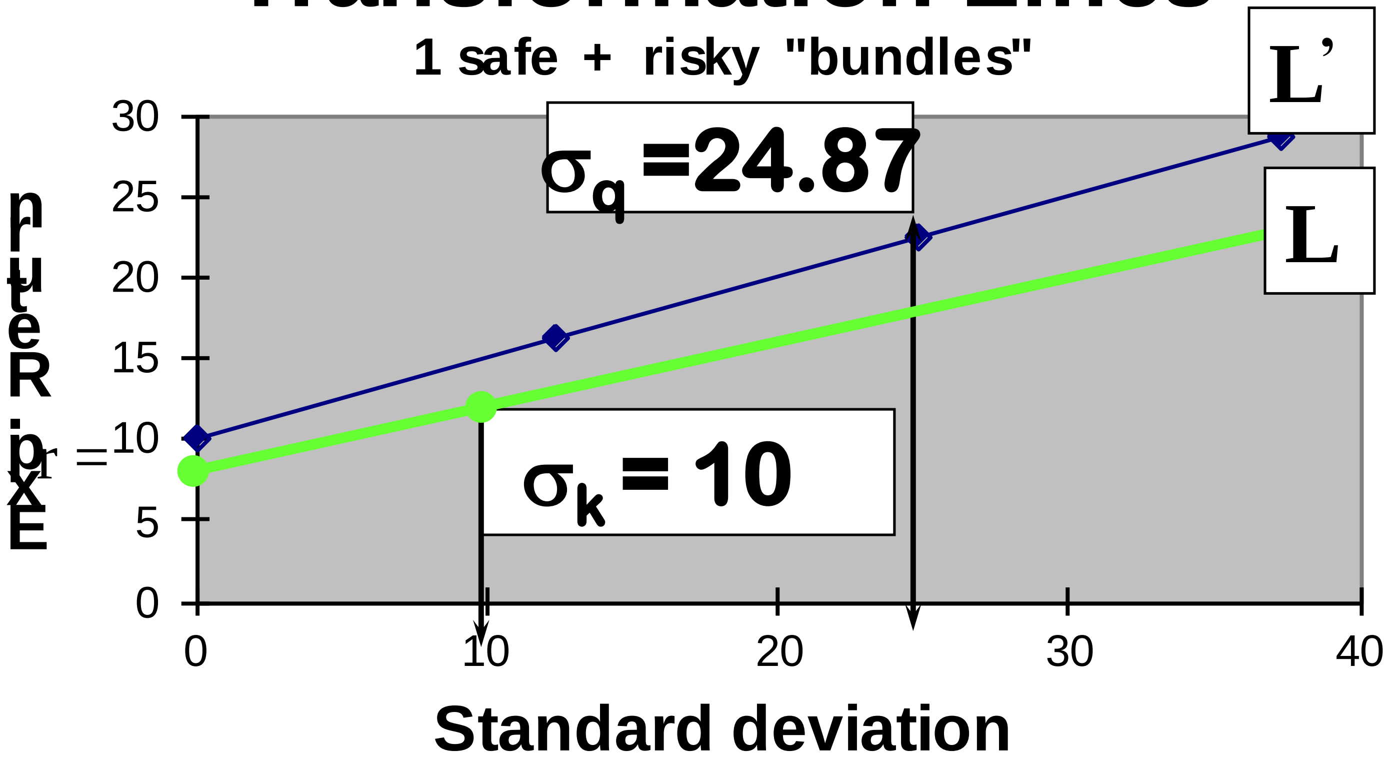
- Safe asset plus ANY ONE ‘arbitrary’ risky bundle,
- gives a specific transformation line (which is straight
- line) between r and the s.d of the risky bundle

- Every single, risky bundle has its own transformation
- line

- Which transformation line is “best”?

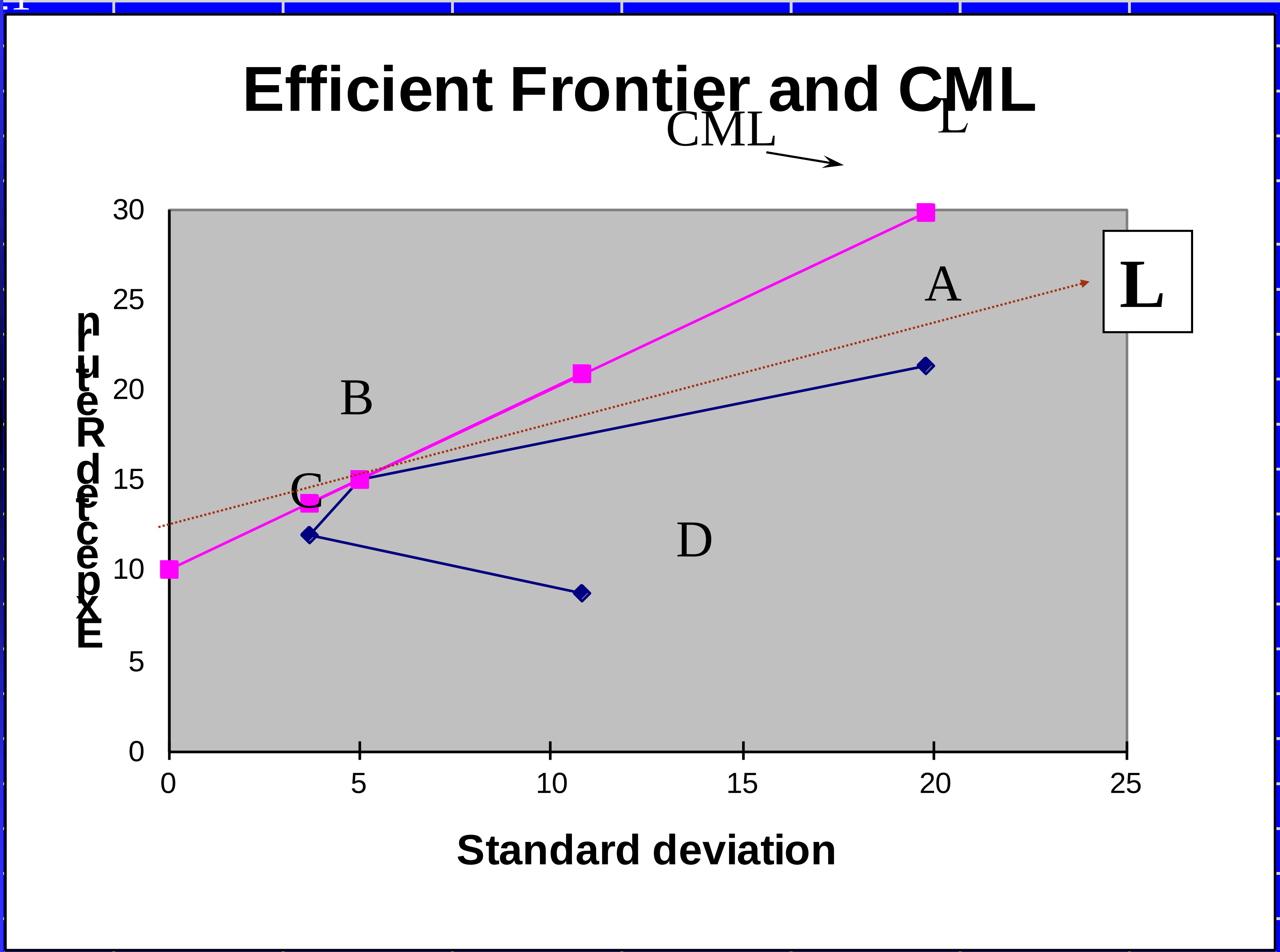
- “THE HIGHEST ACHIEVABLE” = Capital Market Line

Transformation Lines



q and k are both 'points' on the efficient frontier. So q might represent(20%,80%) in risky assets and k might represent (70%,30%). Each "fixed weight" risky bundle has its own transformation line

"B" is highest attainable transformation line, while still remaining on the efficient frontier. 'B' represents the optimal weights (50%,50%) for the risky bundle.



Market Portfolio

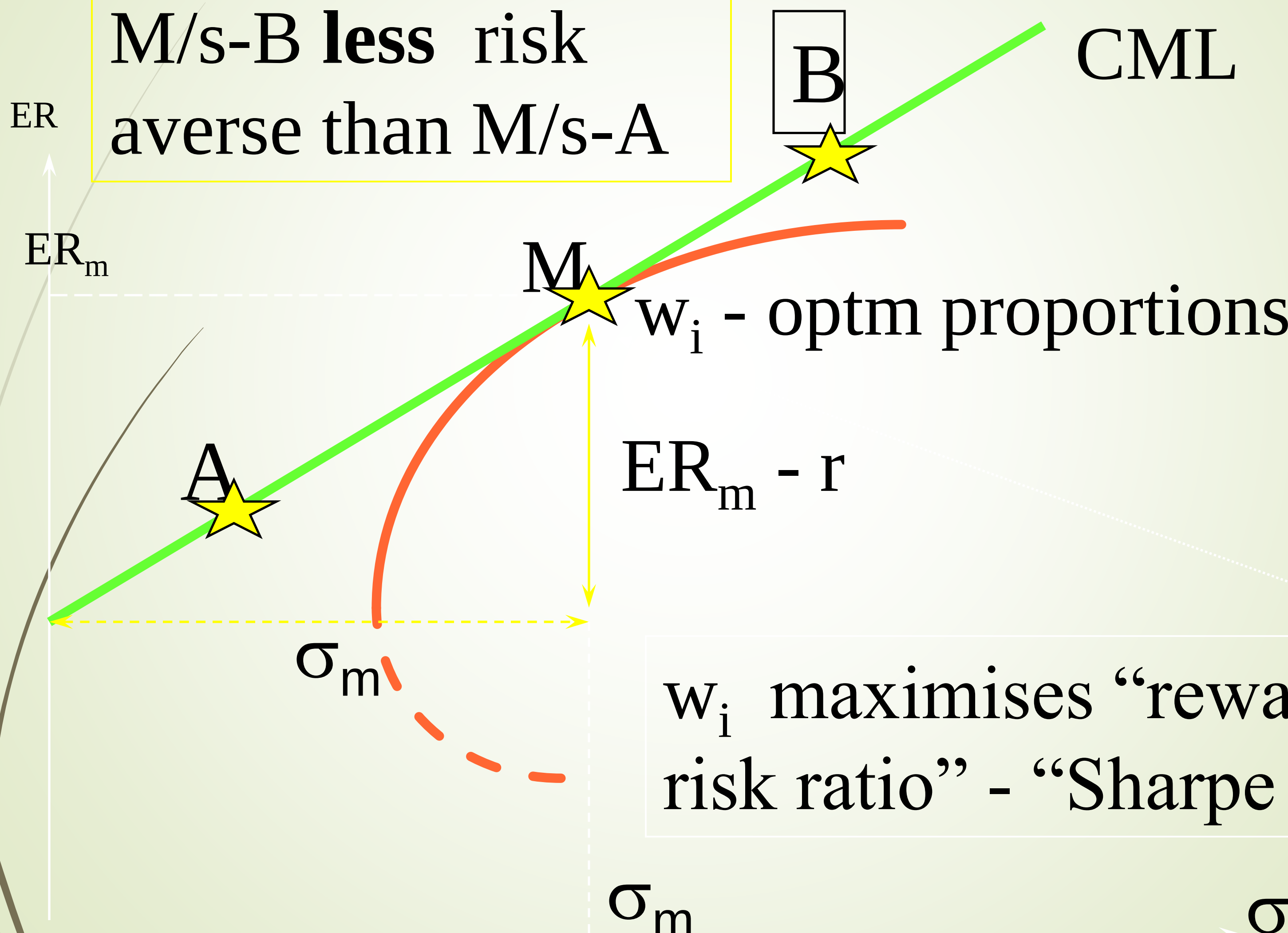
Point-B is therefore a rather special portfolio and hence is known as the "**Market Portfolio**" (as indicated by the subsript 'm' in the next slide)

IF everyone has the same expectations about returns, standard deviation and correlations then:

Everyone chooses point-B (which here gives 50%, 50% held in each risky asset)

CML and Market Portfolio (M)

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



w_i maximises "reward to risk ratio" - "Sharpe Ratio"

END OF SLIDES