Uniwersytet Ekonomiczny

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Performance measurement
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Presentation outline

- Risk adjusted performance measures
- Assessing investment performance
- Risk considerations and ranking performance
- Holding periods and individual property investment performance

Motivation for Performance Analysis

- Investors who pay a fund manager to manage their portfolio require timely information about the investment's performance
- Identification of sources of strengths and weaknesses in decisions
- ***The big question: Has any good performance resulted from good luck or was it the result of skill?***

Why measure property performance?

- From investor's perspective
  - evaluation of investment strategy vis-à-vis other investment classes
  - comparative analysis against competitors and benchmarks
  - isolation of active performance from general market movements
  - identification of investment skills

Measures of Return

- Money Weight Rate of Return – MWRR(IRR)
  - Absolute measure of performance
- Time Weighted Rate of Return – TWRR
  - Enables comparison of performance
- Differences between MWRR and TWRR arise because of cash flows into and out of a portfolio

Money Weighted Rate of Return

$$MWRR = \frac{V_1 - V_0 - C}{V_0 + \frac{C}{2}}$$

where:

V1= Value of investment at the end of the period

Vo = Value of the investment at the start of the period

C = Net income (cash flow) over the period

MWRR/IRR

- The IRR is found from:

$$V_0(1+i)^t + \sum_{j=1}^{k} C_{tj}(1+i)^{tj} = V_t$$

- where,
  - V_0 = initial value of fund
  - V_t = final value of fund
  - C_{tj} = cash flow at time tj
  - k = number of cash flows
- Fund value only required at beginning and end of year

Time Weighted Rate of Return

- If the period of analysis is divided into n sub-periods the TWRR is calculated as:

$$TWRR = \left[\frac{V_1}{V_0} x \frac{V_2}{V_1 + C_1} x \frac{V_3}{V_2 + C_2} x..x \frac{Vn}{V(n-1) + C(n-1)}\right] - 1$$

where:
Vi = Market value just before the ith cash flow
Ci = ith cash flow

Example of MWRR Calculation

- The returns for two portfolios, A and B, are 6% and 10% in two consecutive six-monthly periods. Assume that both portfolios start with a value of €1000 and that there is an injection of €500 of new money into portfolio B at the start of the second period. The value of each portfolio at the end of 12 months is:

Value of Portfolio A: 1000 x 1.06 x 1.10 = 1166
Value of Portfolio B: 1000 x 1.06 x 1.10 + 500 x 1.10 = 1716

The respective MWRR for each portfolio is:

MWRR(A) =

$$\frac{1166 - 1000}{1000} = 0.166$$

MWRR(B) =

$$\frac{1716 - 1000 - 500}{1000 + \frac{500}{2}} = 0.173$$

Example of TWRR Calculation

- The TWRR for portfolio A is:
- TWRR(A) = $\left(\frac{1060}{1000}\right)\left(\frac{1166}{1060+0}\right)-1=0.166$
- TWRR(B) = $\left(\frac{1060}{1000}\right)\left(\frac{1716}{1060+500}\right)-1=0.166$

This demonstrates that the TWRR has the desirable property of being independent of the timing of the cash flows. The best performing fund in absolute terms was fund B, but in comparative terms there was no difference in performance.

Evaluating Performance

- In performance analysis you need to make relevant comparisons
- Performance should be evaluated on a relative basis; not on absolute basis!
- The investor needs to compare the returns of his/her manager with the returns that would have been obtained had he/she invested in an alternative portfolio with similar risk

Example

- Let's say that you decide to invest in a diversified equity portfolio with average risk. You see that the return was 20%.
  - is this satisfactory?
- Suppose the FTA All-Share Index has produced, for the same period, a total return of 15%.

  Can you say that the fund, for this period, had a superior return?

Evaluating investment performance

- An investor will reference a 'benchmark' portfolio to assess performance. *These benchmark portfolios must be relevant (similar risk), feasible and known in advance*

  Ĝ *relative performance*

- A full comparative analysis of performance should take risk into account
- How are ex-post risk-adjusted returns measured?
- How are risk-adjusted returns assessed?

Risk attitudes

- Different notions of what constitutes risk
- What do investors perceive as risk?
  - IPF survey
- Not achieving target/minimum required return?
- Any single measure will miss rich set of portfolio objectives and constraints
- Risk is context specific as different investors have different end objectives
- More than volatility of returns!

Examples of Risk

- Market/economy-wide factor exposure
- Specific/unique risk
- Liquidity risk (market capacity/'lumpy' investments)
- Default risk
- Matching risk (liabilities)
- Business risk (herd instinct)
- Interest rate risk (debt/gearing)
- Tracking error
- Downside risk
- Value at Risk

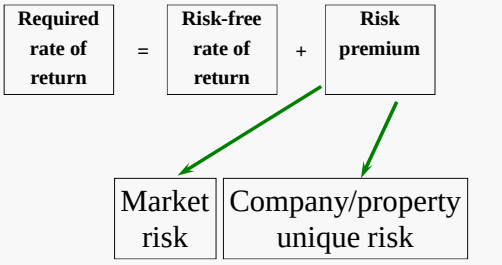
Risk adjusted returns

- Requirement to account for risk in portfolios
- Simplest evaluation is to compare returns to portfolios with 'similar' characteristics:
  - small property portfolios against each other
  - large portfolios against each other
  - peer groups
- However, risk is not explicitly taken into account this way

Two basic ideas about risk and return

- Investors' require compensation for bearing risk
- Investors' only care about an asset's contribution to portfolio risk

Components contributing to return



Risk–adjusted performance measures

- Relative risk-adjusted performance can be ranked by the following measures:
  - Sharpe Index
    - excess return to volatility measure (total risk)
  - Treynor Index
    - excess return to Beta measure
  - Jensen Index
    - differential performance or 'alpha' measure

Text book risk-adjusted returns

- Sharpe Measure
  - Basically the reward to variability ratio that we have already examined. Examines reward to total risk (standard deviation)
- Treynor Measure
  - Examines the reward for a given level of systematic risk (beta)
- Jensen's Alpha
  - Uses the expected return-beta relationship of the CAPM to examine abnormal rewards

Sharpe Measure

The Sharpe measure is exactly the same as the Treynor measure, except that the risk measure is the standard deviation:

$$S_i = \frac{R_i - RFR}{\sigma_i}$$

Treynor Measure

•The Treynor measure calculates the risk premium per unit of risk (β_i)

$$T_i = \frac{R_i - RFR}{\beta_i}$$

• Note that this is simply the slope of the line between the RFR and the risk-return plot for the security
• A higher slope indicates a better risk-return trade-off
• Therefore, higher T_i generally indicates better performance

Jensen Performance Index

- Performance is measured by the so-called *alpha* value:

Actual Performance – Expected Performance
=
Out-performance

$$\alpha_p = r_p - (\bar{r}_f + \beta_p(\bar{r}_M - \bar{r}_f))$$

- Expected performance above assumes CAPM market pricing
- *Caution*: If the expected performance is arrived at using a different approach (model?), the conclusion about alpha changes!

Example

Portfolio	Return	RFR	Beta	Std. Dev.	Treynor	Sharpe
X	15%	5%	2.50	20%	0.0400	0.5000
Y	8%	5%	0.50	14%	0.0600	0.2143
Z	6%	5%	0.35	9%	0.0286	0.1111
Market	10%	5%	1.00	11%	0.0500	0.4545

Issues:
1: Conflicting results
2: Should one be using any of these measures?
3: Need to consider relevant Benchmark

Example 2

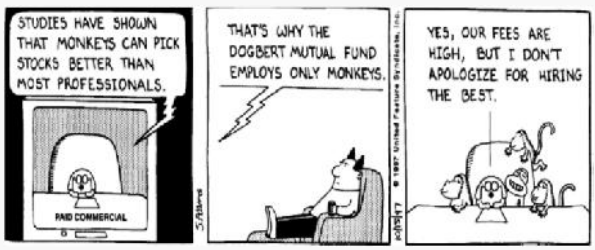
- Calculate Sharpe, Treynor and Jensen measures for each portfolio if the risk free rate is 7%

Portfolio	Return	Beta	±
A	0.16	1.25	0.15
B	0.12	0.10	0.18
C	0.10	0.75	0.14
MARKET	0.13	1.00	0.11

Example 2

Port	Sharpe	Treynor	Jensen
A			
B			
C			
M			

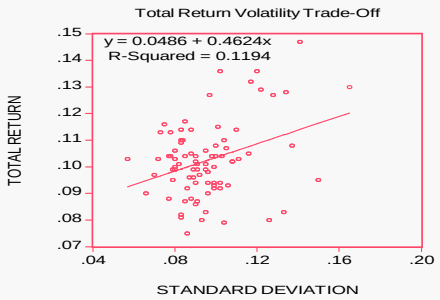
…picking winners



Standard deviation as a risk measure

- Standard deviation equates risk with uncertainty
- Use implies symmetric distribution
- Upside potential penalised to same extent as downside volatility
  - equal weight assigned to observations above & below the mean
- Measures risk relative to the mean
- Same risk for ***all*** goals

Average performance and volatility



Average return and volatility

- Weak linear association
- Given poor diversification of most real estate portfolios, SD likely to reflect idiosyncratic risk
  - systematic factors likely to account for returns
  - non-symmetric distribution of returns/skewness

  ⇒ downside risk measures may be more appropriate for assessment

Downside risk

- Defined by below-target semi-deviation
- Standard deviation of below-target returns
- Differentiates between risk and uncertainty
- Naturally incorporates skewness
- Recognises that upside volatility is better than downside volatility
- Combines *frequency* and *magnitude* of bad outcomes
- No single riskless asset
- Downside probability is the likelihood of failure!

A measure of down-side risk-adjusted performance

Sortino Ratio =
(achieved return - target return)/downside risk

Ranking sensitive to adopted measure

Ranking of risk-adjusted performance shows that the appropriate risk measures need to be carefully considered as different measures give different rankings, as case study will later demonstrate

Conclusion

…since an investor worries about underperformance rather than over-performance, semi-deviation is a more appropriate measure of investor's risk than variance

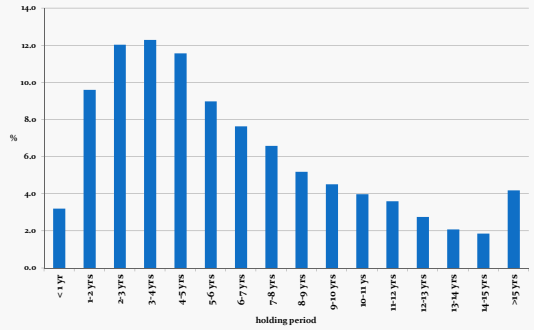
Markowitz (1992)

Holding Periods and Performance

Data: held and sold properties 1983-2009

Sector	Total	Sold	Held
Industrial	4,236	2,543	1,693
Offices	5,785	4,236	1,549
Retail warehouses	2,012	1,221	791
Shopping centres	460	291	169
Standard retail	6,061	5,250	811
Total	**18,554**	**13,541**	**5,013**

Distribution of sold properties: 1983-2009



Average holding periods 1983-2009

	Holding Period			Properties Sold: %				
	Median	Mean	Std Dev	< 2 yr	2 < 6 yr	6 < 10 yr	10 < 15 yr	> 15 yr
All property	5.1	6.2	4.2	12.8%	44.9%	23.6%	14.2%	4.2%
Industrial	4.4	5.4	3.7	15.3%	49.7%	21.9%	11.0%	2.0%
Offices	5	6.1	4.1	12.1%	46.8%	23.0%	14.8%	3.3%
Retail warehouses	4.6	5.5	3.7	14.6%	49.8%	24.6%	9.6%	2.3%
Shopping centres	5.3	6.4	4.3	11.3%	45.0%	23.0%	15.5%	5.2%
Standard retail	5.6	6.8	4.5	11.8%	40.1%	25.4%	16.8%	5.9%

Winners/Losers

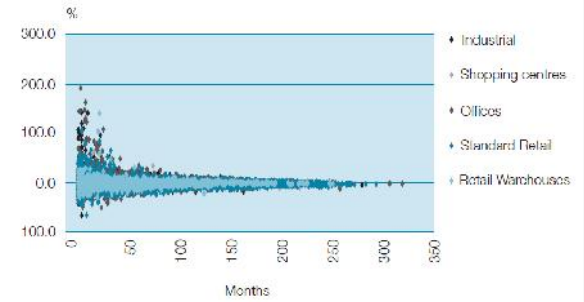
Winners:

- the average annual return over the holding period *exceeds* the average annual sector return
  - ⇨ positive excess returns

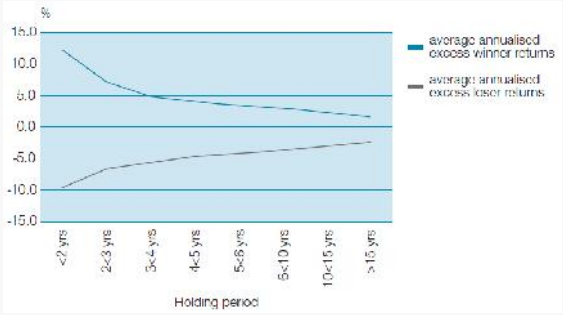
Losers:

- the average annual return over the holding period *is less than* the average annual sector return
  - ⇨ negative excess returns

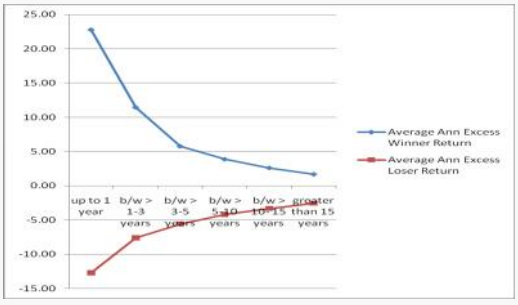
Distribution of average annualised excess returns All properties 1



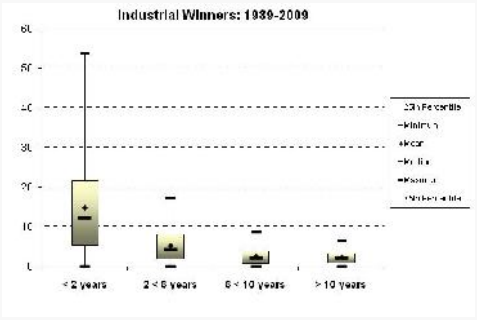
Distribution of average annualised excess returns All properties 2



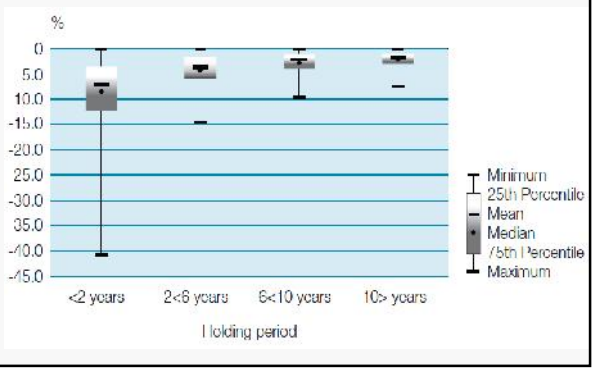
Distribution of average annual excess returns (relative to IPD benchmark) for all properties (sample 1983-2009)



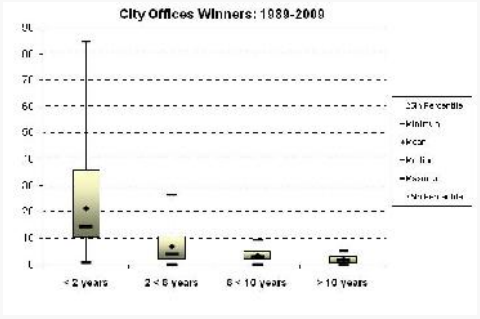
Distribution of average annual excess winner returns for industrials



Distribution of average annual excess *loser* returns for industrials 1993-2003



Distribution of average annual excess winner returns for City offices



Distribution of average annual excess winner returns for shops

Appendix: CAPM Summary - relating risk with reward

Asset Pricing

- Asst pricing is concerned with how investors price assets in a rational way under conditions of uncertainty
- Since the 1960's the predominant financial methodology in financial asset valuation has been the CAPM, a framework for assessing and valuing risk
- Posits that an assets expected return is a positive linear function of 'risk'
- CAPM was the first model to consider the problem of valuation in a ***portfolio*** context by taking uncertainty into account

Cash flows and risk

- Cash flows with the ‘same risk’ should be discounted using the same rate
- Cash flows with ‘different risk’ should be discounted using different rates
- ‘More risky cash flows’ should be discounted using a higher rate
  - what does ‘risk’ mean?
  - how do we measure risk?
- Pricing issue:
  - how does ‘more risky’ translate into ‘higher discount rate’?
  - how is risk priced?

Quantifying Present Value

- Requirement for an *explicit* development of the idea that investors require higher returns for riskier investments

  $\Rightarrow$ statement about how prices ought to behave
- CAPM provides a framework

Risk and return relationship

- The valuation equation formally linking risk and return is known as the *capital asset pricing model* or *CAPM* for short
- One major assumption the model makes is that investors choose between portfolios on the basis of expected return and variance/standard deviation

Which is the appropriate measure of risk?

- Standard deviation of an asset's rate of return is a useful measure of its stand-alone risk
- It is not an appropriate measure of the asset's risk when it is part of a portfolio

This is why we have 'Beta'

Beta:a measure of market risk

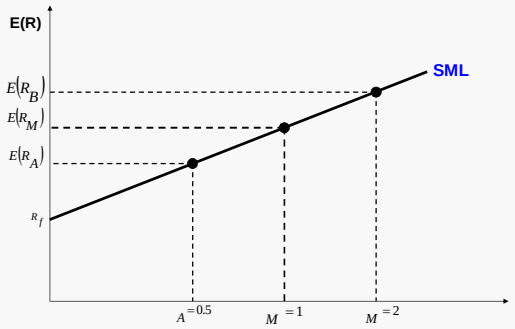
- Specifically, beta is a measure of how an individual asset's returns vary with market returns
- It's a measure of the 'sensitivity' of an individual stock's returns to changes in the market

Measuring 'systematic risk'

- The measure of systematic risk is called *beta*, and is defined as the covariance between the return of a stock and the return on the market portfolio, divided by the variance of the return on the market portfolio:

$$_i = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

Beta and Expected Return



CAPM - Rewards and Risk (Beta)

- We have a simple expression for expected returns on any asset or portfolio

$$E(r_i) = r_f + \beta_i[E(r_m) - r_f]$$

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)}$$

- So only systematic risk matters

Risk and reward: The CAPM equation

$$E(R_i) = R_f + \beta_i(E(R_m) - R_f))$$

where:

$E(R_i)$ = the required return on security i,

R_f = the risk-free rate of interest,

β_i = the beta of security i, and

$E(R_m)$ = the return on the market index

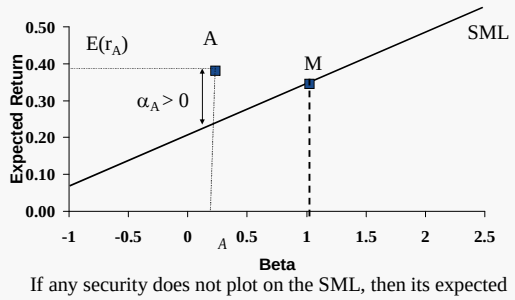
Security Market Line

- The expected return-beta relationship is captured graphically by the Security Market Line (SML).
- "fairly priced" assets must fall exactly on the SML!
- The market beta is equal to 1; hence from the SML (where Beta=1) we can get the expected return from the Market Portfolio.
- The SML provides a benchmark for the evaluation of investment performances.

Securities' Alphas

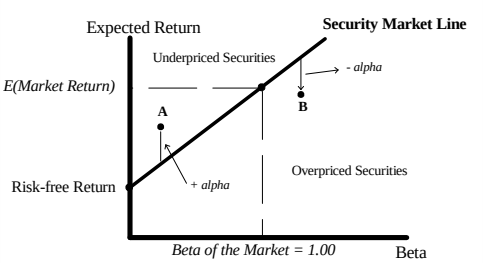
- The security's ***Alpha***, α_i, is the difference between the expected returns predicted by the CAPM and the actual returns. Nonzero alphas mean that securities do not plot on the SML.
- *Example: Let us say that the expected market return is 14%, risk free rate is 6% and that a stock has a beta of 1.2.*
- Then the SML would predict the stock's return to be:
- 6% + 1.2(14% - 6%) = 15.6%
- If during the holding period, the stock produced a actual return of 18%, then the security's alpha is 2.4%

Security Market Line



If any security does not plot on the SML, then its expected return is different from its fair return (it is mis-priced). What happens? What could you do?

The Security Market Line



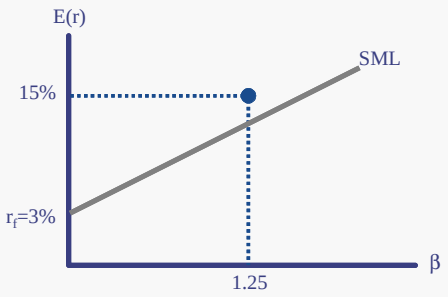
Identifying mis-priced assets

- ***One possible use of the CAPM is security analysis: uncovering securities with nonzero alphas***
- If $\tilde{}_i > 0 (< 0)$, then the asset's expected return is too high (low) according to the CAPM and is under priced (overpriced)
- This is referred to as an abnormal or risk-adjusted return
- The problem: different than zero could be either produced by a mis-specified asset pricing model or an inefficient market (this is the so-called *joint hypothesis problem)*

Disequilibrium example

- Suppose a security with a β of 1.25 is offering expected return of 15%.
- According to SML, it should be 13%.
- Under-priced: offering too high of a rate of return for its level of risk.

Disequilibrium example



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