Uniwersytet Ekonomiczny

George Matysiak

Introduction to Risk, Return & Investment Decisions
October 12th, 2015

Lecture Program

Week	Dzien	Godzina	Termin	Lecture
1	Pn	14:50-16:25	12.10.2015	Introduction to risk, return & investment decisions 1
2	Pn	14:50-16:25	19.10.2015	Introduction to risk, return & investment decisions 2
3	Pn	14:50 16:25	26.10.2015	Introduction to portfolio theory 1
4	Pn	14:50-16:25	02.11.2015	Introduction to portfolio theory 2
5	Pn	14:50-16:25	09.11.2015	Valuation accuracy
6	Pn	14:50 16:25	16.11.2015	Bartek Marona
7	Pn	14:50 16:25	23.11.2015	Bartek Marona
8	Pn	14:50-16:25	30.11.2015	Introduction to asset pricing
9	Pn	14:50-16:25	07.12.2015	Single Index Model
10	Pn	14:50-16:25	14.12.2015	The Benchmarking and tracking error
11	Pn	14:50-16:25	21.12.2015	Modelling & forecasting for investment decisions
12	Pn	14:50-16:25	11.01.2016	Regression analysis for investment
13	Pn	14:50 16:25	11.01.2016	Applied Computer Workshop
14	Pn	14:50 16:25	18.01.2016	Measuring investment performance: risk & return 1
15	Pn	14:50-16:25	25.01.2016	Measuring investment performance: risk & return 2

On completion of the program you should be able to:

- identify and explain theoretical concepts relating to investment strategy, portfolio selection and performance measurement applying them to real estate markets;
- discuss, and appraise critically, relevant literature using investment strategy, portfolio selection and performance measurement models to real estate markets;
- apply theoretical investment strategy and portfolio management principles to practical real estate problems;
- analyse capital market data using quantitative techniques, to identify theoretically optimal portfolio strategies and assess manager performance;
- interpret and evaluate published results of empirical research in the field.

Some reading:

The following textbooks will be referenced:

- Bodie Z, A Kane & A.J. Marcus, Investments, (McGraw-Hill International Edition)
- Brown G & G Matysiak (2000) Real Estate Investment: A Capital Market Approach (London: Financial Times Prentice Hall)
- In addition, you will be provided with appropriate articles and other references

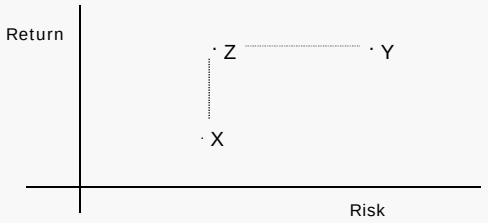
RISK, RETURN & PORTFOLIO THEORY: INTRODUCTION

Some basic principles:

- Investors try to maximise end wealth
- Investors try to minimise risk
- Investors require a reward for risk
- Different investors have different attitudes to risk
- Investors are forward looking
- Assets may be combined into portfolios
- Portfolios diversify away risk
- Diversification depends upon the correlation between assets
- There exists a set of efficient portfolios
- Risk = Systematic Risk + Specific Risk
- Systematic risk cannot be diversified away
- Prices should reflect systematic risk level

…are property investment decisions better than this?

INVESTMENT RISK: RISK - RETURN SPACE



INVESTORS ALWAYS PREFER HIGHER RETURNS TO LOWER RETURNS AND LESS RISK TO MORE RISK.
Z IS SUPERIOR TO BOTH X AND Y.
BUT HOW DO WE CHOSE BETWEEN X & Y?

IT WILL DEPEND ON ATTITUDE TOWARDS RISK

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 & RETURN CALCULATIONS

Return: Income Return & Capital Appreciation
IN THE FUTURE

Risk: The Uncertainty of the Return
The Volatility of Returns
Usually the Standard Deviation

Can We Use Historic Performance as a guide?

- Time scales
- We'll explore this in the computing class

Rate of Total Return

RETURN:

- Return on capital invested
= reflects inrease/decrease in capital invested

- Cashflow in relation to capital employed

Total Return = Capital Return + Income Return

$$\frac{P_t - P_{t-1} + C_t}{P_{t-1}} = \frac{P_t}{P_{t-1}} - 1 + \frac{C_t}{P_{t-1}}$$

RISK & RETURN

Value: 2010 Q3 £1million; 20011 Q3 £1.1million

Rent, over the four quarters £70,000

Return = $\frac{1100 - 1000 + 70}{1000} = \frac{1100}{1000} - 1 + \frac{70}{1000} = 0.17 or 17\%$

Properly, one should account for the timing of the cashflow (e.g. quarterly rents) and adjust for any capital invested (e.g. repairs).

Money Weighted Rate of Return – takes into account cash flowing into and out of a fund, effectively the IRR.

Time Weighted Rate of Return – geometric mean of all sub-period returns. Fairer measure if fund manager has no control over timing of investment. (example to follow)

RISK & RETURN

RETURN: CALCULATIONS

We can easily work out historic return
- Directly for each individual asset
- From an index of performance (e.g. IPD, FTA)

Arithmetic Mean:
(i) calculate year on year prices r = $(P_t/P_{t-1})-1$
(ii) calculate the average/mean return = $\Sigma r/n$

Geometric Mean or Compound Growth:
(i) divide end value by start value
(ii) take the n^{th} root then subtract one = $[P_n / P_0]^{(1/n)} - 1$
e.g. start 2002= 100, end 2011 = 250
Geometric mean = $[250/100]^{(1/10)}-1$ = 0.096 or 9.6%

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:

$$\text{MWRR(A)} = \frac{1166 - 1000}{1000} = 0.166$$

$$\text{MWRR(B)} = \frac{1716 - 1000 - 500}{1000 + \frac{500}{2}} = 0.173$$

Example of TWRR Calculation

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

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.

Risk and return

- A key investment indicator is expected total return
- A second important investment indicator is risk
- Risk is a measure of the probability of expected return not being achieved
- Traditional measure of risk is *variance* or *standard deviation* of expected returns

What is Risk?

- The possibility that *actual* return will differ from *expected* return
- Uncertainty in the distribution of possible outcomes

How do we measure risk?

- Risk is a measure of the uncertainty surrounding *expected return*
- Traditional measure of risk is variance or standard deviation of expected returns
- Historical data is used as a proxy for the future
  - Issues (time scales)
- Standard deviation can be used to estimate the range of possible outcomes around the 'best guess' of expected return

RISK & RETURN

INVESTMENT RISK

How certain is the return? The more uncertain, the more risky the asset.
Risk then seen as variability of capital and income

If return is measured as a mean (average) return
Then risk is the variance / standard deviation

$\sigma = \{\Sigma(X - \mu)^2 / (n-1)\}^{(1/2)}$

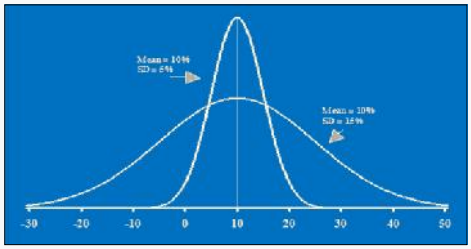
where X is return for the period and
μ is the mean return over time

Note that returns below and above average return contribute to risk, downside and upside risk;
Investors more concerned with downside?

Note also Business Risk and other Uncertainties

A Measure of Risk?

If expected return is measured as by the mean (average) return then risk is the variance / standard deviation



Risk = Variance?

The Variance or SD would be the correct measure of risk if either:

- Investors have a quadratic utility function or
- Returns (or logged returns) are normally distributed

- Note that returns below and above average return contribute to risk, downside and upside risk;
- ...but surveys show investors are more concerned with downside risk!

RISK & RETURN IN STRATEGY - 1

EXPECTATIONS

Investment Strategy should be forward looking

The Risk & Return should be Expectations

Is the past a guide to the future?

Can we rely on historic averages / patterns?

The property cycle, business cycle & timing

Structural shifts and the macro-economy

Diversification

- Risk reduction is a well understood concept
  - Don't put all your eggs in one basket: diversify risk!

Diversification

One of the few areas in economics where you get a 'free lunch' i.e. less risk without necessarily reducing expected return!

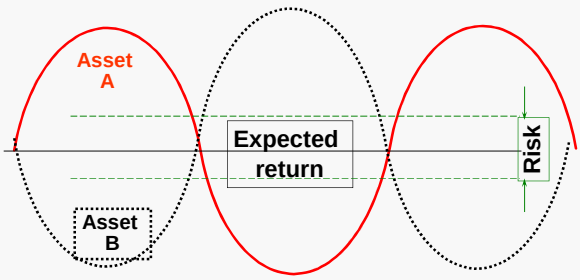
The mean/variance hypothesis

- More return is better than less return
- Less risk is better than more risk
- Investment A is better than investment B if, and only if, its expected return is higher and its risk is equal to or less than that of investment B
- However, a more rational approach may be to combine, *holding both A and B*

Portfolios

- Combining several securities into a portfolio can reduce overall risk
- How does this work?

Risk and Return Profile Multi Asset (Portfolio)



Assets A & B are negatively correlated

Portfolios of Securities: Return

- Investors' opportunity set is comprised not only of sets of individual securities but also combinations, or *portfolios*, of securities
- The achieved return on a portfolio is the weighted average of returns on component portfolios/securities:

$$R_{pt} = \sum_{i=1}^{N} w_i R_{it}$$

- The expected return is also a weighted average

$$E(R_{pt}) = \sum_{i=1}^{N} w_i E(R_{it})$$

Portfolios of Securities: Risk

- *However*, the standard deviation of a portfolio is NOT simply a weighted average of securities standard deviations
- We also need to account for co-variances
- Example with 2 risky securities X and Y

$$\sigma_p^2 = w_x^2\sigma_x^2 + w_y^2\sigma_y^2 + 2w_x w_y \mathrm{Cov}(xy)$$

  - *or*

$$\pm_p^2 = w_x^2 \pm_x^2 + w_y^2 \pm_y^2 + 2w_x w_y \pm_x \pm_y \rho_{xy}$$

- Will the portfolio standard deviation be higher or lower than a simple weighted average?

Example

Risk Diversification

	Share of Investment (weight)	Risk (SD)
Asset A:	0.5	8
Asset B:	0.5	8
Correlation:	0.5	
Portfolio consisting of both assets		
Total Volatility:	48	
Standard Dev:	6.928203 < 8	

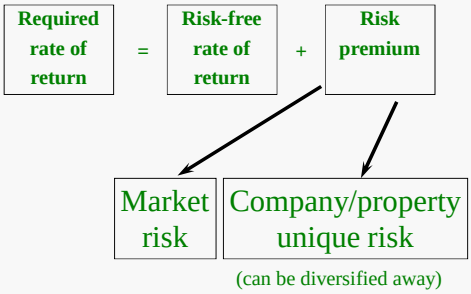
Example (continued)

Risk Diversification	
Different correlation values	
Correlation	Portfolio Risk (SD %)
-1	0
-0.75	2.828427125
-0.5	4
-0.25	4.898979486
0	5.656854249
0.25	6.32455532
0.5	6.92820323
0.75	7.483314774
1	8

Observation

Combinations of less than perfectly correlated assets result in risk reduction

Components contributing to return



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

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

Investment question

- Let's say that you decide to invest in a *diversified* equity portfolio with average risk. You obtain a return that 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?

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