

Investment preliminaries

We are going to go on to consider investing in **stocks**

- also known as **equities**
- also known as **shares**

But first we need to cover some preliminaries.

Note that, in the real world, if we invest in stocks we will pay **transaction cost** associated with:

- buying; or
- selling

stock. For the majority of this course we will assume transaction cost is zero.

One **basis point (bp)** is 1/100 of one percent. Transactions costs are often given in basis points. As an example of transaction cost we typically need to pay some commission to an intermediary third party if we decide to buy (or sell) one unit of a stock. As you would expect such transactions costs vary:

- by stock, typically according to how liquid (easily bought/sold) the stock is
- by how much you wish to trade (e.g. number of units of the stock you are buying/selling).

For the large investor, dealing with transactions involving many millions of pounds, such transaction costs might be around 15 basis points for a highly liquid stock.

Note that aside from direct (easily seen) transaction costs there are less direct transaction costs. For example if we are a major player in the market and we suddenly decide to sell a large amount of stock in a particular company:

- what do you think happens to the market price for that stock?
- how is that a transaction cost?

A key point to grasp is that **returns are relative**. If you make an investment in a single stock and that stock goes up (increases in price) by 5% over the year you might at first sight be happy. But suppose you then learn that the market (say as represented by an equity index) has risen by 10% that year. Obviously the increase of 5% on the stock does not appear as attractive as it did at first sight.

Common equity indices are:

- Dow Jones
- S&P500
- Russell 1000
- Russell 2000
- Russell 3000
- Wilshire 5000
- Nasdaq
- FTSE All Share
- FTSE 100
- Hang Seng
- DAX
- Nikkei 225

Some of these indices are of **fixed cardinality** (number of stocks/companies in the index fixed) some are not. For example the S&P500 is a fixed cardinality index with precisely 500 stocks (companies) in the index, the FTSE All Share is not (neither is the Wilshire 5000 – you cannot tell from the index name!). The composition of all indices changes over time (as the underlying companies change, some cease to exist, others grow large enough to warrant inclusion in the index).

You can see current index values at:

- <http://uk.finance.yahoo.com/>
- <http://finance.yahoo.com/>

The FTSE 100 yesterday (for example) was:

Index Value:	6,229.80
Trade Time:	4:36PM
Change:	▲43.20 (0.70%)
Prev Close:	6,186.60
Open:	6,186.60
Day's Range:	6,186.60 - 6,229.80
52wk Range:	5,391.70 - 6,250.40

The index value quoted, 6229.80 is calculated as:

sum over the companies in the index of:

number of shares issued multiplied by current price = total worth of the company (total market capitalisation, market cap)

divided by a large constant value to turn the answer into a meaningful number

Most equity indices are calculated in this way – but not all. The Nikkei 225 for example is not.

Be clear – when you make an investment in a single stock you are exposed to:

- **market risk**, by choosing to invest in the market (e.g. UK or USA) where the stock is traded; and
- **stock risk**, the individual stock may do better or worse than the “average”, e.g. the change in the “market” as represented by the change in the index

The key concept in stock investment is **diversification** (not putting all of your eggs in one basket). This helps to reduce risk (by spreading, and hopefully reducing, your stock risk). However (assuming you invest in just one market, e.g. the UK) you are still exposed to market risk. If you choose to invest in more than one market (say the UK and USA) you may be reducing market risk but what other risk are you running?

The bundle of stocks that one chooses to invest in is called a **portfolio**

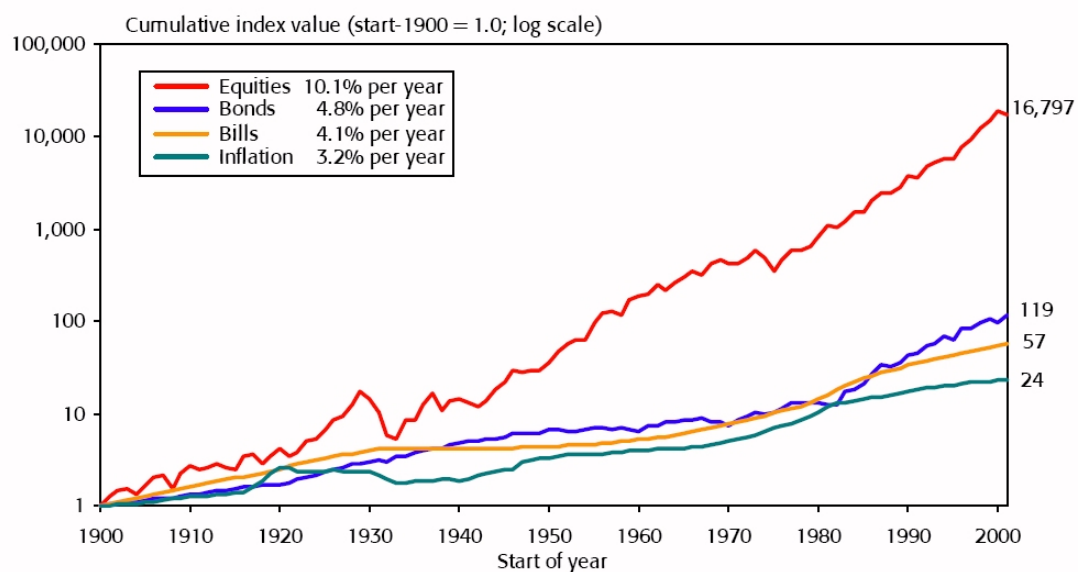
Be clear – although we can reduce risk we do not know the future and irrespective of how we choose our stock portfolio we are taking risk. What we hope is that by using

past data (for example in relation to stock prices) in a systematic and logical fashion we can make better portfolio decisions than we otherwise would.

You should also be clear is that there are some investments that are (within a single market) effectively “risk-free”. For example if I buy UK (or US) government bonds – these are instruments that guarantee to pay a certain amount of interest. Barring the collapse of these governments (an unlikely occurrence, and if it did happen one suspects we would have more to worry about than getting interest payments from the government!) this investment is risk-free. Of course you may worry that your capital and the interest you receive will be eroded in value by inflation – but this is something that affects all investments and so is not peculiar to government bonds.

If we can make risk-free investments why might we make risky investments such as equities? The simple answer, at least for equities, is that historically investing in equities has (over the long-term) provided higher returns than investing in government bonds. This is true both in the UK and USA.

As an illustration the figure below, from Dimson, Marsh, and Staunton: Triumph of the Optimists, show the return on US assets since 1900



So who has money to invest – not you (obviously) as a student mostly likely in debt, nor me as a UK academic (not a financially profitable career – at least mine has not been!). The simple answer is that as you enter your working life you will have to make payments for the future, e.g.

- for a pension at the end of your working life
- for life insurance so your family and dependents receive some payment should you die
- for private health care provision should you become ill

Those organisations who take this money from you could let it lie untouched in a bank, or they could put it into government bonds. But they know that historically equities give better returns. They also know that they may not need to pay you anything for many tens of years (if at all), and so they can afford to take a long-term

view of their investments. In the modern western world such organisations far outweigh private investors in equity markets.

One thing you should be clear about with respect to investment is what is known as **survivor bias**. As an analogy you may have seen interviewed on the TV someone who has reached a very old age (say 105 years old). When asked about the secret of their long life they reply along the lines of “*one glass of yak’s milk a day*”. Is this therefore the secret of longevity? No – what you do not see is all those people who drank one glass a day, but never made it to 105.

In a similar fashion you may see an investment fund advertise along the lines “*over the last X years we have out-performed the market*”, where X varies – the implication being they have investment skill. What you do not see advertised is all those firms that failed to out-perform the market over the same time period (and who most likely simply closed their doors to new business). Whether the firm that survived actually has investment skill, or whether it is simply pure chance, is very hard to decide.

Portfolio selection – a manual approach

The data below is as in the example we will use throughout this course. You can see there we have the prices for five stocks (A to E), observed over 5 time periods (labelled T=0,1,2,3,4).

Stock prices

A	B	C	D	E	Period
916	630.5	440	642	740	0
932	639.5	440.5	642	755	1
910.5	644.5	443	634	761	2
872	626.5	446	642.5	712	3
874	637	465	617.5	675	T=4

There are a number of simple “manual approaches” to forming a portfolio:

- one share – buy one share in each stock
- equal weight (equal split) – give an equal proportion of the investment you make to each stock

Note that you are probably used to calculating return on an investment as:

$$\text{return (\%)} = 100(\text{change in value})/(\text{original value})$$

This is sometimes referred to as discrete time return

In quantitative finance we almost always use a different measure of return calculated as

$$\text{return (\%)} = 100 * \log \text{ to the base } e \text{ of } [(\text{new value})/(\text{original value})]$$

This is sometimes referred to as continuous time return. In Excel the function LN gives log to the base e.

Under continuous time return if we are earning interest on an initial investment of £A at a fractional interest rate of r for t years we will have at the end of the period a sum (£) equal to Ae^{rt} .

Question: for the FTSE 100 index shown above, current value 6229.80, previous close 6186.60 what is the return using discrete and continuous time return?

Below we show the effect of the two “manual approaches” to forming a portfolio discussed above:

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Period	one share portfolio	equal split portfolio	Number of shares bought under an equal split, investing 10000000, at T=0				
	value	value	A	B	C	D	E
0	3369	10000000	2183	3172	4545	3115	2703
1	3409	10106297					
2	3393	10077871					
3	3299	9844396					
T=4	3269	9790552					

discrete time return (%)	-2.97	-2.09
continuous time return (%)	-3.01	-2.12