4.2.1 Risk Identification and Assessment

Unit: Unit 1 – Treasury Strategy

Module: Module 4 – Financial risk

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Summary: Risk management starts with identification of risks and their assessment, in terms initially of probability and impact. Ultimately measurement of risks needs to be standardised, so that the concepts of risk appetite and budgeting can be adopted. Quick calculation around a risk to achieve an order of magnitude for risks is a key skill for a treasurer.

Keywords: risk identification, budgetary process, management accounts, risk mapping, probability, impact, expected value

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Learning outcomes:

1. Risk management starts with identification.
2. Treasurers should distinguish risks in trading operations from those of ownership.
3. Risks can be identifies by many methods:
   a) From a risk classification diagram
   b) From the budgetary / planning process
   c) From the management accounts by variance analysis
   d) From line by line account analysis
   e) From sectoral and peer group observation
4. An approach to assessment is to map risks by probability and impact.
5. Probability X Impact gives an expected value for a risk.
6. Market risks can move in favour of the firm, which makes risk mapping more challenging.
7. Risks must be quantified in some way, ultimately by a common measure.
8. Measures of probability require a time period, but can be by product cycle or man-hours as well as normal time.
9. Measures of impact can be very different, e.g. eps impact, shareholder value, financial covenants effect etc.
10. A key skill for a treasurer is to be able to calculate risk quickly, to achieve an order of magnitude.

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1 Introduction

The risk framework tells us to start by identifying and assessing risk, creating a risk profile. We concentrate on financial risks here, where the major risks comprise:

- foreign exchange risk
- interest rate risk
- commodity risk
- pension risk

This process of developing a risk profile requires an examination of the risks inherent in the sector the firm operates within, the effects of wider macroeconomic forces and the risks facing the firm itself.

Firm-wide risk identification may be performed from scratch:

- to support a new venture or market
- where the risk management process is to be formalised
- because a new treasurer or risk manager wants to go back to basics.

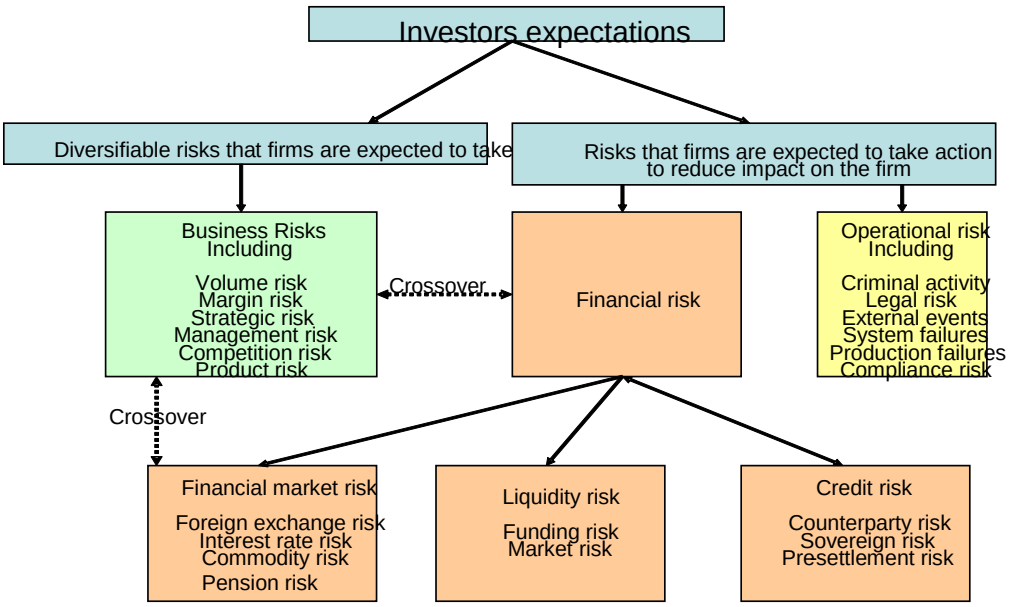
If you are starting from scratch, then a firm-wide risk identification process will need coordinated input from the entire management team, to consider all the risks that could possibly impact the firm.

More usually, you will be working within an established firm and senior management should already have a good understanding of the key risks the firm faces. These key risks should already be reviewed regularly and systematically, for example in the monthly management reporting cycle. Things do change so a regular review is very useful. Many disasters have happened because management did not react to changes in their business.

One approach to the risk assessment process seeks to identify both a probability for each identified risk and its likely impact should it materialise. Initially this will be on a qualitative (i.e. judgemental) basis. The aim is to generate a 'risk map' which provides management with the information for setting indicative priorities for dealing with each risk, and for taking broad decisions as to how each key risk should be dealt with.

Measurement is a crucial ingredient for in risk and should start to be addressed in the assessment process. This gives a common language to all risks and allows risks to be prioritised easily.

Exhibit 1: Risk taxonomy



2 Identification

The identification of a firm's risk exposures and their source (known as risk profiling) generates an inventory of the risks a firm faces (sometimes known as the risk register). The identification is helped by a categorisation of risks. Risk is inherent in almost any commercial decision and so a risk register could theoretically become quite large very quickly. The firm is ultimately measured in financial terms so any risk is in theory a financial risk. However, here we will limit ourselves to the financial consequences of financial risks. Financial risks will come from two sources. Firstly, are those arising from trading operations, such as commodity risk in the cost or sale price of goods or risk when goods are bought and sold in different currencies. Secondly are those arising from ownership, such as pensions risk, interest rate risk or translation risk.

2.1 Methods of identification

The starting point for all identification is to understand the firm and its value proposition. A good understanding of the firm, its strategy, markets, products, geography etc. are crucial to identifying risk. While treasurers may understand the firm from working within it or within a firm from the same sector, actually a formal study in the form of a PEST analysis or Porter's Five Forces or some other analysis is incredibly useful. A simple look at the annual report and accounts might not be sufficient to gain a real understanding of the firm. Strategy documents used by the board are essential reading for the treasurer. It also helps to understand how investors might measure the firm and understand what risks they expect the firm to be taking.

A treasurer must also do his homework before embarking on risk identification missions to operations.

Example 1: Financial risks in trading operations

Honey Pty is an Australian outsourced provider of logistics services in the mining industry. Honey manages the entire supply chain for plant and machinery spares for its clients worldwide, taking orders for spares, sourcing them, and ensuring they are delivered on time and also processing returns and refurbishments. Honey's biggest (US-based) client is developing oil sand deposits in North America. Honey's operations are centralised near Sydney and its cost base (and functional currency) is AUD.

Honey's commercial team wanted to keep its contracts simple, and in all contracts the monthly fee is payable in AUD, aligned to the volume of work performed by Honey in the previous month. The total fee comprises a fixed element plus a variable element based on total value per territory processed in the month. The AUD amount of the variable element is calculated by reference to Honey's monthly accounting rate for the currency of each territory, in order to avoid an FX exposure in Honey's accounts.

Honey's commercial team is worried that the profitability of the North American logistics is decreasing when measured against the volume of orders (as opposed to value) actually processed.

Honey's treasurer identifies that although Honey's service contracts are expressed in AUD throughout, the variable fee is based on a volume measure in foreign currency. AUD has been strengthening against USD, so the value of the variable fee (and hence the profitability of the service contract) has decreased.

The treasurer therefore needed to do some quick thinking to establish responsibility for the identification (and subsequent management) of this risk.

It is vital to realise that treasury has a responsibility to ensure that the right questions are being asked, so that it can take appropriate action if need be.

2.1.1 From the risk classification diagram

The classification diagram (or other taxonomy) is the obvious starting point to identify risks. If the classifications are approved by senior management this will give added authority to the treasurer and be a good introduction when identifying risks. The diagram will help to explain the link between treasury risks and commercial risks, and as an aid to discussion.

2.1.2 From the budgetary process

The assumptions made during the planning process (from which the budget usually emerges) and their consequent budgetary outcomes are excellent ways to discover risk. Some of the questions that a treasurer might pose here include:

- What exchange rate assumptions are made in the plans?
- What commodity prices are assumed in the plans?
- What interest rate assumptions are made in the plans?
- What returns, risks and correlations are assumed in pension projections?

Of course an ERM approach can also be taken and the treasurer can ask questions about how these assumptions interact with general business forecasting.

2.1.3 From the management accounts

Probably the main tool available here is variance analysis where actual outcomes can be compared to budgets or prior periods or to firms operating in similar fields.

2.1.4 From the line by line analysis of management and statutory accounts

As well as variance analysis of management accounts, it is also possible to query management and statutory accounts line by line to establish where risks might lie. Exhibit 2 shows typical questions that might be asked in such an analysis.

Exhibit 2: Line by line analysis

INCOME STATEMENT

Turnover	To whom does the company sell?
	Are customers price or quality sensitive?
	Do customers have access to alternative products?
	What are the standard terms of business?
	Where does the company sell?
	What is the proportion of domestic and international sales?
	Which currencies are sales made in?
	Are exchange controls operating in certain countries?
	Is there a concentration by country, industry or customer?
	Where are the company's competitors based?
	What currencies do competitors sell in?
	What currencies do competitors buy in?
	What is the competitors hedging policy?
Cost of goods sold	Where does the firm manufacture the goods it sells?
	What goes into what the firm makes or does?
	Where are the company's suppliers based?
	What currencies do suppliers invoice in?
	Do suppliers carry currency risk?
Other costs	How significant is interest income and expense?
	Are premises, equipment or vehicles leased?
	Are the rental payments effectively fixed rate finance?
BALANCE SHEET	
	In which currencies are its major assets and liabilities denominated?
	What is the economic value attributable to these assets, businesses and liabilities denominated in these currencies?
	Are receivables and payables concentrated in a few large counterparties?
	What is the currency denomination of receivables and payables?
	Does the company finance its customers?
	What is the company's financial structure?
	What is the maturity profile of its debts?
	In which markets does it raise finance?
	What is the fixed / floating structure of its debts?
	Does the company have debt that includes financial covenants?
	What impact does the pension fund have on finances?
	Does the company have cash on deposit?

2.1.5 From sectoral and peer group analysis

Observing the issues that have confronted competitors or peer group companies is an incredibly valuable technique for identifying risks. The work can range from simple observations of catastrophes to detailed analysis of risk management policies, as well as understanding the peer group approach from sales feedback, when salesmen will come face to face with the products offered to customers by competitors.

Example 3: Risk management from peer group observations
Several retail groups announce sales figures on a regular basis, even weekly. They are observed by other retail groups to see if their own sales figures are tracking them, to highlight risks to their own operations.

2.2 Identification case study

Example 4: Identifying core risks
Let's consider Green Parrot AG, a fictional manufacturer of quality chocolate and confectionery products, headquartered in Switzerland. Green Parrot sells its products mainly to large wholesale distributors, chain grocery stores and vending companies in Europe and other locations worldwide. The company changes its prices to customers when necessary to accommodate changes in raw material and manufacturing costs, the competitive environment and profit objectives, while at the same time maintaining consumer value. Price increases help to offset increases in input costs, including raw and packaging materials, fuel, utilities, and transportation, and employee benefits.

Cocoa is the most significant raw material used to produce chocolate products. Cocoa beans are grown principally in Far Eastern, West African and South American equatorial regions. West Africa accounts for approximately 70 percent of the world's crop of cocoa beans. Green Parrot's investors evaluate the company's performance based primarily on Earnings per Share (EPS), which is expected to be CHF25.00 per share this year.

From this overview of the company, we can already identify some core risks.

Define / Identify Risk	Classify	Source
Increases in raw material and energy costs could affect future financial results.	Business – margin risk Financial – commodity risk	Cost fluctuations in commodities such as energy and cocoa. Problems with supply.
Price increases may not be sufficient to offset cost increases and maintain profitability.	Business – margin risk & volume risk	Sales volumes fall due to price increases, leading to overall fall in revenue.
Market demand for new and existing products could decline.	Business – volume risk	Loss of competitive position in market. Failure of a customer or customers.
Currency Fluctuations could significantly impact cash flows and reported results.	Financial – Foreign Exchange risk	Purchases and sales are made in foreign currency, with fluctuating exchange rates.
Changes in national or international laws and regulations could increase costs and liabilities or adversely affect demand for products.	Business – strategic risk Operational – legal & external event risk.	Changes in national or international regulations regarding the product, or the management of overseas operations.

Notice how some of these risks fall into more than one classification; and how although they all refer to financial performance, only one would be classified as pure financial risk.

In Example 4, we considered the core risks for the organisation as a whole. However, often we need to focus on a particular type of risk or business function and consider the issues in more detail. In Example 5, we will look at Green Parrot again, this time from a typical treasury context of providing risk management support to the Sales Department. Remember, we are looking here at only one small part of the firm and to properly develop a risk profile, you must understand the firm as a whole.

Example 5: Market demand risk in more detail

The following risk was identified in Example 4:

Define / Identify Risk	Classify	Source
Market demand for new and existing products could decline	Business – volume risk	Loss of competitive position in market. Failure of a key customer or

Constituents of this risk include:

- Products fail to appeal to customers and consumers.
- Failure to develop new products.
- Failure to advertise and market products effectively.
- Products are given inadequate shelf space at point of consumer sale.
- Slow response to consumer trends.
- Consumer health concerns.
- Changes in consumer demographics.
- Customer concentration and credit risk of significant individual customers or classes of customer.

Green Parrot views its risks primarily from a commercial perspective, so most of these constituents will be addressed by departments such as Sales, Product Development and Marketing. However credit risk is a financial risk, where the treasurer can assist directly. And indirectly, the treasurer needs to know the cash flow implications of any of these constituents not being managed effectively.

3 Assessment

Assessment is the next stage of the risk management framework. Risks identified and placed on the risk register must now be assessed. This involves making qualitative judgements concerning the risks facing the firm, and the aim of risk assessment is basically to work out how big the risk is and how much further effort should be made to deal with it. More formally this comprises making an assessment of:

- The probability of a risk or event actually happening
- The financial impact on the firm if the risk or event were to actually happen.

This allows management to prioritise those risks with most potential to damage the firm, for further analysis, evaluation and management.

3.1 Risk mapping

One useful way of assessing risks systematically is with a probability / impact matrix. Each identified risk is recorded on a diagram or grid according to its likelihood and its potential impact, producing a *risk map*. Exhibit 3 shows an example of such a risk map.

Exhibit 3: Probability/Impact Matrix[1]

		Likelihood or Frequency				
		Very unlikely	**Low**	**Medium**	**High**	**Certain/ very probable**
Severity of Consequenc	**Catastrophic**	**C**	**B**	**B**	**A**	**A**
	High	**D**	**C**	**B**	**B**	**A**
	Medium	**D**	**D**	**C**	**B**	**B**
	Low	**E**	**D**	**D**	**C**	**B**
	Insignificant	**E**	**E**	**D**	**D**	**C**

A	**Extreme:** Very high probability & impact; top priority for action
B	**Major:** High probability & impact; 2nd priority for action
C	**Medium:** Medium probability & impact; 3rd priority for action
D	**Low:** Low probability & impact; 4th priority for action
E	**Negligible:** Minimal probability & impact; lowest priority

On the probability / impact matrix, note how both the probability and the impact combine to form the assessment. What has happened here is that probability is multiplied by severity to produce a risk prioritisation measure. This is the equivalent of producing an 'expected value', a technique used in many areas of risk management.

Example 6: Expected value

A six sided die is thrown many times. The expected value (EV) of the average score per throw is 3.5 calculated as follows:

$$EV = \frac{1x1}{6} + \frac{2x1}{6} + \frac{3x1}{6} + \frac{4x1}{6} + \frac{5x1}{6} + \frac{6x1}{6} = 3.5$$

$$EV = \frac{1.1}{6} + \frac{2.1}{6} + \frac{3.1}{6} + \frac{4.1}{6} + \frac{5.1}{6} + \frac{6.1}{6} = 3.5$$

The long run average score per throw will be 3.5.

Returning to Green Parrot AG from Example 4, we can now map the risks identified on to the probability/impact matrix, producing a 'risk map'. This assessment is a qualitative judgement based upon a sound understanding of both the business and the environment in which Green Parrot operates.

[1] Reference: Risk Management Ranking Methodology and risk assessment matrix (p27) in Sadgrove, K. (2005) *The Complete Guide to Business Risk Management*, Gower Publishing Limited.

Example 4 continued: Assessment of Green Parrot's core risks

		Likelihood or Frequency				
		Very unlikely	Low	Medium	High	Certain/ very probable
Severity of consequence	Catastrophic					
	High					1
	Medium			3	2	4
	Low	5				
	Insignificant					

Key:

1	Increases in raw material and energy costs could affect future financial results.
2	Price increases may not be sufficient to offset cost increases and maintain profitability.
3	Market demand for new and existing products could decline.
4	Currency fluctuations could significantly impact cash flows and reported results.
5	Changes in national or international laws and regulations could increase our costs and liabilities or adversely affect demand for our products.

3.2 Events

It is worth spending a little time on understanding the nature of risk and how we can then identify and assess risks under an approach such as a probability / impact matrix. Risk management tends to focus on events, the *loss* of a particular customer, the *appearance* of competition, the *occurrence* of fire or theft. This language is partly borrowed from the insurance market, where an event has to be defined so that loss follows and the right to a claim arises. However, most of business is not like that. Risks can grow slowly. A new product offered by a competitor operating in the same field might not be a risk while production capacity for it is low, but it could be a risk as factories are built and the product gains ground in the market; and so on.

In the financial risk area, where market risk is involved it can be even more confusing. For any market rate which affects a firm, the probability of a large move is lower than the probability of a small move. Equally the impact of a large move is greater than the impact of a small move. Because rates can move in either direction, the expected value will indicate no change from the present. None of this is very helpful when trying to assess risk.

Example 6: Probability / impact of market movements

Hubble Inc is a quite highly geared manufacturer of computer hardware parts. Its debt of 100 is floating and its EBITDA is 20. It has generated the following sensitivity table for interest cover. The current all in interest rate for its debt is 3%.

			Interest rate plus margin			
		1.0%	2.0%	3.0%	4.0%	5.0%
EBITDA / interest		20.00	10.00	6.67	5.00	4.00

The probability of a move to 5% is lower than a move to 4%, but the impact is greater. It plots the following probability / impact map.

		Likelihood or Frequency				
		Very unlikely	**Low**	**Medium**	**High**	**Certain/ very probable**
Severity of consequence	**Catastrophic**					
	High		**5.0% (cover =4)**			
	Medium			**4.0% (cover = 5)**		
	Low	**5**				
	Insignificant					

Interest rate risk therefore generates a line on a risk map. In this case it does, however, qualify as a category C risk as shown in Exhibit 3. The product of the two results, an approach to expected value, might also indicate the same answer. However, if the outcome where cover is 4 implies a loan covenant breach, this might constitute a Category B risk – greater priority.

Because risk maps tend towards an event-driven approach, the treasurer may have to define levels for prices consistent with a particular event. For instance, if interest rates over 5% would cause a covenant breach for a borrower, then managing that risk would be a higher priority task than managing the risk that rates rose over 4%.

Of course, market movements can also be favourable, in which case they cannot easily be dealt with on a risk map, although so-called 'opportunity maps' have been explored[2].

[2] See e.g.: http://www.businessweek.com/innovate/content/feb2009/id2009029_618352.htm

3.3 Quantification of risks

The next obvious stage in the assessment process is to quantify the risks. Arguably without quantification, or measurement, the whole risk management process is useless. We must be able to say if a risk is large or small and so we must have a language of measurement of some sort and we must be prepared to make these measurements of risk. Without measurement, the concepts of risk tolerance, risk appetite and risk budgeting become meaningless. Even a poor measure of risk is better than no measure of risk, although a sense of perspective probably needs to be applied to the concept of measurement as measures may be resisted for many types of risk.

We need to measure both probability and impact.

3.3.1 Measures of probability

The science of probability is sufficiently well advanced and we can use its concepts to measure this. Examples include:

- One occurrence expected every [x] years
- Probability p of an occurrence ($0<p<1$) in the next [y] months

However, alternatives such as product cycles or man-hours might be appropriate for the time component of this measure and are commonly used in manufacturing and commercial applications.

3.3.2 Measures of impact

This concept is a little more difficult because there are several choices available:

Exhibit 3: Measure of risk impact

Measure	Impact of the event
EPS	On earnings per share for current or future periods
Shareholder value	Straight impact on share price through discounting all future cash flow lost
Cash flow at risk	Looks explicitly at cash flow rather than valuation - for current or future periods
Sales impact	Loss in sales
Margin	Reduction in margin
Working capital	Impact on working capital
Financial covenants, e.g. interest cover or Debt / EBITDA	Impact on covenants and proximity to breach
Money amount	A simple monetary amount (e.g. as indicated by VaR approach)

The list is not meant to be exhaustive and there will be advantages and disadvantages for each measure. A different measure may be needed for different risks and there is an argument for more than one measure to be used. For example, a risk might be to sales volume at one level and to shareholder value at a different level. The first measure talks the language of operational management while the second talks the language of investor relations or credit management. However, for risk budgeting to work properly, there has at some stage to be a common measurement.

3.4 Measurement case study

Returning again to Green Parrot, some measures have been added to the risk map.

Example 7: Quantifying risk

Taking the core risks mapped in Example 4, the likelihood of frequency and the severity of the consequences have been provisionally quantified. Green Parrot has chosen percentage effect on EPS and time horizons of one occurrence (in a number of years) as criteria appropriate to its business.

		Likelihood or Frequency: One occurrence expected in:				
		Very unlikely > 25 yrs	**Low 10-25 yrs**	**Medium 3-10 yrs**	**High 1-3 yrs**	**Certain/very probable annual**
Severity of Consequence – effect on EPS	**Catastrophic >25%**					
	High 10% - 25%					**1**
	Medium 5% - 10%			**3**	**2**	**4**
	Low 2% - 5%	**5**				
	Insignificant <2%					

Green Parrot has elected EPS as its measure of impact. At the end of the day, EPS is the single most important measure for Green Parrot, so the impact of each risk is worked through to EPS. Note that were Green Parrot's circumstances to change, so that for instance cash generation became of critical importance, the whole risk map would have to be reworked.

4 Assessment on the back of an envelope

Every treasurer has a story to tell of being put on the spot on risk management.

Example 8: Back of the envelope CFO / Treasurer conversation

Treasurer:	I'm worried about our interest rate risk
CFO:	Why?
Treasurer:	We have quite a lot of floating rate debt
CFO:	So?
Treasurer:	If interest rates rise, our interest charge goes up
CFO:	So?
Treasurer:	Well, we would be paying more interest than we do now
CFO:	How much more?
Treasurer:	Well it depends on how much interest rates rise?
CFO:	How much will they rise?
Treasurer:	Well, no-one knows that
CFO:	Then why should I worry?
Treasurer:	Because of the risk
CFO:	But you don't know how big the risk is
Treasurer:	I'm worried about our interest cover covenant
CFO:	But we passed easily last time
Treasurer:	Our profits have fallen slightly since then
CFO:	So how close are we to failing?
Treasurer:	Well, I'd have to work that out
CFO:	Very close or not very close?
Treasurer:	It depends on what our profits will be, and how much we borrow
CFO:	Very close or not very close?
Treasurer:	We'll probably be all right this time
CFO:	How probable?
Treasurer:	50/50?
CFO:	That's terrible. Go and get some numbers done properly

In this case the treasurer should have been much better prepared before this conversation but a treasurer might also have to react quickly to unexpected questions.

Example 9: Back of the envelope

The following question is based on the MCT Case Study examination in April 2010:TIG plc is an international tobacco company; it uses GBP as functional currency, but most of its production facilities are outside UK. Some key data:

	Group £m	Sterling £m	Other Currencies £m (by difference)
Revenue	12,122	Not available	Not Available
Net worth	7,215	Not available	Not available
Debt	12,161	1,754	10,407
Cash	2,309	219	2,090

Required:
How material is currency transaction and currency translation risk for TIG? Where possible quantify and indicate the level of sensitivity.

Answer:
FX TRANSACTION RISK
It may be better to describe this as economic risk. There is little hard data in the case on which to estimate trade flows. It is probable that manufacture is largely domestic and that the purchase of leaf, where not grown locally, will be the major driver.
As a rough estimate, possibly 10% of revenue could be exposed to transaction risk.
± 10% (£12,122 x 10%) discounted at 6% for three months = £114m

FX TRANSLATION RISK
To assess the impact on gearing and net worth you need data by currency for net worth, debt and cash. This is not directly reported in the case so you need to assemble it and make some assumptions:
Assume max 20% net worth in UK, as there is relatively little manufacture in the UK.

Restate our key data:

	Group £m	Sterling £m	Other Currencies £m (by difference)
Revenue	12,122	Not available	Not Available
Net worth	7,215	20% x 7,215 = 1,430	5,785
Debt	12,161	1,754	10,407
Cash	2,309	219	2,090

<u>Gearing / Net Worth</u>
Net worth ± 10% currency = ± £579m i.e. ± 8% total

Net Debt ± 10% currency = ± £832m [(10,407 - 2,090) * 10%]

i.e. Net gearing increases from $\frac{9852}{7215}$=1.37 to $\frac{9852+832}{7215-579}$=1.61. A significant change.
The changes are sizeable although a unidirectional shift in all currencies is unusual. If the debt is at all aligned with assets, then the change will not be so great.

Making further assumptions about segmental currency earnings, the impact of FX changes on interest cover could also be estimated.

It is clearly a useful skill to be able to quickly give an order of magnitude to a risk, and the treasurer needs to develop a feel for the key drivers of the 'classic' financial risks. Example 10 shows how this might be done in pensions risk.

Example 10: Back of the envelope DB pensions risk
In the following table, we make simple calculations for the major risks involved.

Equities
If we assume that equities comprise 50% of the assets, then with an annual volatility of 20% we might expect the risk in a year to be around 20%.

Fund managers
Assets will be invested with fund managers, whose individual performance may deviate from their benchmark by around 4%, leads to a 4% risk.

Interest rates / inflation
Interest rates apply to liabilities and if the liabilities have a duration of 20 years and annual volatility of rates is around 1.1%,, this leads to a risk of around 20%.

Longevity
This is individual to each scheme but a typical example is shown. One way to look at this might be to consider that a 1 year increase n longevity means 1 more year of pensions in payment, which is an easy number to find.

Assets / liabilities	Quantum	Sensitivity / duration	Volatility	Risk
Equity	50%	1	20%	10%
Fund managers	100%	1	4%	4%
Interest rates	100%	18-20 years	1.1%	20-22%
Inflation	100%	18-20 years	1%	18-20%
Longevity				5%