Activity 33.1 (page 592): Cash-flow uncertainties

For each of the following investment projects, explain one reason why there is likely to be some uncertainty about the future net cash-flow forecasts earned by them:

- a project to construct a factory to make large and expensive luxury cars [3]
  - Sales will depend on the state of the economy.
  - Competitor actions will affect sales.
- an investment in a new computerised banking system offering customers new services using the latest 'state-of-the-art' equipment that has not yet been thoroughly tested [3]
  - It will be difficult to predict uptake of services as they are new.
  - As system is not fully tested, future costs are uncertain.
- cash-flow forecasts for a new sports centre that are based on a small market research sample of the local population [3]
  - Sample size is small and could be unrepresentative.
  - Answers given in research do not necessarily reflect how people will react in reality.
- the building of a new toll motorway between two cities [3]
  - Demand for new roads is difficult to predict. Depends on state of the economy and level of the toll.
- the construction of an oil-fired power station. [3]
  - Weather, which is unpredictable, will affect energy consumption.
  - Price of oil is subject to large fluctuations over time, e.g. increase in price to $147 in 2008 followed by sharp decline to under $40 per barrel in 2009. These changes are difficult to predict.

Activity 33.2 (page 595): Textile company plans investment

1 Calculate the payback for both projects. [6]

<table>
<thead>
<tr>
<th>Year</th>
<th>Project X</th>
<th>Cumulative Net cash flow Project X ($)</th>
<th>Project Y</th>
<th>Cumulative Net cash flow Project Y ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>($50,000)</td>
<td>(50,000)</td>
<td>($80,000)</td>
<td>(80,000)</td>
</tr>
<tr>
<td>1</td>
<td>$25,000</td>
<td>(25,000)</td>
<td>$45,000</td>
<td>(35,000)</td>
</tr>
<tr>
<td>2</td>
<td>$20,000</td>
<td>(5,000)</td>
<td>$35,000</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>$20,000</td>
<td>15,000</td>
<td>$17,000</td>
<td>17,000</td>
</tr>
<tr>
<td>4</td>
<td>$15,000</td>
<td>30,000</td>
<td>$15,000</td>
<td>32,000</td>
</tr>
<tr>
<td>5</td>
<td>$10,000</td>
<td>40,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Payback for project X = 2 years and 3 months [number of months into the third year = $5,000 + $20,000 \times 12$

Payback for project Y = 2 years
A

2. Explain which project should be selected if payback is the only criterion used – and why. [3]

Project Y has a quicker payback and should be selected. A quicker payback reduces risk and is important to businesses that have limited finance available.

3. Calculate ARR for both projects. [6]

\[
\text{ARR} = \frac{\text{average profit}}{\text{initial investment}} \times 100
\]

For project X: profit = $40,000. Therefore, average profit = 40,000 ÷ 5 = $8,000.
ARR = 8,000 × 100 = 16%

For project Y: profit = $32,000. Therefore, average profit = 32,000 ÷ 4 = $8,000
ARR = 8,000 × 100 = 10%

4. The business has a cut-off or criterion rate of 11% for all new projects. Would either project be acceptable with this restriction? [3]

Project X is acceptable as its ARR is 16%, that is 5% points above the minimum acceptable ARR.

5. Taking both the results of payback and ARR together, which project would you advise the business to invest in and why? [7]

With regard to the payback period, project Y has a marginal advantage over project X. However, there is a significant difference in the ARR for the two projects. At 16%, project X provides a much higher rate of return than project Y. For every $1 invested, project X returns an annual profit of $0.16 compared to just $0.10 for project Y.

ARR focuses on profitability, which is the central objective of business investment decisions.

It should be noted that as project X generates net cash flows over a five-year period, there is greater uncertainty as to the overall cash flow; predictions for later years are likely to be inaccurate. The bulk of project Y’s forecast cash flow is in the first two years and is, therefore, more likely to be accurate.

Project X requires less initial capital than project Y; it may, therefore, be easier to finance and cause less strain on liquidity.

6. What additional information would help you advise the business on the more suitable project? [5]

- Cash flows received in the future have less real value than cash flows today – What will the inflation rate be in the future?
- Impact on employees and other stakeholders of the investments – will workers need retraining? Will the investment lead to redundancies?
• How much disruption will be caused as the machinery is installed?
• What will be the impact on quality and quality control of the new machinery?

Activity 33.3 (page 599): Discounting cash flows

1 Calculate the present-day values of the following cash flows:

- $10,000 expected in four years' time at prevailing rate of interest of 10% [2]
  
  Present-day value = cash flow x discount factor
  
  \[10,000 \times 0.68 = \$6,800\]

- $2,000 expected in six years' time at prevailing rate of interest of 16% [2]
  
  \[2,000 \times 0.41 = \$820\]

- $6,000 expected in one year's time at prevailing rate of interest of 20%. [2]
  
  \[6,000 \times 0.83 = \$4,980\]

2 The following net cash flows have been forecast by a manufacturer for the purchase of a labour-saving machine:

<table>
<thead>
<tr>
<th>Year</th>
<th>Net cash flow ($)</th>
<th>Cumulative cash flow ($)</th>
<th>Discounted cash flow @ 10% ($)</th>
<th>Cumulative discounted cash flow ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(15,000)</td>
<td>(15,000)</td>
<td>(15,000)</td>
<td>(15,000)</td>
</tr>
<tr>
<td>1</td>
<td>8,000</td>
<td>(7,000)</td>
<td>(7,280)</td>
<td>(7,720)</td>
</tr>
<tr>
<td>2</td>
<td>10,000</td>
<td>3,000</td>
<td>8,300</td>
<td>580</td>
</tr>
<tr>
<td>3</td>
<td>5,000</td>
<td>8,000</td>
<td>3,750</td>
<td>4,330</td>
</tr>
<tr>
<td>4</td>
<td>5,000</td>
<td>13,000</td>
<td>3,400</td>
<td>7,730</td>
</tr>
</tbody>
</table>

• Calculate the simple payback period. [3]
  
  Payback is in the second year after \(7,000 \div 10,000 \times 12 = 8.4\) months. Payback is 1 year and 8.4 months.

• Discount all cash flows at a rate of discount of 10%. [4]

• Calculate the discounted payback period. [3]
  
  Discounted payback is in the second year after \(7,720 \div 8,300 \times 12 = 11.2\) months. Discounted payback is 1 year and 11.2 months.

• Calculate the net present value. [3]
  
  \[\text{NPV} = \$7,730\]
Activity 33.4 (page 599): Net present value

Using the data in Table 33.7:

- recalculate the net present value at a discount rate of 20% [4]

<table>
<thead>
<tr>
<th>Year</th>
<th>Net cash flow ($)</th>
<th>Discount Factor @20%</th>
<th>Discounted cash flow ($)</th>
<th>Cumulative discounted cash flow ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(10,000)</td>
<td>1</td>
<td>(10,000)</td>
<td>(10,000)</td>
</tr>
<tr>
<td>1</td>
<td>5,000</td>
<td>0.83</td>
<td>4,150</td>
<td>(5,850)</td>
</tr>
<tr>
<td>2</td>
<td>4,000</td>
<td>0.69</td>
<td>2,760</td>
<td>(3,090)</td>
</tr>
<tr>
<td>3</td>
<td>3,000</td>
<td>0.58</td>
<td>1,740</td>
<td>(1,350)</td>
</tr>
<tr>
<td>4</td>
<td>2,000</td>
<td>0.48</td>
<td>960</td>
<td>(390)</td>
</tr>
</tbody>
</table>

NPV = –$390

- explain why the net present value is negative [2]

The net present value is negative because the future cash flows have been so heavily discounted that the cumulative discounted net cash flows are less than the initial investment.

- explain why the project would not be viable if the business had to borrow finance at 20% [2]

If the business had to borrow finance at 20%, then future cash flows are not sufficient to cover the cost of the investment. The project has a negative net present value.

- if the criterion rate used by the business for new investments is 10%, would this project have a positive net present value, and would it therefore be acceptable? [4]

If the rate for new investments is 10%, the NPV is $1,480. Therefore, it is worth considering this investment.

Activity 33.5 – answer provided on Student’s CD-ROM.

Revision case study 1 (page 603): King and Green Ltd

1 Calculate the total labour costs of option 2 for each year of operation. [3]

Production workers will be paid $7,000 per year. There are four machines and one worker per machine is needed for each of the two shifts. Therefore, eight workers are needed in total.

Labour cost = $7,000 \times 8 = $56,000.

The table below provides data for questions 2 and 3.
### Option 1

<table>
<thead>
<tr>
<th>Year</th>
<th>Option 1 net cash flow ($)</th>
<th>Cumulative cash flow ($)</th>
<th>Discount rate @ 10%</th>
<th>Discounted cash flow ($)</th>
<th>Discounted cumulative cash flow ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(355,000)</td>
<td>(355,000)</td>
<td>1</td>
<td>(355,000)</td>
<td>(355,000)</td>
</tr>
<tr>
<td>1</td>
<td>130,000</td>
<td>(225,000)</td>
<td>0.91</td>
<td>118,300</td>
<td>(236,700)</td>
</tr>
<tr>
<td>2</td>
<td>100,000</td>
<td>(125,000)</td>
<td>0.83</td>
<td>83,000</td>
<td>(153,700)</td>
</tr>
<tr>
<td>3</td>
<td>80,000</td>
<td>(45,000)</td>
<td>0.75</td>
<td>60,000</td>
<td>(93,700)</td>
</tr>
<tr>
<td>4</td>
<td>80,000</td>
<td>35,000</td>
<td>0.68</td>
<td>54,400</td>
<td>(39,300)</td>
</tr>
<tr>
<td>5</td>
<td>60,000</td>
<td>95,000</td>
<td>0.62</td>
<td>37,200</td>
<td>(2,100)</td>
</tr>
</tbody>
</table>

### Option 2

<table>
<thead>
<tr>
<th>Year</th>
<th>Option 2 net cash flow ($)</th>
<th>Cumulative cash flow ($)</th>
<th>Discount rate @ 10%</th>
<th>Discounted cash flow ($)</th>
<th>Discounted cumulative cash flow ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(140,000)</td>
<td>(140,000)</td>
<td>1</td>
<td>(140,000)</td>
<td>(140,000)</td>
</tr>
<tr>
<td>1</td>
<td>64,000</td>
<td>(76,000)</td>
<td>0.91</td>
<td>58,240</td>
<td>(81,760)</td>
</tr>
<tr>
<td>2</td>
<td>44,000</td>
<td>(153,700)</td>
<td>0.83</td>
<td>36,520</td>
<td>(45,240)</td>
</tr>
<tr>
<td>3</td>
<td>44,000</td>
<td>(93,700)</td>
<td>0.75</td>
<td>33,000</td>
<td>(12,240)</td>
</tr>
<tr>
<td>4</td>
<td>24,000</td>
<td>(36,000)</td>
<td>0.68</td>
<td>16,320</td>
<td>4,080</td>
</tr>
<tr>
<td>5</td>
<td>24,000</td>
<td>60,000</td>
<td>0.62</td>
<td>14,880</td>
<td>18,960</td>
</tr>
</tbody>
</table>

2. Recalculate the net cash flows for both options, taking the labour costs into account. [6]

3. Using these cash flows, undertake an investment appraisal of the two options using:

   - **payback** [6]
     
     Option 1 = 3 years and 7 months. [In year 4: 45,000 + 80,000 × 12 = 6.75 months]
     
     Option 2 = 2 years and 9 months. [In year 3: 32,000 + 44,000 × 12 = 8.7 months]

   - **discounted payback** [6]
     
     Option 1 does not provide a discounted payback.
     
     Option 2 = 3 years and 9 months [In year 4: 12,240 + 16,320 × 12 = 9 months]

   - **average rate of return** [6]
     
     Option 1: Annual profit = 95,000 + 5 = $19,000
               ARR = 19,000 + 355,000 × 100 = 5.4%
     
     Option 2: Annual profit = 60,000 + 5 = $12,000
               ARR = 12,000 + 140,000 × 100 = 8.6%

   - **net present value.** [6]
     
     Option 1 = -$2,100
     Option 2 = $18,960

4. Using only the results of your investment appraisal, which option would you advise the directors to accept? [4]

   Option 2 is preferable because it has:
   - a quicker payback – therefore, it is less risky.
   - a higher ARR – for each $1 invested, it has a higher rate of return.
   - a positive NPV – if the firm has to borrow money at a rate of 10%, then option 1 is not worthwhile as its NPV is negative.
Explain two other factors might influence the final investment decision. [6]

- Consideration of corporate social responsibility – option 1 will minimise water pollution. Option 2 might face opposition from the local community because of concerns about pollution.
- Impact on workforce – option 2 requires more workers. Option 1 would lead to a loss of jobs, so might be resisted by employees. However, with the high labour costs there is the danger that any increase in wages would significantly affect profitability.
- Reliability – option 2 has an established record for reliability. This is important in meeting customer expectations. If the fully automated machinery breaks down, it may be expensive to fix due to its technical complexity.

Revision case study 2 (page 604): Investing to stay competitive

1 Calculate the forecast annual net cash flows from the information given. [8]

Unit contribution for each unit sold is 1.25 – 0.5 = $0.75
Additional operating costs are $1m for Y and 0.5m for Z

Project Y: net cash flow = 8m × 0.75 – 1m = $5m in years 1, 2, 3 and 4. In year 5, there will be an additional $1m regarding the residual value of the machine.

Project Z: Net cash flow is 6m × 0.75 – 0.5m = $4m in years 1, 2 and 3. In year 4, the residual value of the machine is $0.5m. This will be an additional cash inflow in that year.

2 Present all relevant data in a table and calculate the simple payback period for both projects. [4]

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Y Net cash flow ($)</th>
<th>Cumulative cash flow ($)</th>
<th>Project Z Net cash flow ($)</th>
<th>Cumulative cash flow ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(20,000,000)</td>
<td>(20,000,000)</td>
<td>(12,000,000)</td>
<td>(12,000,000)</td>
</tr>
<tr>
<td>1</td>
<td>5,000,000</td>
<td>(15,000,000)</td>
<td>4,000,000</td>
<td>(8,000,000)</td>
</tr>
<tr>
<td>2</td>
<td>5,000,000</td>
<td>(10,000,000)</td>
<td>4,000,000</td>
<td>(4,000,000)</td>
</tr>
<tr>
<td>3</td>
<td>5,000,000</td>
<td>(5,000,000)</td>
<td>4,000,000</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>5,000,000</td>
<td>0</td>
<td>4,500,000</td>
<td>4,500,000</td>
</tr>
<tr>
<td>5</td>
<td>6,000,000</td>
<td>6,000,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Project Y payback is four years.
Project Z payback is three years.
3  Calculate the ARR for both projects. [4]

ARR = annual profit ÷ initial capital cost × 100

Project Y makes an annual profit of $1.2m
ARR = $1.2m ÷ $20m × 100 = 6%

Project Z makes an annual profit of $1.125m
ARR = $1.125m ÷ $12m × 100 = 9.375%

4  Calculate the net present value for both projects. The company’s existing cost of borrowed capital is 12%. [8]

<table>
<thead>
<tr>
<th>Year</th>
<th>Project Y</th>
<th>Discounted cash flow @ 12% ($)</th>
<th>Project Z</th>
<th>Discounted cash flow @ 12% ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>(20,000,000)</td>
<td>(20,000,000)</td>
<td>(12,000,000)</td>
<td>(12,000,000)</td>
</tr>
<tr>
<td>1</td>
<td>5,000,000</td>
<td>4,450,000</td>
<td>4,000,000</td>
<td>3,560,000</td>
</tr>
<tr>
<td>2</td>
<td>5,000,000</td>
<td>3,950,000</td>
<td>4,000,000</td>
<td>3,160,000</td>
</tr>
<tr>
<td>3</td>
<td>5,000,000</td>
<td>3,550,000</td>
<td>4,000,000</td>
<td>2,840,000</td>
</tr>
<tr>
<td>4</td>
<td>5,000,000</td>
<td>3,200,000</td>
<td>4,500,000</td>
<td>2,880,000</td>
</tr>
<tr>
<td>5</td>
<td>6,000,000</td>
<td>3,420,000</td>
<td>440,000</td>
<td></td>
</tr>
</tbody>
</table>

Project Y: NPV = -$1,430,000
Project Z: NPV = $440,000

5  Estimate, using the graphical technique, the internal rate of return for both projects. [12]

This can be done by calculating NPV at two further discount rates and plotting results on a graph.

IRR for Project Y is 9%.
IRR for Project Z is 14%.
Using your results for all four methods of investment appraisal, write a report to the directors to advise them which project they should opt for, on the basis of quantitative information. [12]

Relevant issues include:

- Project Y makes a higher annual profit, but, as the purchase price is $8 million more, its annual rate of return is only 6% compared to 9.74% for project Z. Profitability is a fundamental goal of the business and project Z is forecast to be more profitable.
- The payback for project Z is three years compared with four years for project Y. A quick payback reduces risk as the predicted cash flows are sooner. Payback is particularly important if a business is short of finance.
- The NPV for project Z is $440,000 at a discount rate of 12% and is, therefore, worth consideration. However, the NPV for project Y is negative; that is, taking into account the time value of money, the project does not generate sufficient net cash flows to justify the initial capital cost.
- The IRR for project Z is 14% compared with just 9% for project Y. This appraisal technique objectively compares projects costing different amounts and, therefore, indicates that project Z is preferable, assuming that the estimates on which the calculation is based are accurate.

Evaluation may consider:
The quantitative evidence is clear: option Z is the favoured investment as it has a higher rate of return, quicker payback and a positive NPV. Project Z is also significantly cheaper and, therefore, the business does not require such a healthy cash position to proceed with the investment.

To what extent do you think qualitative factors should influence investment decisions such as this one by Asia Print plc? [10]

Managers should always consider qualitative factors alongside the quantitative investment appraisal techniques. In some cases, qualitative factors will prove decisive. The qualitative factors relevant to this decision include:

- Impact on the current workforce – project Y would lead to six redundancies, whereas project Z would only require three redundancies. Opposition from the workforce is likely to be greater with regard to project Z. The union has expressed concern about job cuts; management should consider consulting the union to avoid industrial relations problems.
- Training for workers – for project Y, workers would have to be trained. Asia Print plc would have to select workers carefully and there could be discontent from workers about who is chosen.
- Impact on the environment – project Z machinery is noisy and there could be opposition from the local community. Asia Print plc may be concerned about corporate social responsibility.
- Impact on customers – project Y is highly automated and allows links with customers that will speed up the production of materials. This could help Asia Print’s reputation and help maintain market share.
Reliability of machinery – project Z uses a proven technology, whereas project Y uses new technology which may prove to be unreliable. Thus, there is an increased risk with project Y.

**Evaluation may consider:**
Qualitative factors are important and should influence decisions such as this because businesses have a responsibility not just to shareholders but also to other stakeholders such as employees and the local community. However, there may be conflict between the wishes of different stakeholder groups and difficulty in weighing the relative importance of those factors.

**Essay**

1 a *Explain:*

- the payback method of investment appraisal and
- the average rate of return method. [10]

Payback and ARR are quantitative investment appraisal techniques. Neither technique takes into account the qualitative factors that influence an investment decision. Both techniques require businesses to estimate the capital expenditure involved in an investment and the subsequent net cash flows from the project. Net cash flows are the expected revenues from the investment, less the running costs of it.

The data used are not certain; they are forecasts based on judgement, guesswork and/or research.

**Payback** – this appraisal technique calculates how many months it takes for an investment to generate sufficient net cash flows to match the initial capital expenditure. If a project costs $500,000 and is expected to return $100,000 per annum, then the payback is five years.

This technique is quick and easy to calculate and easily understood by managers. By concentrating on the speed of return of cash flows, the technique focuses on the more accurate short-term forecasts of the project’s profitability. However, payback does not take into account the overall profitability of the project as it ignores cash flows occurring after the payback period.

**ARR** – this also requires estimates to be made of a project’s life expectancy and the residual value of the investment.

From the estimates made, the ARR is found by calculating the average yearly profit of the investment as a percentage of its capital cost.

The formula used is: $$\text{ARR} = \frac{\text{annual profit}}{\text{initial capital cost}} \times 100.$$ ARR focuses on profitability, which is the key objective of most businesses. It provides a rate of return and enables simple comparison to be made between projects. However, like payback, ARR ignores the time value of money.

**Top tip**
It is useful to provide a worked example to clarify the explanation.
b Discuss the view that as quantitative investment appraisal is based on potentially inaccurate cash-flow forecasts there is little point in a business such as Apple using these two techniques when choosing between investment projects. [15]

Although cash-flow forecasts are quite likely to be inaccurate because the business environment is dynamic, it does not follow that quantitative investment techniques are pointless. Reasons for conducting quantitative investment appraisal include:

- They will help to identify the degree of risk associated with different projects. For example, if it is estimated that the ARR of a project is high, then there is more chance of it being successful than a project with a low rate of return.
- Where payback is expected to be just one or two years, it is quite likely that estimates of cash flows will prove to be relatively accurate.
- They provide a means for making comparisons between projects based on objective criteria. Therefore, they help make decisions about which projects should be pursued.
- The techniques encourage businesses to consider the future and make decisions based on an analysis of expected demand and costs associated with an investment.
- In analysing future cash flows, businesses are able to assess the probability of their estimates being correct. This can be taken into account when making the final decision.

**Evaluation may consider:**

Investment appraisal techniques, such as ARR and payback, are a necessary part of a business’s evaluation of investment decisions. However, there are many other factors that should be taken into account alongside this quantitative analysis. The possible inaccuracy of the estimates simply indicates that managers should treat the results with caution and question on what basis the estimates have been made.