**Lecture 8 notes**

* All the answers to G plc [question from the power point presentation on ‘Investment Appraisal’] are included in these notes below.
* The **discount factor and the annuity factor** tables are included at the end of this note.
* ‘Cost-Volume-Profit analysis’ was introduced in the last lecture. **Please read/revise the power point presentation on this topic.**
* **Please attempt the 2 questions [H Ltd and J plc] set out below**.

G plc

Question:

The management of G plc is considering investing in three projects. The finance director has prepared the following estimates for the three projects A, B and C are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| Project | A | B | C |
| Cash flows in: |  |  |  |
| Year 0 | (60,000) | (120,000) | (180,000) |
| Year 1 | 25,000 | 50,000 | 95,000 |
| Year 2 | 30,000 | 70,000 | 80,000 |
| Year 3 | 32,000 | 80,000 | 58,000 |

The company’s cost of capital is 10 %. and company’s required payback is 2 years

Present value factors @ 10 % is:

|  |  |  |  |
| --- | --- | --- | --- |
| Year | 1 | 2 | 3 |
| Present value factors | 0.909 | 0.826 | 0.751 |

**Required:**

**a) Calculate the following for the 3 projects:**

* **payback**
* **net present value**

**b) Rank the three projects in order of investment potential using the above 2 methods:**

**c) Which projects may be recommended if the projects are mutually exclusive. Explain your selection**

**d) Critically evaluate the above methods.**

**e) State five other factors that require consideration before a final decision is made.**

**f) Calculate the payback and NPV for project D (details are below) and advice on its feasibility.**

**Initial investment is £100,000 with an annuity of £35,000 p.a. for 5 years. The residual value of assets is expected to be £14,000.**

**Payback required is 3 years and the cost of capital for similar projects are 10%.**

**-------------------------------------------------------------------------------------------**

**INDICATIVE CONTENT /SUGGESTED ANSWER**

**a)**

Calculation of payback period:

Project A

|  |  |  |
| --- | --- | --- |
|  | CF £000 | Cumulative CF £000 |
| Year - 1 | 25 | 25 |
| 2 | 30 | 55 |
| 3 | 32 | 87 |

Payback for A = 2 + [5 / 32] = 2 + 0.156 = 2.156 years.

Payback for B = 2 years (by observation of the cumulative cash flows)

Payback for C = 2 + 5 / 58 = 2. 09 years.

|  |
| --- |
| **THE FOLLOWING EXPLANATION IS NOT NEEDED IN THE EXAM – JUST SHOW THE CALCULATIONS AS ABOVE.**  **The payback calculation for A can be explained as follows –**  The initial investment of £60,000 for A is recovered between the cumulative cash flows of years 2 and 3. Hence the payback is between years 2 and 3. |
| Year 2’s cumulative cash flow of £55,000 requires an additional £5,000 (to make up the initial investment of £60,000). This additional £5,000 is from year 3’s cash flow of £32,000] |
| Payback for Project A = 2 years + £5,000 / £32,000 = 2 years + 0.156 year = 2.156 or 2.16 years |
| Payback for Projects B is exactly 2 years (by observation of its cumulative cash flows). |
| Payback for Project C |
|  |
| |  |  |  | | --- | --- | --- | |  | CF £000 | Cumulative CF £000 | | Year - 1 | 95 | 95 | | 2 | 80 | 175 | | 3 | 58 | 233 | |
| The payback for C = 2 + £5000 / £58,000 = 2.09 years (Using a similar reasoning as that of project A) |

Calculation of NPV

NPVs @ 10 % for all 3 projects in £000s:

Project A: 25 x 0.909 + 30 x 0.826 + 32 x 0.751 – 60

= 22.725 + 24.78 + 25.032 – 60 = 11.537

Project A’s NPV @ 10 % = £11,537

Similarly, NPVs for Projects B and C are: £43,350 and £15,993 respectively (please note: in an exam scenario, students are expected to show similar workings as that of Project A)

**b)**

Ranking of projects:

* Payback – shortest payback ranked first; reject those outside the maximum payback specified by management.
* NPV – highest positive ranked first

|  |  |  |  |
| --- | --- | --- | --- |
| Project | A | B | C |
| Payback ranking | - | 1 | - |
| NPV ranking | 3 | 1 | 2 |

**c)** All investment decisions should be made using any DCF method – in this case, NPV.

All 3 projects show a positive NPV, i.e. an **economic profit** @ 10 % cost of capital. Hence all 3 projects are viable.

However, in a **mutually exclusive** scenario, **project B is recommended** for selection since it has the **highest NPV.** This selection will lead to an increase in the present value of the company and consequently will result in an increase in shareholders’ wealth and the company’s share price.

Payback may be used as an additional criterion **and not as the** **primary/main method** for investment decisions since it does not take account of the required risk / return (ignores time value of money).

**d)** The advantage of both methods, payback and NPV, is that both use cash flows (objectively determined) rather than subjective accounting profits.

**Payback** method has the following strengths / advantages:

-- is quick & easy to calculate.

-- readily understood by users / managers.

-- since the cashflows beyond the payback criteria set by management are ignored, this can relieve management of the difficulties of forecasting over a long time period horizon. The ranking approach deals with this problem of forecasting by favouring projects with shorter payback period. The assumption here is that forecasting risks of project cash flow increase over time – the further away into future the more difficult it is to determine the cash flows. (you may be more certain of in you want to do today compared to what you want to do tomorrow or in one month or ten years’ time)

Payback has the following problems / weaknesses / disadvantages in its use for investment decisions:

– does not account for time value of money (an adequate return to providers of long – term funds) and so is not directly related to the presumed objective of shareholder wealth maximisation.

-- has no objective accept/reject decision rule (since this rule / criterion is set by management).

-- it ignores cash flows beyond the payback period.

**NPV** has the following advantages:

-- this method accounts for time value of money – return required by providers of long-term funds used in long term investments / projects and so is directly related to the objective of shareholder wealth maximisation.

-- it considers all the cashflows of the investment

-- provides clear decision rules for both accept /reject and ranking decisions.

NPV have these challenges / criticisms /disadvantages:

-- though there are software packages available to deal with the calculations speedily & accurately it may pose a challenge in understanding its significance. So, often the alternative DCF method, IRR, expressed in percentage terms may be preferable to NPV.

-- it can be difficult to identify the correct discount rate / cost of capital / rate of return to account for time value of money.

**e)**

Other factors (financial & non - financial) that may need consideration before a final decision include the following:

* Accuracy and completeness of the analysis
* Inflation may require consideration
* Taxation implications
* Impact on sales of existing products/services
* Reaction of competitors
* Environmental considerations
* Industrial relations – management and employee issues relating to the introduction of new techniques / machinery & tools / rules
* Impact of existing / new legislation

**f)**

Payback = Initial investment / Annual cashflow

= £100,000 / £35,000 = 2.86 years

NPV @10% = 3.791 x £35,000 + 0.621 x £14,000 – £100,000

= £132,685 + £8,694 – £100,000 = £41,379

The project’s NPV is positive and makes an economic profit

of £41,379. Hence it is feasible/viable on quantitative terms.

In addition, the project’s payback is less than 3 years and satisfies

the payback criteria set by the company - an additional but not

the main reason to accept the project.

* **Please attempt the 2 questions [H Ltd and J plc] set out below**.
* H Ltd

H Ltd plans to introduce a new product next year. Its budgeted capacity is 120,000 units.

Relevant budgeted data for next year for the new product are:

Selling price per unit £150

Variable cost per unit £100

Total fixed costs per annum £3,000,000

Planned production and sales is 100,000 units

***Required:***

**a)** Calculate the existing budgeted profit. *(4 marks)*

**b)** Calculate the existing budgeted break-even point and margin of

safety. *(5 marks)*

**c)** Calculate the profit if the selling price was set at £175 and 90,000

units are produced and sold. *(6 marks)*

**d)** Calculate the profit, breakeven point and the margin of safety if

the design and quality of the product is improved by spending

£10 more per unit on material, spending £100,000 more on

marketing/promotions and producing and selling 20,000 units

at a price of £180 each. *(10 marks)*

**e)** State the limitations of the above analysis. *(5 marks)*

* J plc

The following investment proposal is being considered by J plc to increase its market share of one of the company’s products over the next four years.

* Product market research forecasts the additional sales volumes expected for the next 4 years as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year | 1 | 2 | 3 | 4 |
| Sales (units) | 2100 | 2200 | 2300 | 2000 |

* An initial investment of £50,000 (year 0) will be required immediately to purchase new plant and equipment. This will be sold for £20,000 at the end 4 years.
* The product’s contribution is £20 per unit.
* Incremental fixed costs will be £15,000 per annum for the 4 years.
* The company’s cost of capital is 10 % and the payback required from such investments is 2.5 years.

**Required for the investment proposal:**

**a) The relevant annual cash flows for the proposal. [7 marks]**

**b) The Payback and the Net Present Value (NPV). [7 marks]**

**c) Advice the company. [5 marks]**

**d) Calculate the BEP, profit and margin of safety for year 1.**

**Discount Factor Table**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | *Discount rate (i)* | | | |  |  |  |  |
| *Years* |  |  |  |  |  |  |  |  |  |  |  |
| *(N)* | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0.990 | 0.980 | 0.971 | 0.962 | 0.952 | 0.943 | 0.935 | 0.926 | 0.917 | 0.909 | 1 |
| 2 | 0.980 | 0.961 | 0.943 | 0.925 | 0.907 | 0.890 | 0.873 | 0.857 | 0.842 | 0.826 | 2 |
| 3 | 0.971 | 0.942 | 0.915 | 0.889 | 0.864 | 0.840 | 0.816 | 0.794 | 0.772 | 0.751 | 3 |
| 4 | 0.961 | 0.924 | 0.888 | 0.855 | 0.823 | 0.792 | 0.763 | 0.735 | 0.708 | 0.683 | 4 |
| 5 | 0.951 | 0.906 | 0.863 | 0.822 | 0.784 | 0.747 | 0.713 | 0.681 | 0.650 | 0.621 | 5 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | 0.942 | 0.888 | 0.837 | 0.790 | 0.746 | 0.705 | 0.666 | 0.630 | 0.596 | 0.564 | 6 |
| 7 | 0.933 | 0.871 | 0.813 | 0.760 | 0.711 | 0.665 | 0.623 | 0.583 | 0.547 | 0.513 | 7 |
| 8 | 0.923 | 0.853 | 0.789 | 0.731 | 0.677 | 0.627 | 0.582 | 0.540 | 0.502 | 0.467 | 8 |
| 9 | 0.914 | 0.837 | 0.766 | 0.703 | 0.645 | 0.592 | 0.544 | 0.500 | 0.460 | 0.424 | 9 |
| 10 | 0.905 | 0.820 | 0.744 | 0.676 | 0.614 | 0.558 | 0.508 | 0.463 | 0.422 | 0.386 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | 0.896 | 0.804 | 0.722 | 0.650 | 0.585 | 0.527 | 0.475 | 0.429 | 0.388 | 0.350 | 11 |
| 12 | 0.887 | 0.788 | 0.701 | 0.625 | 0.557 | 0.497 | 0.444 | 0.397 | 0.356 | 0.319 | 12 |
| 13 | 0.879 | 0.773 | 0.681 | 0.601 | 0.530 | 0.469 | 0.415 | 0.368 | 0.326 | 0.290 | 13 |
| 14 | 0.870 | 0.758 | 0.661 | 0.577 | 0.505 | 0.442 | 0.388 | 0.340 | 0.299 | 0.263 | 14 |
| 15 | 0.861 | 0.743 | 0.642 | 0.555 | 0.481 | 0.417 | 0.362 | 0.315 | 0.275 | 0.239 | 15 |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0.901 | 0.893 | 0.885 | 0.877 | 0.870 | 0.862 | 0.855 | 0.847 | 0.840 | 0.833 | 1 |
| 2 | 0.812 | 0.797 | 0.783 | 0.769 | 0.756 | 0.743 | 0.731 | 0.718 | 0.706 | 0.694 | 2 |
| 3 | 0.731 | 0.712 | 0.693 | 0.675 | 0.658 | 0.641 | 0.624 | 0.609 | 0.593 | 0.579 | 3 |
| 4 | 0.659 | 0.636 | 0.613 | 0.592 | 0.572 | 0.552 | 0.534 | 0.516 | 0.499 | 0.482 | 4 |
| 5 | 0.593 | 0.567 | 0.543 | 0.519 | 0.497 | 0.476 | 0.456 | 0.437 | 0.419 | 0.402 | 5 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | 0.535 | 0.507 | 0.480 | 0.456 | 0.432 | 0.410 | 0.390 | 0.370 | 0.352 | 0.335 | 6 |
| 7 | 0.482 | 0.452 | 0.425 | 0.400 | 0.376 | 0.354 | 0.333 | 0.314 | 0.296 | 0.279 | 7 |
| 8 | 0.434 | 0.404 | 0.376 | 0.351 | 0.327 | 0.305 | 0.285 | 0.266 | 0.249 | 0.233 | 8 |
| 9 | 0.391 | 0.361 | 0.333 | 0.308 | 0.284 | 0.263 | 0.243 | 0.225 | 0.209 | 0.194 | 9 |
| 10 | 0.352 | 0.322 | 0.295 | 0.270 | 0.247 | 0.227 | 0.208 | 0.191 | 0.176 | 0.162 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | 0.317 | 0.287 | 0.261 | 0.237 | 0.215 | 0.195 | 0.178 | 0.162 | 0.148 | 0.135 | 11 |
| 12 | 0.286 | 0.257 | 0.231 | 0.208 | 0.187 | 0.168 | 0.152 | 0.137 | 0.124 | 0.112 | 12 |
| 13 | 0.258 | 0.229 | 0.204 | 0.182 | 0.163 | 0.145 | 0.130 | 0.116 | 0.104 | 0.093 | 13 |
| 14 | 0.232 | 0.205 | 0.181 | 0.160 | 0.141 | 0.125 | 0.111 | 0.099 | 0.088 | 0.078 | 14 |
| 15 | 0.209 | 0.183 | 0.160 | 0.140 | 0.123 | 0.108 | 0.095 | 0.084 | 0.074 | 0.065 | 15 |
|  |  |  |  |  |  |  |  |  |  |  |  |

**Annuity Factor Table**

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  | *Discount rate (r)* | | | |  |  |  |  |
| *Cash Flows* |  |  |  |  |  |  |  |  |  |  |  |
| *(N)* | 1% | 2% | 3% | 4% | 5% | 6% | 7% | 8% | 9% | 10% |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0.990 | 0.980 | 0.971 | 0.962 | 0.952 | 0.943 | 0.935 | 0.926 | 0.917 | 0.909 | 1 |
| 2 | 1.970 | 1.942 | 1.913 | 1.886 | 1.859 | 1.833 | 1.808 | 1.783 | 1.759 | 1.736 | 2 |
| 3 | 2.941 | 2.884 | 2.829 | 2.775 | 2.723 | 2.673 | 2.624 | 2.577 | 2.531 | 2.487 | 3 |
| 4 | 3.902 | 3.808 | 3.717 | 3.630 | 3.546 | 3.465 | 3.387 | 3.312 | 3.240 | 3.170 | 4 |
| 5 | 4.853 | 4.713 | 4.580 | 4.452 | 4.329 | 4.212 | 4.100 | 3.993 | 3.890 | 3.791 | 5 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | 5.795 | 5.601 | 5.417 | 5.242 | 5.076 | 4.917 | 4.767 | 4.623 | 4.486 | 4.355 | 6 |
| 7 | 6.728 | 6.472 | 6.230 | 6.002 | 5.786 | 5.582 | 5.389 | 5.206 | 5.033 | 4.868 | 7 |
| 8 | 7.652 | 7.325 | 7.020 | 6.733 | 6.463 | 6.210 | 5.971 | 5.747 | 5.535 | 5.335 | 8 |
| 9 | 8.566 | 8.162 | 7.786 | 7.435 | 7.108 | 6.802 | 6.515 | 6.247 | 5.995 | 5.759 | 9 |
| 10 | 9.471 | 8.983 | 8.530 | 8.111 | 7.722 | 7.360 | 7.024 | 6.710 | 6.418 | 6.145 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | 10.368 | 9.787 | 9.253 | 8.760 | 8.306 | 7.887 | 7.499 | 7.139 | 6.805 | 6.495 | 11 |
| 12 | 11.255 | 10.575 | 9.954 | 9.385 | 8.863 | 8.384 | 7.943 | 7.536 | 7.161 | 6.814 | 12 |
| 13 | 12.134 | 11.348 | 10.635 | 9.986 | 9.394 | 8.853 | 8.358 | 7.904 | 7.487 | 7.103 | 13 |
| 14 | 13.004 | 12.106 | 11.296 | 10.563 | 9.899 | 9.295 | 8.745 | 8.244 | 7.786 | 7.367 | 14 |
| 15 | 13.865 | 12.849 | 11.938 | 11.118 | 10.380 | 9.712 | 9.108 | 8.559 | 8.061 | 7.606 | 15 |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | 11% | 12% | 13% | 14% | 15% | 16% | 17% | 18% | 19% | 20% |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 1 | 0.901 | 0.893 | 0.885 | 0.877 | 0.870 | 0.862 | 0.855 | 0.847 | 0.840 | 0.833 | 1 |
| 2 | 1.713 | 1.690 | 1.668 | 1.647 | 1.626 | 1.605 | 1.585 | 1.566 | 1.547 | 1.528 | 2 |
| 3 | 2.444 | 2.402 | 2.361 | 2.322 | 2.283 | 2.246 | 2.210 | 2.174 | 2.140 | 2.106 | 3 |
| 4 | 3.102 | 3.037 | 2.974 | 2.914 | 2.855 | 2.798 | 2.743 | 2.690 | 2.639 | 2.589 | 4 |
| 5 | 3.696 | 3.605 | 3.517 | 3.433 | 3.352 | 3.274 | 3.199 | 3.127 | 3.058 | 2.991 | 5 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 6 | 4.231 | 4.111 | 3.998 | 3.889 | 3.784 | 3.685 | 3.589 | 3.498 | 3.410 | 3.326 | 6 |
| 7 | 4.712 | 4.564 | 4.423 | 4.288 | 4.160 | 4.039 | 3.922 | 3.812 | 3.706 | 3.605 | 7 |
| 8 | 5.146 | 4.968 | 4.799 | 4.639 | 4.487 | 4.344 | 4.207 | 4.078 | 3.954 | 3.837 | 8 |
| 9 | 5.537 | 5.328 | 5.132 | 4.946 | 4.772 | 4.607 | 4.451 | 4.303 | 4.163 | 4.031 | 9 |
| 10 | 5.889 | 5.650 | 5.426 | 5.216 | 5.019 | 4.833 | 4.659 | 4.494 | 4.339 | 4.192 | 10 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| 11 | 6.207 | 5.938 | 5.687 | 5.453 | 5.234 | 5.029 | 4.836 | 4.656 | 4.486 | 4.327 | 11 |
| 12 | 6.492 | 6.194 | 5.918 | 5.660 | 5.421 | 5.197 | 4.988 | 4.793 | 4.611 | 4.439 | 12 |
| 13 | 6.750 | 6.424 | 6.122 | 5.842 | 5.583 | 5.342 | 5.118 | 4.910 | 4.715 | 4.533 | 13 |
| 14 | 6.982 | 6.628 | 6.302 | 6.002 | 5.724 | 5.468 | 5.229 | 5.008 | 4.802 | 4.611 | 14 |
| 15 | 7.191 | 6.811 | 6.462 | 6.142 | 5.847 | 5.575 | 5.324 | 5.092 | 4.876 | 4.675 | 15 |
|  |  |  |  |  |  |  |  |  |  |  |  |

**End of lecture 8 notes**