Handbook for Financial and Development Professionals

Chapter 7

Introduction to Finance for Non-financial Professionals

Basic Concepts of Financial Analysis

- Interest and Interest Rates
- Types of Loans
- Net Present Value
- Internal Rate of Return
- Debt Service Coverage

Interest and Interest Rates

Interest is the cost or value of money. An interest rate is the amount, usually stated as a percentage, demanded by a lender or an investor to make an amount of money available to a borrower.

- $1,000 borrowed for 1 year at 12% interest requires the repayment of $1,120, of which $1,000 is the principal (abbreviated capital or lower case P) and $120 is interest (I or i). Together they are called Principal and Interest (abbreviated P & I or p + i).

- $1,000 borrowed for 1 year at 1% per month, compounded (meaning paying interest on interest as well as principal) requires a payment of $1,127 at the end of the year. P= $1,000; I = $127.

- $1,000 borrowed for 2 years at 12% per year, compounded, requires a payment of $1,254 at the end of 2 years.

Interest is always compounded unless clearly specified to be Simple Interest (which means interest on principal only with no interest charged on interest).

An interest calculation based on borrowing $1,000 for 5 years at 12% interest per year follows:

Year 0 [1]*	$1000.00
Add: 12% for Year 1	120.00
End of Year 1	$1,120.00
Add 12% for Year 2	134.40
EOY[2] 2	$1,254.40
Add 12% for Year 3	150.53

[1] * Year 0 is the point in time when a loan is made.

[2] EOY = end of year

EOY 3	$1,404.93
Add 12% for Year 4	168.59
EOY 4	$1,573.52
Add 12% for Year 5	188.82
EOY 5	$1,762.34

P = $1,000.00
I = $ 762.00

On a calculator:

PV = 1000;
I (i)= 12%
N (n) = 5
Solve for FV (future value)

On Excel or other spreadsheets:

Open *f** (function)
Choose Financial Functions
Choose FV
Rate = 12%
Nper = 5 (number of periods)
PMT = 0
PV = 1000
"OK"

Three Types of Loan Calculations (based on $1,000 at 12% for 5 years)

- Interest Only
- Equal Payment *(on Excel, choose Financial functions, PMT)*
- Equal Principal Payment *(principal amounts are the same, interest amount declines over time)*

Year→	1	2	3	4	5	Total
Interest Only	$ 120.00	$ 120.00	$ 120.00	$ 120.00	$1,120.00	$ 1,600
Equal Payment	$ 277.41	$ 277.41	$ 277.41	$ 277.41	$ 277.41	$ 1,387
Equal Principal	$ 320.00	$ 296.00	$ 272.00	$ 248.00	$ 224.00	$ 1,360

Net Present Value

An interest rate looks forward in time. It represents what someone expects to earn in the future.

A discount rate serves the same function, except that it works backwards in time, taking a future cash flow and giving it a value today.

Present Value (called Net Present Value or NPV) of three different future cash flows today (year 0), discounted at 12% follow.

0	1	2	3	4	5	Total
$1,000	$ 120.00	$ 120.00	$ 120.00	$ 120.00	$1,120.00	$ 1,600
$1,000	$ 277.41	$ 277.41	$ 277.41	$ 277.41	$ 277.41	$ 1,387
$1,000	$ 320.00	$ 296.00	$ 272.00	$ 248.00	$ 224.00	$ 1,360

On a Calculator:

I = 12%, enter PMTS in order, solve for PV

On Excel:

for each line, enter each value for year 1, 2, 3, 4, 5…*f**…financial…NPV…rate = 12%…values as entered…"OK"

Excel Spreadsheet:

12% Discount Rate

1	2	3	4	5	Total	NPV
120.00	120.00	120.00	120.00	1120.00	1600.00	1000.00
277.41	277.41	277.41	277.41	277.41	1387.05	1000.00
320.00	296.00	272.00	248.00	224.00	1360.00	1000.00

This small exercise demonstrates that from a mathematics perspective all three payment plans are the same. However, they are not the same when factors other than mathematics are considered.

For example, perhaps the lender expects inflation to occur. The first payment plan (interest only) "back end loads" the stream of revenue. During inflation periods money value declines; thus money earlier is better than money later. The opposite would be true for the borrower.

Another example might involve the needs of the lender to have cash available at certain points in the future (say Year 3) because of another opportunity or an obligation. Payment Plan #1 (Interest only) gets the lender only $360 in the first three years, while the other plans get the lender $832 and $888. While the mathematics are the same from an NPV perspective the cash flow is not if the lender needs $800 in 3 years.

Looked at from the borrower's perspective it is important that payment plans match ability to pay, on the one hand, and ability to borrow in the future, on the other. Thus, the back-end loaded payment plan might appear attractive (by pushing off large payment obligations); however, it will inhibit the borrower from making a second (perhaps larger and more important) loan more than would the other payment plans.

While an NPV calculation can demonstrate that these three payment plans are mathematically the same the reality is that from an entrepreneur's perspective "all loan payments are not created equal" even if the NPV is the same.

The real purpose of NPV analysis is to compare the present value of future investment opportunities. Theoretically, the present value of a future stream of cash (outgoing and incoming) must be positive to justify an investment. In other words, if a project is worth more than it costs its NPV will be positive. Three examples follow of similar cash flows, all adding to the same total cash flow over 5 years. A net present value analysis – also called discounted cash flow analysis – allows the entrepreneur to compare among these three choices.

Year	0	1	2	3	4	5	Year 0-5 Total	NPV at 12%
Case A	$ (1,000)	$ 300	$ 240	$ 240	$ 270	$ 350	$ 400	$0.18
Case B	$ (1,000)	$ 350	$ 280	$ 350	$ 280	$ 140	$ 400	$37.70
Case C	$ (1,000)	$ 350	$ 350	$ 300	$ 200	$ 200	$ 400	$40.75

Note: outgoing cash (in Year zero) is always shown as a negative, as it would in a checkbook.

Looking at these three choices, only two have a positive NPV at a 12% discount rate (the third is actually slightly positive, a $0.18). Observe what happens if the discount rate changes.

First, if it is <u>lowered from 12% to 8%:</u>

0	1	2	3	4	5	Year 0-5 Total	NPV at 8%
$(1,000)	$ 300	$ 240	$ 240	$ 270	$ 350	$ 400	$102.52
$(1,000)	$ 350	$ 280	$ 350	$ 280	$ 140	$ 400	$132.46
$(1,000)	$ 350	$ 350	$ 300	$ 200	$ 200	$ 400	$134.64

All of the choices have positive net present values.

Observe what happens, however, when our discount rate – the interest rate we need to recover in order to be profitable – rises to 16%:

0	1	2	3	4	5	Year 0-5 Total	NPV at 16%
$ (1,000)	$ 300	$ 240	$ 240	$ 270	$ 350	$ 400	($80.61)
$ (1,000)	$ 350	$ 280	$ 350	$ 280	$ 140	$ 400	($38.50)
$ (1,000)	$ 350	$ 350	$ 300	$ 200	$ 200	$ 400	($34.73)

In this case all of the choices fail the test of having a positive net present value.

What does this short exercise demonstrate?

It demonstrates that in financial analysis, in general, and in net present value analysis in particular, the choice of discount rate is crucial.

What are the factors to be considered in selecting a discount rate to apply to a project? Though oversimplified, the following information needs to be estimated.

- For the project being evaluated what portion of the project will be financed with loans? Even the best of projects rarely finance more than 70% of the cost with debt. 50%-60% is more likely.
- What will the expected interest rate be on this loan? This can usually be determined by taking the current rate offered to good credit projects and companies and adding a few percentage points (2-6) for the additional risk of this project. Or, similar projects can be researched and an interest rate inferred. An interest rate typically includes the following components:
  - Base cost of money
  - Allowance for inflation
  - Allowance for profit
  - Allowance for cost to administer the loan
  - Factor for the risk of the project.
- Expected return requirements of investors providing equity.

These three pieces of information can help determine a discount rate.
- Assume debt from lenders will be 60% of the financing.
- Conversely, equity will be 40%.
- If loans for excellent projects are being made at 7% per year in dollar terms and this project is moderately more risky than other projects (because those projects may have more creditworthy sponsors or contracts) then add 3% for additional risk.
- If investors demand 18% to provide equity (a reasonable estimate in a market where debt would cost 10-12%), then a discount rate can be estimated:
  - 60% * 10% = 6.0%
  - 40% * 18% = 7.2%
  - Combined = 13.2%

Applying this result to our previous three choices provides us with the following result.

0	1	2	3	4	5	Year 0-5 Total	NPV at 13%
$ (1,000)	$ 300	$ 240	$ 240	$ 270	$ 350	$ 400	($26.07)
$ (1,000)	$ 350	$ 280	$ 350	$ 280	$ 140	$ 400	$13.09
$ (1,000)	$ 350	$ 350	$ 300	$ 200	$ 200	$ 400	$16.37

Two of the proposals produce a positive net present value.

Must you calculate a discount rate to analyze a project or set of project alternatives? The answer is no. A companion technique – internal rate of return – allows for project analysis or the comparison of project alternatives without having a specific discount rate.

Internal Rate of Return

An internal rate of return calculation allows you to determine the interest rate that a project will earn on the original amount of capital invested. In other words it provides the discount rate that a project produces rather than applying a discount rate determined from outside the project. Unfortunately, internal rate of return – IRR – requires a calculator or a computer, whereas NPV can be prepared, if needed, with a pencil and either a formula or an interest and discount rate table.

Calculator:
- Enter Cfo (first year cash flow, which must be negative)
- Enter Cf1, Cf2 etc
- Solve for IRR

Excel:
- Enter cash flows in cells
- Open *f**
- Choose Financial
- Choose IRR
- "OK"
- Highlight values from Year 0 to Year 5
- "OK"

Year	0	1	2	3	4	5	Year 0-5 Total
Case A	$ (1,000)	$ 300	$ 240	$ 240	$ 270	$ 350	$ 400
Case B	$ (1,000)	$ 350	$ 280	$ 350	$ 280	$ 140	$ 400
Case C	$ (1,000)	$ 350	$ 350	$ 300	$ 200	$ 200	$ 400

IRR for A	12.0%
IRR for B	13.9%
IRR for C	14.1%

Debt Service Coverage

Debt Service is the amount a project pays (or proposes to pay) each year for principal and interest. An important measure of a project's ability to pay is its Debt Service Coverage; that is, the amount of debt service to be paid when compared with the funds available to pay that debt service.

If a project's income is $1,000,000 and its operating expenses are $475,000 it has $525,000 available to pay principal and interest on loans (debt service). If the project borrows $2,200,000 for 12 years at 12% interest with equal payments every year, its obligation is $355,000. When compared to the $525,000 available for debt service the project has what is called a 1.5 times debt service coverage or debt service coverage ratio or DSCR (arrived at by dividing $525,000 by $355,000).

Rarely do projects have such uniform debt service coverage calculations. For this reason analysts look at what is called Average Debt Service Coverage (the sum of all the year's available amounts divided by the sum of all the debt service payments) and examine the coverage ratios of each year. Usually, analysts will then focus on the lowest debt service coverage years as well as the average.

Year	1	2	3	4	5	6
Income	$1,000	$1,000	$1,000	$1,000	$1,000	$1,100
Operating	475	475	475	475	575	475
Avail for D/S	$525	$525	$525	$525	$425	$625
Debt Service	$355	$355	$355	$355	$355	$355
DSCR	1.5	1.5	1.5	1.5	1.2	1.8

Year	7	8	9	10	11	12	Total
Income	$1,100	$1,100	$1,100	$1,100	$1,100	$1,100	$6,100
Operating	475	475	475	575	475	475	$2,950
Avail for D/S	$625	$625	$625	$525	$625	$625	$3,150
Debt Service	$355	$355	$355	$355	$355	$355	$2,131
DSCR	1.8	1.8	1.8	1.5	1.8	1.8	1.5

Why are debt service coverage ratios important and how are they used? DSCRs are important because they tell a lender what excess exists in the event revenues or expenses are less or greater than estimated. Most lenders have a specific coverage "test" that must be met for both average and lowest year debt service coverage. If a project cannot meet these tests then a number of options exist, including:

- Lowering the amount to be borrowed (thereby increasing the amount of equity that needs to be put in a project).
- Setting up reserves or credit agreements to pay the shortfall amount in the specific year (for example, setting aside $100,000 for this purpose to cover the shortfall in year 5 in the above example).

Essentially Debt Service Coverage calculations determine how much debt a project can afford. Combined with IRR, these two tools assist the entrepreneur to determine what is practical to propose to lenders and investors.