EFR summary

Finance 1, FEB12003X

2024-2025

Lectures and Exercise Lectures 1 to 2

Weeks 1 to 2

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Details

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Finance 1 – IBEB – Lecture 1, week 1

Types of financial statements

Balance Sheet. Firm's financial position at a point in time (firm's assets and liabilities)
Income Statement. Firm's earnings (firm's revenues and expenses)
Statement of Cash Flows. Indicates the amount of cash generated by the firm.
Statement of Stockholders' Equity. Breaks down the stockholders' equity into issuing shares and retained earnings.

Statement of cash flows

Free cash flow (FCF) - the cash flow available for the company to repay creditors, pay dividends and interest to investors.

The statement of cash flow includes **3 sections:** Operating activity, investing activity, and financing activity

Factor	Location
+ EBIT x (1- Tax Rate)	Income Statement
+ Non-cash Expenses (Depreciation, Amortization, etc.)	Income Statement
- Change in (Current Assets - Current Liabilities)	Balance Sheet (current period and previous period)
- Capital Expenditures (CAPEX)	Balance Sheet: Property, Plant, and Equipment (current period and previous period)
= Free Cash Flow	

Valuation indicators

Book value versus market value

Book value: how accountants evaluate a firm based on the sum of the net profits that were not paid out as dividends over the lifetime of the company. This is the book value of the firm's equity (Equity = Assets - Liability).

Financial economists, on the other hand, assess the value of a firm's equity by looking at its **market value** (or market capitalisation). This equals # shares outstanding * stock price.

$$market - to - book\ (MB)\ ratio\ =\ market\ value\ of\ equity\ /\ book\ value\ of\ equity$$

When creditors and shareholders have more positive views on the firm's future than the suggestion from its book value, MB is often greater than 1. An obvious example is the potentially huge difference between the market value and the book value of a (great) football player.

Enterprise value: the market value of the firm's (underlying) assets that generate cash flows. This is the cost one needs to pay when taking over the enterprise.

enterprise value (EV) = market value of equity + debt - cash.

Cash here is the excess cash that is not needed for the firm's operating activities and can be paid back to investors without harming the business. This is different from working capital (cash needed to run the firm).

Risk-return relations

The higher the risk, the higher the required return.

No arbitrage

Arbitrage: without taking risks, you make a profit
No arbitrage: you cannot make a profit without taking risks

Time value of money

Financial decisions are often made by comparing values:

1. Values can be compared only at the same point in time
2. Compound cash flow to move it forward in time

$$FV_n = C * (1 + r)^n$$

3. Discount cash flow to move it backward in time:

$$PV = \frac{C}{(1+r)^n}$$

Valuing a stream of cash flows

Present value of a cash flow stream

$$PV = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n}$$

Future value of a cash flow stream

$$FV = PV(1 + r)^n$$

Annuities - Fixed period. Present value of annuity with growth

$$PV(annuity\ with\ growth) = \frac{C}{(r+g)}[1 - (\frac{1+g}{1+r})^N]$$

Perpetuities - Infinite life.

$$PV(perpetuity) = C/r$$
$$PV(growing\ perpetuity) = C/(r - g)$$

Growing perpetuity: perpetuity where the payments increase at a constant rate, g.

Discounting with the risk-free rate

Risk-free interest rate, r_f: interest rate at which money can be borrowed or lent without risk over that period

If future payments are risky, premium needs to be added to interest rate to account for riskiness (higher risk => higher interest rate).

Financial decision-making

Cost-benefit analysis for an investment opportunity can be done by calculating the Net Present Value (NPV) using the formula:

$$NPV = PV(benefits) - PV(costs)$$

NPV decision rule: invest in the alternative with the highest NPV. Choosing this alternative is equivalent to receiving its NPV in cash today.

The net present value of a stream of cash flows can be valued by summing the discounted values of each future cash flow with the appropriate interest rates regarding the time distance.

Law of one price: If equivalent investment opportunities trade simultaneously in different markets, then the price of trading should be the same everywhere. If this law does not hold, then an arbitrage opportunity exists.

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Exercise lecture 1, week 1

Introduction to financial statement analysis

Firms' disclosure of financial information

Financial statements are firm-issued accounting reports with past performance information. They are filled with the SEC (Securities and Exchange Commission). Financial statement analysis is used to compare the firm with itself over time, and compare the firm to other similar firms.

Balance sheet

A firm's balance sheet is a snapshot in time of the firm's financial position.

The balance sheet identity is given by:

Assets = Liabilities + Stockholders' Equity.

Assets: what the firm owns.

- Current assets: cash or assets that are expected to be turned into cash within a year. This category includes cash, marketable securities (short-term low-risk investments like government bonds), accounts receivable, inventories, and other current assets such as pre-paid expenses.
- Long-term assets include net property, plant, and equipment (book value=cost of acquisition-accumulated depreciation), goodwill and intangible assets and other long-term assets, such as investments in long-term securities.

Liabilities: what the firm owes.

- Current liabilities are to be paid within a year. This includes accounts payable, short-term debt/notes payable, current maturities of long-term debt, and other current liabilities such as taxes payable, wages payable.

*__Net working capital__ is the capital that is available in the short term to run the business:

Net working capital = current assets - current liabilities.

- Long-term liabilities consist of other liabilities with the maturity of longer than one year and include long-term debt, capital leases, and deferred taxes.

Stockholders' Equity: the difference between the value of the firm's assets and liabilities.

- Book value of equity can be negative because it is calculated as the difference between book value of assets and book value of liabilities. However, many of the firm's valuable assets may not be reflected in the balance sheet (for example: the firm's reputation).

- Market value of equity (Market Capitalization) = Market price per share × number of shares outstanding. This cannot be negative and often differs substantially from book value.

- Market-to-book ratio (or Price-to-book ratio)

  $market - to - book\ (MB)\ ratio\ =\ market\ value\ of\ equity\ /\ book\ value\ of\ equity$

  Value stocks: $MB\ ratio\ <\ 1$

  Growth stocks: $MB\ ratio\ >\ 1$

- Total enterprise value (TEV)

$$enterprise\ value\ (EV)\ =\ market\ value\ of\ equity\ +\ debt\ -\ cash$$

Income statement

Income statement indicates the flows of revenues and expenses over a period of time.

- An important component of an income statement is the "bottom line" (net income = earnings in a period).

Earning calculations:

Total sales/revenue
-
Cost of sales
—————————————
Gross profit
-
Operating expenses
—————————————
Operating income
+/-
Other income/expenses
—————————————
Earnings before interest and tax (EBIT)
+/-
Interest income/interest expenses
—————————————
Pre tax income
-
Taxes
—————————————
Net income

Net income/No of shares outstanding = EPS

Statement of Cash Flows

Net income typically does not equal the amount of cash the firm has earned, because it includes non-cash expenses such as depreciation and amortization, and excludes cash uses such as investment in property, plant, and equipment or expenditures on inventory.

A statement of cash flows can be used to calculate free cash flows (FCF) and enterprise value. It includes three sections:

1. Operating Activity: Adjusts net income for all non-cash items related to operating activities and changes in net working capital.
Adjustments:

- Depreciation / amortization: add the amount of depreciation / amortization (as a non-cash expense)
- Account receivable: deduct the increases (as the cash is not yet been received)
- Accounts payable: add the increases (cash have not been paid yet)
- Inventories: deduct the increases (any increases in inventory are paid by cash)

2. Investment Activity: all cash required for investment activities

- Capital expenditures (purchasing PPE)
- Trading of marketable securities
- Acquisition related expenditures

3. Financing Activity:

- Payments of dividends (cash outflow, therefore is deducted)
  retained earnings = net income - dividends
- Changes in borrowings (increases in borrowings are cash inflows)

Financial decision-making and law of one price

Financial decision making: Investment should be made when $PV(benefits) > PV(costs)$.

$$NPV = PV(benefits) - PV(costs) \rightarrow NPV > 0$$

Arbitrage refers to taking advantage of the price difference when buying and selling equivalent goods in different markets. An arbitrage opportunity occurs when it is possible to make a profit without taking any risk or making any investment.

Normal market is a competitive market in which there is no arbitrage opportunity.

Law of One Price: If equivalent investment opportunities are traded at the same time in different normal markets, then they must trade for the same price in both markets.

Time value of money

PV shortcut formulas

Perpetuities

- Constant cash flow: $PV = \frac{C}{r}$
- Growing cash flow: $PV = \frac{C}{(r-g)}$

Annuities

- Constant cash flow: $PV = \frac{C}{r} \times \left[1 - \frac{1}{(1+r)^n}\right]$
- Growing cash flow: $PV = \frac{C}{r-g} \times \left[1 - \left(\frac{(1+g)}{(1+r)}\right)^n\right]$
  (g=growth rate; n=number of periods; C=cash flow; r=interest rate)

Type of cash flows	Constant cash flows	Growing cash flows
Perpetuities *(last forever)*	$g = 0, n \to \infty$ $PV\ (perpetuity) = \frac{C}{r}$	$g < r, n \to \infty$ $PV\ (growing\ perpetuity) = \frac{C}{(r-g)}$
Annuities *(N periods)*	$g = 0, n \to N$ $PV\ (annuity) = \frac{C}{r} \times \left[1 - \frac{1}{(1+r)^N}\right]$	$n \to N$ $PV\ (growing\ annuity) = \frac{C}{r-g} \times \left[1 - \left(\frac{(1+g)}{(1+r)}\right)^N\right]$

Interest rates

Effective Annual Rate (EAR) indicates the total amount of interest that will be earned at the end of one year. Typically used in present value calculations for yearly cash flows as it considers the effect of compounding. Also referred to as the Effective Annual Yield (EAY) or Annual Percentage Yield (APY).

Annual Percentage Rate (APR) indicates the amount of simple interest earned in one year.

Simple interest is the amount of interest earned without the effect of compounding. The APR is typically less than the EAR.
* Note that the APR cannot be used as a discount rate without adjustments made.

The APR with k compounding periods is a way of quoting the actual interest earned each compounding period:

$$Interest\ Rate\ per\ Compounding\ Period\ =\ APR\ /\left(\frac{k\ periods}{year}\right)$$

To convert an APR to an EAR, we can use the following formula:

$$1\ +\ EAR\ =\left(1\ +\frac{APR}{k}\right)^{k}$$

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Lecture & Exercise lecture 2, week 2

Valuing bonds

Bond: A tradable loan, which generally has a fixed maturity and fixed coupon payments (cash flow stream).

2 types of bonds

1. Zero coupon bond: Offers a single payment.

- Purchaser pays the price of the bond
- The bond promises in K-year to pay the bondholder a single payment, called face value (par value)
- The date of this payment is called the maturity date. K is the time to maturity

2. Coupon bond: Zero coupon bonds with additional periodic payments

- The bond promises in K-year to pay the bondholder a single payment, called face value
- The date of this payment is called the maturity date. K is the time to maturity
- Additional coupons: At regular intervals until maturity, the bondholder receives a coupon payment
- Coupon rate: the ratio of total annual coupon to face value

Bond price: present value of cash flows

Step 1: Identify all cash flows
Step 2: Discount these cash flows using rules of time travel. For very long-term bonds, we can use the annuity formula for the coupons + present value of final payment of face value

- Annuity without growth

$$PV_A = \frac{C}{r}\left[1 - \left(\frac{1}{1+r}\right)^T\right]$$

- Bond value = PV (coupon value)+ PV (face value)

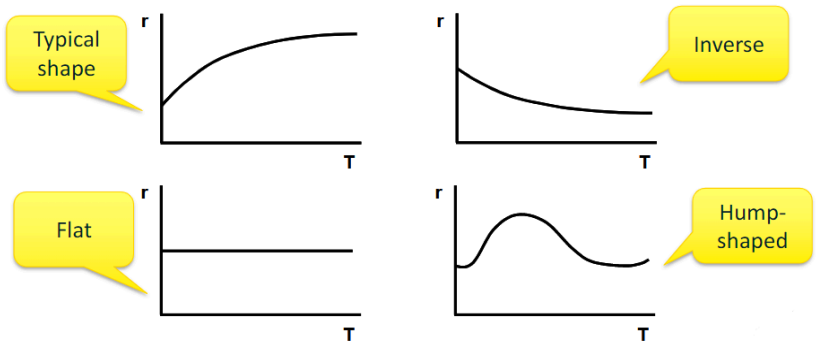
$$PV_B = \frac{Coupon}{r}\left[1 - \left(\frac{1}{1+r}\right)^T\right] + \frac{Face\ value}{(1+r)^T}$$

What drives bond prices

1. Interest rate

When interest rates rise, bond prices typically decline.

Term structure of interest rates indicates how interest rates vary with the maturity at one point in time. The most typical case depicts an upward-sloping term structure, because the longer the time until maturity the higher the interest rate.



2. Risk of default

The possibility of default adds a credit spread, increasing the required return and lowering the bond's price.

$$Price = \sum_{t=1}^{T} \frac{Face\ value}{\left(1+r_f+credit\ spread\right)^t}$$

Bond price: yield to maturity

The bond **yield** is another way to express the bond price:

$$Price = \sum_{t=1}^{T} \frac{C_t}{(1+r_t)^t} = \sum_{t=1}^{T} \frac{C_t}{(1+YTM)^t}$$

*YTM: weighted average of spot rate used for discounting.

Spot rates and forward rates

The difference between the spot rate (r) and forward rate (f) is that the spot rate always starts at time t=0 and lasts until a further point in time regardless how far this point is. But forward rates last from one point in time to the next point in time.

The law of one price must hold, therefore the general formula for period n:

$$(1 + f_{n-1,n}) = (1 + r_n)^n / (1 + r_{n-1})^{n-1}$$

Investment decision rules

1. Net present value (NPV)

$$NPV = \sum_{t=0}^{T} CF_t / (1 + R_t)^t = -INV_0 + \sum_{t=1}^{T} CF_t / (1 + R_t)^t$$

Choose the investment with the highest NPV

Complexities in Using NPV

1. Comparing projects with varying durations.
2. Capital constraints

Duration of the projects

When choosing from the projects with different duration, we have to extend the timeline of the projects as fair comparison can be done only if periods are equal.

Capital constraints

Sometimes firms have many positive NPV projects and they can't invest in all of them simultaneously

To tackle this, we take the following steps:
Step 1: Form all possible combinations between available projects
Step 2: Cancel those combinations that are impossible due to limited budget
Step 3: Choose the combination with the highest NPV

Profitability index (NPV per constrained resource) = NPV/Investments

It can be used to identify the optimal combination of projects to invest in under the budget constraint. Rank projects by PI and select the ones with the highest indicator.

$$PI = \frac{value\ created}{resource\ consumed} = \frac{NPV}{resource\ consumed}$$

Strengths of using NPV

- Often right and unambiguous
- Incorporates time value of money
- Easy to compare between projects
- Takes investment size into account
- Can compare one large project versus several smaller ones

Weakness:

- Needs an appropriate discount rate

2. Payback period

The payback period (PBP): The amount of time it takes to recover or pay back the initial investment
=> If the payback period is less than a pre-specified length of ime, you should accept the project. Otherwise, you reject it

Formula:

$$INV_{t=0} \leq \sum_{t=1}^{PBP} CF_t$$

Pitfalls of the PBP method

- Ignores the project's capital cost and value of money
- Ignores cash flows after the payback period

Even though the answer is not always correct, this alternative method is used because of uncertainty in the long run, because the future is hard to predict.

3. Internal rate of return (IRR)

Internal rate of return (IRR) is the interest rate at which the NPV of an investment project equals zero.

- Invest if IRR > capital cost and don't invest if IRR < capital cost
- If $IRR > r$ this indicates that $NPV > 0$ and hence it is attractive to do the project.
- Choose the project with the highest IRR

The IRR can only be deduced by trial and error and the formula is such that:

$$0 = \sum_{t=0}^{T} CF_t / (1 + IRR)^t$$

Pitfalls of the IRR method: It ignores the size of a project, and with longer duration projects where reinvestment is assumed this might be a disadvantage. In case of

positive and negative cash flows there is a possibility for multiple IRRs to exist with positive and negative interest rates when NPV is zero.

Capital budgeting

The process of analyzing investment opportunities and deciding which one to choose is called capital budgeting.

Incremental cash flows = the difference between doing and not doing the project.

Cannibalization occurs when the introduction of a new product has an adverse impact on the sales of existing products.

Opportunity cost - the revenue that could have been earned with an alternative use of the asset.

Sunk costs - unrecoverable costs that are already incurred and therefore irrelevant for the decision making.

$$net\ working\ capital = current\ assets - current\ liabilities$$

$$Free\ Cash\ Flow = (Revenues - Costs - Depreciation) \times (1 - \tau) + Depreciation - \Delta NWC - CapEx$$

Dealing with uncertainty

- **Break-even** analysis: this analysis finds the value of a parameter for which the $NPV = 0$. After this we can determine how likely it is that the parameter value is below or above the break-even amount
- **Sensitivity** analysis: input assumptions in this analysis will be changed within a plausible range, which will affect the NPV.
- **Scenario** analysis: in this analysis, the values of parameters will be determined for multiple scenarios, like a best case and worst case. These scenarios will be compared by their NPV when multiple parameters are changed at the same time.

Valuing stocks

For bonds, the cash flows were known, they consisted of coupons and a principal. But stock only pays dividends, we get the value of what is left of the earnings of a company, which are not known in advance.

Terminology

- Common Stock: security representing a share in the ownership of a corporation.
- Initial Public Offering: the first sale of stock in a corporation to the public.
- Secondary Market: a market, often a stock exchange, in which previously issued shares are traded amongst investors.
- Dividends: payments made by companies to shareholders.
- Dividend yield: ratio of annual dividend to share price. There are different types (for example, stock or cash; preferred and common)
- P/E Ratio: share price divided by earnings per share (price-to-earnings)

Two ways to estimate the value of a stock: **Dividend Discount Model (DDM)** or estimating the **value using comparable firms**.

Dividend Discount Model (DDM)

$R_E = R_t + \ equity\ risk\ premium;\ P_0 = \frac{div_1}{1+r_E} + \frac{P_1}{1+r_E} \Rightarrow r_E = \frac{div_1}{P_0} + \frac{P_1 - P_0}{P_0}$

where $\frac{div_1}{P_0}$ represents dividend yield, and $\frac{P_1 - P_0}{P_0}$ the capital gains rate. If we assume there will be no dividend growth, we use the following formula to calculate the value of a stock:

$$P_0 = \sum_{t=1}^{\infty} div\ /\ (1 + R_E)^t$$

The **Gordon growth model** assumes a constant dividend growth, g, shown in the formula:

$$P_0 = \sum_{t=1}^{\infty} (div \times (1 + g)^{t-1})/\ (1 + R_E)^t = \frac{div}{R_E - g}$$

Disadvantages of this model: Everything is very dependent on the first dividend forecast, if this is wrong, this has a big impact on the value of the stock. Also, the growth rate cannot be bigger than the equity cost of capital here.

Multiple valuation of comparable stocks

A company does not have to pay all earnings, they can keep them as retained earnings, which they can use for new investments.

$$div_t = EarningsPerShare_t \times Dividend\ payout\ rate\ (k)_t$$

$$EPS = \frac{earnings_t}{shares\ outstanding}$$

By combining this formula with dividend discount model we can arrive at P/E ratio:

$$\frac{Price}{Earnings} = \frac{k}{R_E - g}$$

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