Financial Theory – Lecture 1

Fredrik Armerin, Uppsala university, 2024

Agenda

- Choice under certainty.
- Basics of financial securities and markets.

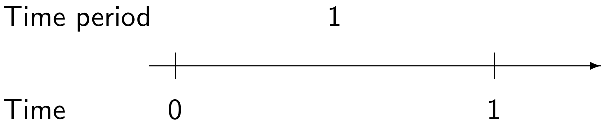
The second part of the lecture is based on

- Sections 1.1-1.7 in the course book.

Choice under certainty

Consider the following situation:

- A consumer lives for one period.



  Note the difference between a time and a time period.

- The consumption at time t is chosen at time t, and is denoted c_t. In this model $t = 0, 1$.

Choice under certainty

- The individual has income e_t at time $t = 0, 1$.
- There is a bank account with interest rate r that the individual can use to lend and borrow money.

The income e_0 is diveded into consumption and savings S:

$$e_0 = c_0 + S.$$

Choice under certainty

The individual's consumption at time 1 is given by

$$c_1 = e_1 + S \cdot (1 + r).$$

That is

$$\begin{aligned} \text{Time 1 consumption} &= \text{Time 1 income} \\ &\qquad + (\text{Amount saved at time 0}) \cdot (1 + r). \end{aligned}$$

Note that S can be both positive and negative, while $c_0, c_1 \geq 0$.

The consumer can choose any non-negative pair (c_0, c_1) such that

$$c_0 + S = e_0 \quad \text{and} \quad c_1 = e_1 + S(1 + r).$$

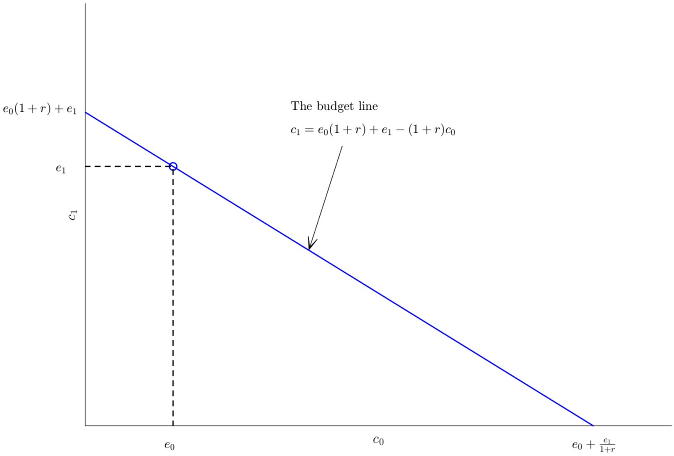
Now, since $c_0 + S = e_0$ we can write $S = e_0 - c_0$. This gives

$$\begin{aligned} c_1 &= e_1 + S(1+r) \\ &= e_1 + (e_0 - c_0) \cdot (1+r) \\ &= e_0(1+r) + e_1 - (1+r)c_0. \end{aligned}$$

This is the budget line.

$$c_1 = \underbrace{e_0(1+r) + e_1}_{\text{Intercept}} \underbrace{-(1+r)}_{\text{Slope}} c_0.$$

Choice under certainty



The budget line

$$c_1 = e_0(1+r) + e_1 - (1+r)c_0$$

can be written

$$c_0 + \frac{c_1}{1+r} = e_0 + \frac{e_1}{1+r}.$$

The interpretation of this is

Present value of consumption = Present value of income.

Choice under certainty

Given the budget contraint, we need to choose the optimal consumption (c_0, c_1).

The choice of consumption will depend on the individual's preferences, and will in general be different for different individuals.

The preferences are represented by a utility function, and we can found the optimal consumption pair by using indifference curves.

Choice under certainty

The individual wants to solve the optimisation problem

$$\max_{c_0, c_1} U(c_0, c_1) \quad \text{subject to} \quad c_0 + \frac{c_1}{1+r} = e_0 + \frac{e_1}{1+r},$$

where $U(c_0, c_1)$ is the utility of consuming the pair (c_0, c_1).

To do this we form the Lagrangian:

$$L = U(c_0, c_1) + \lambda \left(e_0 + \frac{e_1}{1+r} - c_0 - \frac{c_1}{1+r} \right).$$

The first-order conditions are

$$\begin{aligned}
\frac{\partial L}{\partial c_0} &= \frac{\partial U}{\partial c_0} - \lambda = 0 \quad \Leftrightarrow \quad \frac{\partial U}{\partial c_0} = \lambda \\
\frac{\partial L}{\partial c_1} &= \frac{\partial U}{\partial c_1} - \frac{\lambda}{(1+r)} = 0 \quad \Leftrightarrow \quad \frac{\partial U}{\partial c_1} = \frac{\lambda}{(1+r)} \\
\frac{\partial L}{\partial \lambda} &= e_0 + \frac{e_1}{1+r} - c_0 - \frac{c_1}{1+r} = 0.
\end{aligned}$$

Choice under certainty

The two first conditions can be combined to

$$\frac{\frac{\partial U}{\partial c_0}}{\frac{\partial U}{\partial c_1}} = 1 + r.$$

Fixing a utility level $\overline{U}$,

$$\overline{U} = U(c_0, c_1),$$

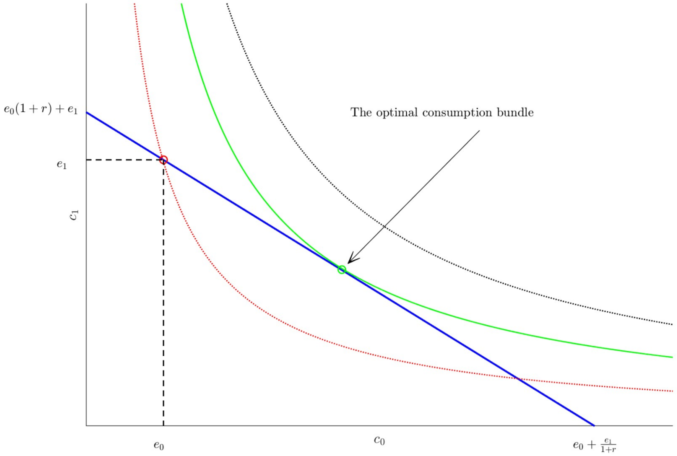
we get

$$0 = \frac{\partial U}{\partial c_0} dc_0 + \frac{\partial U}{\partial c_1} dc_1 \quad \Rightarrow \quad \frac{dc_1}{dc_0} = -\frac{\frac{\partial U}{\partial c_0}}{\frac{\partial U}{\partial c_1}}.$$

Hence, at optimum,

$$\frac{dc_1}{dc_0} = -(1 + r) \;\longleftarrow\; \text{Slope of the budget constraint.}$$

Choice under certainty



Choice under certainty

If there was no capital market (in this example represented by the bank account), then we have to consume

$$c_0 = e_0 \text{ and } c_1 = e_1.$$

The introduction of a capital market results in the possibility to choose a consumption pair (c_0, c_1) that can give the individual a higher utility than the original one.

Choice under certainty

Compare this situation to the one you have seen in the courses in microeconomics:

$$\max_{x_1,x_2} U(x_1, x_2) \ \text{ subject to } \ p_1 x_1 + p_2 x_2 = m.$$

Recall our optimisation problem:

$$\max_{c_0,c_1} U(c_0, c_1) \ \text{ subject to } \ 1 \cdot c_0 + \frac{1}{1+r} \cdot c_1 = e_0 + \frac{e_1}{1+r}.$$

- The price of consumption at time 0 is 1.
- The price of consumption at time 1 is $\frac{1}{1+r}$.
- The income is $e_0 + \frac{e_1}{1+r}$.

Financial markets

From Munk (p. 1):

> *A financial market is simply a market in which one or more financial assets are traded.*

A market can be physical or electronic. Nowadys they are mainly electronic.

- Primary markets: Issuance of new securities.
- Secondary markets: Trading of previously issued securities. Often on an exchange.
- Over-the-counter (OTC) markets: Trading issued securities that are not traded on an exchange.

Financial markets

On a financial market suppliers of capital (who presently has an excess of capital) meet with users of capital (who presently need capital).

Capital is transferred both across time and across different countries and/or industries.

A financial market can also be used to transfer risk between different participants, pool resources and provide information.

Finally,

> *Financial markets are closely linked to the macroeconomy.*

(Munk, p. 17.)

Securities

A security can be seen as a contract that gives the right to receive future benefits under some set of conditions.

There are many different types of financial assets – created in order to fulfill one or more demands of the buyer or seller.

Common types of securities are:

- Stocks.
- Bonds.
- Derivatives.

Stocks

- Also referred to as "common stock".
- Represents a share of the ownership of a company.
- Cash flows generated by holding a stock are the dividends paid out.
- An owner of a stock, also known as a shareholder, has limited liability.
- On the other hand, the shareholders are residual claimants to the company's assets.

Bonds and other debt-related securities

By issuing a bond, an entity (a company, a government, a municipality,...) can borrow money from investors.

The investor gets interest rate payments (called coupons) and at the maturity date the borrowed amount, known as the face value of the bond, is paid back.

There are other debt intruments – we will return to them when we discuss how bonds are valued.

- Money market: Debt instruments where all payments are within a year of issuance.
- Fixed-income market: Debt instruments where at least one payment is at a time over a year from the issuance.

Derivative securities

Financial instruments whose value depend on one or more "underlying".

Examples of underlyings are stocks, interest rates and exchange rates.

Examples of derivates:

- Forward contracts.
- Futures contracts.
- Options.
- Swaps.

They are treated in Chapter 14-15 in Munk, and are not included in this course.

Alternative asset classes

Other asset classes than the previous mentioned are usually referred to as alternative asset classes.

They include:

- Commodities.
- Real estate.
- Infrastructure.

Indirect investing

Instead of buying financial assets directly, they can be bought indirectly.

- Mutual funds.
- Exchange-traded funds (ETFs).
- Real estate investment trusts (REITs).

Main players

Governments, municipalities and other public offices
Mostly demand capital by issuing bonds to finance budget deficits. Some countries have sovereign wealth funds which supplies capital to the market

Central banks
Controls a country's supply of money. By allowing commerical banks to borrow money from the central bank the money supply increases, and by letting them lend money to central bank the money supply decreases.

Central banks can buy financial intruments in the market (quantitative easing).

Main players

Other players

- Financial intermediaries.
  - Commercial banks.
  - Investment banks.
  - Pension funds.
  - Hedge funds.
- Foundations and endowments.