

# Money and Financial Markets

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## Outline:

1. Financial Markets from a Macroeconomic Viewpoint
  - 1.1 Overview over Financial Markets
  - 1.2 Interest Rate Theory
  - 1.3 Function and Measurement of Money
2. Theory of Financial Structure
  - 2.1 Financial Intermediates
  - 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity
  - 2.3 Adverse Selection Problems
  - 2.4 Moral Hazard Problems
3. The Money Supply Process
  - 3.1 Creation of Central Bank Money (Money Base)
  - 3.2 Multiple Deposit Creation and the Multiplier
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4. Theory of Money Demand
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5. Central Banking and Transmission of Policy
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6. Monetary Macroeconomics
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  - 6.2 New Keynesian Macroeconomics
7. International Aspects
  - 7.1 Markets for Foreign Exchange
  - 7.2 Exchange Rate Theory
  - 7.3 Monetary Policy in an Open Economy

## Basic Literature:

- ▶ Mishkin, Frederic S. (2006), *The Economics of Money, Banking, and Financial Markets*, 7<sup>th</sup> ed., Boston et al: Pearson International Edition.
- ▶ Bailey, Roy E. (2005), *The Economics of Financial Markets*, Cambridge: Cambridge University Press.
- ▶ Bofinger, Peter (2001), *Monetary Policy: Goals, Institutions, Strategies, and Instruments*. Oxford: Oxford University Press.

References to more specific literature can be found in the slide collection.

# Motivation

## Why study Money and Financial Markets?

Markets for bonds, stocks, loans etc. are essential for economic activity:

- ▶ capital allocation:  
transferring funds from saver/lender to investor/borrower
- ▶ risk allocation:  
risk sharing, diversification, asset transformation
- ▶ transferring liquidity
- ▶ providing information (e.g. via interest rates and stock prices)

# Motivation

## Why study Money and Financial Markets?

- ▶ Understanding how agents and institutions behave on these markets (e.g. bank management of assets and liabilities).
- ▶ Understanding the processes on these markets (e.g. issues of expectation formation, pricing, stability/fragility).
- ▶ Impact of financial transactions on the real sphere (e.g. via interest rates, exchange rates, credit supply).
- ▶ How money is created and how money supply affects inflation and income.
- ▶ Understanding central bank policy and its effects on inflation and the real sphere.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### Outline:

1.1.1 Asset Market Classifications

1.1.2 Bond Markets

1.1.3 Loan Markets

1.1.4 Equity Markets

1.1.5 Further Markets

### *Basic literature:*

Mishkin (2006), chapter 2 and parts of chapter 5

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

**(Financial) Asset:** Financial instrument, type of a financial property. The sum of all assets is the financial wealth.

*Examples:* Currency, checkable deposits, bonds, stock shares, claims from loan contracts,...

Different assets have different properties:

- ▶ **Expected returns** (interest rates, difference in buying and selling price) – an increase in expected returns makes an asset c.p. more attractive = demand will increase
- ▶ **Risk** (returns may have a variance, possible covariance with other assets) – an increase of risk makes an asset c.p. less attractive = demand will decrease
- ▶ **Liquidity** (how fast can the asset be sold or used for transactions) – the more liquid the asset is c.p., the more attractive it is = demand will increase

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

Assets are traded on **asset markets**: In contrast to goods markets (“producer”, “consumer”) it is possible that an individual or an institution is on the supply *and* the demand side.

Economic theory is interested into the questions (e.g.):

- ▶ How do different types of agents (e.g. banks, non-banks) structure their balance sheet = how do they behave on the demand and supply side on the asset markets?
- ▶ How can the price movements in aggregated markets be explained?

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

#### a) Debt and Equity Markets

##### Debt:

- ▶ Contractual agreement, where the borrower pays the holder of the asset a fixed amount (interest rate) per period until a specified expiration date (maturity date). The borrowed amount is returned until (or at) the maturity date.
- ▶ The maturity of a debt is the time until the expiration date (*short-term* < 1 year, *long-term* > 10 years)
- ▶ *Examples:* Consumer loans/credits, mortgages, bonds
- ▶ Depending on the contract, the borrower can sell the asset, especially bonds.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

#### Equity:

- ▶ The buyer of an equity has a claim to share the net income and the assets of the seller's business. The net income is an uncertain residual and is often payed as dividends. The instrument has usually no expiration date, hence the funds are not returned to the holder of the equity.
- ▶ *Example:* Stock shares
- ▶ The holder of an equity can sell the asset e.g. on the stock exchange market.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

#### **Advantages and disadvantages:**

- ▶ Debt: Regular payments are more or less certain (unless the debtor stays solvent).
- ▶ Equity: Residual payments are uncertain. “Residual” means that the firm has to pay the debtors (and taxes) first.
- ▶ Debt: Return of the borrowed amount is more or less certain. In case of insolvency the creditor has a prior claim on the remaining assets.
- ▶ Equity: The selling price of an equity asset is uncertain. Hence, the return of the invested amount is uncertain. Secondary claim on remaining assets in case of insolvency.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

#### **Advantages and disadvantages: (cont.)**

- ▶ Debt: Holder do not profit from increasing profitability and increasing firm value since their payments are fixed.
- ▶ Equity: The holder profits directly by higher dividends and increased value of their shares.
- ▶ Debt: Holder has not the right to vote about management issues and about the distribution of the net income of the firm.
- ▶ Equity: Holder has these rights.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

## b) Primary, Secondary and Derivative Markets

### Primary Market:

- ▶ New issues of assets are sold to initial buyers.

*Example:* Firm sells new stock shares or new bonds to an investment bank; a bank and a firm sign a new loans contract; the central bank issues currencies by open market operations.

### Secondary Markets:

- ▶ Once an asset has been issued it can be traded at the current price. The transactions are often performed by brokers instead of the asset holders themselves.

*Example:* Stock exchange, foreign exchange.

### Derivative Markets:

- ▶ Not the assets themselves are traded but other claims related to the underlying assets, e.g. the *right* to buy a certain asset to a certain price within a certain period.

*Example:* Options, Futures.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

- ▶ Secondary markets make assets more **liquid**: A contract can be sold to a current price. Increasing liquidity makes the assets more desirable.
- ▶ On secondary markets the price is determined by the **flow of information** as well as by *expectations* of many agents. In efficient markets the price reflect the risk-return performance of an asset due to new information. The (expected) price on secondary markets also determine the price on the primary market.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

#### c) Exchanges and OTC Markets (→ secondary markets):

##### Exchange:

- ▶ Organized centralized trading of assets, high transparency of bids, asks and price setting, very competitive, almost arbitrage-free.

##### Over the counter (OTC):

- ▶ Decentralized market where the seller sells the assets “over the counter” to any buyer. Since OTC dealers are connected by computer networks, there is also a high price transparency and competitiveness.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.1 Asset Market Classifications

#### d) Money and Capital Markets:

##### Money Market:

- ▶ Short-term contracts (maturity  $< 1$  year) with high liquidity

##### Capital Markets:

- ▶ Long-term contracts (maturity  $> 1$  year, assets without expiration date like stock shares)

Note, that this definition of a “money market” differs from the term as used in macroeconomics where “money” is defined in a specific manner.

Sometimes “money market” = market for central bank reserves (e.g. interbank market).

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.2 Bond Markets

Bonds are issued by firms (corporate bonds) or by government (governmental, treasury, municipal bonds).

Two types of bonds:

- ▶ **Coupon-bond:** The owner of the bond receives a fixed payment per year (coupon rate) until the maturity date. At the maturity date the specified final amount (face value, par value) is paid. Special case: perpetuity bond without an expiration date.
- ▶ **Discount bond** (zero-coupon bond): There is no coupon interest rate. The bond is sold to a price below the face value. At the maturity date the owner receives the face value.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.2 Bond Markets

Interest rate  $i$  when holding the bond until maturity:

$$P_0 = \frac{F}{(1+i)^n} + \sum_{t=1}^n \frac{C}{(1+i)^t}$$

with  $P_0$  = bonds price in  $t = 0$ ,  $F$  = face value,  $C$  = coupon rate,  $n$  = maturity date.

Expected return  $r$  when holding the bond for one period (before maturity, without discounting):

$$r = \frac{C + P_{t+1} - P_t}{P_t}$$

where  $P_{t+1}$  is the *expected* bonds price in  $t + 1$ .

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.2 Bond Markets

- ▶ In both formulas there is an inverse relationship between interest rate/return and the bonds price.
- ▶ If the interest rate is lower than expected return it would be profitable for all bonds holders to hold the bond only for one period and to sell it in  $t + 1$ . Therefore, it can be expected that  $P_{t+1}$  will fall, which results in a decreasing  $r$ . In the opposite case, the holders would decide to hold the bond for a longer time (until maturity). The prices in  $t + 1$  will therefore rise until  $i$  and  $r$  will be equal.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.2 Bond Markets

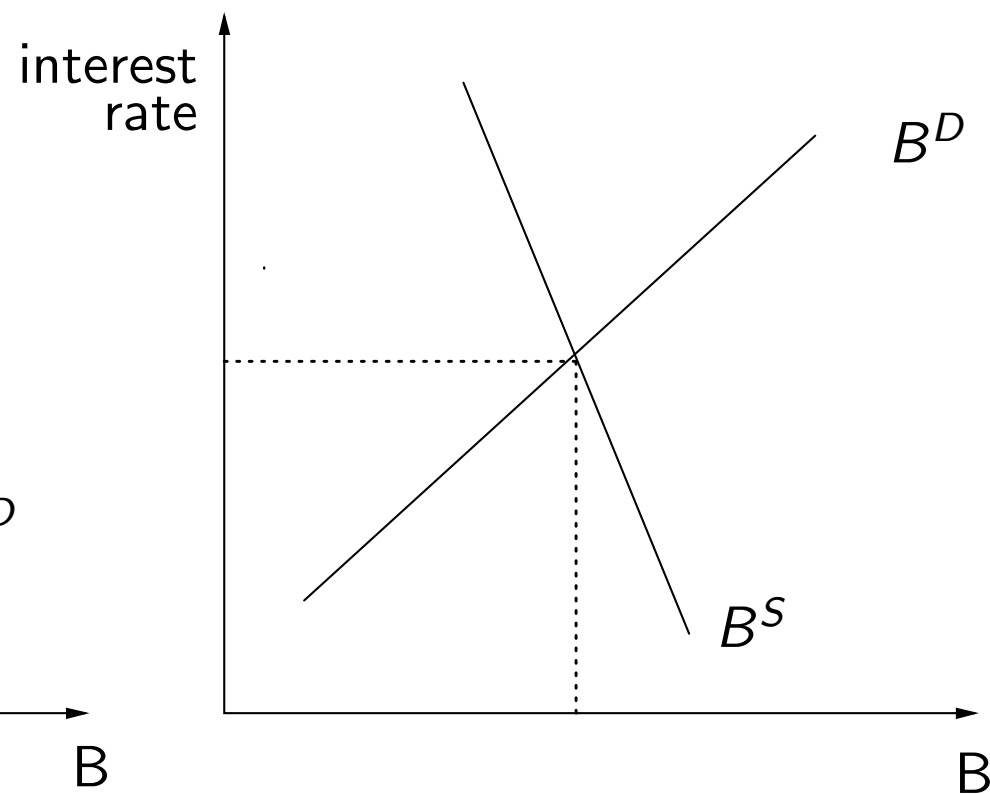
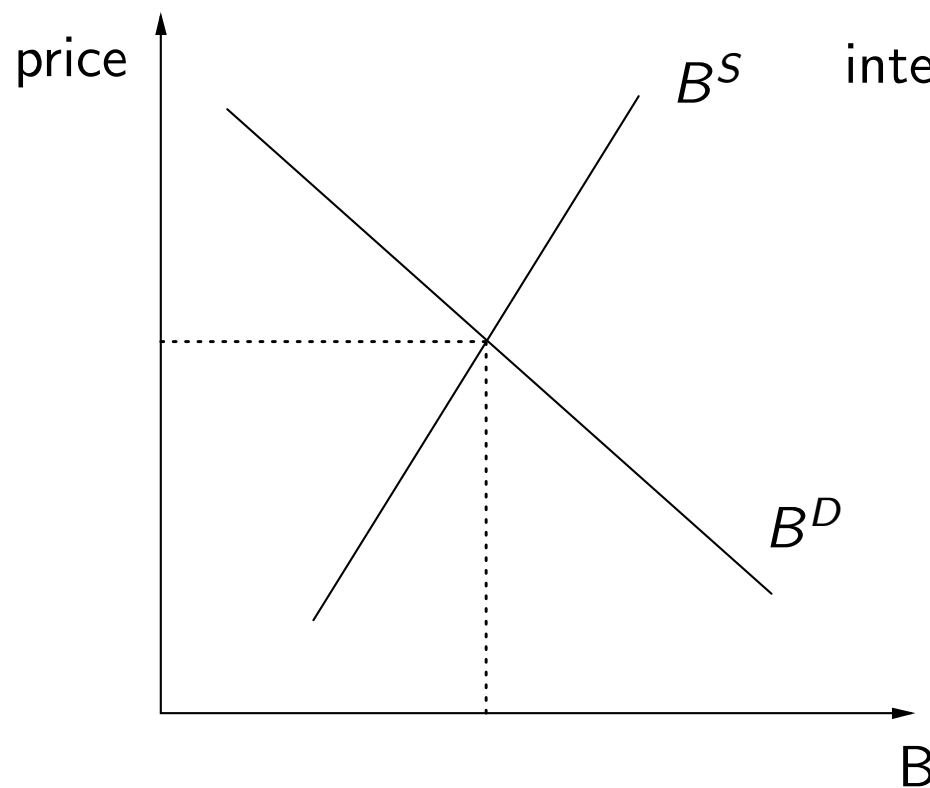
Slope of demand and supply curves:

- ▶ The demand for bonds is negatively correlated with the bonds price but positively correlated with the interest rate  $i$ .
- ▶ If the interest rate is low and – vice versa – the bonds price is high it is more attractive for governments, firms or institutions to issue bonds to finance their activities. The supply curve can be assumed to be downward sloped in  $i$ . Alternatively, in the short run the bonds supply can be assumed to be exogenously fixed.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.2 Bond Markets



# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.3 Loan Markets

#### Types of loans:

**Simple loan:** The borrowed amount  $L$  is paid back plus interest payment  $IP$  at the maturity date  $n$ . The interest rate  $i$  then solves:

$$L = \frac{L + IP}{(1 + i)^n}$$

**Fixed-payment loan:** Borrowed amount is paid back including interest in fixed payments  $FP$  (amortisation plus interest) per period until maturity date. The interest rate  $i$  then solves

$$L = \sum_{t=1}^n \frac{FP}{(1 + i)^t}$$

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.3 Loan Markets

- ▶ **Solvency:** Ability of the borrower to pay back the loan plus interest.
- ▶ **Risk:** Probability distribution for the cases that the borrower is able to pay back  $\alpha$  percent of loan plus interest; typical measure for risk: variance.

*Example:* Full return (probability  $p$ ) versus total loss (probability  $1 - p$ )

*Expected return:*  $r = pi + (1 - p)(-1)$

*Variance of return:*  $\sigma_r^2 = p(i - r)^2 + (1 - p)(-1 - r)^2$

(If  $p = 1$  then  $r = i$  and  $\sigma_r^2 = 0$ )

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.3 Loan Markets

- ▶ Borrower has to provide **collaterals**. The lender can claim the collateral in case of insolvency.
- ▶ In case of **mortgages** the borrower is not allowed (or it is not possible) to sell the collateral. The lender has the right to claim the collateral unless the loan is fully returned.
- ▶ There is **asymmetric information** about  $p$  before the contract (adverse selection problem), and after the contract when the loan is used to finance an uncertain project (moral hazard problem). See section 2.3 – 2.4.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.4 Equity Markets

- ▶ **Stock shares** as the most common type of equities.
- ▶ An owner of a stock share has
  - ▶ claims on the net residual profits → occasionally paid dividends.
  - ▶ claims on the “firm value”.
- ▶ What is the “firm value” ?
  - ▶ Net present value of expected cash flow?
  - ▶ Value of the physical and non-physical assets? (Knowledge base, patents, reputation)?
- ▶ Different models on pricing stock shares
- ▶ Problems:
  - ▶ Expectations depend sensitively on news flow.
  - ▶ Expectations may be driven by less rational determinants (moods, herding effects etc.)
  - ▶ Expectations are a source of speculation, speculation may drive the prices, price movements confirm speculation (→ bubbles).
- ▶ High volatility of stock prices, high risk.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.4 Equity Markets

A case for bubbles? (Dow Jones Index, logarithmic scale)



# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.4 Equity Markets

A case for bubbles? (Intershop Communications stock shares)



# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.5 Further Markets

#### Options:

- ▶ Option contracts are derivatives.
- ▶ The holder of an option has the *right* (not the obligation) to buy or to sell an underlying asset (e.g. stock shares, bonds, foreign exchange, oil, crop,...) to a predetermined price until a defined expiration date.
  - Buy = call option
  - Sell = put option
- ▶ The option itself can be traded. The institution which issues the option has the obligation to buy/sell the underlying asset if the holder of an option wishes to exercise his right.
- ▶ The pricing of options is complicated and is not addressed in this lecture. The volatility of option prices is high. If the right is not exercised until the expiration date (this can be rational!) there is a 100% loss for the buyer of the option.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.5 Further Markets

#### Futures:

- ▶ Future contracts are derivatives similar to options.
- ▶ The main difference is that buyer and seller are *obliged* to execute the transaction (and option holder has only the *right* to do that).
- ▶ The date of transaction is determined in the contract.

#### Why options and futures?

- ▶ Derivative contracts are like “bets” when expectations of buyers and sellers are divergent. Due to leverage effects there is a potential for high profits from speculative derivative contracts. Hence it is an instrument to incorporate more information into the price system.
- ▶ Derivatives can be used to hedge risks of the underlying asset. E.g. the holder of a stock may buy “put options” to ensure that he can sell the stock for a price which can not undercut a certain limit.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.1 Overview over Financial Markets

### 1.1.5 Further Markets

#### Foreign Exchange Markets:

- ▶ Foreign exchange/currency are also assets.
- ▶ Transactions on foreign exchange markets can be caused by underlying transactions on goods or capital markets (e.g. change sale earnings into domestic currency, demand for foreign exchange in order to pay back a loan).
- ▶ Transactions can also be caused by the expectation that the demanded foreign exchange will appreciate (speculation).
- ▶ There are *spot* markets and *future* markets for foreign exchange. The latter can e.g. be used for hedging the risks of an underlying transaction on the goods market.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### Outline:

1.2.1 Behavior of Interest Rates

1.2.2 Risk Structure of Interest Rates

1.2.3 Term Structure of Interest Rates

### *Literatur:*

Mishkin (2006), chapter 4, 5, parts of chapter 6

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.1 Behavior of Interest Rates

Equilibrium interest rates for bonds changes with....

- ▶ ... demand shifts by Net Financial Wealth (+), expected inflation (-), changes in expected returns (+), risk (-), liquidity (+) of bonds (or vice versa in case of alternative assets).
- ▶ ... supply shifts by changed profitability of investment opportunities (+), expected inflation (+), governmental activities (deficit spending) (+).

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.1 Behavior of Interest Rates

#### The role of expected inflation

- ▶ Real interest rate = nominal interest rate - inflation rate

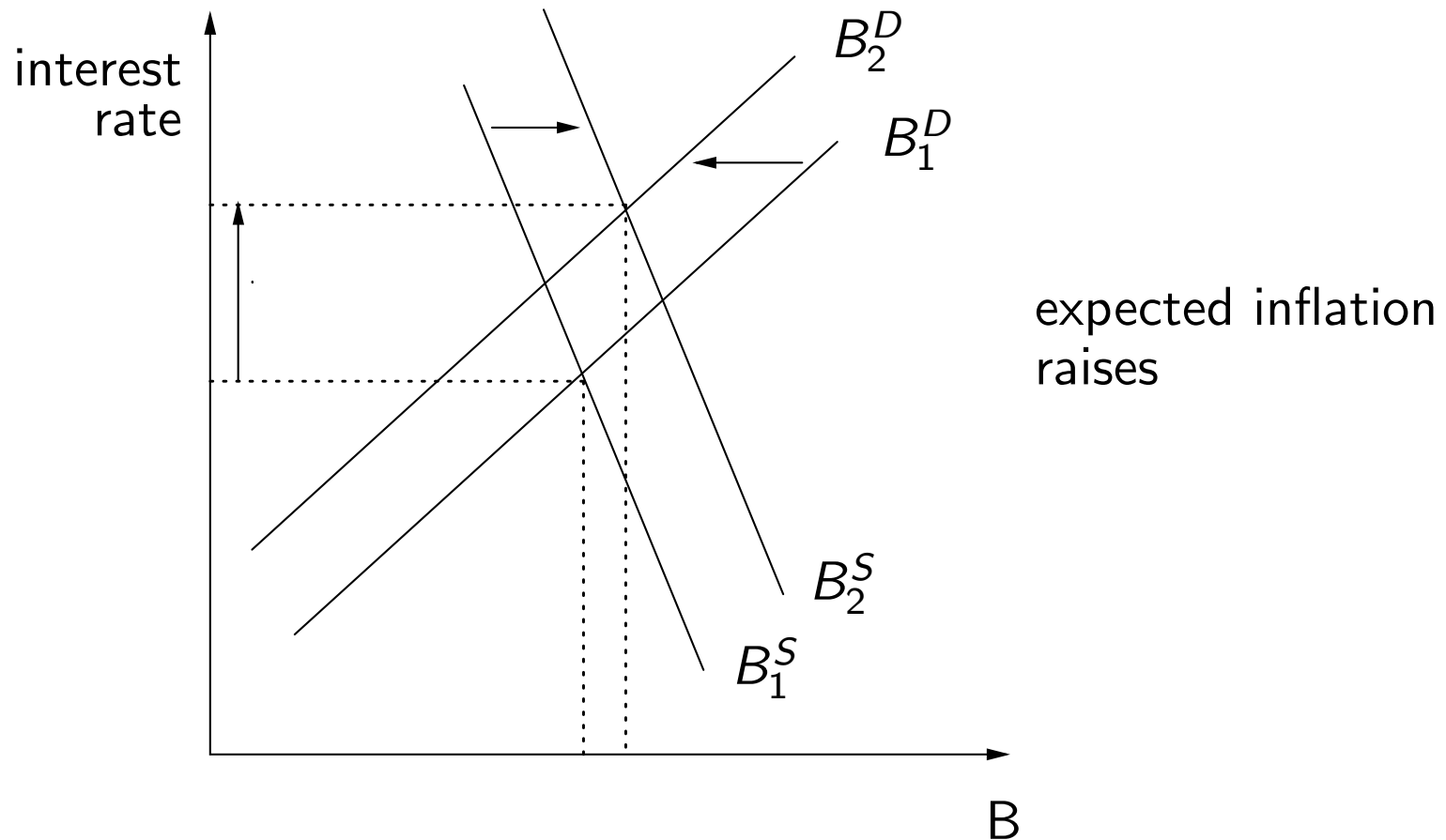
$$i^{real} = i - \hat{p}$$

- ▶ Debt contracts specify fixed payments per time interval. The *real* value of the payments decreases with inflation. This is bad for the creditor/lender but good for the debtor/borrower (distribution effect of inflation).
- ▶ Holding debt assets becomes less attractive, portfolios are restructured in favor of alternative assets. This leads to an increase of the nominal interest rates (Fisher effect).

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.1 Behavior of Interest Rates



(Source: Mishkin (2006), p.101)

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.1 Behavior of Interest Rates



(Source: Mishkin (2006), p.101)

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.2 Risk Structure of Interest Rates

**Risk:** (details in Bailey (2005), chapter 4)

- ▶ Realized returns are uncertain, they are dispersed around an (estimated) mean.
- ▶ Agents can assumed to be risk averse = utility function is concave in returns:  $u'(r) > 0, u''(r) < 0$ .

**Risk premium:**

Given a return of a risk-free asset  $A$ , which markup (risk premium  $RP$ ) on the return will be necessary so that the utility of the uncertain asset  $B$  equals the utility of asset  $A$ ?

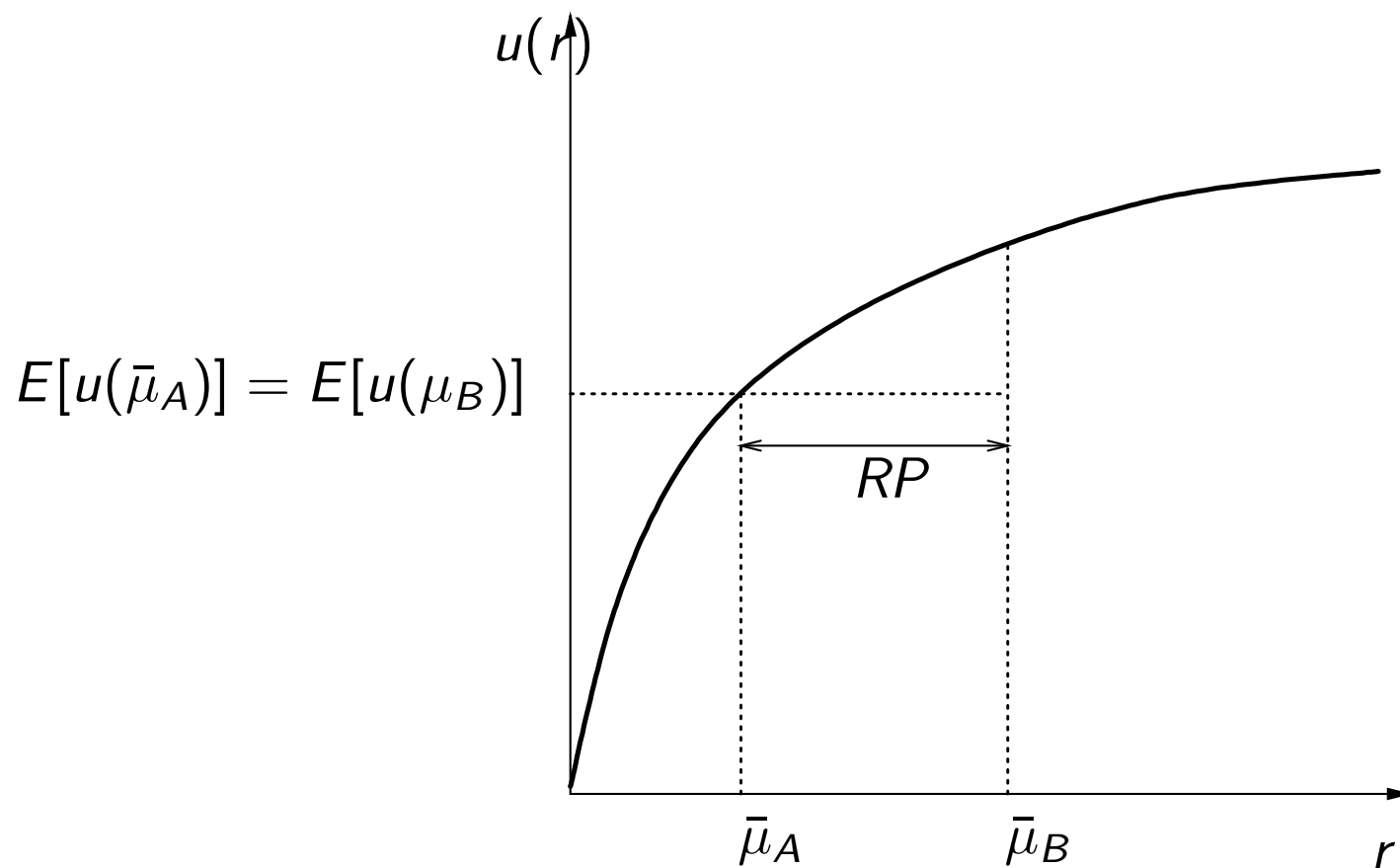
$$\mu_A = \bar{\mu}_A, \quad \mu_B = \bar{\mu}_B + \epsilon, \quad E[\epsilon] = 0, \quad V[\epsilon] > 0$$

$$E[u(\mu_A)] = E[u(\mu_B)] \quad \iff \quad \bar{\mu}_A + RP = \bar{\mu}_B$$

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.2 Risk Structure of Interest Rates



# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.2 Risk Structure of Interest Rates

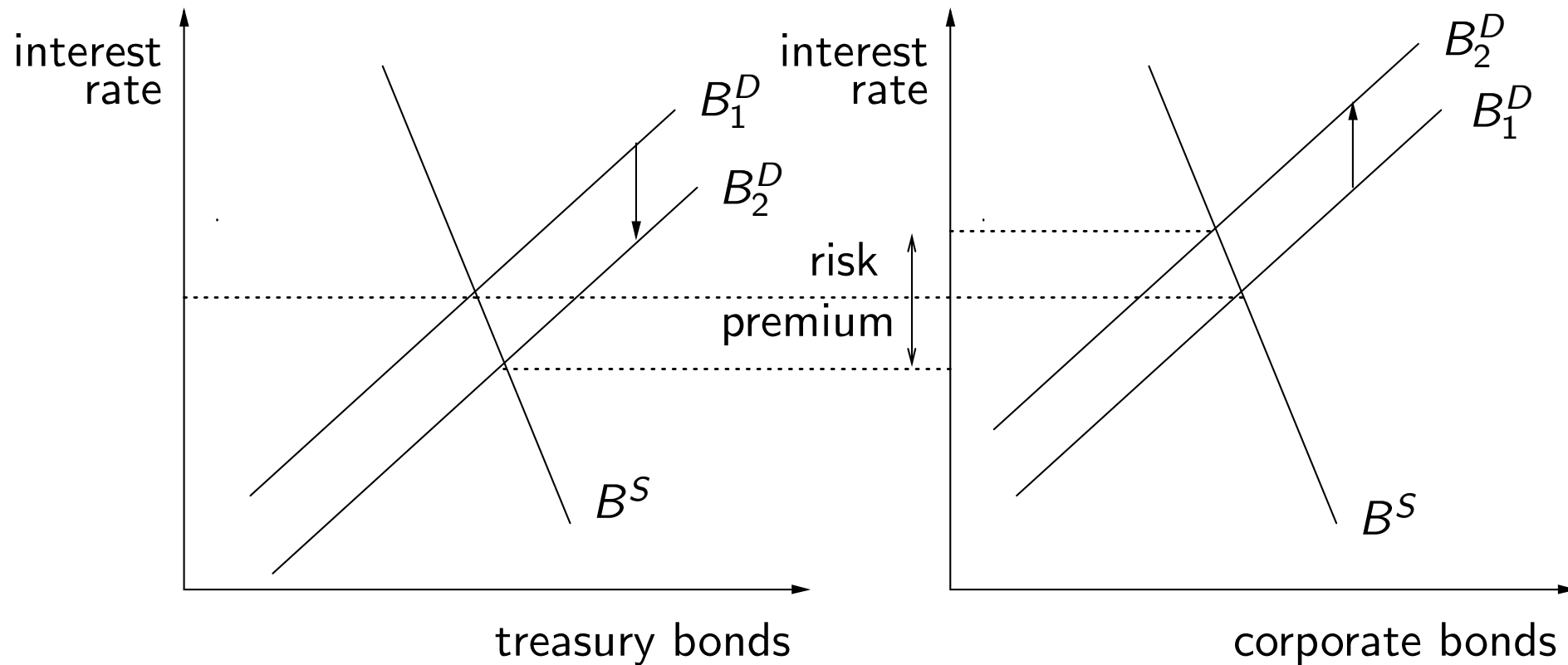
- ▶ The risk premium increases with the risk  $V[\epsilon]$ .
- ▶ Debt assets with higher risk have a higher nominal interest rate ( $\rightarrow$  risk spread of interest rates).
- ▶ The interest rates of more risky bonds are higher than of low risk bonds – e.g. corporate bonds are more risky than US government bonds, bonds of AAA-rated firms are less risky than of BBB-rated firms.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.1 Behavior of Interest Rates

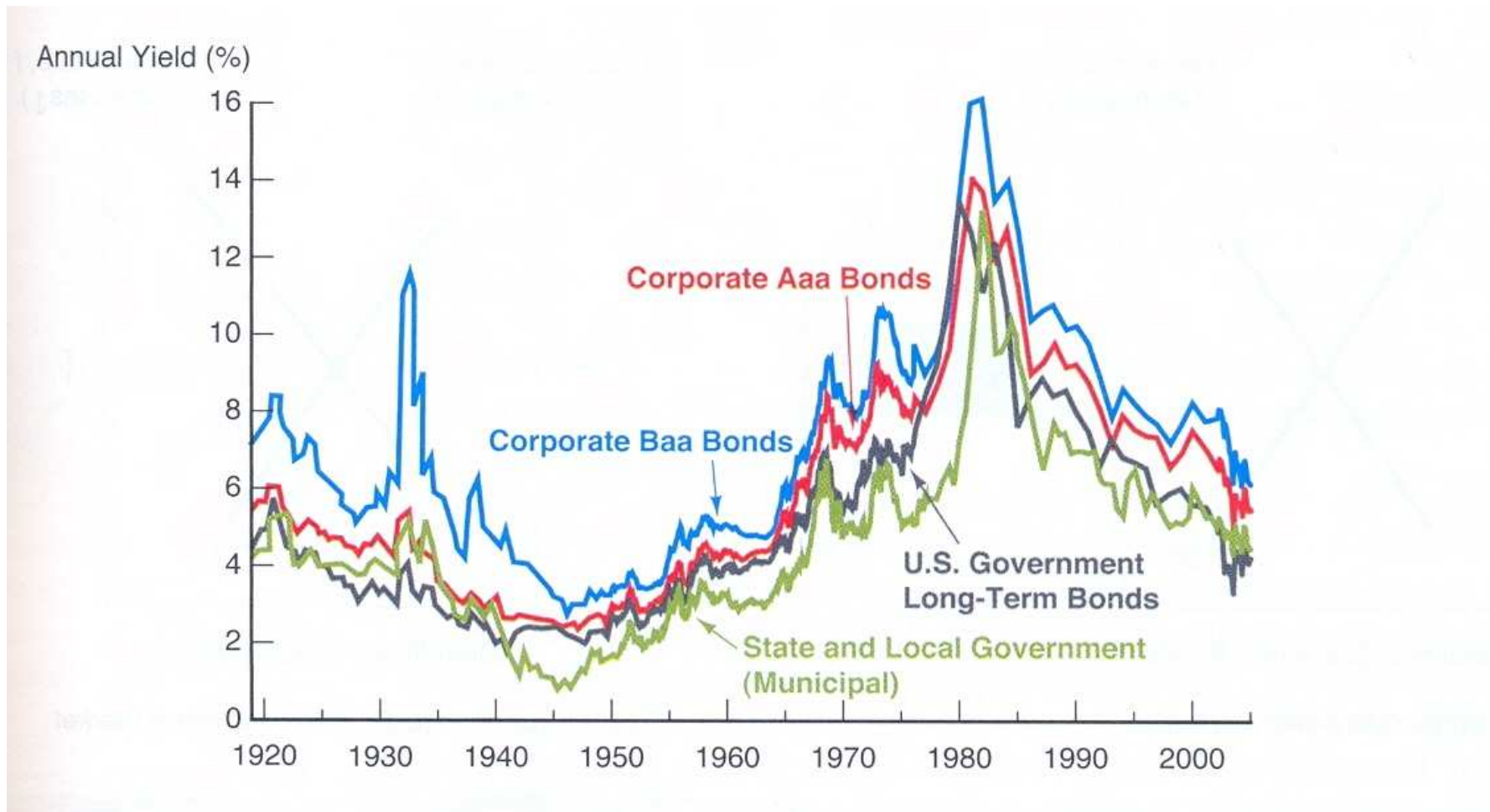
increasing risk of corporate bonds



# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.1 Behavior of Interest Rates



(source: Mishkin (2006), p.121)

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.2 Risk Structure of Interest Rates

Interest rate differentials can furthermore be explained by

- ▶ different **liquidity** of bonds or loan contracts: The more illiquid an asset is, the higher the interest rate must be in order to compensate this disadvantage.
- ▶ different income **taxes** on interest payments: The more the interest payments are taxed, the higher the nominal interest rate will be.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.3 Term Structure of Interest Rates

#### **Yield Curve:**

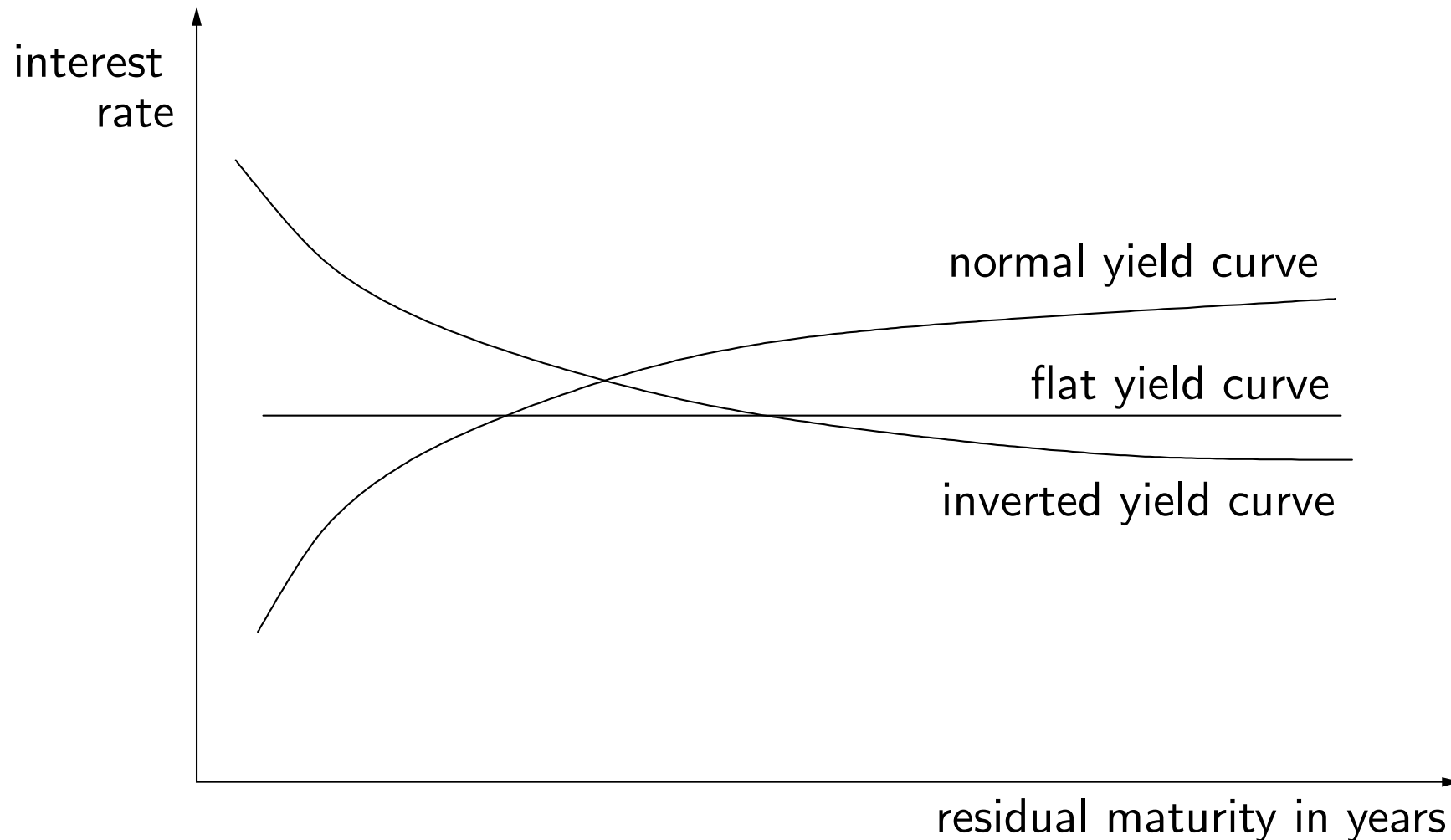
Describes the term structure of interest rates for bonds of a given type (with identical risk and liquidity characteristics)

- ▶ Upward sloping yield curve (“normal yield curve”): long-term interest rate above short-term interest rates
- ▶ Downward sloping yield curve (“inverted yield curve”): vice versa
- ▶ Flat yield curve: same interest rate in short and long run
- ▶ (Inverted) U-shaped yield curve etc.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.3 Term Structure of Interest Rates



(daily and historical yield curves can be interactively calculated on the ECB's home page: [www.ecb.int/stats/money/yc/html/index.en.html](http://www.ecb.int/stats/money/yc/html/index.en.html))

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.3 Term Structure of Interest Rates

#### Expectations Theory

- ▶ *Normal yield curve:* The current interest rate level is low. Agents expect increasing economic activity (productivity, profitability, but also inflation increase). Therefore the demand for funds to finance additional investments will increase. The expected interest rate level will rise (= falling bonds prices). If you buy a long-term bond today the expected higher interest rates and lower bonds prices in the future have to be reflected in the current interest rate.
- ▶ *Inverted yield curve:* vice versa.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.3 Term Structure of Interest Rates

*Example:* Amount  $L$  is invested for two periods.

Question: Buying one long-term contract or two subsequent short-term contracts?

$$R_{long} = L \cdot (1 + i_{0,2})^2$$

$$R_{short} = L \cdot (1 + i_{0,1})(1 + i_{1,1})$$

where  $i_{j,k}$  is the interest rate at time  $j$  for a  $k$ -period contract.

In an arbitrage-free market we have  $R_{long} = R_{short}$  which implies

$$i_{0,2} = \sqrt{(1 + i_{0,1})(1 + i_{1,1})} - 1$$

where  $i_{1,1}$  is the *expected* interest rate. The current long-term interest rate is the geometric mean of the current and the expected short-term interest rate in the future.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.3 Term Structure of Interest Rates

If expectations are not systematically false, there should be a correlation between the slope of yield curves and the business cycle: Before a cyclical downturn the yield curve will become flat or inverted. Before an economic recovery the slope of the yield curve will rise.

#### **Empirical Literature:**

Bernhard, H., Gerlach, S. (1998), Does the Term Structure Predict Recessions? The International Evidence. *International Journal of Finance and Economics* Vol. 3(3), 195-215.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.2 Interest Rate Theory

### 1.2.3 Term Structure of Interest Rates

#### **Segmented Markets Theory:**

Long- and short-term bonds are not perfect substitutes, they are traded in different (segmented) markets (cannot explain systematic moves of yield curves).

#### **Liquidity and Risk Premium Theory:**

Long- and short-term bonds are substitutes, but short-term bonds have a higher liquidity and lower risk of bonds price changes in the future and therefore lower interest rates (this is additional to the expectations theory and explains a “bias” to upward sloped yield curves).

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### Outline:

1.3.1 Functions

1.3.2 Monetary Aggregates

1.3.3 Other Definitions of Money

### *Literature:*

Bofinger (2001), chapter 1

Mishkin (2006), chapter 3

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.1 Functions

*„Money is what money does. Money is defined by its function.“ (J. Hicks 1976)*

#### **Functions:**

- ▶ Medium of Exchange
- ▶ Unit of Account
- ▶ Store of Value

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.1 Functions

#### Medium of Exchange:

- ▶ Without money each good can possibly be exchanged with each other good (bartering). Hence we have for  $n$  goods  $n(n - 1)/2$  exchange relations = relative prices.
- ▶ Finding a transaction partner with symmetric exchange wishes (A: books  $\rightarrow$  whiskey, B: whiskey  $\rightarrow$  books) is extremely expensive  $\Rightarrow$  transaction costs. Since there are numerous possibilities to exchange goods “over several edges” (e.g. books  $\rightarrow$  butter  $\rightarrow$  cutting hair  $\rightarrow$  whiskey) there are extremely high information costs to find the best exchange relation.
- ▶ Money as a generally accepted medium of exchange leads to a dramatic decrease in transaction costs (only  $n$  money prices)

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.1 Functions

#### **Unit of Account:**

- ▶ *Money as a numeraire:* Money prices makes comparisons very easy (what is “cheap”, what is “expensive”?), hence money reduces information costs.
- ▶ *Money as the source of accounting systems:* A general unit enables accounting systems like balance sheets to measure the financial wealth or current accounting systems to measure the inflow and outflow of money and earnings per period.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.1 Functions

#### Store of Value:

- ▶ Receiving money (instead of goods or services) enables the money holder to buy goods and services to an arbitrary time. His purchasing power is conserved.
- ▶ If the disposition of the agent changes over time, the stored money can be used for varying expenditures → concept of liquidity, money as the asset with the highest degree of liquidity.
- ▶ The possibilities for intertemporal decisions (like savings in  $t_0$  for additional production and consumption in  $t_1$ ) increase dramatically with such a store of value.
- ▶ Problem: Inflation! Money may be substituted by real assets. This function of money is fulfilled by another asset.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.1 Functions

- ▶ The functions define money in an abstract manner.
- ▶ There are different *forms of appearance of money* (financial assets) like currency, deposits, time deposits, checks etc.
- ▶ It is reasonable to define collections of financial assets which are called monetary aggregates.

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.2 Monetary Aggregates

M1 =            currency in circulation  
                  + overnight deposits

---

M2 = M1 + deposits with an agreed maturity of up to two years  
          + deposits redeemable at notice of up to three months.

---

M3 = M2 + repurchase agreements  
          + money market fund shares  
          + debt securities with a maturity of up to two years

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.2 Monetary Aggregates

#### Monetary aggregates in July 2008 (Bill. Euro)

(source: ECB):

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currency in circulation	649.7	
overnight deposits	3167.3	⇒ M1=3817.0
deposits mat. < 2 years	2383.0	
red. deposits < 3 months	1530.1	⇒ M2=7730.1
repos	346.4	
money market fund shares	726.8	
debt sec. < 2 years	288.0	⇒ M3=9091.3

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# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.2 Monetary Aggregates

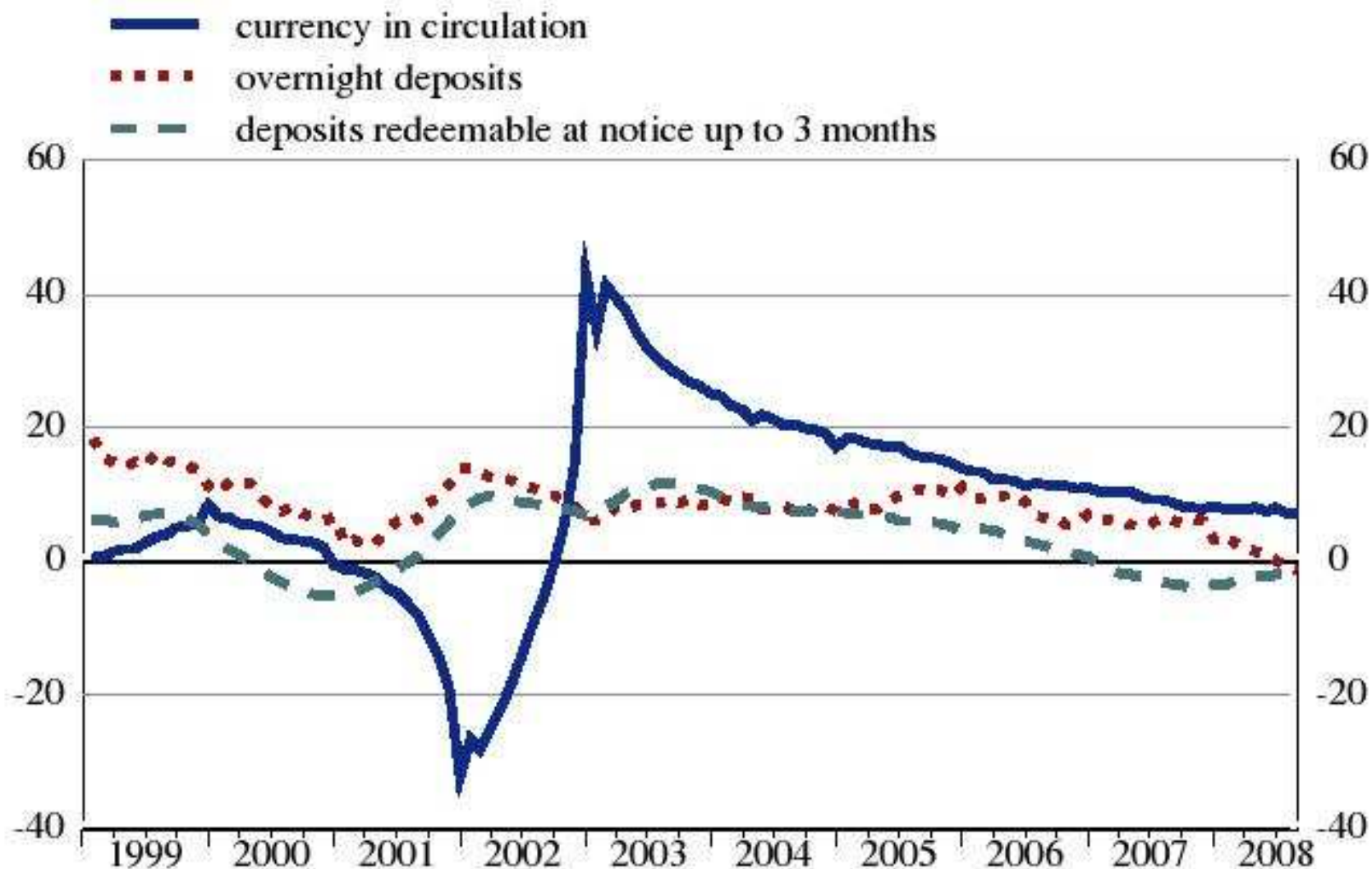


(Source: ECB)

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.2 Monetary Aggregates



(Source: ECB)

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.3 Other Definitions of Money

#### Definition by the transmission mechanism

- ▶ There are different transmission theories on how monetary shocks affects the real sphere or the inflation rate.
- ▶ Take a transmission theory. Money  $M$  then includes all financial assets which confirm the transmission theory.
- ▶ Advantage: If the transmission theory is “true” the aggregate  $M$  is a good subgoal for monetary policy.
- ▶ Problem: If  $M$  is defined in this way then the underlying transmission theory can not be falsified. It is a tautology!

# 1. Financial Markets from a Macroeconomic Viewpoint

## 1.3 Function and Measurement of Money

### 1.3.3 Other Definitions of Money

#### Econometric definition

- ▶ There are different theories of money demand. In the long run it can be assumed that the money market is in equilibrium, i.e. money equals money demand.
- ▶ Take a theory of money demand. Money includes then all financial assets which are demanded by the agents to fulfill the functions of money (example: Keynes theory  $L^d(Y, i)$ ). Statistic regression then decides whether a type of financial asset is significant to explain money demand.
- ▶ Advantage: The definition of money is based on an economic theory rather than being arbitrary or a matter of convention.
- ▶ Problem: If  $M$  is defined in this way the underlying money demand theory can not be falsified since it is tautologically constructed.

## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### Outline:

#### 2.1.1 Economic Functions of Financial Intermediates (FI)

- ▶ Reducing Transaction Costs
- ▶ Risk Sharing
- ▶ Dealing with Asymmetric Information

#### 2.1.2 Types of Financial Intermediates

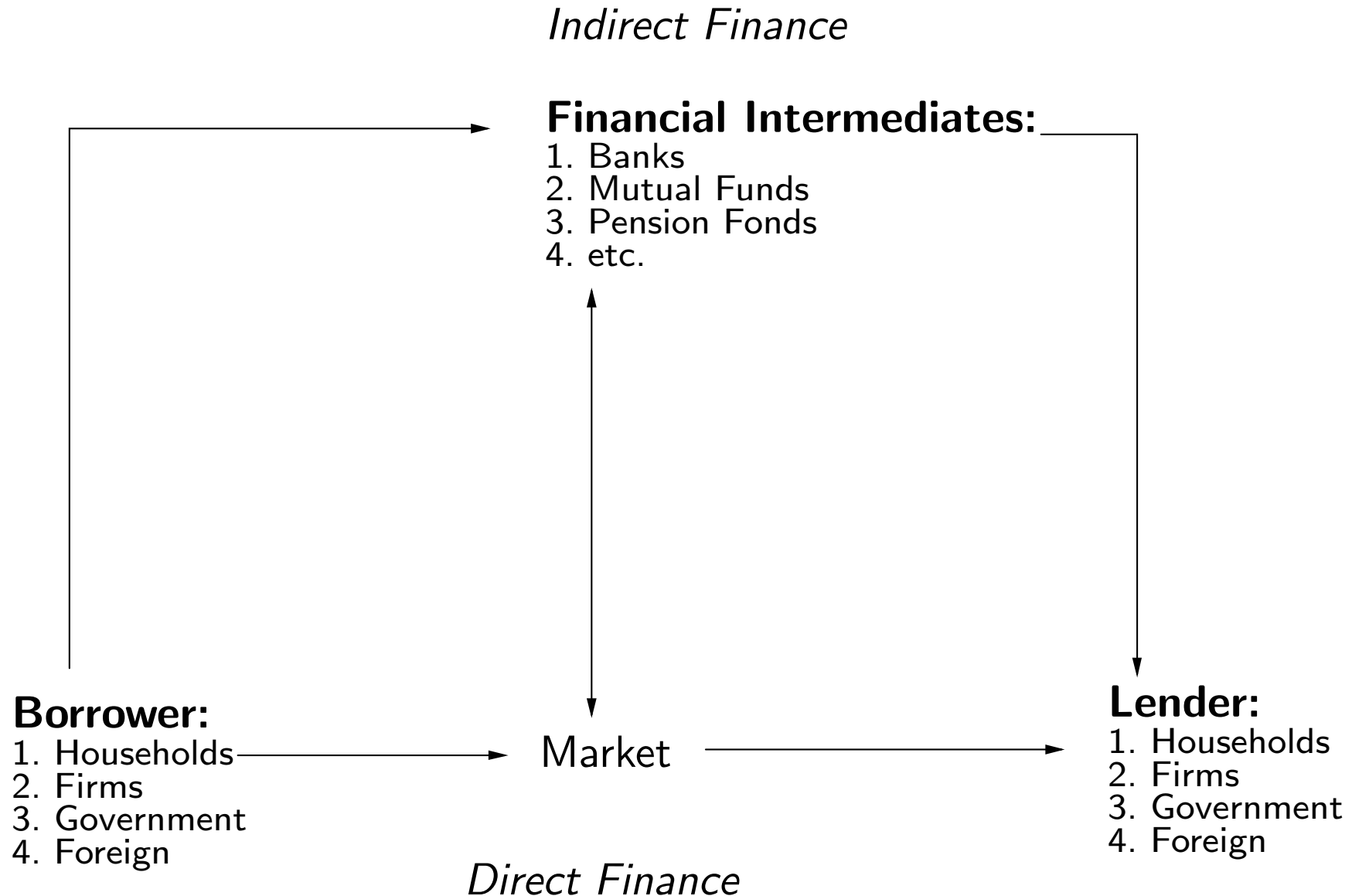
#### *Literature:*

Mishkin (2006), chapter 2

## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### 2.1.1 Economic Functions of Financial Intermediates



## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### 2.1.1 Economic Functions of Financial Intermediates

##### a) Reducing Transaction Costs

- ▶ FI have *economies of scale*:

getting information about demanded and provided funds, assessing risks, bargaining, designing and enforcing contracts, buying/selling stock shares – these tasks can be accomplished by FI with much lower transaction costs by specialized information processing abilities, large transaction volumes, specific human capital (expertise)

- ▶ FI have *economies of scope*:

FI provide additional services like risk diversification, optimizing portfolios, and consulting. Sometimes these services need the same infrastructure and the same human capital. Hence it *may* reduce cost when one FI provides these services.

## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### 2.1.1 Economic Functions of Financial Intermediates

##### b) Dealing with Risk:

- ▶ Risks: Investment projects may fail, borrowers may become insolvent.
- ▶ Reducing the risk by pooling them; reducing the risks arising from asymmetric information problems (see below).
- ▶ Reducing the risk by selling assets with different risk/return structures which are preferred by the lender/saver (asset transformation, e.g. time deposit, fund shares).
- ▶ Trading risky assets means that also risks are traded, all prices contain a “risk premium”.

## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### 2.1.1 Economic Functions of Financial Intermediates

#### c) Dealing with asymmetric information (see 2.3 – 2.4)

##### ▶ Adverse Selection:

- ▶ Hidden characteristics of a potential borrower (e.g.) before a contracting.
- ▶ Borrower knows his risk better than the lender.
- ▶ If lender offers a contract which is optimal for a borrower with average risks, this may be unattractive for those with good risks. This may result in a market failure.

##### ▶ Moral Hazard:

- ▶ Hidden action of a borrower (e.g.) after contracting.
  - ▶ Borrower takes the money to engage in a project that is undesirable for the lender. This reduces the probability for a successfully returned credit.
- ▶ FI may alleviate this problem e.g. by screening, collaterals, optimal design of contracts. Again, they have the resources to do that with low transaction costs.

## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### 2.1.2 Types of Financial Intermediates

##### **Depository institutions (banks):**

- ▶ Accept deposits from individuals and institutions as liabilities, providing loans and mortgages as assets.
- ▶ Example: Commercial banks, thrifts.

##### **Contractual savings institutions:**

- ▶ Accept premiums and contributions from government, firms and individuals as liabilities, investment in bonds, stocks and government securities.
- ▶ Example: life insurance, pension funds, retirement funds

##### **Investment intermediates:**

- ▶ Selling commercial stocks, bonds or shares as liabilities, providing business loans and investment in stocks and bonds as assets.
- ▶ Example: Finance companies, mutual funds, private equity funds

## 2. Theory of Financial Structure

### 2.1 Financial Intermediates

#### 2.1.2 Types of Financial Intermediates

Type of FI	Primary Liabilities	Primary Assets	Value
<i>Depository Institutions</i>			
Commercial Bank	Deposits	Loans, mortgages, bonds	6141
Thifts	Deposits	Mortgages, consumer loans	2240
<i>Contractual saving Institutions</i>			
Life Insurance Companies	premiums	Bonds, mortgages	3969
Fire/Caualty Insur. Comp.	premiums	bonds, stocks	1116
Pension funds	employer/employee contributions	bonds, stocks	4330
Gov. retirement funds	employer/employee contributions	bonds, stocks	2046
<i>Investment Intermediates</i>			
Finance Companies	commercial papers, stocks, bonds	loans	1385
Mutual Funds	issued shares	bonds, stocks	4969
Money market mutual funds	issued shares	money market instr.	1912

(US Data 2004 , Bill. Dollar; source: Mishkin (2006), Tables 1 and 2)

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### Outline:

2.2.1 General Principles of Bank Management

2.2.2 Theory of Portfolio Selection

2.2.3 The Value at Risk Approach

#### *Literature:*

Mishkin (2006), chapter 9

Bailey (2005), chapter 5

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.1 General Principles of Bank Management

#### *The Bank's Balance Sheet*

Assets	Liabilities
<ul style="list-style-type: none"><li>▶ Reserves (required, excess)</li><li>▶ Cash</li><li>▶ Securities/Bonds<ul style="list-style-type: none"><li>▶ firm bonds</li><li>▶ governmental bonds</li></ul></li><li>▶ Loans<ul style="list-style-type: none"><li>▶ industrial</li><li>▶ consumer</li><li>▶ real estate</li><li>▶ inter-bank</li><li>▶ other</li></ul></li><li>▶ Other assets (e.g. physical assets)</li></ul>	<ul style="list-style-type: none"><li>▶ (Checkable) Overnight deposits</li><li>▶ Nontransaction desposits<ul style="list-style-type: none"><li>▶ Time deposits</li><li>▶ Redeemable deposits (saving accounts)</li></ul></li><li>▶ Borrowings<ul style="list-style-type: none"><li>▶ Inter-bank loans</li><li>▶ Central bank loans</li><li>▶ Other</li></ul></li><li>▶ Bank Capital</li></ul>

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.1 General Principles of Bank Management

##### a) Liquidity Management

- ▶ For deposit outflows the bank needs liquid assets like cash or reserves.
- ▶ If there are not enough liquid positions on the asset side the bank needs expensive overnight loans or has to sell other assets, or it becomes illiquid. These are costs of deposit outflows.
- ▶ Problem: If customers receive a signal of liquidity problems they also wish to draw their deposits. This enforces the liquidity problem and may lead to bankruptcy.
- ▶ Liquidity management has to balance the liquidity of assets with the deposit position on the liability side. More generally: Given a probability distribution of inflows and outflows on the liability side, the asset side should be structured to meet the obligations to the depositors.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.1 General Principles of Bank Management

- ▶ The higher the expected deposit outflows and/or the higher the cost of deposit outflows are the more excess reserves are required.

#### b) Asset Management

- ▶ Management of risk and return of the assets (portfolio approach). Finding the mix of risky and riskless assets with the highest expected utility (assumption: risk aversion).
- ▶ The liquidity considerations (see a)) can be seen as an additional restriction to portfolio management.
- ▶ Portfolio theory is a core concept in (financial) economics. Details are given in the next subsection.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.1 General Principles of Bank Management

##### c) Liability management

- ▶ Deposits are not “given” and not the only source of funds. Decision how to acquire which types of liabilities.
- ▶ Differences of liabilities:
  - ▶ How fast could an additional liability be acquired?
  - ▶ Probability of outflows
  - ▶ Costs = interest rates (e.g. for time deposits, for inter-bank or central bank loans)
- ▶ Development of new financial instruments (e.g. certificates of deposits (CD) which are similar to bonds)

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.1 General Principles of Bank Management

##### d) Bank Capital Management

- ▶ Most assets have risks: Credits may fail, bonds prices may fall. Hence, the value of the asset side is volatile.
- ▶ With a certain probability the losses of the asset side may exceed the bank capital: the bank becomes insolvent.
- ▶ Actual development: Large bank crisis in the USA in 2008. About 500 Billion Dollar asset values (especially housing loans and mortgages) had to be written off.
- ▶ The higher the bank capital (in percent of the liability side), the lower is the risk of insolvency.
- ▶ But: The return on equity (RoE) of the bank owners (return on assets / bank capital) is c.p. lower when the bank capital has a higher share of the liability side → trade-off!

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

### Outline of Portfolio Theory

(Bailey (2005), chapter 5)

- ▶ We address the case of two risky and one risk-free asset. “Risky” means, that the returns are stochastic.

- ▶ Notation:

$\mu_i$  expected return of risky asset  $i = 1, 2$

$\sigma_{12}$  covariance between the returns of asset 1 and 2

$\sigma_{ii}$  variance of returns of asset  $i = 1, 2$

$a_i$  proportion of portfolio invested in asset  $i$ ,  $\sum_i a_i = 1$

$r_0$  return of the risk-free asset

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

##### a) The portfolio $P$ of risky assets

We have

$$\mu_P = \sum_i a_i \mu_i \quad (1)$$

$$\sigma_P^2 = \sum_i \sum_j a_i a_j \sigma_{ij} \quad (2)$$

In case of two risky assets the proportion  $a_1$  (obviously  $a_2 = 1 - a_1$ ) determines the expected return and the variance of the portfolio.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

##### b) Efficiency Frontier

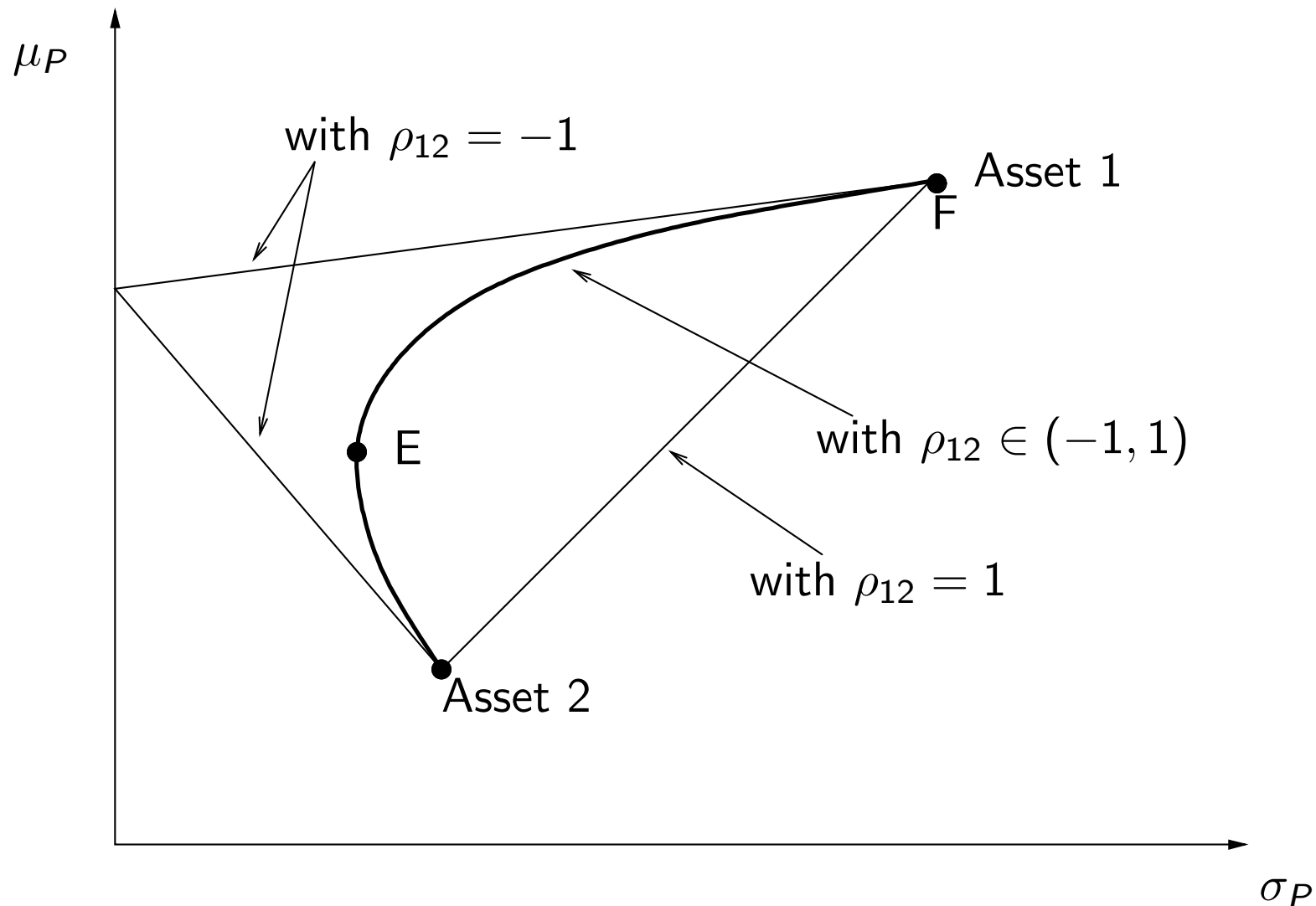
- ▶ In case of more than two risky assets the convex set of proportions  $a_1, \dots, a_n$  define a convex set of  $(\mu_P, \sigma_P^2)$ -combinations.
- ▶ Most of these combinations are inefficient, since there exist many portfolios with the same  $\mu_P$  but different  $\sigma_P^2$ .
- ▶ In the first step, the efficiency frontier has to be derived by minimizing  $\sigma_P^2$  (over  $a_i = 1, \dots, n$ ) under the constraints of a given  $\mu_P = \bar{\mu}_P$  and  $\sum_i a_i = 1$
- ▶ In case of two risky assets, this step is not necessary since  $a_i$  determines a unique  $(\mu_P, \sigma_P^2)$ -combination.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

The shape of the efficiency frontier EF depends on the covariance ( $\rho_{12} = \sigma_{12}/(\sigma_1\sigma_2)$  is the correlation coefficient).



## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

##### c) Optimal portfolio without a risk-free asset

- ▶ From the set of efficient portfolios choose the optimal portfolio which maximizes the utility function.
- ▶ **Mean-Variance-Approach:**

$$\max_{a_i} E[u(r_P)] = \mu_P - \theta \sigma_P^2 \quad \text{with} \quad \sum_i a_i = 1$$

with  $\theta > 0$  as the degree of risk aversion.

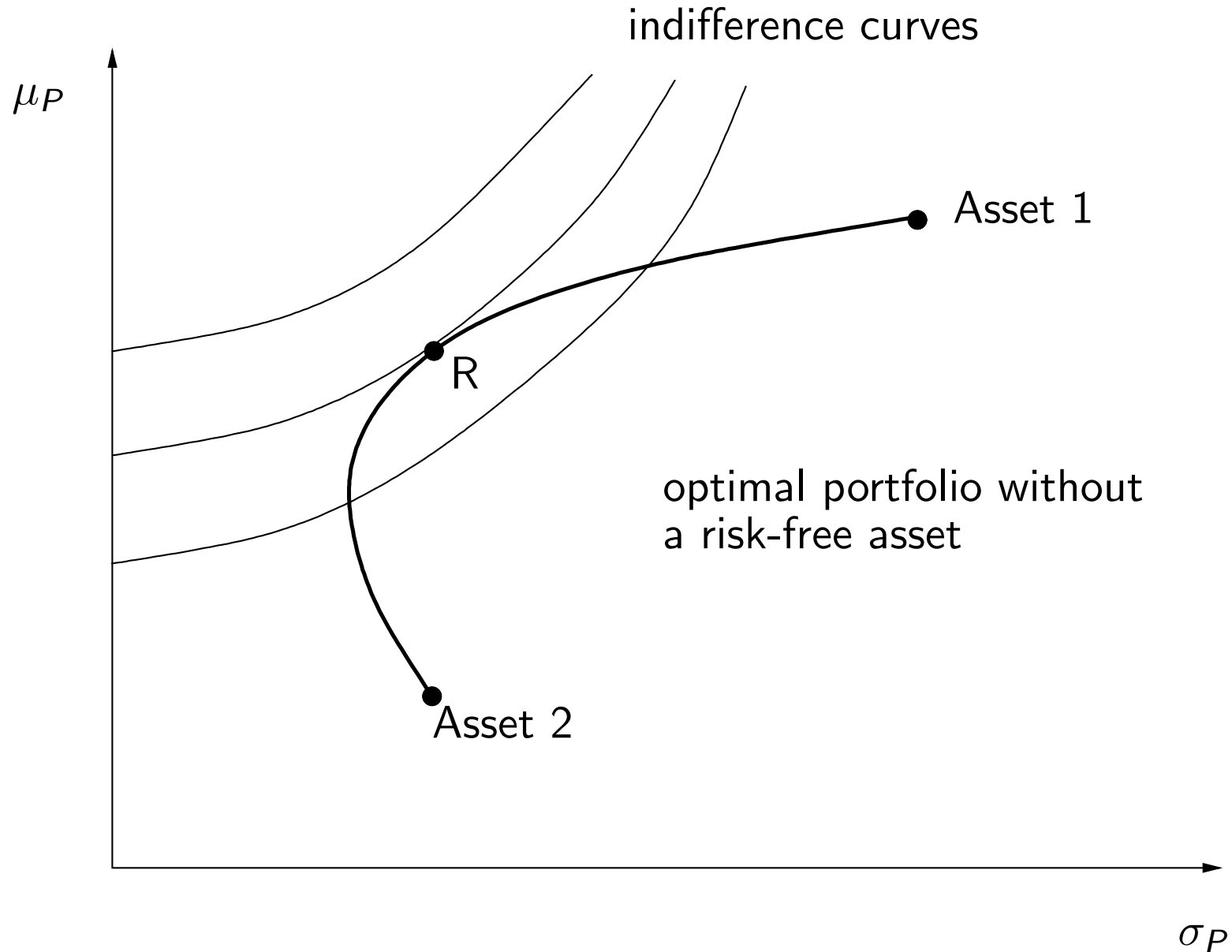
*Note:* This is a special type of utility function. From a theoretical point of view it is not necessary that the preferences can be represented by a utility function of *this* type.

- ▶ In a  $(\mu_P, \sigma_P)$ -diagram the indifference curves are upwards sloped. The tangential point (R) of the indifference curve with the efficient portfolio frontier is the solution of the optimization problem.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection



## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

##### d) Optimal portfolio with one risk-free asset

- ▶ Now we combine the risky portfolio with the risk-free asset (with  $r_0 \geq 0$  and zero variance). We first derive a point  $Z$  on the efficiency frontier (a point  $(\mu_Z, \sigma_Z)$ ) which will be combined with the point of the risk-free asset (the point  $(r_0, 0)$ ).
- ▶ Starting from  $(r_0, 0)$  there is a tangency to the efficiency frontier with  $Z$  as the tangential point.
- ▶ The optimal mix of the risky portfolio  $Z$  with the risk-free asset is, again, derived by the tangential point of the indifference curves with the tangency.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

More technically:

- ▶ Starting from a proportion  $a_0 = 0$  we can increase the proportion of the risk-free asset only by decreasing the proportion of (at least) one risky asset:  $\Delta a_0 = -\Delta a_i$ .
- ▶ How does this affect the expected returns and the variance of the *complete* portfolio  $P$ ?

$$\Delta\mu_P = (\mu_i - r_0)\Delta a_i \quad (3)$$

$$\Delta\sigma_P = \beta_{iP}\sigma_P\Delta a_i \quad \text{with } \beta_{iP} = \frac{\sigma_{iP}}{\sigma_P^2} \quad (4)$$

The term  $\sigma_{iP}$  is the covariance of asset  $i$  with the whole portfolio. The term  $\beta_{iP}$  captures the relationship of covariance of asset  $i$  and the variance of the whole portfolio. The term  $\beta_{iP}\sigma_P$  then denotes the change of the portfolio risk resulting from a change in proportion of asset  $i$  ( $\Delta\sigma_P/\Delta a_i$ ).

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

For an *efficient* portfolio it is necessary that the expression

$$\frac{\Delta\mu_P}{\Delta\sigma_P} = \frac{\mu_i - r_0}{\beta_{iP}\sigma_P} = \frac{\mu_P - r_0}{\sigma_P} \quad (5)$$

holds true for all assets  $i$  and hence for all efficient portfolios  $P$  (note that  $\beta_{PP} = 1$ ).

Otherwise, if the reduction of the risky asset 1 leads to a lower loss of expected return and/or to a lower increase of the portfolio risk than asset 2, then it is optimal only to reduce asset 1. This changes the structure of the risky part of the portfolio. An efficient risky portfolio requires that the change of the proportion disturbs the expected return per unit of risk in the same way.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

Note that  $\Delta\mu_P/\Delta\sigma_P$  denotes the slope of a linear function in the  $(\mu_P, \sigma_P)$ -space.

If (5) holds true for all efficient portfolios then it holds true for  $Z$  (containing only risky assets)

$$\frac{\mu_P - r_0}{\sigma_P} = \frac{\mu_Z - r_0}{\sigma_Z} \quad (6)$$

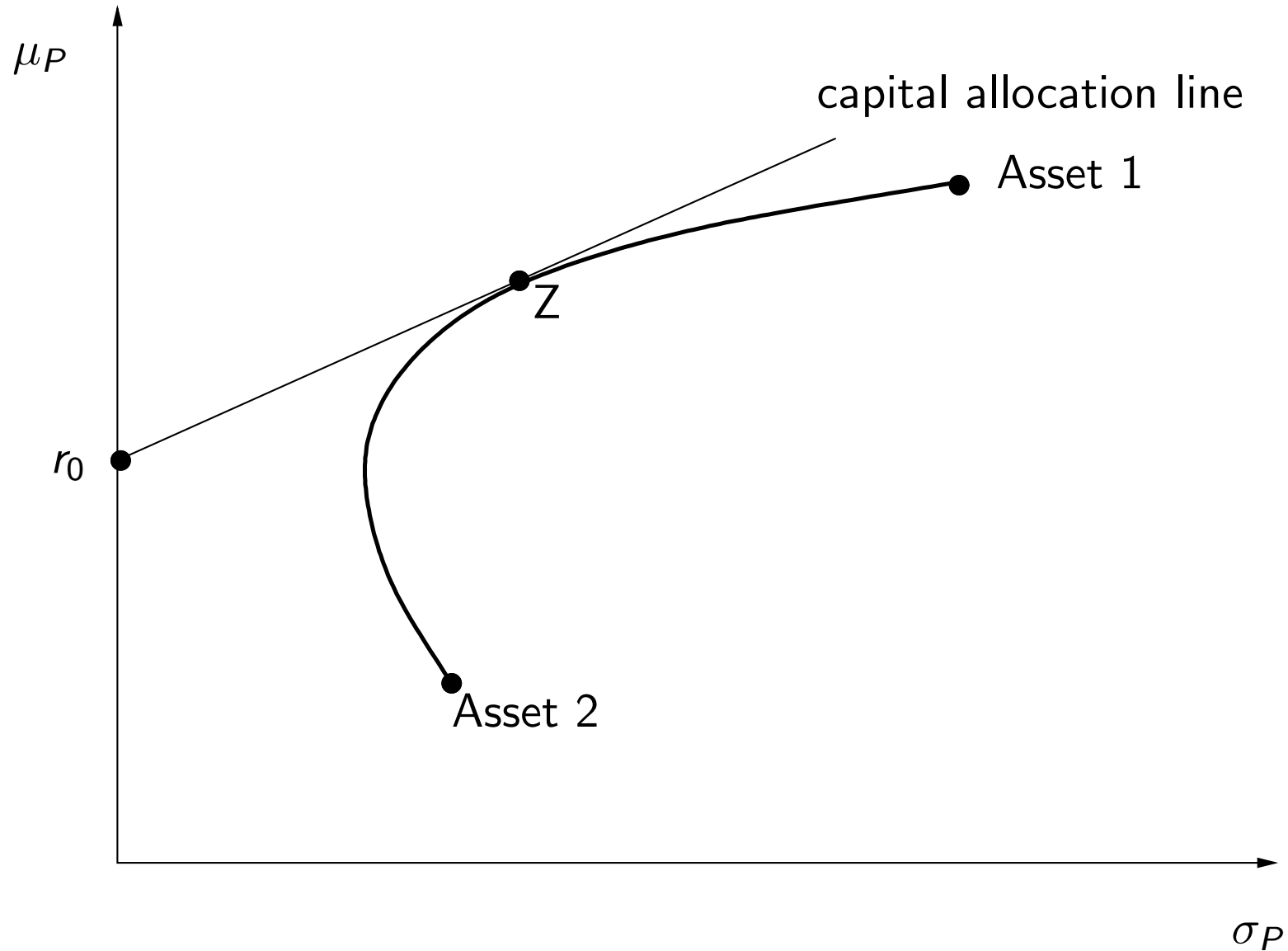
$$\Rightarrow \mu_p = r_0 + \left( \frac{\mu_Z - r_0}{\sigma_Z} \right) \sigma_P \quad (7)$$

This is sometimes called the *capital allocation line* and is the tangency in the following figure.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection



## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection

The efficient portfolio  $Z$  of risky assets is optimal without knowing anything about the risk preferences.

$$\mu_P = q\mu_Z + (1 - q)r_0 \quad (8)$$

$$\sigma_P^2 = q^2\sigma_Z^2 \quad (9)$$

It follows for the utility function

$$\begin{aligned} \max_{q \in [0,1]} u(\mu_P, \sigma_P^2) &= \mu_P - \theta\sigma_P^2 \\ \Rightarrow \max_{q \in [0,1]} u(\mu_P, \sigma_P^2) &= q\mu_Z + (1 - q)r_0 - \theta q^2\sigma_Z^2 \quad (10) \end{aligned}$$

From first order conditions we have

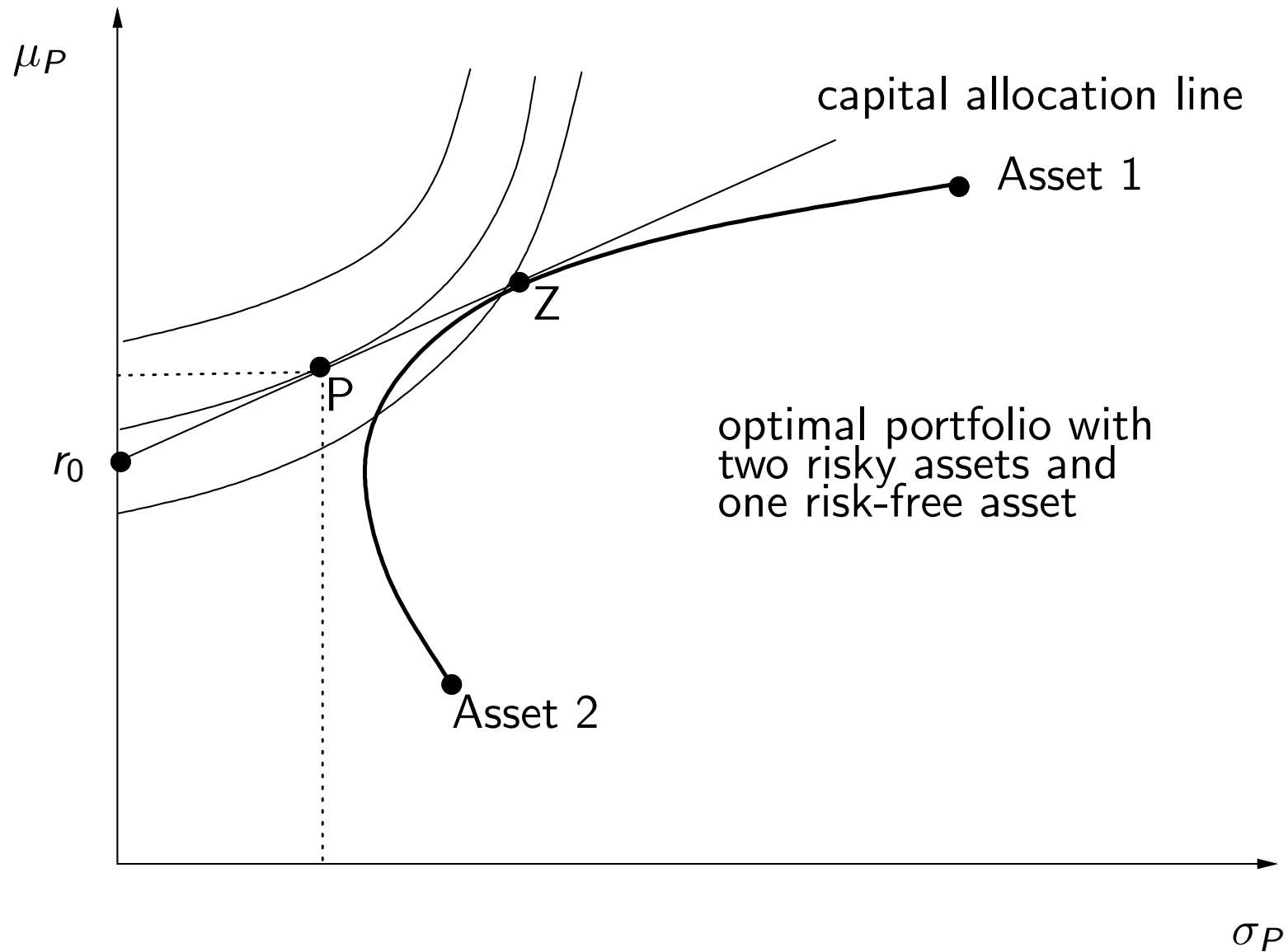
$$q = \frac{\mu_Z - r_0}{2\theta\sigma_Z^2}$$

(Second order condition always holds true.)

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.2 Theory of Portfolio Selection



## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

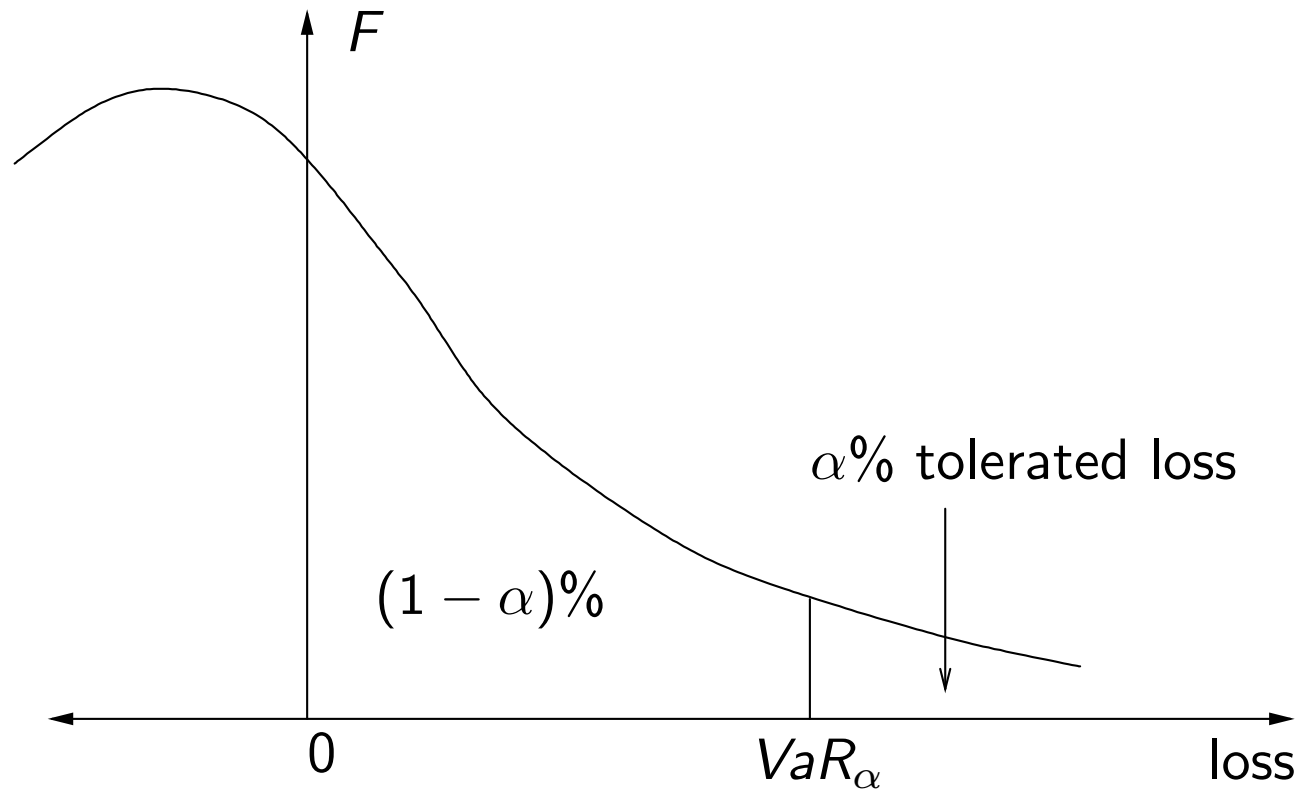
Now we turn back to *solvency* and *liquidity* management considerations.

- ▶ Once, the optimal portfolio is determined, the value of the assets is uncertain: Bad loans have to be depreciated, the bonds prices may fall  $\Rightarrow$  the value of the assets is a stochastic variable.
- ▶ For a given period (e.g. 1 month) it is possible to construct a probability distribution  $F$  for the **losses of value** (where negative losses are gains).
- ▶ Assume that the bank management (or the regulation authority) wishes that in the given period the bank stays solvent with a probability of  $1 - \alpha\%$ . Then the upper  $\alpha$ -fractil of the distribution  $F$  denotes the (tolerated) losses – the  $VaR_\alpha$  benchmark – which can be expected with probability of  $\alpha\%$ .

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach



## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

- ▶ In order to stay solvent the bank has to keep bank capital which covers (at least) the  $VaR_\alpha$  benchmark, for example  $BC \geq VaR_{1\%}$ . Staying solvent means that the obligations to the depositors can be fulfilled.
- ▶ If  $VaR_\alpha$  is determined, then  $r_\alpha$  denotes the percentage of the asset volume  $A$  which will be lost with probability  $\alpha$ :

$$VaR_\alpha = r_\alpha A$$
$$\Rightarrow \frac{BC}{A} \geq r_\alpha$$

- ▶ *Example:* If  $\alpha = 0.01$  and  $r_{0.01} = 0.15$  then 15% of the asset volume are lost with probability of 1%. If  $BC \geq r_{0.01}A$  then losses which exceed bank capital (insolvency) have a probability less than 1%.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

### **VaR-based decisions about portfolio volume and debt/equity relation (example):**

Let  $D$  be the deposits and  $BC$  the bank capital. Neglecting other positions in the balance sheet, we have  $A = D + BC$ . Assume a quadratic cost function  $C(A) = \frac{1}{2}cA^2$ . The interest rate for deposits is  $r_D$  and the expected (but uncertain) return of the asset portfolio is  $r_A$ . The expected profits are given by

$$\max_{A>0} G = r_A A - r_D D - \frac{1}{2}cA^2 \quad (11)$$

$$= (r_A - r_D(1 - r_\alpha))A - \frac{1}{2}cA^2 \quad (12)$$

with  $BC = VaR_\alpha = r_\alpha A$  and the balance sheet equation.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

Solution of the maximization problem leads to

$$A^* = \frac{r_A - r_D(1 - r_\alpha)}{c} \quad (13)$$

and with

$$D^* = (1 - r_\alpha)A^* \quad (14)$$

$$BC^* = r_\alpha A^* \quad (15)$$

we have

$$V^* = \frac{D^*}{BC^*} = \frac{1 - r_\alpha}{r_\alpha} \quad (16)$$

where  $A^*$  denotes the optimal portfolio volume and  $V^*$  the optimal liability/equity relation.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

- ▶ Depending on the probability distribution  $F$  a change in the solvency policy (choosing  $\alpha$ ) leads to non-proportional adaptations of  $A$  and  $BC$ .
- ▶ Achieving the optimal volume of the asset and liability side can be restricted since the bank may face limitations on the market for capital.

#### *Literature:*

Broll, U., Wahl, J. (2003), Value at Risk and Bank Equity.  
*Jahrbücher für Nationalökonomie und Statistik* Vol. 223, 129-135.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

#### Applying VaR to Liquidity Management:

- ▶ Consider, again, the case that there is a risk-free liquid asset (excess reserves), while the deposits  $D$  are assumed to be stochastic. The bank's liquidity management should ensure that the bank stays liquid when depositors wish to draw their deposits.
- ▶ The VaR approach can also be applied to this task: Let  $G$  be the probability distribution of daily deposit outflows (where negative outflows are inflows). Then  $\beta$  is the probability that the outflows exceeds the liquid excess reserves and the bank gets into liquidity troubles.
- ▶ Similar to the  $BC/A = r_\alpha$  ratio in case of solvency we have a ratio  $r_\beta$  of excess reserves and deposits to ensure liquidity with a probability of  $\beta$  percent.

## 2. Theory of Financial Structure

### 2.2 Portfolio Selection and the Management of Return, Risk and Liquidity

#### 2.2.3 The Value at Risk Approach

- ▶ It has to be noted that the VaR approach to liquidity is an additional constraint for the portfolio management: The share of the most liquid asset (here e.g.: excess reserves) is determined by the degree of risk aversion of the bank but is also restricted by the VaR approach.
- ▶ Summing up: The bank makes *simultaneous* decisions about the volume and the structure of the asset and the liability side.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### Outline:

2.3.1 Introduction

2.3.2 How Adverse Selection Influences Financial Structure

2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

2.3.4 What Stylized Facts are Explained by Adverse Selection?

#### *Literature:*

Mishkin (2006), chapter 8

Wolfstetter, E. (1999), *Topics in Microeconomics*, chapter 9

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.1 Introduction

#### Information Asymmetries:

- ▶ before contracting: hidden characteristics → adverse selection
  - ▶ buying shares or bonds of a firm  $\Rightarrow$  characteristics are not known to the buyer
  - ▶ providing a loan to a borrower with unknown ability to pay back the loan (credit risk)
    - $\Rightarrow$  decision is based on expectations about the characteristics
    - $\Rightarrow$  expectations are built on prior and posterior information
    - $\Rightarrow$  limited possibilities to reveal the unknown characteristics
    - $\Rightarrow$  Pooling vs. Separating equilibria
- ▶ after contracting: hidden action → moral hazard

Firm uses the funds for financing projects which are more risky than indicated in the negotiation with the lender or buyer of a share. The latter can not observe this, but they can expect that there is an incentive for moral hazard.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

### Markets for Lemons

- ▶ Akerlof, G.A. (1970), The Market for Lemons: Qualitative Uncertainty and the Market Mechanism. *Quarterly Journal of Economics* Vol. 84, 499-500.
- ▶ Wolfstetter, E. (1999), *Topics in Microeconomics*. (Chapter 9.2.1)

Nobel Prize 2001 to George A. Akerlof, A. Michael Spence, Joseph E. Stiglitz „for their analyses of markets with asymmetric information“.

Foundation of market imperfections or market failures due to information asymmetries.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

The original version: Market for used cars

- ▶ Cars have a different quality  $q$  (from “very good”  $q = b$  to “bad”  $q = 0$ , bad cars = “lemons”)
- ▶ The seller is privately informed about the quality  $q \in [0, b]$ .
- ▶ The seller will accept any price  $p \geq q$ .
- ▶ The buyer is willing to pay any price  $p \leq \alpha \cdot q$  with  $\alpha > 1$ .
- ▶ For any given  $q$  there exists a price  $\in [q, \alpha q]$  where buyer and seller mutually benefit from the deal.
- ▶ **But:** The buyer is not able to observe  $q$   
⇒ building expectations  $E[q]$ .

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

Assume that the quality  $q$  is *uniformly distributed* on  $[0, b]$ . This is known by the buyer. For any used car the expected quality is hence  $E[q] = b/2$ . Therefore

$$p(E[q]) \leq \alpha \cdot \frac{b}{2}$$

Two cases:

- ▶ *Case 1:*  $\alpha \geq 2$ . Then the buyer is willing to pay  $p \geq b$  and all cars will be sold.
- ▶ *Case 2:*  $1 < \alpha < 2$ . Then the market breaks down!

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

Market breakdown:

- ▶ For  $\alpha < 2$  the buyer will never pay  $p = b$ .
- ▶ No high quality cars ( $q = b$ ) will be sold. They can be removed from the interval (e.g.  $q \in [0, b - \epsilon]$ ).
- ▶ This can be anticipated by the buyer. The expected average quality decreases (e.g.  $E[q] = (b - \epsilon)/2$ ).
- ▶ The willingness to pay also decreases.
- ▶ The remaining best quality cars leave the market.
- ▶ and so forth... (“race to the bottom”)

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

Or in another way:

- ▶ Assume an arbitrary market price  $p > 0$ . Obviously there are only sellers in the market with  $q_i \in [0, p]$ . The average quality is hence  $E[q] = \frac{p}{2}$ .
- ▶ This is known by the buyers. They are willing to pay maximum  $p(E[q]) = \alpha/2 \cdot p$ .
- ▶ For  $\alpha < 2$  this is lower than the market price and no deal comes about.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

##### Financial Markets:

- ▶ Firm needs funds to finance a risky project. The funds can be obtained by debt or equity. Assume that the firm demands for a loan  $L$ .
- ▶ The (risk neutral) firm is willing to pay an interest rate  $i_L$  which does not exceed the expected return of the project  $r$ .
- ▶ The bank will provide the loan  $L$  when the interest rate covers at least the interest rate for a secure asset  $i_S$  plus the risk premium  $RP$ .
- ▶ Assume that the loan is either returned successfully with probability  $1 - p$  or it fails completely with probability  $p$ . The minimum risk premium is therefore:

$$L(1 + i_S) = L(1 + i_L)(1 - p) + 0 \cdot p \quad (17)$$

$$\Rightarrow RP = i_L - i_S = \frac{p}{1 - p}(1 + i_S) \quad (18)$$

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

- ▶ Problem:  $p$  is *private information* of the firm = not known by the bank!
- ▶ Offering a loan contract with an interest rate  $i_L$  (and risk premium) based on the *expected* probability  $E[p]$  taken from a prior distribution of risks.
- ▶ Typically the expected return and the risk of investment projects are positively correlated. Firms with *profitable low risk projects* with

$$r < i_S + \frac{E[p]}{(1 - E[p])}(1 + i_S)$$

will not receive a loan contract!

- ▶ The remaining projects are hence more risky which leads to an increase of  $E[p] \Rightarrow$  a similar mechanism as in the “market for lemons” example applies.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

##### Credit Rationing:

Adverse Selection Effect: With an increasing interest rate more and more good (= low risk) projects leave the market and the expected risk increases:

$$E[p] = E[p(i_L)], \quad \frac{dE[p(i_L)]}{di_L} > 0$$

Profit maximizing bank:

$$\max_{i_L} \pi = (1 - E[p(i_L)])(1 + i_L)L \quad (19)$$

$$\Rightarrow \frac{d\pi}{di_L} = -\frac{dE[p(i_L)]}{di_L}(1 + i_L)L + (1 - E[p(i_L)])L = 0 \quad (20)$$

$$\Rightarrow i_L^* = \frac{(1 - E[p(i_L)]) - \frac{dE[p(i_L)]}{di_L}}{\frac{dE[p(i_L)]}{di_L}} \quad (21)$$

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

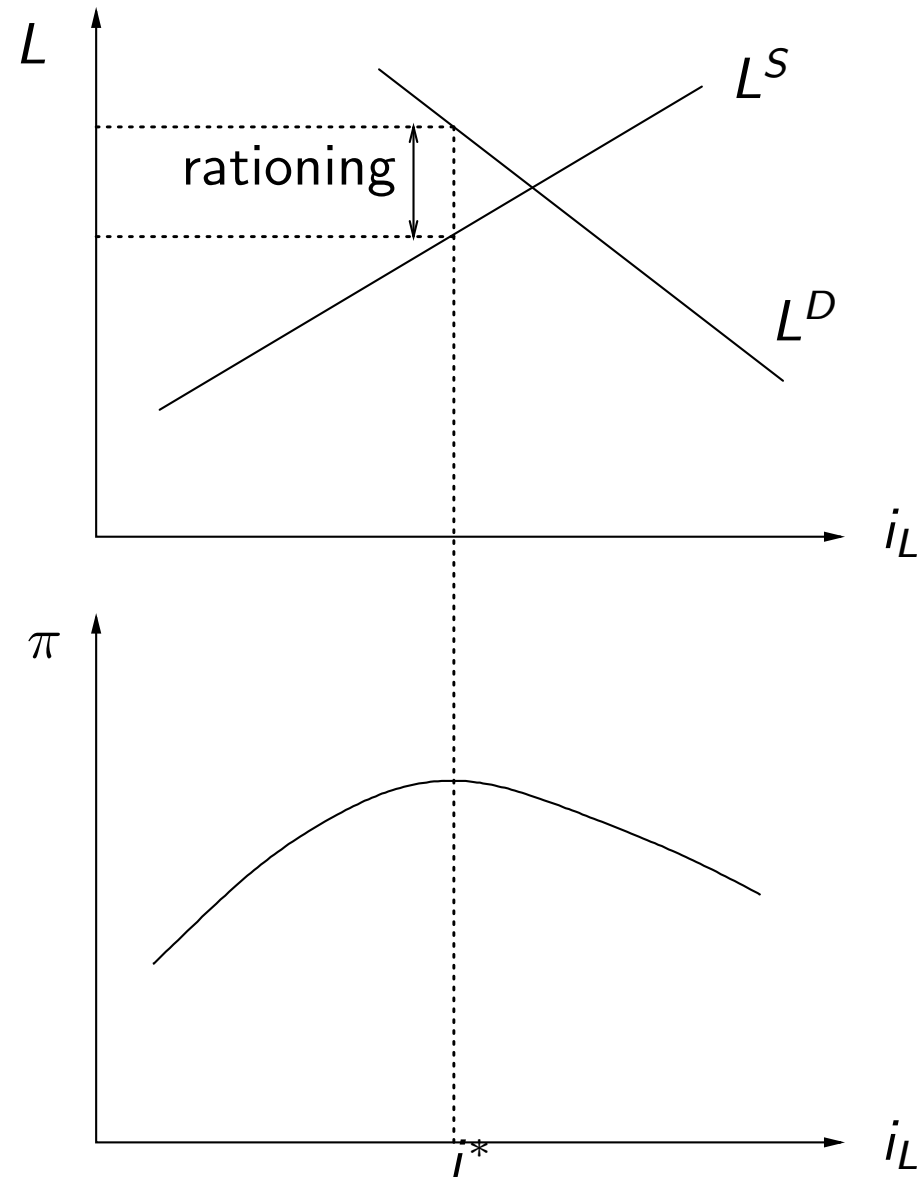
What are the consequences?

- ▶ The profits do not monotonously increase with market interest rate  $i_L$ .
- ▶ If loans demand increases *there is not necessarily a Walrasian adjustment of the equilibrium interest rate!*
- ▶ The demand side of the loans market will be rationed.
- ▶ Existence of *rationing equilibria*.
- ▶ The notional plans of the firms cannot be fulfilled  
⇒ spillover to other markets
  - ▶ e.g. markets for bonds or equities to finance the project
  - ▶ e.g. markets for investment goods

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure



## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.2 How Adverse Selection Influences Financial Structure

Literature:

- ▶ Stiglitz, J., Weiss, A. (1981), Credit Rationing in Markets with Imperfect Information. *American Economic Review* 71, 393-410.
- ▶ Greenwald, B., Stiglitz, J., Weiss, A. (1984), Information Imperfections in the Capital Market and Macroeconomic Fluctuations. *American Economic Review* 74, 194-199.

Note:

- ▶ The problem of rationing may be (partially) overcome e.g. by collaterals.
- ▶ The problem may also occur in bonds and stock markets: The price which the initial buyer is willing to pay reflects his uncertainty about the risk type of the firm!

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

There are different ways how to solve or to alleviate the problem:

- ▶ Providing better information = decreasing information asymmetry
  - ▶ *Screening*: The less informed agent has an incentive
    - ▶ to collect information by himself
    - ▶ to buy additional information supplied by other agents
    - ▶ to provide different contracts with self-selection effects
  - ▶ *Signalling*: The privately informed agent has an incentive to provide a trustworthy (costly) signal about his characteristics.
  - ▶ *Governmental Regulation*
- ▶ Collateral and Net Worth

The information asymmetry is not resolved but has minor consequences since in case of a failed project the return of the loan do not fail.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

### Screening by collecting information

- ▶ High information costs, especially for lenders with low expertise.
- ▶ Bank as a financial intermediate with expertise and specialized human capital reduces such information costs:
  - ▶ Multiple lender of funds  $\Rightarrow$  bank deposits
  - ▶ Bank is pooling the risks and guarantees the depositor an interest rate
  - ▶ Screening costs of multiple non-specialized lenders are reduced and transferred to the bank
  - ▶ The bank as the intermediate lender faces a lower information asymmetry
- ▶ The existence of a professional banking system is a prerequisite for a working credit market (crucial for developing countries).

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

#### Screening by buying information provided by others

- ▶ Rating agencies (e.g. Standard & Poors, Moody): (Large) Borrowers are rated according to a standardized scale (see Mishkin (2006), chapter 6, p.123)
- ▶ In Germany: SCHUFA (Schutzgemeinschaft für allgemeine Kreditsicherung)

#### Problems:

- ▶ *Free-rider problem* since information is a non-rival good. Once, when information is made public, there is no incentive anymore to pay for it.
- ▶ How *trustworthy* is that information? Moral Hazard problem of information providing institutions since the customer (e.g. bank) is not able to assess the reliability of the information.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

### **Governmental Regulation:**

If investors need financial funds, e.g. by demanding credits or selling bonds or stocks, they can be forced by law to provide some information to reduce the information asymmetry. E.g.

- ▶ adhere standard accounting principles
- ▶ providing information about the balance sheet and other (financial) indicators like sales, earnings, assets
- ▶ in case of stock markets: publish relevant informations regularly; annual meeting of shareholders etc.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

#### Signalling:

- ▶ A firm with a low risk project has an incentive to provide a signal so that the lender is informed about the low risk (and charging a low risk premium).
- ▶ If signalling should make sense...
  - (a) the signal must be costly
  - (b) there must exist signals that are too expensive for a high risk firm but not too expensive for low risk firms  $\Rightarrow$  discrimination is possible.
- ▶ Otherwise high risk firms have an incentive to *imitate* the signal so that signalling provides no information (pooling equilibrium).

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

Signalling means “building reputation”. Reputation signals (e.g.):

- ▶ Loans have been successfully returned in the past.
- ▶ Projects are financed also with equity capital.
- ▶ Firm provides voluntarily more sensitive information than required by law.
- ▶ Firm has valuable assets (→ similar to collaterals).

This may be a problem for new and small firms.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

##### Collaterals:

- ▶ In case of failure of the investment project the investor has other assets which can be sold to meet the debt obligations.
- ▶ The borrower must prove that he has such collaterals before signing the credit contract.
- ▶ The credit contract may include the obligation that a certain asset must not be sold before the credit is returned successfully.
- ▶ The credit contract includes that lender automatically becomes the owner of an asset in case of a credit failure.
- ▶ The credit contract includes that the lender has property rights on the asset which are returned to the borrower in case of a successfully returned credit ⇒ mortgages (e.g. in case of housing, real estate)

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

Collaterals  $C$  lower the risk premium:

$$L(1 + i_S) = L(1 + i_L)(1 - p) + pC \quad (22)$$

$$\Rightarrow RP = i_L - i_S = \frac{p}{1 - p}(1 + i_S) - \frac{p}{1 - p} \frac{C}{L} \quad (23)$$

with  $C = \arg \max\{0, (1 + i_S)L\}$ . In case of  $C = L(1 + i_S)$  there is no credit risk for the lender anymore.

#### Problems:

- ▶ Providing collaterals is costly (e.g. opportunity costs).
- ▶ The access to collaterals is limited (e.g. start-up companies).
- ▶ The value of collaterals may be uncertain (see the recent housing crisis in the U.S. – dramatic decrease of house prices = decrease of the value of collaterals)

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.3 Solutions: Screening, Signalling, Regulation, Collaterals

Literature on Collaterals:

- ▶ Bester, H. (1985), Rationing in Credit Market with Imperfect Information. *American Economic Review* 75, 850-855.
- ▶ Besanko, D., Thakor, A. V. (1987), Collateral and Rationing: Sorting Equilibria in Monopolistic and Competitive Credit Markets. *International Economic Review* 28, 671-689.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.4 What Stylized Facts are Explained by Adverse Selection?

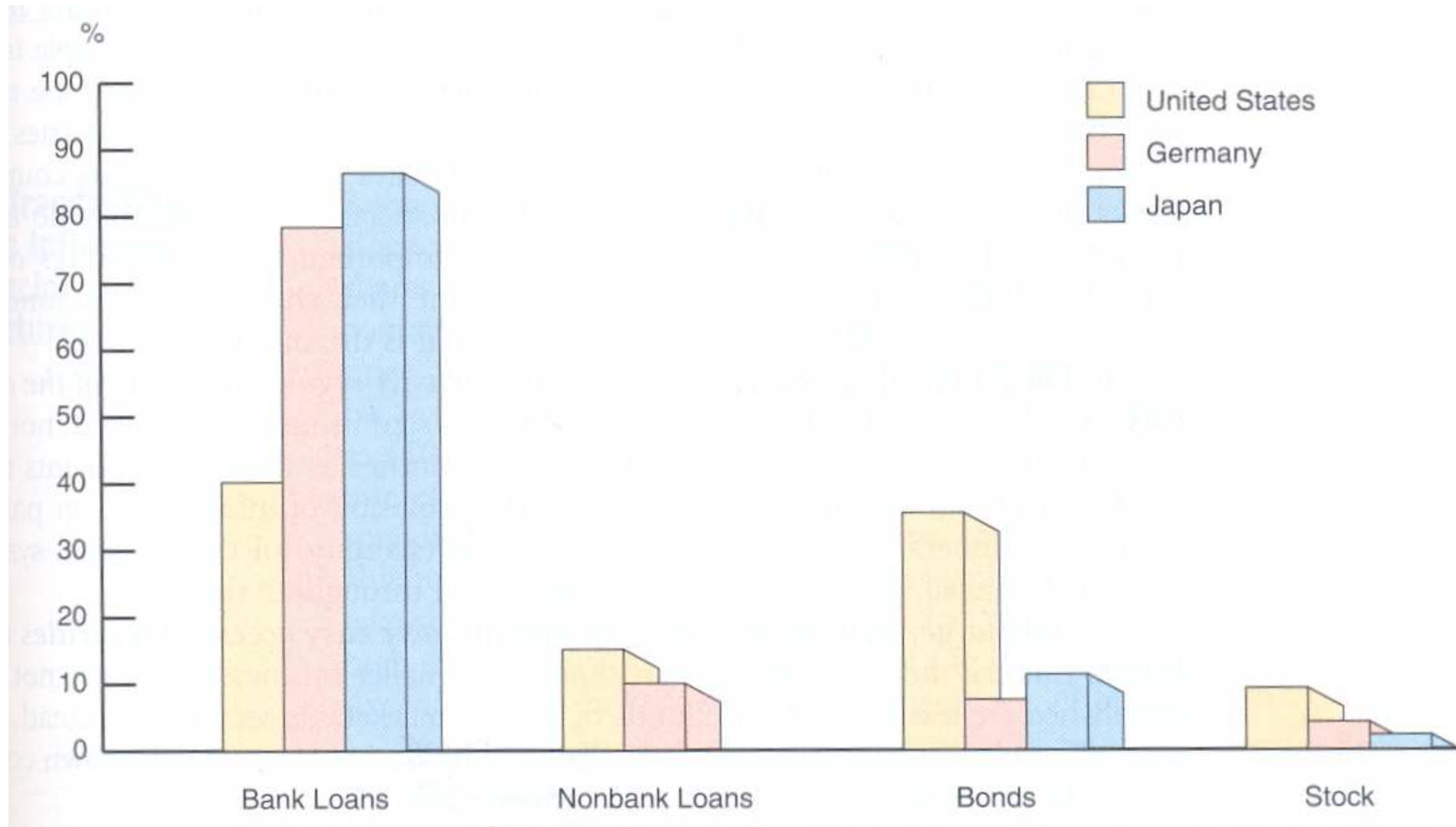
##### *1. Credit and loans are an important source of financing business*

- ▶ One could think that there is an incentive for a firm to finance their business primarily by selling equities (e.g. stocks), since the stock owner only have claims on the residual profit.
- ▶ Due to information asymmetries about risky business projects the owner of financial funds prefer to buy assets with a lower risk like bonds, or to buy “risk-free” assets like time deposits which are used by the financial intermediates to provide credits.
- ▶ Financial intermediates have lower costs to achieve information about the risky business.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.4 What Stylized Facts are Explained by Adverse Selection?



(Source: Mishkin (2006), p.171)

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.4 What Stylized Facts are Explained by Adverse Selection?

*2. Indirect Financing via Intermediates (like banks) is much more important than Direct Financing*

- ▶ The same argument applies

*3. The financial system is one of the most regulated sectors in the economy.*

- ▶ Regulation is needed to alleviate the problems of information asymmetries.

## 2. Theory of Financial Structure

### 2.3 Adverse Selection Problems

#### 2.3.4 What Stylized Facts are Explained by Adverse Selection?

*4. Large well-established firms have a more easy access to financial funds than small or new firms.*

- ▶ Large firms have more expertise as well as more economies of scale to provide detailed information.
- ▶ Only large firms are rated by rating agencies.
- ▶ Well-established firms have built up reputation.
- ▶ Large firms can provide much more collaterals.

*5. Collaterals are a prevalent ingredient of loan contracts for firms and households.*

- ▶ Collaterals lead to a drastic decrease of risk premiums what alleviates the adverse selection effect.
- ▶ Combining different interest rates and collateral requirements may lead to self-selection (separating equilibrium).

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### Outline:

2.4.1 Introduction into Principal-Agent-Problems

2.4.2 How Moral Hazard Affects the Choice Between Debt and Equity

2.4.3 Solving Moral Hazard Problems

2.4.4 What Stylized Facts are Explained by Moral Hazard?

#### Literature:

Mishkin (2006), chapter 8

Wolfstetter, E. (1999), *Topics in Microeconomics*. Cambridge University Press, chapter 11

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.1 Introduction into Principal-Agent-Problems

##### General Structure:

- ▶ Principal offers a contract to the agent.
- ▶ The payoff depends on the unobservable behavior of the agent as well as on stochastic variables.

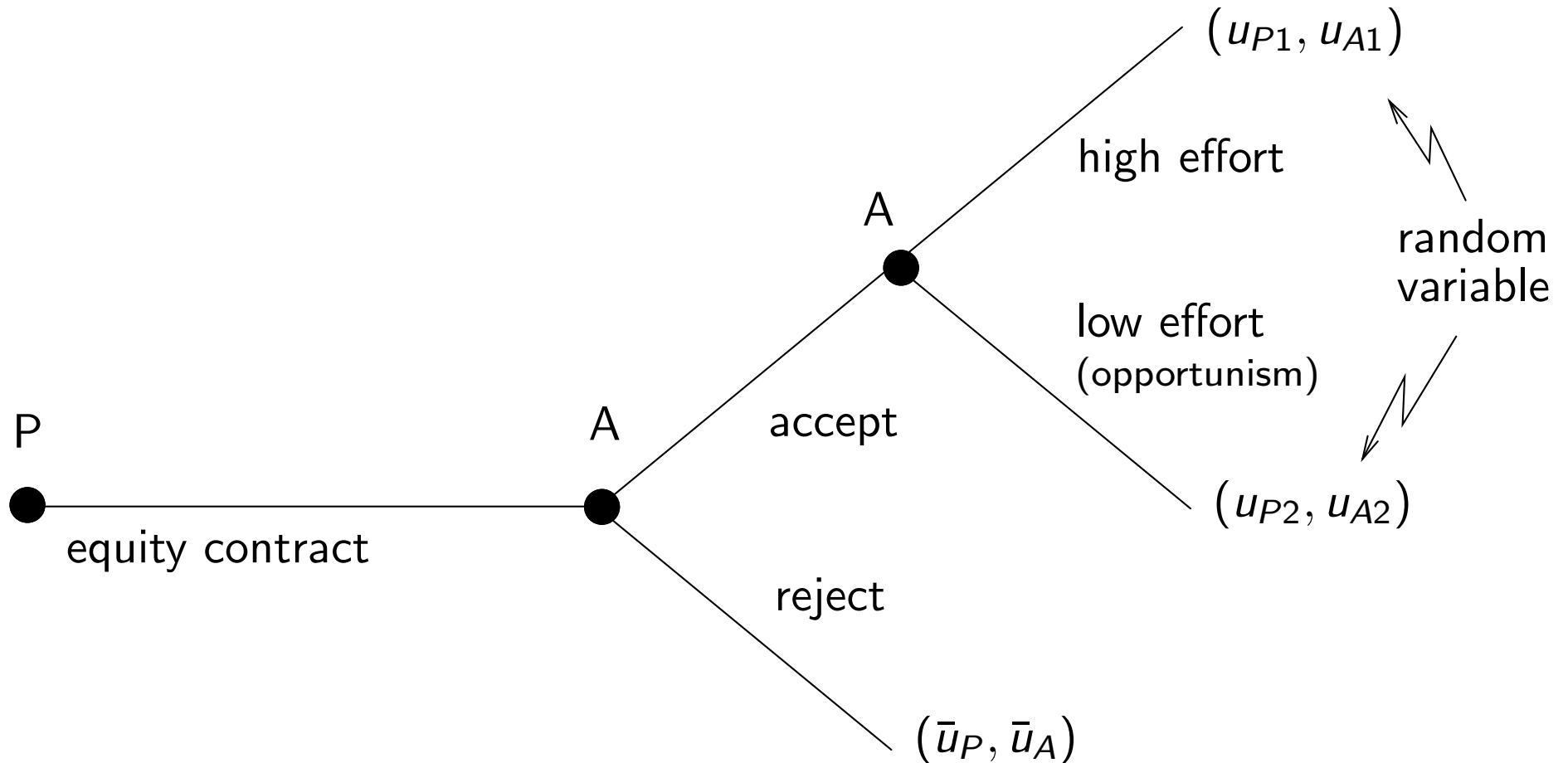
##### *Examples*

- ▶ Employer-employee relationship: The outcome for the employer depends on the unobservable effort of the employee.
- ▶ Borrower-lender relationship: The risk of debt failure depends on the choice of the lender (financing high risk or low risk projects)
- ▶ The agent has an incentive to exploit the unobservability of his choice in order to maximize his own utility instead of making decisions in accordance to the preferences of the principal (= moral hazard). This can be anticipated by the principal. How to construct an incentive compatible contract?

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

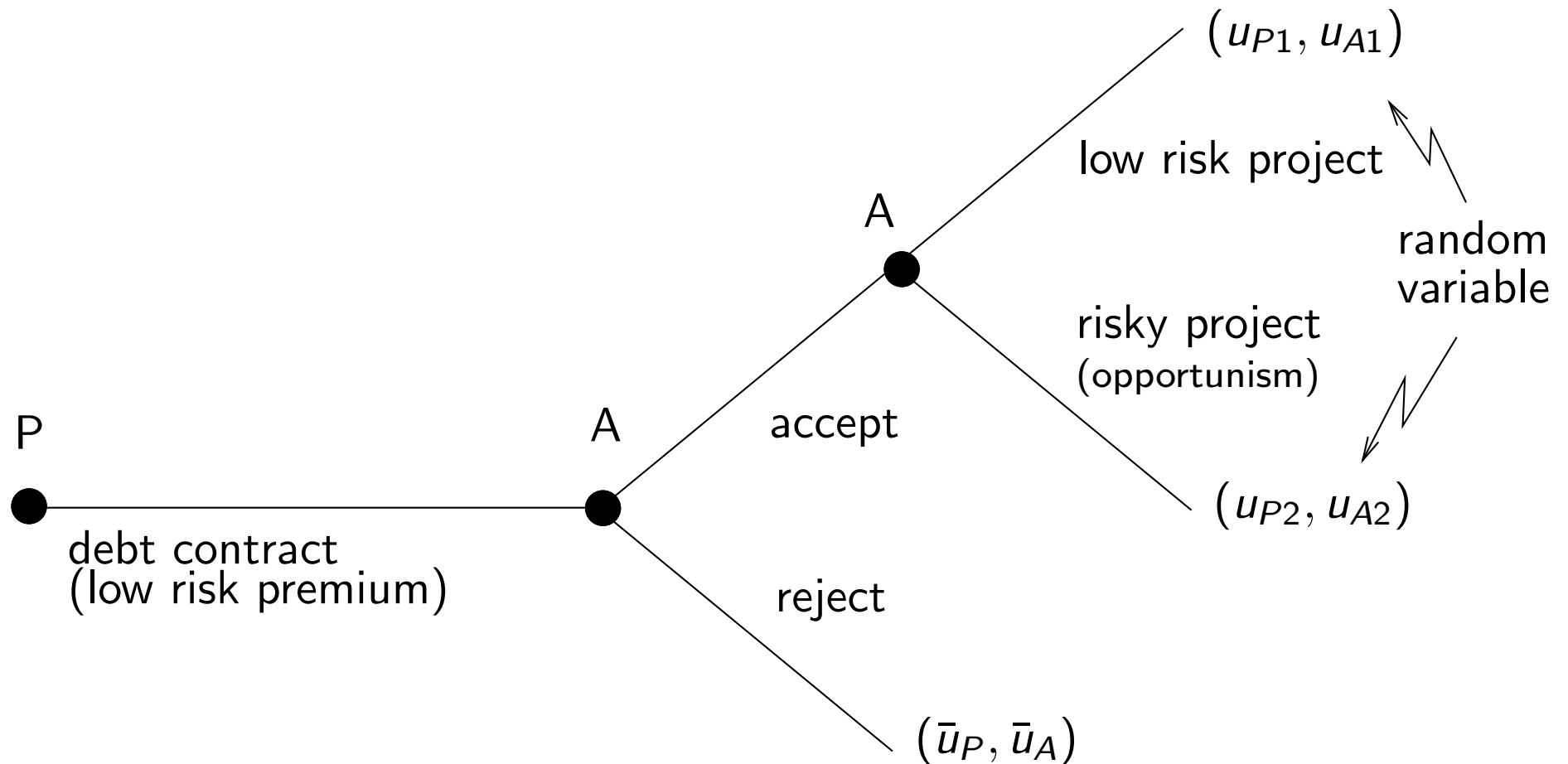
#### 2.4.1 Introduction into Principal-Agent-Problems



## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.1 Introduction into Principal-Agent-Problems



## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

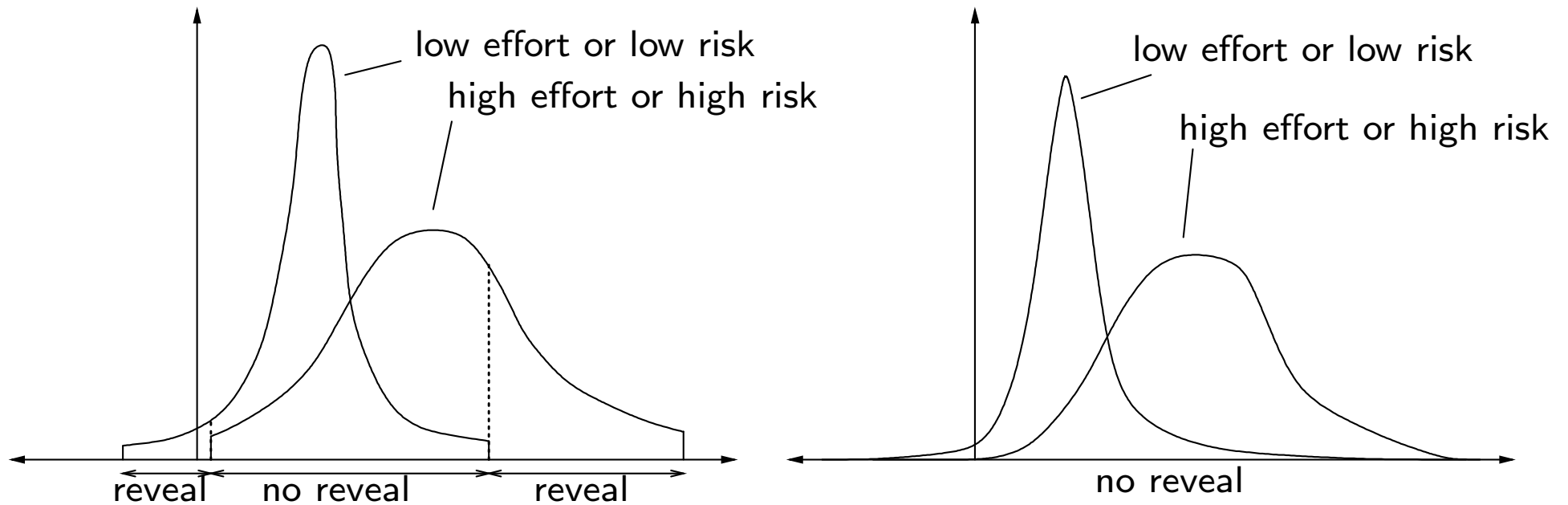
#### 2.4.1 Introduction into Principal-Agent-Problems

- ▶ The principal is (at the best case) able to observe the outcome of the agent's decision, not the decision itself = hidden action (except for monitoring).
- ▶ In some cases it is possible to conclude from the outcome to the underlying actions of the agent (revelation), in other cases this is not possible (non-revelation).
- ▶ Therefore, the contractual payments can depend on the outcome but not on the behavior of the agent.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.1 Introduction into Principal-Agent-Problems



## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.1 Introduction into Principal-Agent-Problems

### Two types of Moral Hazard problems:

Assume that agent = firm = investor = manager

- ▶ In case of equity contracts the agent tends to reduce his **effort**, since the equity holder benefits from the returns due to his efforts. In case of a debt contract, the lender receives fixed payments, and the agent has an incentive for high efforts since he benefits from the increasing expected return.
  - ▶ In case of debt contracts the agent tends to invest in **too risky projects** than negotiated with the borrower. The reason is that in case of negative returns of the project the debt failed, hence the lender also carries the risk. The risk of the agent, however, is thus limited.
- ⇒ How to construct a financial contract which induces the agent to decide according to the principal's preferences?

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.2 How Moral Hazard Affects the Choice Between Debt and Equity

### Contracting in the presence of Moral Hazard:

- ▶ Assume two decision alternatives for the agent: Financing a low risk project with a medium expected return (A), or a high risk project with a high expected return (B).
- ▶ The financial contract regulates how the **return** of the investment project and how the **risk** is allocated to the principal and the agent (“risk-return-scheme”).
- ▶ The principal anticipates the incentive structure of the agents. He proceeds in two steps:
  1. What is the optimal risk-return-scheme  $S_i$  so that the agent has an incentive to choose a certain alternative ( $i = A, B, \dots$ )?
  2. Which risk-return-scheme  $S_i$  maximizes the utility of the principal?

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.2 How Moral Hazard Affects the Choice Between Debt and Equity

##### Two extreme cases:

- ▶ Fixed payments = low risk for the agent,  
residual return = high risk for the principal

*Examples:* fixed wages in case of employer-employee-relationships; shareholder and fixed payed manager of a firm (equity contract)

- ▶ Residual returns = high risk for the agent,  
fixed payments for the principal

*Example:* premium wages for employee and fixed return for the employer; fixed interest payments for the borrower, residual return for the investor (debt contract)

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.2 How Moral Hazard Affects the Choice Between Debt and Equity

##### **A note on guarantees (suretyship):**

- ▶ Guarantees from third parties (like government) reduces the risk of the lender in case of a credit failure.
- ▶ The lender has a bias towards financing too risky projects.
- ▶ Similar to Moral Hazard effects in case of insurances.
- ▶ Example: current bank crisis in 2008 – if large banks could expect that in case of insolvency they will be a governmental bailout they might be less cautious in buying risky assets.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.3 Solving Moral Hazard Problems

### Equity Markets:

#### *a) Screening/Monitoring:*

- ▶ Providing information about the decisions of the investor and their consequences for earnings and profits. Thus, the actions are less “hidden”.
- ▶ This is costly!
- ▶ If there are many holders of equity capital, a free-riding problem arises.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.3 Solving Moral Hazard Problems

*b) Governmental Regulation:*

Same argument as in case of adverse selection (see above).

*c) Co-determination of management decisions*

This is only possible in case of financial intermediation: Financial funds are given to an FI (e.g. an investment corporation) that buys equities of a firm but also participate in the management.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.3 Solving Moral Hazard Problems

##### *d) Manager contracts*

If managers are payed according to the impact of their decisions on the firm value (e.g. by stock options), it could be expected that they have similar preferences than other holders of equity shares.

##### *e) Mixing with debt contracts*

Similar effect: The lender receives fixed payments, the agent receives the residual profit. He will show much effort and choose projects according to his risk preferences.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.3 Solving Moral Hazard Problems

### Debt Markets:

#### *a) Net Worth*

Sum of assets minus liabilities = Net Worth. A failure of the project (negative returns) reduces the agent's net worth. Hence, he has an interest to choose projects according to his risk preferences instead of exploiting the moral hazard effect and shifting the risk of loss to the lender.

#### *b) Collaterals*

Most debt contracts contain covenants to keep some valuable collaterals. In case of debt failure the lender can claim these collaterals. This works similar to the net worth effect (see above).

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.3 Solving Moral Hazard Problems

##### *c) Provision of information*

The debt contract contains covenants that the borrower must provide (regularly) information about his activities. There may be contractual penalties in case of verified false information.

##### *d) Financial intermediation*

Restrictions in contracts must be monitored and enforced. Intermediaries can do this more effectively and with lower transaction cost than an individual lender.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.3 Solving Moral Hazard Problems

#### Summary:

- ▶ Moral Hazard (MH) arises in both, equity and debt contracts.
- ▶ MH may result in (a) too low effort of the agent, (b) choosing too risky projects.
- ▶ Financial contracts should be designed in an incentive compatible way, i.e. that agent's utility maximizing decisions are compatible with the preferences of the principal. This is not always perfectly possible.
- ▶ There exist some tools how to alleviate the problem of MH.
- ▶ Financial intermediaries have better possibilities to alleviate the MH problem.

## 2. Theory of Financial Structure

### 2.4 Moral Hazard Problems

#### 2.4.4 What Stylized Facts are Explained by Moral Hazard?

1. *Credit and loans are an important source of financing business*
2. *Indirect Financing via Intermediates (like banks) is much more important than Direct Financing*
3. *The financial system is one of the most regulated sectors in the economy.*
5. *Collaterals are a prevalent ingredient of loan contracts for firms and households.*
6. *Debt contracts are typically complicated and contain many restrictions on the behavior of the borrower.*