Lecture 1. Introduction

What is finance?
- Real vs financial investments
- Management of risks
  - Intertemporal vs cross-sectional
- Asset pricing
- Portfolio management
- Performance evaluation
- Financial engineering

Typical issues / myths
- Mutual fund X has the highest annual return. Does X have the best portfolio manager?
  - Performance evaluation
- Speculators bring excessive volatility to stock markets. Should we limit speculation?
  - Arbitrage, market efficiency
- How to support local financial market? Russian companies should make IPO at home, pension funds should not invest abroad
  - Cost of capital, portfolio management
- Central Bank’s reserves are mostly invested in foreign government bonds
  - Diversification, inter-temporal insurance
- Russia’s stabilization fund has accumulated more than $15 bln. Why not invest in domestic projects?
  - Risk insurance, agency problem

Investment environment vs investment process

Financial institutions
- Basic questions
  - Existence
  - History
  - Evolution
  - Convergence
- Financial markets
  - Investors vs borrowers
  - Listing requirements
  - Depositary receipts
  - Counterparty risk
  - Information transparency and insiders
- Financial instruments
  - Cash flow vs control rights
  - First vs second level
  - Indices
- Financial intermediaries
  - Private vs institutional investors
  - Solving agency problem
  - Asset transformation
Asset pricing / project evaluation
- Time dimension: analysis under certainty
  - Fixed income
  - Capital budgeting
- Cross (risk) dimension: analysis under uncertainty
  - States of nature
  - Arbitrage pricing
- Portfolio optimization
  - Diversification
  - Selectivity vs timing
- Equilibrium models
  - Risk factors: expected returns vs volatility

Further topics / courses
- Corporate finance
  - Capital structure
  - IPO, M&A
  - Corporate governance
- Econometrics of financial markets
  - Market efficiency
- Risk management
  - Market vs credit risk
- Behavioral finance
- Law and finance
Lectures 2-4. Financial instruments

Forms of business organization
- Sole proprietorship
- Partnership
- Corporation

Evaluate by
- The life of the entity
- The ability to raise capital
- The owners' liability

Modern corporation
- Advantages
  - Limited liability
    - 1811: general act of incorporation in NY
  - Easy transfer of ownership
  - Unlimited life
  - Ability to raise large amounts of money
- Disadvantages
  - Start-up can be costly
  - Earnings subject to double taxation
  - The agency problem
    - Separation of control and ownership
    - The leverage effect of debt

Equity vs Debt
- Shareholders
  - Control rights (e.g., elect directors)
  - Limited liability
  - Residual claim on assets (after paying up liabilities)
  - Dividends (fully taxable)
- Debtholders
  - Fixed contractual claim against the corporation
  - No voting power unless debt is not paid
  - Interest on debt is tax-deductible

Securities
- Characteristics
  - Contingent contractual claim
  - Marketability
  - Necessary conditions:
    - Record-keeping technology
    - Legal infrastructure (contracting and enforcement)
- Derivatives: second level
  - Payoff depends on the value of other (underlying) securities

Bond characteristics
- Amount / date of issue, maturity, currency, par value
- Coupon payments
  - Frequency, floating vs fixed rate
- Security (attachment to the property)
  - Debenture/note vs bond
- Protective covenants
  - Restrictions on further indebtedness, max dividends
- Seniority
  - Subordinated debt paid after senior debt

What would happen if creditors had control over corporation?

Why is it important for a security to be liquid?

What is the price of a floating rate bond right after the coupon payment?
Fixed Income instruments
- Money market: maturity below 1 year
  - Treasury / corporate bills
    - Zero-coupon / pure discount bonds
  - Repos (repurchase agreements)
    - Collateralized loan
  - Interbank rates
    - E.g., LIBOR
- Capital market
  - Treasury notes and bonds
    - Considered risk-free
  - Federal agency and municipal securities
    - No explicit guarantee
  - Corporate bonds
    - Subject to default risk, may be callable and with collateral

Options
- Right to buy/sell at strike price in the future
  - Call / put
  - European / American
  - Long / short
- Asymmetric payoff
- Driven by volatility of the underlying asset
- Intrinsic value vs time value

Embedded options
- Common equity
  - Call on the value of the firm with strike equal to the face value of debt
- Convertible bonds
  - Hybrid instrument
  - Mitigate the problem of excessive risk taking
- Executive options
- Real options

Exotic options
- Bermudan option
- Exchange option: \( \max(A - B, 0) \)
- Binary option: \( I\{S_T > X\} \)
- Asian option: \( \max(S_{\text{avg}} - X, 0) \)
- Barrier option:
  - Knock-in / knock-out
  - Call / put

Interest rate options
- Cap (on r with strike x): \( \max(r - x, 0) \)
  - Call on %
- Floor: \( \max(x - r, 0) \)
  - Put on %
- Collar of the borrower: \( r - x \)
  - Long cap and short floor
  - Forward on %

Preferred stock
- Preference over common stock in cash rights:
  - in the payments of dividends
  - in the assets in case of bankruptcy
- No voting rights, unless no dividends
- Is it really debt in disguise?
  - Fixed dividend: usually, \textit{cumulative}
Foundations of Finance, NES 2005/6

- Stated liquidating value
- Call provision:
  - Can be converted to common shares

**Forward**
- Obligation to buy/sell at pre-specified (delivery) price at certain time in the future
  - Long/short position
  - The forward price = delivery price that would make the contract worth exactly zero
- Symmetric payoff
- Low liquidity
- Must be offset by the counter deal
- Credit risk

**Futures**
- Standardized exchange-traded contract
  - Amount, quality, delivery date, place, and conditions of the settlement
- Credit risk taken by the exchange
  - The exchange clearing-house is a counter-party
  - Collateral: the initial / maintenance margin
  - Daily marking to market
- Open interest vs trading volume

**Swap**
- Interest rate swap
  - Exchange of fixed-rate and floating-rate interest payments for a fixed par value
- Currency swap
  - Exchange of interest payments in different currencies
- Motivation: comparative advantage
  - E.g., company A has a higher credit rating and comparative advantage for fixed rate debt:
    - \( R(A,\text{fix}) < R(B,\text{fix}), R(A,\text{fl}) < R(B,\text{fl}) \)
    - \( R(B,\text{fix}) - R(A,\text{fix}) > R(B,\text{fl}) - R(A,\text{fl}) \)

**Different types of swaps**
- Step-up / amortizing
  - Changing par
- Extendable / puttable
  - Changing maturity
- Equity swap
  - To avoid taxes
- Deferred/forward swap
- Swaption
  - Option on an interest rate swap

**Major derivative instruments**
- Stocks: options
- Stock index: futures
- Commodities: futures, forwards, options
- Currency (FX): forwards, swaps, options
- Interest rates: swaps, forwards, options
- New: weather / insurance / electricity / credit derivatives
Indices
- Aggregate picture of a particular market segment
  - Should be replicable by investors
  - Benchmark to evaluate portfolio performance
- Weighting
  - Equal vs market cap
  - Free-float adjustment: exclude strategic stakes
- Equity indices:
  - Small-cap vs large-cap
  - Value vs growth
- Fixed income indices
  - Short-term vs long-term
  - High vs low credit rating

Credit derivatives
- Separate credit risk management from the underlying asset
- Types of insured credit risk:
  - Credit event, value of the underlying asset, recovery rate, maturity
- Total return swap
  - Fixed or floating payments in exchange for the current income from the underlying asset
- Credit default swap
  - Regular premium payments in exchange for a one-time premium in case of the credit event

Role of derivatives
- To hedge risks
  - Make risk-offsetting bets
- To speculate
  - Take a view on the future direction of the market
- To lock in arbitrage profit
  - Long-short (self-financed) portfolio
- To change the nature of liability/investment
  - Without a need to remove it
- …at low cost!

Investment strategies
- Naked forward
- Forward spread
  - Calendar / cross
- Naked option
- Covered option
- Spread: options of one type
  - Bear / bull / butterfly / calendar
- Combination: options of different type
  - Straddle / strip / strap / strangle

What are the main types of market participants?
Lectures 5-6. Market microstructure

Examples
- Ticks
  - 1/8 vs 1/32 vs decimal
- Price over 100
  - Stock splits
- Analyst recommendations
  - Conflict of interests
- Failure of LTCM
  - Advanced models did not account for the liquidity crisis

Market participants
- Brokers
  - Trading on behalf of a client
- Dealers
  - Trading for their own account
- Market-makers
  - Providing bid-ask quotes

Placing an order:
- Market
- Limit
- Short sale
  - 'Selling a cow, which you don’t own’
  - Borrow a stock from (another client of) your broker
- Stop loss/buy
  - Conditional market order: to lock in gains

Margin trading:
- Initial / maintenance margin
  - % of MV(assets) kept in the account as collateral
  - The rest is borrowed from the broker
- Margin call
  - If the amount in the account drops below maintenance margin
- Leverage effect: \( r = \frac{\Delta P - \text{interest}}{P_0 \text{margin}} \)

Classification of financial markets
- Bank credits
  - Commercial vs Interbank
- Foreign exchange (FX)
  - Spot / forward exchange
  - Deposit-loan
    - National markets
    - Euro markets
- Security market
  - Primary
  - Secondary
    - Exchange: NYSE, LSE (stocks), CBOT, LIFFE (derivatives)
    - OTC (over-the-counter): NASDAQ
Desirable characteristics

- Informational transparency
- Min transaction costs
- Liquidity
  - Ability to open or close large positions without strong effect on prices
  - Tightness / depth / resiliency
- Informational efficiency
  - Speed of incorporating information to prices

Market types

- Degree of continuity
  - Periodic vs continuous systems
- Reliance on market makers
  - Auction / order-driven market
  - Dealer / quote-driven market: market maker takes the opposite side of every transaction
- Degree of automation
  - Floor vs screen-based electronic systems
- Protocols
  - Rules regarding program trading
  - Choice of minimum tick
  - Rules to halt trading, circuit breakers
- Transparency: providing info before (quotes, depths) and after (actual prices, volumes) the trades
  - Extent of dissemination: brokers, customers, or public
  - Speed of dissemination: real time / delayed feed
  - Degree of anonymity: hidden orders, counterparty disclosure
  - Permitting off-exchange / upstairs trading

Three basic trading systems

- Batch auction / call market: NYSE open
  - Agents submit demands to the auctioneer who sets common market clearing price
- Continuous auction: NYSE intraday, Euronext
  - Floor: brokers trade with each other on behalf of their clients
  - Electronic: the system displays the best limit orders and automatically executes incoming market orders
- Dealership market: NASDAQ
  - Market-makers provide bid and ask prices at which other agents may trade

<table>
<thead>
<tr>
<th>Stock exchange</th>
<th>OTC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auction</td>
<td>Dealer market</td>
</tr>
<tr>
<td>One center</td>
<td>Different locations</td>
</tr>
<tr>
<td>Access only for members</td>
<td>Much wider membership</td>
</tr>
<tr>
<td>Listing with strong requirements for companies</td>
<td>No or weaker requirements</td>
</tr>
<tr>
<td>Quoting: a single price</td>
<td>Bid/ask quotes or limit order book</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Market Type</th>
<th>Nasdaq- NMS</th>
<th>NYSE Open</th>
<th>NYSE Intraday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>×</td>
<td></td>
<td>×</td>
</tr>
<tr>
<td>Floor-based</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Dealer Presence</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Multilateral</td>
<td>×</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transparency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-trade Quotes</td>
<td>×</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Post-trade Reports</td>
<td>×</td>
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</tbody>
</table>

In which market:
- Do the prices adjust quicker to new info?
- Is it harder to trade anonymously?
- Are the transaction costs lower?
- Is the execution risk lower?
Recent developments
- Trading online
- Exchange-traded funds (ETFs)
  - Mimick indices
  - E.g., Cubes, Spiders, Diamonds
- Electronic Communication Networks (ECNs)
  - Automated systems for disclosing / executing trades
- Program trading

Structural shifts
- Technological innovations
- Substantial increase in trading volume
- Competition between exchanges and ECNs
- Proliferation of new financial instruments

Regulation of stock trading
- Circuit breakers
  - Restrictions on trading if prices reach a threshold
- Legislation
  - Firms: public disclosure of relevant info
  - Employees: no insider trading
  - Market participants: fair trading
- Monitoring by SEC
  - Key divisions: CorpFin, MktRegulation, Enforcement

Market microstructure models: process by which investors’ latent demands are ultimately translated into prices and volumes – ‘looking inside the black box’
- Price formation / discovery
  - How prices impound info over time
  - Determinants of trading costs
- Market structure and design
  - Trading process vs price formation
- Transparency
  - Info and disclosure
- Interaction with other areas in finance
  - CorpFin: IPO underpricing, stock splits
  - Asset Pricing: liquidity as risk factor, anomalies vs trading costs
  - IntlFin: ADRs, cross-border flows

Selected issues
- What are the components of the bid-ask spread?
  - Risk aversion / Inventory control / Info asymmetry
- Why is trading concentrated at the opening and closing?
  - Optimal choice of timing the trade by uninformed
- Is continuous bilateral system better than periodic multilateral one?
- Is it good for a stock to be traded in several markets?
  - Gravitation vs stratification
- Should the limit order book be displayed in public?
- How to execute block trades optimally?
Lectures 7-9. Financial intermediaries

Rationales for the existence of FI
- Transaction costs and economies of scale
  - Special human and technological skills
  - Cross-sectional and temporal reusability of information
- Information-based rationales
  - Market mechanisms may be unable to efficiently resolve information problems
    - Info asymmetry: ex ante prospects / ex post return of the borrower
    - Free-rider problem among investors
  - FIs acquire information about the borrowers and monitor their performance
    - Diversification benefits
  - Who monitors the monitor?
    - Debt contract: bank deposits
    - Equity claim (in case of easily priced assets): mutual funds

Services of Financial Intermediaries
- Brokerage: bringing together providers and users of capital without modifying the claim
  - Transactions services (e.g., check-writing)
  - Financial advice (e.g., portfolio management)
  - Screening and certification (e.g., bond ratings)
- Qualitative asset transformation: transforming the financial claims borrowers prefer into claims that savers prefer to hold
  - Liquidity and payment intermediation
  - Maturity intermediation
  - Denomination intermediation
  - Diversification intermediation
  - Information intermediation

Commercial banks
- Long-term illiquid assets financed by short-term liquid deposits
  - Interest rate risk
    - Refinancing / reinvestment risk
  - Credit risk
    - Firm-specific / systematic / country risk
  - Off balance sheet risk (e.g., letter of credit)
  - Operational risk
  - Liquidity risk
- Danger of bank runs
  - Sequential service constraint
- Eliminating bank runs
  - Capital requirements
    - But: may induce more risks
  - Deposit insurance / lender of last resort
    - But: may induce excessive risk-taking by the banks
  - Interbank market
    - But: coordination problem among banks
- Securitization: selling claims against a specific part of the bank’s assets
  - Reducing info distortions
  - Better risk sharing
  - But: weaker monitoring incentives

Why are deposits typically short-term?

Which types of loans are better suited for securitization?
Financing: Banks vs Capital Markets

<table>
<thead>
<tr>
<th>Banks</th>
<th>Capital Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td>The intermediary charges an additional layer of costs</td>
<td>Lower interest, but larger initial (time / financial) costs</td>
</tr>
<tr>
<td>Close monitoring of the borrower</td>
<td>Tough info requirements</td>
</tr>
<tr>
<td>Usually, not very large (except for syndicated loans)</td>
<td>Free-rider problem</td>
</tr>
<tr>
<td>The form of credit may be very flexible and project-specific (e.g., credit line)</td>
<td>Usually, standard contract</td>
</tr>
<tr>
<td>May restructure the credit in the future</td>
<td>Harsh budget constraint</td>
</tr>
<tr>
<td>May extract information rent</td>
<td></td>
</tr>
</tbody>
</table>

What will choose firms:
- with unestablished credit reputation?
- with good prospects for future profits?
- with severe intra-firm incentive problems?

Do banks have a future?
- Only the largest firms have access to bond markets
  - Tough information requirements to corporations issuing bonds
- Large companies rely on syndicated bank loans to finance large projects
  - Info requirement / greater control
- Banks are well-suited for the transfer of the control from shareholders
  - Banks restructure and recapitalize firms in financial distress
- Banks provide sophisticated financial products

Is more competition always good?
- Recent trends in banking:
  - EU: integration and cross-country competition
  - USA: lifting restrictions on universal banking
  - Russia: allowing entry of foreign banks?
- Intensified competition in banking regarded with suspicion:
  - Lower rents => excessive risk taking and failures
  - Larger winner’s curse in bidding for loans => undue conservatism
  - Higher systemic risks

Investment banks
- Securities intermediation:
  - Issuance by companies and governments (e.g., IPO)
  - Purchase by investors
  - Financial advice on M&A, project finance, structured products, etc.
- Cyclical nature of earnings
  - Large profit in a strong market

Insurance companies
- Transfer risks from clients to themselves for a fee
  - Life / health / property and casualty insurance
- Fixed liabilities: annuity
  - Long-term investments: bonds, RE, etc.
- Rising demand
  - Aging of the population
- Reinsurance: e.g., Lloyds
- Suffered from recent terror acts and catastrophes
Banking in the US
- 1927: the McFadden act
  - Prohibiting interstate banking
- 1933: the Glass-Steagall act
  - Separation of commercial and investment banking
  - CBs cannot own voting equity
- 1999: the Gramm-Leach-Bliley act
  - Allowed consolidation of CB, IB, and insurance companies

Banking outside of the US
- Large universal banks
  - Full range of financial services
  - Nationwide branch network
  - E.g., Fuji, Sumitomo, Credit Lyonnais, Deutsche, HSBC, ABN-AMRO
- Substantial stock (cross) ownership
  - Active role in corporate management
- Smaller, but rising importance of security markets

Money managers: investing money into a portfolio of assets
- Specific risk-return profile
  - Stocks vs bonds (vs derivatives)
  - Conservative vs aggressive
  - Domestic vs intl
- Nature of liabilities
  - Equity vs debt
- Managerial compensation
  - Asset-based vs performance-based
- Methods of distribution
  - Direct vs via broker
- Regulation

Mutual funds
- Role of the management company
  - Fund family (complex)
- Management fee:
  - Asset-based: proportional to TNA
  - Performance-based: must be symmetric around the benchmark
- Open vs closed funds
  - Shares are “marked to market” daily: NAV = TNA/(# shares)
- Active vs passive (index) funds
- Load vs no-load funds (A/B/C)
  - Sales loads: front-end / back-end / 12b-1 fee

Benefits of investing via MF
- Low transaction costs
  - Easy way to buy a diversified portfolio
- Customer services
  - Liquidity insurance
- Professional management
  - Selecting right stocks at right time?
Stylized facts about MFs
- Largest FI in the US
- There are over 8,000 MFs (more than stocks)
- On average, MFs do not earn positive performance adjusted for risk and expenses
- (Mostly bad) performance persists
- New money flows mostly in top performers,
  o …but does not really flow out from poor performers
- Many funds deviate from their stated objectives

Pension funds
- ‘Fixed’ liabilities
  o Defined contribution vs defined benefit plans
- More conservative strategy
- US: 401(k) plans
  o Investors themselves select PFs

Hedge funds
- More aggressive strategy
  o Long-short / macro / event-driven
  o High leverage
  o Usually, low systematic risk
- Strict entrance restrictions
- Management fee:
  o Typically, 20% of profit, with high watermark provision
- High attrition rate

Wealth management: providing personalized services to high net worth customers
- Wealth management: mass segment ($100,000-$1mln)
  o Portfolio management
  o E.g., Citibank, ING
- Private banking: for new riches
  o Financial (e.g., tax and estate) planning, cash and asset management
  o E.g., HSBC, UBS
- Family office: for old wealthy families
  o E.g., Piktet, Courtz

Recent scandals with FIs
- Insider trading
  o October 31, 2001: Goldman Sachs economist received info about 30y US Treasuries before the official release, traders earned $3.8 mln in 8 minutes
  o September 2003: Goldman Sachs paid $9.3 mln to SEC
- Investment banks: analysts’ conflict of interests
  o Analysts gave overoptimistic recommendations on IB clients’ stocks
  o December 2002: top 10 banks paid $1.4 bln as compensation
  o NASD required to separate analytical and IB depts of the same company
- Mutual funds, 2003: late trading
  o Some clients could trade at NAV fixed at 4pm on the same day
- Brokers’ pre-emptive trading
  o Brokers made own trades before executing their clients’ orders
  o December 2004: 5 top NYSE market-makers paid $240 mln to settle
Regulators in the US and Russia
- FRS / ЦБ РФ
  - Bank regulation
  - Monetary policy
- FDIC / ACB
  - Deposit insurance
- SEC / ФСФР
  - Securities operations

The “too big to fail” issue
- Continental Illinois Bank, one of the largest US banks
  - 1983-84: many defaults on loans
  - May 1984: massive deposit withdrawals
- Help from regulators:
  - FRS: credits via the discount window
  - FDIC: guarantee on all deposits, even beyond $100,000 limit
  - July 1984: FDIC purchased some loans and provided over $5 bln in capital
- At the same time, many smaller banks were not rescued
- “The rescue effort was less expensive than dealing with CIB’s failure”
- Arguments for
  - Direct costs of the bank’s failure
  - Domino effect: chain reaction
- Arguments against
  - Direct costs: FDIC recovered $1.1 bln of the $2.8 bln troubled loans it bought from CIB
  - Unfair competition
  - Incentive effects

Unification of intl banking regulation
- 1978: the Intl Banking Act in the US
  - Similar regulation for domestic and foreign banks operating in the US
- 1987: Single European Act
  - Free capital flow and expansion across the countries
  - Similar regulations on competition, mergers, taxes, etc. for European and foreign banks
- 1988: uniform capital adequacy guidelines for banks of 12 developed countries
  - Similar regulation for domestic and foreign banks operating in the US

Rating agencies
- Independent certification
  - Credit quality
  - Corporate governance
- Major players:
  - S&P, Moody’s, Fitch

Global trends
- Consolidation
- Increase in competition => declining margins
  - Both intl and across different types of FIs
- Traditional banking is shrinking
- New financial services and products growing
- Deregulation and unification of the regulation
Lectures 10-11. Analysis under certainty

Asset valuation
- Discounted cash flow approach: \( P_0 = \sum_t CF_t / (1+r)^t \)
- Bonds:
  - Assuming same discount rate: \( P_0 = \sum_{t=1:T} C_t / (1+r)^t + F / (1+r)^T \)
- Stocks:
  - Constant dividends: \( P_0 = C_1 / r \)
  - Dividends growing at rate \( g \): \( P_0 = C_1 / (r-g) \)

Definitions of rates
- Reinvestment:
  - Simple vs compound interest: \( P_T = P_0 (1+r_s T) = P_0 (1+r_C)^T \)
- Frequency of compounding:
  - Nominal (coupon) rate (payments \( m \) times a year)…
  - vs effective (annual) rate: \( r_E = (1+r_N(m)/m)^m - 1 \)
- Continuous compounding:
  - Log-return: \( r_C = m \log(1+r_N(m)/m) = \log(1+r_E) \)

Yield to maturity / internal yield / bond yield
- Rate that equates cash flows on the bond with its market value
- Internal rate of return earned from holding a bond to maturity
  - Assuming reinvestment at same rate
- Par yield
  - Coupon rate that causes the bond price to equal its face value
- Current yield
  - Annual coupon payment divided by the bond’s price
  - Often quoted but useless
- Zero rate (at \( t \) for payment at \( T \)): \( y(t, T) = \left[ \frac{1}{P(t, T)} \right]^{1/(T-t)} \)
  - YTM of a zero-coupon bond maturing at \( T \), with current price \( P(t, T) \) and face value of 1
  - How to get zero rates from coupon bond prices?
    - Bootstrapping method: coupon bond as a portfolio of zero-coupon bonds
- Spot rate: \( r(t) \equiv y(t, t+1) \)
- One-period zero rate
- Forward rate: \( f(t, T) = P(t, T) / P(t, T+1) \)
  - Rate on a one-period credit from \( T \) to \( T+1 \)

Term structure of interest rates
- Relationship between yields and maturities
  - For bonds of a uniform quality (risks and taxes)
  - E.g., Treasury / Baa
- Equivalent ways to present TSIR:
  - Discount curve: \( P(t, T), \text{ with } P(T, T) = 1 \)
  - Zero curve: \( y(t, T) = \left[ \frac{1}{P(t, T)} \right]^{1/(T-t)} \)
  - Forward curve: \( f(t, T) = P(t, T) / P(t, T+1) \)
- Upward sloping yield curve: Fwd Rate > Zero Rate > Par Yield

Theories of the term structure: why different yield curves?
- Expectations theory:
  - Unbiased expectations hypothesis: \( f(t, T) = E_t[r(T)] \)
  - Term structure is explained by expected spot rates
    - Upward sloping yield curve: signal that spot rate will increase
Liquidity preference theory:
- Investors demand a premium for bonds with higher risk
  - Long-term bonds require a liquidity premium
- Upward sloping yield curve: forward rates higher than expected future zero rates

Preferred habitat:
- Investors try to match the life of their assets with liabilities
- There is a premium for maturities with insufficient demand

Market segmentation:
- Short, medium and long rates are determined independently of each other
  - SR%: D – corporations financing their sr obligations (e.g., trade credit), S – banks
  - LR%: D – corporations financing lr inv projects, S – insurance co-s, pension funds
- Investors don’t react to yield differentials between the maturities

Empirical estimation of TSIR:
- Discrete rates:
  - Regression \( P = cD_1 + cD_2 + \ldots + (c+F)D_T \), where \( D_t = 1/P(0,t) = 1/y(0,t)^t \)
- Continuous rates:
  - Regression \( P = \sum_{t=1}^{T} c_t (a_0+a_1t+a_2t^2+\ldots) = a_0\sum_{t=1}^{T}tc_t+a_1\sum_{t=1}^{T} ttc_t+a_2\sum_{t=1}^{T} t^2c_t+\ldots \)

Modeling changes in bond prices:
- Due to passage of time:
  - E.g., flat yield curve: \( \Delta P = r P_0 \)
- Unanticipated shift in the TSIR:
  - Need to approximate the function \( P = f(y) \)
  - Duration: sensitivity of a bond’s price to the change in the interest rates

Macaulay’s duration:
\( P_0 = \sum_{t=1}^{T} C_t / y^t \Rightarrow \frac{\partial P}{\partial y} = -\sum_{t=1}^{T} tC_t / y^{t+1} \)
\[ \Lambda = \left[ \frac{\partial P}{P} \right] = -D \frac{\Delta y}{y} \]
- Wtd-avg maturity of bond payments
  - Generalized maturity for coupon bonds, \( D \leq T \)
- Elasticity of a bond’s price wrt ytm
  - The larger the duration, the riskier is the bond
- For small changes in %: \( \Delta P \approx -D P \Delta y/y = -[D/y] P \Delta y \)
  - \( D^* = D/y \): modified duration

Properties:
- C, coupon: -
- Y, %: -
- T, maturity: +

Limitations:
- Assumes horizontal TSIR
- Applies only to small changes in %

Fisher-Weil duration: \( D = -\sum_{t=1}^{T} t C_t / (P y_t) \)
- Fisher-Weil duration
- For parallel shifts of (non-horizontal) TSIR

Convexity:
\[ \frac{\partial^2 P}{\partial y^2} = -\sum_{t=1}^{T} t(t+1)C_t / y^{t+2} \]
\[ C = -\sum_{t=1}^{T} t(t+1)C_t / (P y_t) \]
\[ \Delta P/P \approx -D \Delta y/y + \frac{1}{2} C (\Delta y/y)^2 \]
Non-parallel shifts:
- Two types: LR% usually more stable than SR%
- Analytical approach:
  - E.g., assume \( d \ln y(t,T) = K^{T-t+1} d \ln r(t) \)
- Empirical approach:
  - Separate estimation of duration \( D^* = -[\Delta P/P] / \Delta y \) for SR and LR%

Immunization (wrt interest rate risk)
- Duration matching: \( D(\text{assets}) = D(\text{liabilities}) \)
  - This is active strategy, since both duration and TSIR change with time
    - Exact immunization requires frequent rebalancing (and large transaction costs)
  - Need correct measure of duration (and possibly convexity)
  - Does not insure against large shifts in the yield curve
- Typical strategies:
  - Cash flow matching
    - Exact immunization
  - Barbell: ptf of the shortest and the longest bonds
    - Can use same bonds for different liabilities
  - Focused: one bond with the required duration
    - Has similar convexity to that of the liabilities

Capital budgeting: analysis of investment projects
- Evaluate a given project:
  - Consider incremental cash flows
  - Use opportunity cost of funds as discount rate
- Net Present Value: \( \text{NPV} = \sum_i CF_i / (1+R)^i \)
  - Accept projects with \( \text{NPV} > 0 \)
- Internal Rate of Return: \( \text{IRR} = \text{discount rate that sets NPV to zero} \)
  - Accept projects with \( R < \text{IRR} \)

Investment decision rules: IRR vs NPV
- IRR may not exist or there may be multiple IRR
- IRR ignores the term structure of interest rates
- Mutually exclusive projects
  - IRR_A > IRR_B does not imply that A is preferable
  - Value additivity broken: can be IRR_A+C < IRR_B+C
  - Need to compute incremental IRR
- Projects of unequal lives
  - Annualized NPV
- Capital rationing
  - Linear programming: max NPV under budget constraints
- Sensitivity analysis
Lecture 12. Behavioral finance

Selected issues
- What are the typical patterns of the irrational behavior?
- How does it affect financial markets?
- Can one use the knowledge of behavioral biases to profit from it?

Behavioural theories
- Prospect theory
  - Loss aversion
  - Overstatement of low probabilities
- Overconfidence
- Regret
- Cognitive dissonance
- Reference points
- Representative heuristics
  - Diversification: 1/N bias
- Herding and informational cascades

Lecture 13. Law, finance, and growth

Selected issues
- How to measure country’s financial development?
- How is it related to legal system and industrial growth?
- What are typical financial systems?
- How do they differ in vulnerability to crisis?

Measures of Russia’s financial development
- Stock market
  - Size and liquidity of the domestic market
    - Market equity cap to GDP
    - # instruments (actively) traded locally
    - # IPOs
    - Free float
    - Trading volume / turnover rate
    - Transaction costs / bid-ask spread
  - Global integration
    - Share of foreign currency denominated obligations
    - # IPOs / trading volume abroad
    - Share of foreign investors in trading volume / ownership
    - Correlation (degree of co-integration) between Russian and foreign indices
  - Returns and risks
    - Mean return / st.dev. / Sharpe coefficient
    - Synchronicity of individual stock prices
    - Sensitivity to domestic / global risk factors
    - Duration / credit rating / YTM of bonds
    - Default / term spread
- Corporate sector
  - Corporate governance
  - Financial policy
- Banking system
Lecture 14. FSFR strategy

FSFR: Why do we need developed financial market?
- Contributes to economic growth
- Increases allocation efficiency
- Allows longer-term investment projects
- Makes the cost of capital lower
- Stimulates innovations
- Having a large number of financial instruments helps to achieve macro stability
- Makes the economy less sensitive to external shocks and systemic crises

What is the market cap of Russian stock market?
- Equity: from 17% of GDP in 2000 to 42% (7 trln rub) in 2004
- Corporate bonds: from 0.5% in 2000 to 2% in 2004
- Derivatives: 8 bln rub in 2004
- Insurance: 1400 companies, premiums of 0.5 trln rub,
- Investment funds: 286, over 100 bln rub in 2004, 85 thous investors

Characteristics of Russian fin market:
- Low free float: 5-25%
- Trading volume migrates to foreign stock exchanges via ADRs (75% in 2004)
- The bulk of pension money is still in the State Pension Fund investing only in state bonds
- Still narrow, concentrated and mostly illiquid market

Why do large companies choose to issue stocks or bonds abroad?
- Local legislation is less developed
- Foreign investors: high transaction costs and insufficient protection in Russia
- Local demand is not sufficient

Main directions of FSFR strategy
- Developing market infrastructure
  - Central depository, clearing, monitoring of risks, taxation, promoting pension reform and life insurance
- Easier regulation for companies entering the capital market
  - Derivatives market, securitization, mortgages, laws
- Legislation protecting investor rights
  - Info transparency (IAS), insider trading, CG (esp at reorganization)
- Reform the fin regulation system
  - Mega-regulator

Sample exam questions
- Scope of financial markets
  - Which country has the highest ratio of total fin assets to GDP?
    - Luxembourg (over 4000%), UK, Neth, US, Switzerland (over 200%)
  - How does the ratio of bonds to stocks vary across the countries?
    - LDCs have more bonds
  - What is the largest inst investor in the world judging by fin assets?
    - Insurance companies ($12 trln), pension funds, investment companies (both 10)
  - What inst investor has the fastest growth of assets in the world?
    - Investment companies (17%), pension funds (11), insurance companies (9)
• FSFR
  o Why need mega-regulator?
  o How to attract trading to domestic exchanges?
• Margin
  o What is the benefit from trading on margin?
  o Which type of traders / FIs usually uses high leverage?
  o Why don’t others trade with high leverage?
• Which type of order minimizes the time risk?
• What are the components of the bid-ask spread?
• What can help to prevent bank runs?
• What is the purpose of securitization?
• Should the central bank rescue a large bank in trouble?
• What is the risk of long forward position?
  o For hedger / speculator
• How to replicate forward with options?
• How to replicate swaption with option on a bond?
• Which strategy brings small stable income most of the time and sometimes huge losses?
  o How can hedge funds fool investors looking for high past returns?
• How to replicate call option with stock and bond?
  o Binomial tree
• Is there need for new Russian stock/bond indices? If yes, which ones would you suggest?
• What is the interest rate risk of a risk-free zero-coupon bond? Redeemable bond?
• What is the duration of a floating-rate bond?
• Which type of indices would you construct for Russian bonds?