Lecture 1

Fixed Income Derivatives (33601)

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Outline of This Session

- Introduction to the financial industry
  - Role of money and money business in history
  - History of financial industry in modern period
  - Review of the period after WW2
  - The crisis of 2007-8 and changes in the industry in the post-crisis period
  - FED actions
- Risk-free rate of return
  - Definition and possible proxies
  - Role of collateral in definition of risk-free rate

What is Financial Industry?

- Industry that has money as subject and underlying asset
- Industry that manages supply and demand of money
- Industry that transports money throughout the economy in space and time and provides financial services
- Main institutions: banks, credit unions, brokerages, asset management companies, hedge funds, exchanges, credit card companies, insurance companies, pension funds, private equity companies, proprietary trading companies, accounting companies, consumer finance companies
- Old and traditionally unpopular industry
- The most dominating Industry of the recent decades
- The Industry of cyclical crises
- Fixed Income Industry is a part that mostly deals with debt and time value of money as opposed to equity

Money: Its Role and first Appearance

- Money is believed to appear about 3 thousand years ago.
- What do we need money for?
- How did people trade before money was invented?
- Most often traded asset: hunting tools in exchange for whole or part of hunted animal.
- What could serve as money?
- About 1100 B.C. in China they started using little replicas of real tools as money
- 600 B.C., Lydia's King Alyattes minted the first official currency. The coins were made from electrum, a mixture of silver and gold that occurs naturally, and stamped with pictures that acted as denominations.

Role of Trade and Finance in Earlier Cultures I

- Civic Republican Tradition: Concept of "virtue" in ancient Greece;
- Aristotle believed that well governed city-state should not have citizens live a merchant's way; He also believed that commerce tended toward excess ("pleonexia" or greediness);
- Lending money for profit was unjust and unnatural because money is sterile
- Christian Tradition: The Gospels warned that riches were a threat to salvation; Usury was considered one of the greatest sins; The role of money was only to facilitate the exchange, but money could not be used to make more money;

The Role of Trade and Finance in Earlier Cultures II

- Jewish Tradition: Jews were allowed to lend to non-Jews, but lending with interest to each other was prohibited
- Middle ages: growth of cities required more reliable excange and trading to support city population with food
- In the 12th century the church resolved the conflict between the Christian tradition and the growing role of commerce and need to borrow money by allowing Jews to engage in forbidden economic activity
- But the stigma remained in the culture:
  "Neither a borrower nor a lender be; For loan oft loses both itself and friend, And borrowing dulls the edge of husbandry."
  W. Shakespeare, Hamlet

The Birth of Financial Capitalism in Europe I

- The amount of trade in Europe increased starting in early 15th century to the level that started creating global economies.
- Early 15th-mid 17th centuries: Portugal combined the arab triangular and traditional square sails on caravel and built colonies in West Africa, Brazil and India and used them in spice trade.
- Spain dominated most of America and conducted bullion trade.
- After the Reformation period and the independence war with Spain The Dutch Republic became the world economic leader; especially when the Dutch East India Company was founded (1602)
- The company used military to drive British and Portuguese out of Spice Islands, established colonies, was granted the right to make treaties and engage in wars

The Birth of Financial Capitalism in Europe II

- By 1669 the East India Company was the richest private company the world had ever seen
- Another global market dominated by Dutch: herring which was major source of protein for Europe.
- By the mid-17th century the Dutch were the most commercially oriented nation in Europe: They created stock markets
- The bank of Amsterdam was founded in 1609 and became the most important bank in Europe
- By mid-18th century with the help of such thinkers as Voltaire, Adam Smith the concept of capitalism was developed and became the dominating idea in the Western economies

The Birth of Financial Capitalism in Europe III

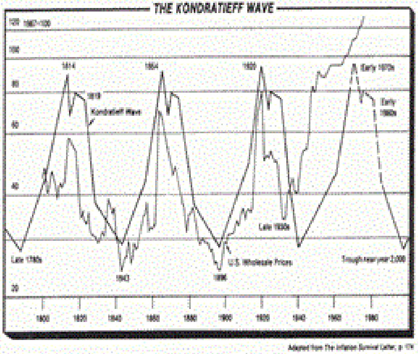
- In the course of the 18th century, Britain replaced Holland as the great commercial and naval power of the era, and one reason for that was the founding of the Bank of England in 1694
- Until then wars were often decided by whichever government was the first to run out of money
- Before the government borrowed money from private moneylenders at a high interest rate because the government was not considered a particularly good borrower
- As a result of financial revolution in Britain the government was able to borrow at a much lower rate using shares of South Sea Company, bonds and treasury bills of Bank of England. The government guaranteed loans by improving tax collection
- The failure of the South Sea Company (which many consider a prototype of the central bank) in 1720 and the earlier burst of the tulip bubble (1640) were the first financial crises of the era of financial capitalism

Kondratieff Cycles

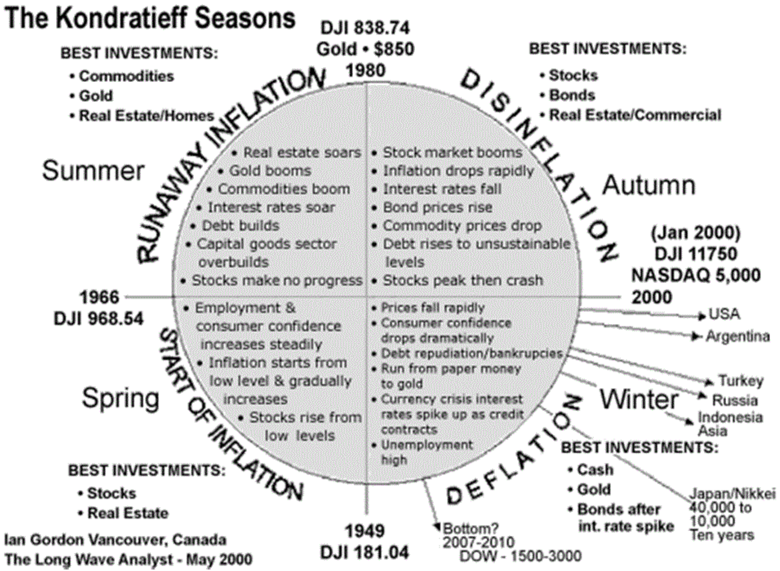
- At least since the tulip bubble financial crashes have been coming regularly
- In 1930s a Soviet economist Kondratieff was asked by Stalin to prove that the final crisis of capitalism that the world had at the time will lead to victory of socialism globally
- Instead the economist found that such crises occur periodically; he tracked them back to the crash of the South Sea Company
- Upset Stalin sent Kondratieff to camps where he disappeared some time around 1938
- Kondratieff cycles have approximate period of 60 years and have phases named by seasons
- We are in one of the the latest winter periods now

Nikolai Kondratieff

Nikolai Kondratieff (1892 – 1938)



Kondratieff Cycles



Development of the Industrial- Borrowing Complex in the Post-War period

- WW2 left much of the world economy in ruins
- The only economy not destroyed was the economy in the US
- The US inevitably became the next leader of global trading after Britain starting the middle of the 20-th century
- The new world order was cemented by Bretton Woods Agreement and Marshall Plan
- These developments resulted in the post-war structure of the financial system
- Bretton Woods Agreement and Marshall Plan created conditions for the "European miracle", later followed by "Japanese miracle", "Korean miracle", etc.
- But at the same time they set in motion forces behind the major economic issues of the post-war period

Bretton Woods System - I

- Shortage of US dollar assets in global economy was the main characteristic until 1958:
  - US economy is the strongest and the currency is the most trustworthy
  - USD pegged to gold at $35 per ounce was undervalued
  - European currencies pegged to gold at prewar levels were overvalued
  - There was still open market for gold
- Glut of the 60s:
  - Increased demand gave rise to pyramid of the US assets
  - That followed by a pyramid of the European currencies
- Growth of consumerism counterbalanced the pyramid trends up to a point:
  - Introduction of credit cards in the 50s
  - Incomes were still growing
  - Savings rate is still at healthy 8%

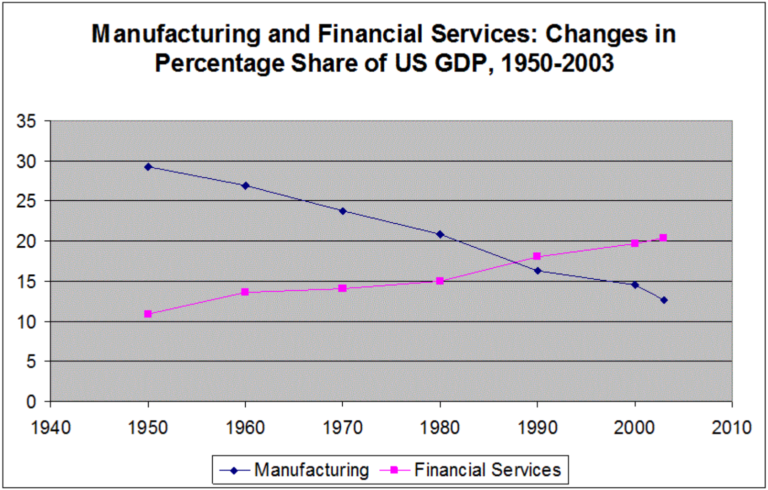
Bretton Woods System - II

- Increase of the household debt was another factor mitigating currency pyramids:
  - William McChesney Martin, then Federal Reserve Board chairman, was worrying about the 60s resemblance to the 20s
  - Dow Jones Industrial touched 1000
  - Television advertising and easiness of consumer credit increased consumer debt by two thirds; mortgage debt more than doubled
- End of the gold standard in 1971:
  - Trade deficits in US and gold standard created pressure on US gold reserves which at the beginning of the period were the world largest
  - Depletion of the gold reserves by 1970
  - Buildup of excess US currency in Europe
  - Chaos in FX markets
- Saudi Arabia and OPEC agreed to price oil in dollars (oil standard) mitigating the USD problems and recycling petro-dollars through the US banks back into the US economy

Debt Bubble Begins

- Broad deregulation of credit-card and banking industry started in late 70s
- In 80s the total credit market debt as a share of US GDP accelerated with intensity comparable only with 1920s
- At the same time manufacturing started shrinking as a result of globalization
- End of the Cold War brought enormous expansion of the dollar zone
- Shock of the Japanese financial intervention in early 90s
- The market boom helped to regain the leadership
- Further drop in savings rate

Financial Industry Grew Larger than Manufacturing in Early 1990s.



Development of Financial Mathematics

- Exchange traded options became very popular since Black, Scholes, Merton theory was developed in 1970s
- Traders changed the meaning of the volatility parameter, but volatility remained independent of strike until the crash of 1987
- Since 1987 the market started trading options with "smile"
- By 1990s exchange option trading became mature
- Large banks started buying successful proprietary trading firms in order to build OTC derivatives business
- Many "quants" joined the industry to work together with colleagues in academia on new generations of models

The 21st Century Crash

- Trade deficit requires more investment opportunities in US economy
- Central Bank created enormous demand for yield by keeping rates low
- After the .COM crash in 2000 next bubble – MBS market
- Abuse of the mortgage origination system derailed the system
- "Official" name of the crash: the Panic of 2007. Analyzed and compared with the Panic of 1907 in [1], [2]

What the Fed Did and Why. Remarks at the Westchester County Bankers Association, Tarrytown, New York. Speech. Joseph S. Tracy, Exec. Vice President, Federal Reserve Bank of New York, June 25, 2010. http://www.newyorkfed.org/newsevents/speeches/2010/tra100625.html

Liquidity Crises Understanding sources and limiting consequences: A theoretical framework. R. E. Lucas, Jr., N. L. Stokey. University of Chicago. May 2011. Economic Policy Paper 11-3, FRB Minneapolis. https://www.minneapolisfed.org/research/economic-policy-papers/liquidity-crises

Origins of "Great Panics"

- Banks borrow short term and lend long term making money on rates differential
- Partial reservation of deposits is the source of risk
- 1907: there was no FRS. Banks had clearinghouse system to back each other in case of run
- There was an alternative credit supply outside the clearing system: trusts
- In 2007 alternative credit supply came through mutual money market funds
- If banks, trusts and mutual funds in search for yield invest in low quality assets they may create panic among depositors
- Prior to both 1907 and 2007 there were stock market crashes causing demand for investment; bad loans to copper speculators in 1907 and mortgages in 2007 sparked panics after bubble bursting
- But, easing policy causes aggressive search for yield too

FED Actions I

- The panic of 1907 triggered creation of FED as the last resort lender
- Fed structure:
  - The Board of Governors, also known as the Federal Reserve Board, is the national component of the FRS. The board consists of the seven governors, appointed by the president and confirmed by the Senate for 14-year service
  - A network of 12 Federal Reserve Banks and 25 branches make up the Federal Reserve System under the general oversight of the Board of Governors. Reserve Banks are the operating arms of the central bank.
  - Each of the 12 Reserve Banks serves its region of the country. The Banks are named after the locations of their headquarters - Boston, New York, Philadelphia, Cleveland, Richmond, Atlanta, Chicago, St. Louis, Minneapolis, Kansas City, Dallas and San Francisco

FED Actions II

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    - Approximately 38 percent of the 8,039 commercial banks in the United States are members of the Federal Reserve System. National banks must be members; state-chartered banks may join if they meet certain requirements. The member banks are stockholders of the Reserve Bank in their District and as such, are required to hold 3 percent of their capital as stock in their Reserve Banks
    - The Federal Open Market Committee, or FOMC, is the Fed's monetary policymaking body. It is responsible for formulation of a policy designed to promote stable prices and economic growth. Simply put, the FOMC manages the nation's money supply.
      The voting members of the FOMC are the Board of Governors, the president of the Federal Reserve Bank of New York and presidents of four other Reserve Banks, who serve on a rotating basis.
- Traditional tools available to FED:
    - Discount window as a source of liquidity for eligible banks
    - Cutting the discount rate
    - Extending terms of discount window loans from overnight to 30 days

FED Actions III

- Problems:
  - Stigma of borrowing through the discount window
  - Eligible banks were not willing to extend credit to others
  - No way of lending directly to those who needed liquidity
- New liquidity tools:
  - Term Auction Facility (TAF): auctioning a fixed amount with the same collateral as discount window would require. Took care of the stigma
  - Term Securities Lending Facility (TSLF) allowed primary dealers to swap a broad range of now illiquid assets for Treasury securities
  - TSLF came too late for Bear Sterns. With FED approval Bear Sterns was taken over by JPMorgan Chase on March 14, 2008
  - Introduction of Primary Dealer Credit Facility (PDCF) extended the discount window access to all primary dealers
- At the same time FED continued agressively cutting Fed Funds Rate which is the main tool for stimulating the economy

Great Recession of 2008

- The Panic of 2007 turned into the Great Recession of 2008 following the bankruptcy of Lehman Brothers on September 15 and the Fed's emergency assistance to American International Group, Inc.
- FED's response:
  - Fed Funds rate cut to zero by mid-December
  - instituted swap lines to provide dollar liquidity to foreign central banks
  - new liquidity facilities to target specific sectors of the shadow banking system
  - expansion of FED's balance sheet through asset purchases
- At the same time FDIC was protecting bank depositors and prevented runs on many banks: 2008 – 25; 2009 – 140; 2010 – 157
- One of the key consequences of the Great Recession of 2008 is reconsideration of the concept of risk free rate

Risk-Free Rate

- What is risk-free rate?
  - Treasury, but for tax reasons Treasury rate is too low
  - LIBOR (London Interbank Offered Rate): a short term borrowing rate between AA-rated banks, it was considered to be low risk
  - Overnight Indexed Swap (OIS) is more correct candidate, since collateral typically pays OIS rate as interest
- LIBOR appeared as rate offered by a London bank on $US deposit. It soon became the major interest rate index used in interest rate swaps. LIBOR is convenient candidate for risk-free rate: it simplifies swap-based derivatives calculations
- But the only risk-free asset is fully collateralized asset (like home mortgage). Collateral pays compounded Fed Funds interest rate
- Since basis spread (LIBOR-OIS) traditionally was small and stable, market convention made it the standard proxy for risk-free rate
- However, after 2007 basis spread widened from 2 b.p. to 200 b.p. Collateralization and central clearing of swaps has become a standard. As a result OIS is now the risk-free rate