

7CCSMSUF Part 2: Financial Services and Markets

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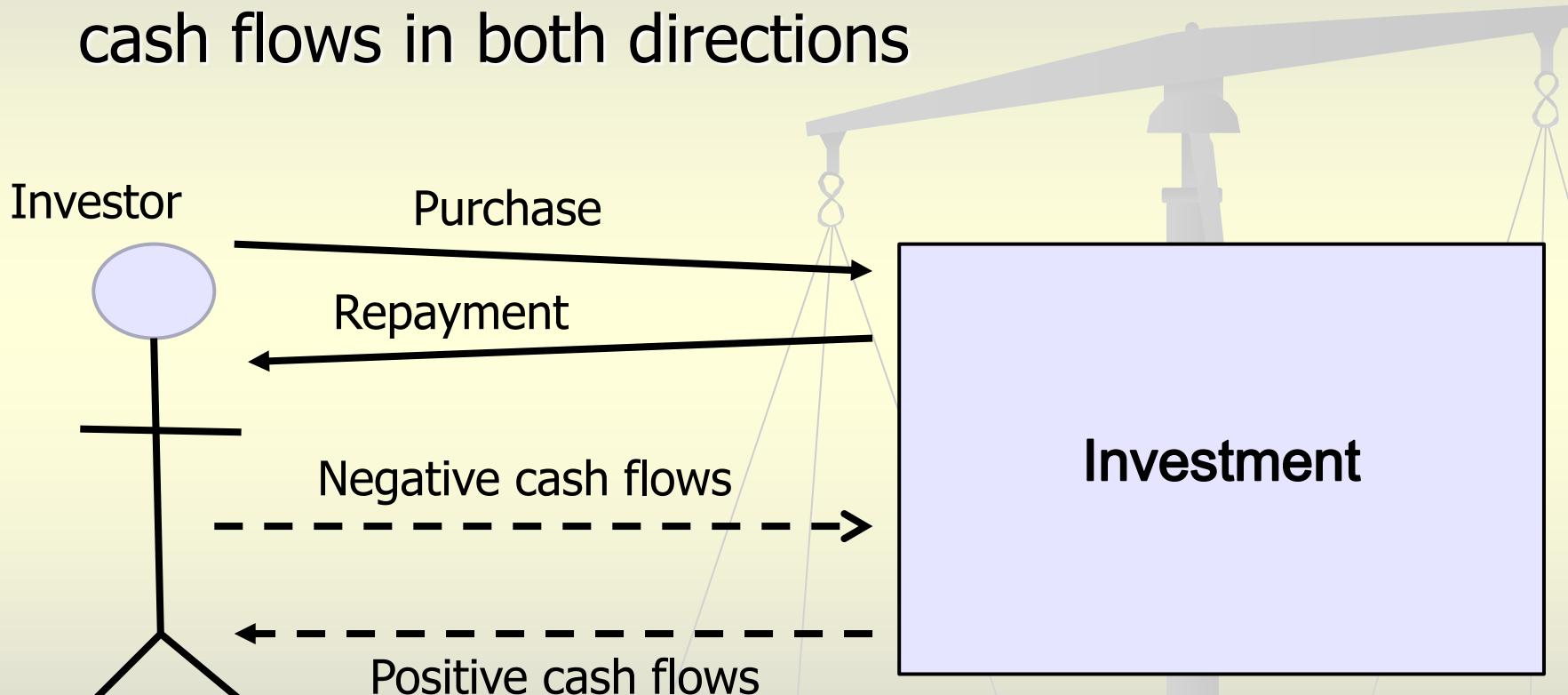
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Financial services and markets

- Generally financial services can be described as the means by which financial products are delivered to those requiring a financial product.
- There are several key actors involved in facilitating a financial service including:
 - The service provider. This could be a commercial bank, insurance company etc.
 - The customer/client. This could be an individual or corporate entity.
 - The regulator. Entities whose objectives are to ensure that service providers treat clients in a manner which does not contravene their rules/guidance and laws.
 - Third party infrastructure providers. Including those providing trading, clearing and other platforms.

Financial products

- Investments involve capital transfers & possibly cash flows in both directions



Transactions

- In delivering a financial service, a number of discrete actions can be undertaken by the provider, each or a collection of which constitute a *transaction*.
- For example a new client requesting a brokerage company to trade securities on its behalf might involve:
 - Account opening procedures in which clients must provide details of tax/national insurance, passport (or driving license) details, address, income and net worth etc.
 - Service provider conducts due diligence on client in line with the proceeds of crime act (POCA) and other relevant regulations
 - Client deposits a minimum amount in the brokers account via a funds transfer
 - Client provides instructions on the type of securities to be bought/sold, price levels etc.

Intermediation

- Much of what is transacted in the financial services sector is undertaken using *intermediation*.
- This is where the service provider acts as an intermediary between 2 of its clients: it conducts a transaction with client B using the funds provided by client A.
- An example is where an institution makes investments on behalf of an investor.

Financial markets

- The term financial markets generally refer to the market in which buyers and sellers trade securities.
- The term also includes regulators, infrastructure providers such as the exchanges, as well as the legal framework supporting the market.

Financial markets

- There are a number of different types of financial markets including:
 - Commodities
 - Foreign exchange
 - Debt (concerning bonds & related products)
 - Equities (concerning shares/stocks)
 - Derivatives (options, futures, etc.)

Moving on from the barrow boy



“The Old Lady just bought half a yard of cable and there are plenty of bids for Bill and Ben”

Barrow boy continued

- The above picture and quote was taken from:
- <http://uk.reuters.com/article/oukoe-uk-markets-slang-forex-idUKTRE80C0LE20120116>
- The old lady refers to the bank of England, a yard is a billion, cable refers to the USD/GBP FX rate and Bill and Ben refers to the Japanese Yen.
- Thus the quote is saying that the bank of England has bought half a billion pounds against the US dollar and there is interest for buying Japanese Yen.

Barrow boy continued

- The term barrow boy derives from the working class background of many city traders of yesteryear having worked their way from the back office through to being a star trader. Much trading was conducted via open outcry, which is a system in which traders shout out their buy/sell orders.
- Much of this type of trading has been replaced with that of electronic trading in which traders can enter buy/sell orders electronically and such orders will (hopefully) be filled (either partially or in full) by offsetting orders by others.

Legal & regulatory context

- Laws and regulations exist to ensure that market participants adhere to prescribed rules/laws for the protection of all parties engaged in financial transactions.
- As with most laws/regulations they act as deterrents but also facilitate for criminal/civil action in the eventuality that they are breached.

Basel standards

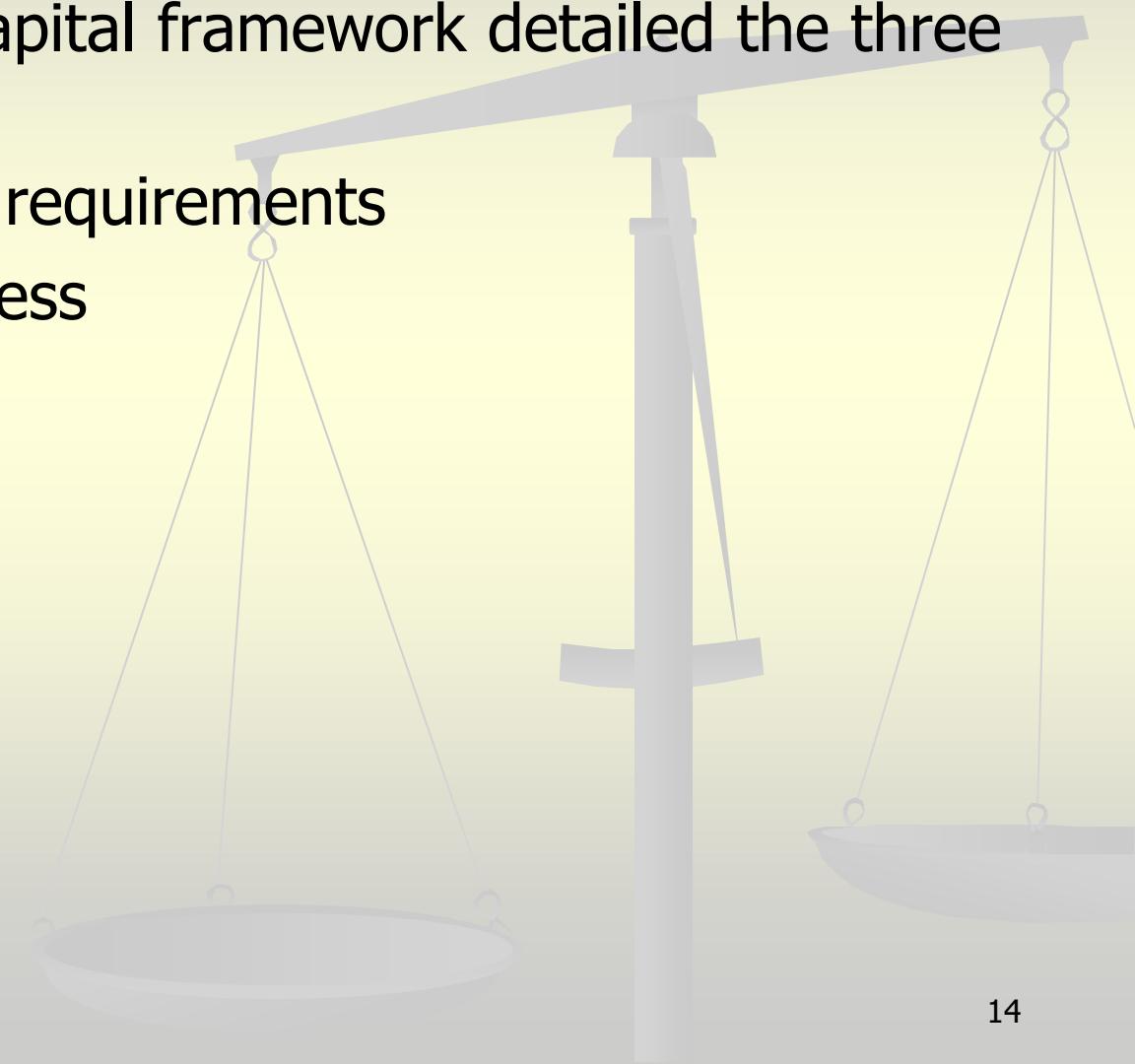
- Significant capital adequacy standards have emanated from the Bank of International Settlements (BIS: <https://www.bis.org/>) which have been adopted by many member countries and hence become regulations at the country level.
- We have Basel I, II and III (<https://www.bis.org/bcbs/basel3.htm>)

Basel I: The Basel Capital Accord

- The 1988 accord called for a minimum ratio of capital to risk-weighted assets of 8% which was to be implemented by 1992. This accord focussed primarily on market risk.
- By 1996 amendments were made to incorporate market risk amendments. These allowed banks to make use of internal models (e.g., Value At Risk – VaR) to determine their market risk capital requirements.

Basel II: the new Capital Framework

- The 2004 revised capital framework detailed the three (3) pillars:
 - Minimum capital requirements
 - Supervisory process
 - Disclosure

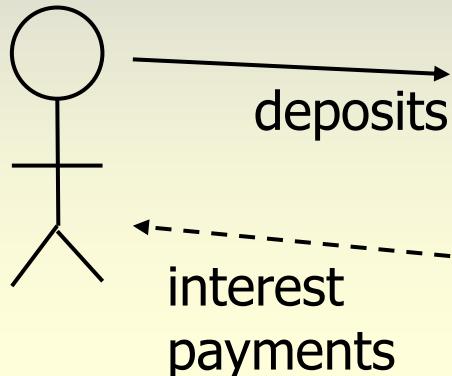


Basel 2½/3

- In January 2009 principles for sound liquidity risk management and supervision were issued. Later in 2009 further documents were issued covering securitisations, off-balance vehicles and trading book exposures.
- In 2010 the Basel III standards were issued covering (amongst other aspects): counter-cyclical credit buffer, leverage ratio
- Tighter definitions of capital were introduced in 2012—2019 and the updates continue.

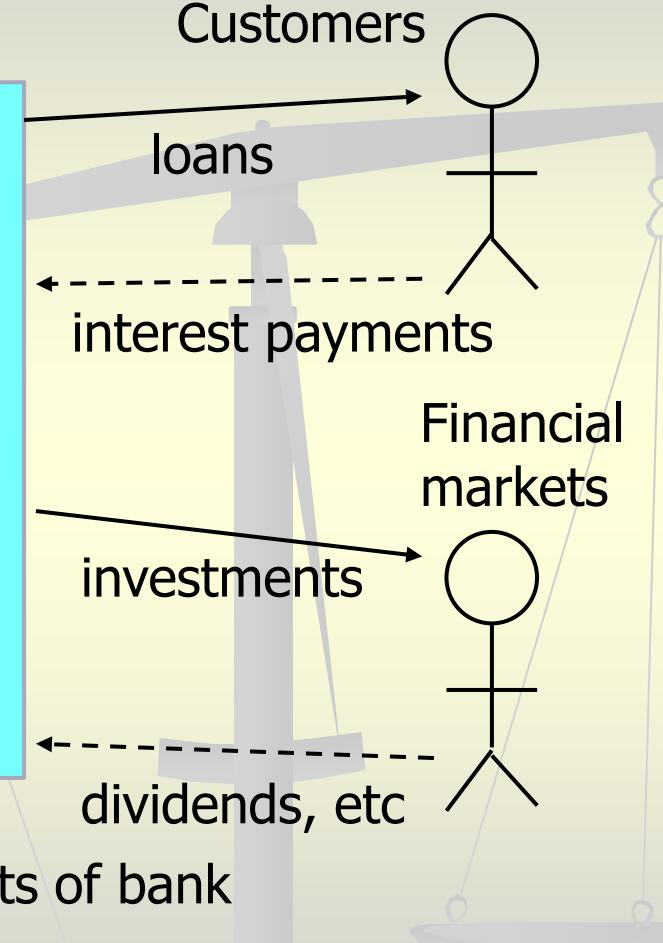
Capital requirements of banks

Customers



Liabilities of bank

Customers



$$\text{equity} = \text{assets} - \text{liabilities}$$

$$\text{leverage ratio} = \text{liabilities}/\text{equity} \leq 12.5$$

$$\text{equity} \geq 0.08 * \text{liabilities}$$

Risk Management & Portfolio risk

- Supply and demand (as well as market manipulation) gives rise to risks within trading portfolios. Changes in macro-economic parameters as well as changes in credit quality also gives rise to risks within banking and trading book portfolios.
- Risk management seeks to reduce the effect of losses due to changes in the underlying factors which affect value. In this sense risk can be viewed as downside risk i.e. where losses occur when factors change. Increasingly financial institutions seek to exploit opportunities to monetise gains when things move in the “right” direction.

Risk management continued

- A commercial bank borrows money from retail and corporate clients (i.e. savers or depositors). They then on-lend portions of these borrowed monies to others for a multiplicity of purposes. For example one type of loan might be for a residential real-estate purchase another might be for a car purchase and yet another might be to facilitate capital investment for a corporate entity.
- The risks on the three loans mentioned above are not the same.

Risk management continued

- A lending institution might wish to perform a credit risk assessment (e.g. a credit score or credit rating) on each borrower which reflects the underlying collateral/security as well as systemic (i.e. global market factors such as interest and FX rates) and idiosyncratic e.g. default risk of the borrower.
- As successive loans are added to the portfolio a picture will emerge as to the composition of the borrowers in the portfolio. Different compositions will result in different risk profiles and hence risk-weighted assets.

Risk management continued

- For a banking portfolio certain hedges might be put in place such as credit default swaps, insurance, etc, provisions but such hedges are not likely to be dynamically changing (i.e. selling and buying of hedges) if the portfolio is largely held to maturity.
- However, if a portfolio is a trading portfolio then hedges might be bought and sold at a fairly rapid rate depending on the volatility of the market factors influencing value in the portfolio.

Risk management continued

- A financial institution might want to be able to quantify the risk in a portfolio by analysing the incremental effect of adding a new transaction to the portfolio.
- Risks can be analysed on the basis of sector/industry, currency, borrower, country etc.
- Different estimates of risk are used, of which *Value at Risk (VaR)* and *expected shortfall* are widely used.

Risk management continued

- Value at Risk (VaR): quantifies possible losses over time period, within probability bound
- VaR of 1 day, £500,000, 2% means 98% likely that loss over next 24 hours will be \leq £500,000
- $VaR(T,L,p)$ is $prob(\text{total loss during } T > L) < p$
- But says nothing about lower probabilities: losses could be unlimited!
- To estimate VaR, some mathematical models, such as normal distribution, used. Historical data sampled
- If underlying financial variables do not satisfy expected model, VaR can be misleading.

Risk management continued

- Alternative to VaR is *expected shortfall*: expected loss outside the VaR limit
- Expected shortfall over period T is expected amount lost over T if the total loss exceeds the VaR limit
- Can be estimated by historical analysis, computing the average amount lost in periods T which have total losses outside the VaR limit.

The curse or value of Excel

- Most financial models are developed in Excel.
- Ideas are prototyped and (often times) end up being mission critical applications!
- The benefit of Excel lies in its simplicity, vast library of built-in functions with many off the shelf packages available to include in the tool. It sits on the desk of all those that quant and those that quant not!

Curse or value continued

- Users can even write code in VB, procedurally or using OO style....what's not to like about it?
- Security is compromised as many models built in Excel sit on the PC of the user that created them and a corruption of the disk could lead to a loss of data and/or the model itself.
- Even if Excel models are stored on a shared server data integrity is still an issue. Recall that each Excel model is part of autonomous spreadsheets which might “communicate” with each other but there is no logical data model with enforced data integrity.

Curse or value continued

- As a consequence increased reliance is placed on the creators (or gatekeepers) of the models to provide others with an understanding of the “big picture” that the spreadsheets convey.
- This implies that operational risk is increased for an institution that makes excessive use of Excel for mission critical applications.

What happens now

- At the opposite end of the spectrum financial institutions will both procure the acquisition of trading, middle office and settlement systems from third party vendors as well as develop their own in-house systems

Why develop in-house system when you can buy off the shelf?

- In order to exploit the benefits of proprietary methodologies and processes institutions often prefer to develop their own software systems rather than use third party tools.
- It is not uncommon however, to hear that an institution has similar functionality replicated across a myriad of different systems each of which has cost the firm large sums either to build or to procure and maintain.
- Some finance companies are looking at MDE and other approaches to rationalise their data & systems across their businesses.

JP Morgan & Kapital

- Some institutions e.g. JP Morgan were able to marry concepts of rapid prototyping via spreadsheet like features and OO development in their Kapital system. In this system users were able to create instruments “on the fly” and in a manner which lends itself to verification.
- This is very useful for creating novel instruments for emerging business areas so leads to scalability and enhanced productivity in a fast changing environment.
- The Kapital system is developed in Smalltalk which allowed the use of meta-modelling for detailing the financial and risk models of the system and reflection for models (objects) to value themselves, facilitate data integrity, audit etc.

Poor development infrastructure

- Many financial institutions have dated and poor technology infrastructure, inconsistent data models and fairly inflexible management processes which underserves a dynamically changing sector. Frequently changing and far reaching local and international regulations require institutions to be able to rapidly respond to changing requirements.
- In many instances institutions have to hire many additional contract and permanent staff to accommodate these changing needs

Emerging and going forwards

- Many institutions are still reliant on traditional waterfall models for software development but the industry is transitioning to use of Agile.
- The transition, however, cannot be achieved overnight and requires organisations to “manage a cultural change” from a predominantly serial approach to one that is iterative and more consultative.

Trends

- Financial institutions, increasingly, understand that the nature of their business and the way in which they implement their business process, often times, means that data integrity and data intelligence is a big issue for them.

Big data

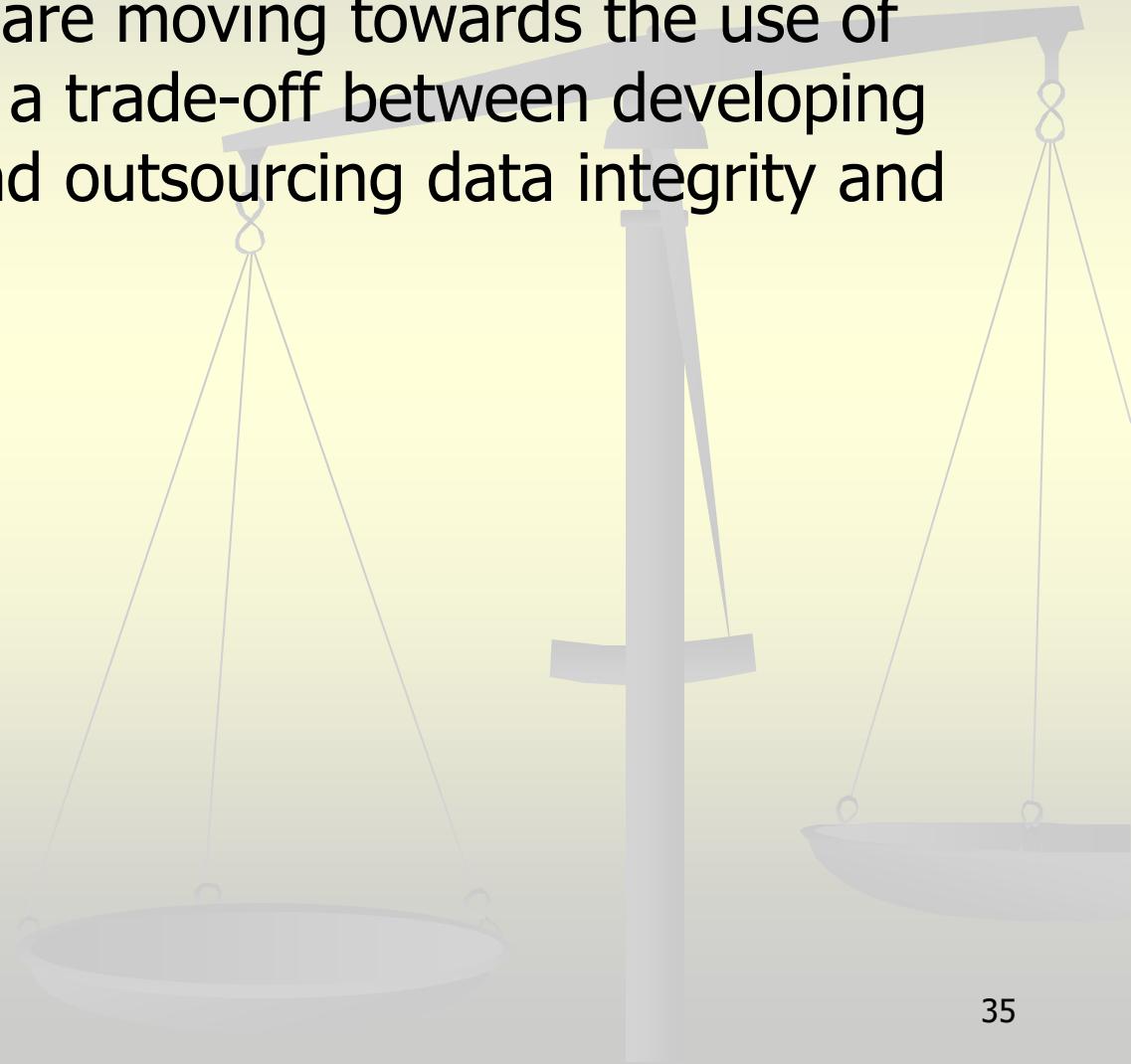
- Big data analysis has and will continue to be a significant area of interest for financial institutions seeking to better understand the trends and relationships embedded within the data and that of exogenous factors.
- This will lead to enhanced business intelligence on which new marketing, product development and new growth areas can be identified and undertaken.

Big data continued

- Big data analysis should not be viewed as a standalone exercise since it should also be used to:
 - Drive the data requirements for the integration of new products in trading and other systems
 - Assess the implications of regulations/laws on the business model of an institution. This implies that organisations need to adopt risk planning for their business processes
 - Assess the implications of business decisions on the risks of an institution across the varied silos with a view towards adopting an enterprise risk management (ERM) framework

Big data continued

- Some organisations are moving towards the use of cloud technology as a trade-off between developing in-house systems and outsourcing data integrity and business continuity



When things go wrong: The “Credit crisis”

- 2007-2009: via CDOs, securities based on mortgages were subject to huge losses due to borrower defaults
- Major financial industry companies were exposed to these losses, some (Lehman Brothers) failed completely, others (RBS; AIG) were bailed out by governments or taken over (Northern Rock)
- Lending shrank, causing business failures, stock market declines, & national recessions lasting several years
- Underlying causes were excessive risk-taking and lack of regulation of financial companies. Leverage ratios increased (average was 45:1 in EU, 35:1 in US), reducing resilience in the face of losses.

When things go wrong: The “Credit Crisis”



When things go wrong: The “Credit Crisis”

Consequences:

- Regulations were strengthened – more supervision of financial institutions (Dodd-Frank act, 2010, in the USA)
- Over-the-counter derivatives trading is now regulated
- Issuers of securitised products must retain 5% of each product
- Stronger liquidity requirements (Basel III)
- Bonus culture changed to encourage more long-term thinking

When things go wrong: Rogue traders

- 1995: Collapse of Barings Bank caused by losses of £827 million by trader Nick Leeson
- 2008: Jerome Kerviel – trading losses of 4.9 billion Euro for Societe Generale
- 2011: Kweku Adoboli – trading losses of \$2 billion for UBS.
- 2012: LIBOR manipulation scandal – apparently coordinated by several banks
- Overall lesson is that better supervision procedures are needed, internally and externally

Summary

- We have given an overview of financial markets and services
- We will use examples of financial analyses during the course to show how different software engineering techniques and underlying technologies can be applied to financial software problems