

# STA201 Week 11: Credit

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# Last Time

- Credit Cards

# This Week

- 1 Credit
- 2 Credit Scores and Ratings
- 3 Risk
- 4 The 2008 Financial Crisis

# Questions...

- Do you know what a credit score is?
- Do you know what your own credit score is?

## Definition

**Credit** is the trust which allows one party to provide money or resources to another party wherein the second party does not reimburse the first party immediately (thereby generating a debt), but promises either to repay or return those resources (or other materials of equal value) at a later date. ([Wikipedia](#))

- In other words:

If you have good credit, I trust you to repay me at a later date

## Credit II

[chainsawsuit.com](http://chainsawsuit.com)



i'm afraid your card was declined beyond human understanding. we have sent it to a research team to find out what went so horribly wrong



# Credit III

- Credit makes the world go round!
- Without credit, there's no investment
- Without investment, there's no economic growth
- For example:

- ① Savings credit: bank uses your deposit to fund business, gives it back when you withdraw  
(and pays you interest)
- ② Student loans: OSAP gives you money for tuition

# Credit IV

- To issue credit, a lender must deem a borrower sufficiently trustworthy
- Of course, it's impossible to sit down and interview every applicant
- It's far more practical to have a *quantitative measure* of a borrower's trustworthiness which any lender has access to
- This is what credit scores, bond ratings, and credit ratings are for

↑  
For individuals

↑  
For firms

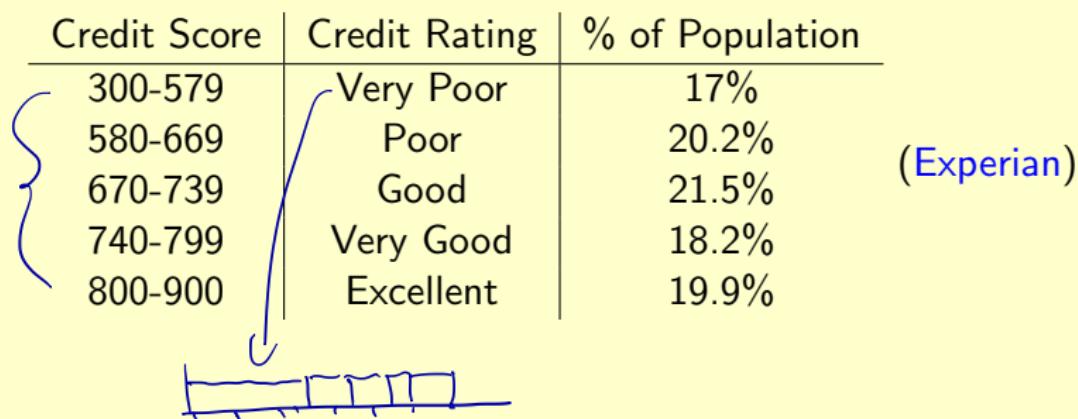
↑  
For countries

# Credit Scores I

- Credit scores are calculated by **credit bureaus**
- In Canada, there are two: TransUnion and Equifax
- Your credit score is a *number*, usually between 300 and 900
- The two credit bureaus may calculate your score slightly differently, but it's based on the same information and the numbers should be quite similar
- You can obtain your credit score for free

## Credit Scores II

- Higher credit scores correspond to better credit quality
- Each institution usually divides the 300-900 range into **tiers** and assigns each tier a **rating**
- Ratings vary, but typically look like this:



# Credit Scores III

- Do banks only want to issue credit cards to people with Excellent credit ratings?

No!, If they did , everyone would pay back on time and the bank wouldn't be able to charge any interest (primary source & revenue)

- Do banks only want to issue credit cards to people with Very Poor credit ratings?

No!, If they did, relatively few would pay back at all  $\Rightarrow$  huge losses

# Credit Scores IV

- How do credit bureaus actually calculate your credit score?  
*(We don't know!)*
- But we do know the **factors** that affect the calculation ([MyFICO.com](http://MyFICO.com) + Video):



## Credit Scores V

- Suppose that a year ago, you originated a VISA and a Mastercard with credit limits of \$2,000 and \$5,000, respectively. Your current balance on the VISA is \$500 and your current balance on the Mastercard is \$2,150.
- What is your total outstanding balance? Your total utilization? Your utilization on each credit card?

$$\text{Total outstanding balance: } 500 + 2150 = 2650$$

$$\text{Total utilization} = \frac{\text{Sum outstanding bal}}{\text{Sum of credit limits}} = \frac{2650}{7000} \approx 37.86\%$$

$$\text{Util on VISA} = \frac{500}{2000} = 25\%$$

$$\text{Util on Mastercard} = \frac{2150}{5000} = 43\%$$

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Optimal level for credit cards: between 10% to 30%

## Credit Scores VII

- Almost all retail credits (credit cards, mortgages, loans, etc.) require monthly payments, to repay outstanding balances and/or accumulated interest
- If a required payment has not been made on time, a customer becomes delinquent
- In Canada, a credit card (or any other retail credit) that remains in delinquency for 90 days (3 months) becomes defaulted (accounting term)
- A default is generally the point at which a lender gives hope that the borrower will make the required payment, and takes steps to recover whatever portion of the outstanding balance it can
- Typically this is less than the full amount, and whatever can't be recovered within 90 more days must be written-off as a loss

# Credit Scores VIII

FYI

## Definition

A **default** is considered to have occurred with regard to a particular obligor when either or both of the two following events have taken place.

- The bank considers that the obligor is unlikely to pay its credit obligations to the banking group in full, without recourse by the bank to actions such as realising security (if held).
- The obligor is past due more than 90 days on any material credit obligation to the banking group. Overdrafts will be considered as being past due once the customer has breached an advised limit or been advised of a limit smaller than current outstanding.

(OSFI)

Office of the Superintendent of Financial Institutions

# Credit Scores IX

- Lenders don't like it when borrowers default!
- It generally leads to the lender losing money; for corporations, a default negatively affects the bottom line (because total assets decreases), so the corporation loses value and its share prices decline
- This is why Payment History always has the highest weight in the calculation of your credit score
- While factors like utilization, number of credit cards originated, and length of credit history are certainly “warning signs”, it’s your payment history (i.e., how close you are – or have been – to defaulting) which matters most to a lender
- Takeaway: **Pay your credit card bills on time!**

# Securities and Bonds

## Definition

A **security** is a kind of investment in a company or in government debt that can be traded on the financial markets and produces an income for the investor (Cambridge)

Examples of securities: Stocks, bonds, options, etc.



## Definition

A **bond** is a security under which an issuer owes the holder a debt and (depending on the terms of the bond) is obliged to pay the holder interest periodically and to repay the principal at a later date

- Bonds are among the simplest of securities
- Think of a car lease (but replace the car with the principal)

# Bond Ratings I

- What about companies/institutions/corporations?
- To accumulate *capital*, corporations generally rely on investments, typically by issuing bonds (and by selling ownership in the company, in the form of stock)
- How is a corporation deemed trustworthy enough to invest in?
- The same principle as personal credit ratings carries over (but on a much larger scale): *If trustworthy enough, people/corps/continues will lend them money*
- A company is considered creditworthy if it appears likely to make interest payments (and ultimately the principal repayments) on the bonds it issues

*Instead of credit bureaus + credit scores, corporations have credit agencies + bond ratings*

# Bond Ratings II



Moody's	S&P	Meaning
<b>Investment Grade Bonds</b>		
Aaa	AAA	Bonds of the highest quality that offer the lowest degree of investment risk. Issuers are considered extremely stable and dependable.
Aa1, Aa2, Aa3	AA+, AA, AA-	Bonds are of high-quality by all standards, but carry a slightly greater degree of long-term investment risk.
A1, A2, A3	A+, A, A-	Bonds with many positive investment qualities.
Baa1, Baa2, Baa3	BBB+, BBB, BBB-	Bonds of medium-grade quality. Security currently appears sufficient, but may be unreliable over the long term.
<b>Non Investment Grade Bonds (Junk Bonds)</b>		
Ba1, Ba2, Ba3	BB+, BB, BB-	Bonds with speculative fundamentals. The security of future payments is only moderate.
B1, B2, B3	B+, B, B-	Bonds that are not attractive investments. Little assurance of long-term payments.
Caa1, Caa2, Caa3	CCC+, CCC, CCC-	Bonds of poor quality. Issuers may be in default or are at risk of being in default.
Ca	CC	Bonds of highly speculative features. Often in default.
C	C	Lowest rated class of bonds.
-	D	In default.

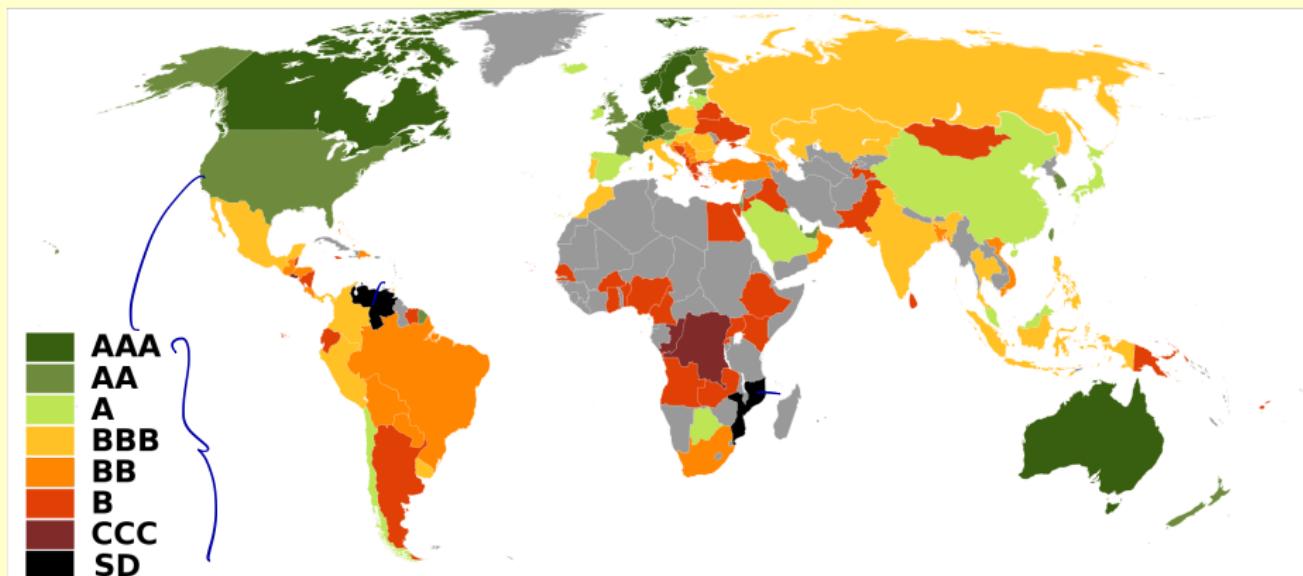
# Credit Ratings I

- There are even standardized ways to measure the credit ratings of countries
- This should not be too surprising: governments must accumulate capital to fund infrastructure, military, economic growth, etc.
- They do so in effectively the same way as corporations do: by issuing government bonds and similar instruments (like GICs in Canada)

Guaranteed  
Investment  
Certificate

# Credit Ratings II

(Sovereign) Credit Ratings



(S&P, 2018)

# Financial Risk

- Risk is commonly defined as the possibility of losing something of value; for our purposes, it is the possibility of losing money
- The financial world runs on *credit* (recall Slide 5)
- Mortgages, for example: very few people can afford to pay cash for their first home)
- Elements of credit:
  - You receive an amount from a lender (e.g., a bank) which you can use now (e.g., money for a house, principal of a bond)
  - You promise to repay the amount *in the future*, plus some amount of interest (e.g., amortization)
  - Because the repayment is in the future, there is some non-zero risk of default
  - Interest is what you pay to the bank for your use of their money now instead of later, and their assuming the risk of your future default

# Is Financial Risk Worthwhile?

- The bank must decide whether the risk (uncertainty) of lending money to you is worth the interest it will receive from you
- Banks have huge repositories of data – enough to create statistical models to predict the risk of default
  - These models often use your *credit score* to predict your creditworthiness
  - The bank's models can be used to adjust their lending policies, including both lending policies (e.g., what kinds of credit cards to offer) and individual policies (e.g., whether to grant you a student loan)

# Customer Data



# The 2008 Financial Crisis - Warning

- Warning: the following summary is **very** oversimplified, and the sequence of events below was only one major factor (out of many) that led to the 2008 Financial Crisis

# The 2008 Financial Crisis - CDOs and MBSs I

- “Liar loans”: people who couldn’t afford their houses were granted mortgages *\*populations grow  
land doesn’t depreciate. Not a “fact”.*
- Because “house prices always rise”, their equity in the house was expected to increase automatically
- MBSs (mortgage-backed securities)
  - A kind of bond which is secured by a pool of mortgages
  - The bondholder earns both interest payments and principal repayments from the underlying mortgages
- A good MBS would have an underlying pool of mortgages with a diverse range of risk
- Prior to 2008, however, MBSs were being packaged together from mostly high-risk (*subprime*) mortgages

↳ On slide 30

# The 2008 Financial Crisis - CDOs and MBSs II

Differences b/w MBS & CDOs → mixture of assets, larger banks, features tranches.

Backed exclusively by Mortgages only, often by smaller banks.

- Around the same time, a similar (and overlapping) financial instrument was exploding in popularity as well:
- CDOs (collateralized debt obligations)
  - A financial instrument created by a bank/securities firm in which a large number of cash-flow generating assets (such as mortgages) are pooled together and arranged into chunks called tranches, which are then sold to investors
    - Ratings agencies assess the credit quality of the CDOs/tranches and assign them ratings
    - Investors buy the tranches from the bank/firm (sometimes paying a premium for some kind of insurance against the tranche defaulting), and collect the cash payments on those cash-generating assets
    - The bank/firm now has its principal amount back, and its role is concluded; the investor now has a steady stream of income, and everyone is happy :D

Not restricted  
to mortgages  
e.g. bonds,  
loans, etc.

↳ collect cash flow by  
seniority .

Investors take  
out large  
loans  
to make this  
purchase

# The 2008 Financial Crisis - CDOs and MBSs III

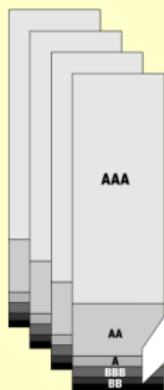
## Collateralized Debt Obligations

Collateralized debt obligations (CDOs) are structured financial instruments that purchase and pool financial assets such as the riskier tranches of various mortgage-backed securities.

Wikipedia

### 1. Purchase

The CDO manager and securities firm select and purchase assets, such as some of the lower-rated tranches of mortgage-backed securities.



New pool  
of RMBS  
and other  
securities

First claim to cash flow from  
principal & interest payments...

### 2. Pool

The CDO manager and securities firm pool various assets in an attempt to get diversification benefits.

### 3. CDO tranches

Similar to mortgage-backed securities, the CDO issues securities in tranches that vary based on their place in the cash flow waterfall.

Low risk, low yield

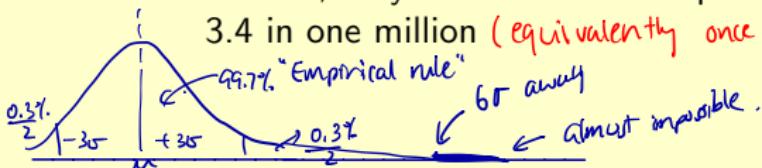


High risk, high yield

# The 2008 Financial Crisis - CDOs and MBSs IV

CDOs w/  
cashflow generating  
assets mainly  
MBSs.

- The high-risk tranches of the mortgage CDOs commanded the highest rates of return (why?) → higher risk = higher reward.
- CDOs are *collateralized* – i.e., the houses themselves were collateral and could be seized in the event of default
- “House prices always rise”
- The CDO buyers calculated the risk of default using the wrong assumption (and the wrong statistical models) *Thought correlation was enough to capture dependence required.*
  - For example: they assumed the independence of events – that defaults, like coin flips, are not related to each other
  - They believed the event of a mass default was a *six sigma* event (i.e., six standard deviations away from the “mean”) *b standard deviations from the mean (low prob)*
  - That is, they believed that the probability of a mass default was about 3.4 in one million (*equivalently once every 2,500,000 days ⇒ 6849 years*)



# The 2008 Financial Crisis - CDOs and MBSs V

- In the mid 2000s, US housing prices were rising steadily as part of the natural economic (business) cycle)
- Tens of thousands of new houses were being built, especially starting in 2006
- US mortgage lenders (strongly) encouraged consumers – *especially high-risk consumers* – to purchase these new houses by offering them misleadingly good mortgages Community Reinvestment Act (1977)  
Encouraged banks to offer mortgages to low/moderate income individuals
- Due to a lack of regulation, even NINJA mortgages were offered: [without checking for] No Income, No Job, or no Assets
- Almost all of these mortgages were adjustable-rate, with extremely attractive initial starting rates



# The 2008 Financial Crisis - CDOs and MBSs VII

- Eventually someone got the idea of taking the separate tranches from the mortgage CDOs and forming *new CDOs* out of them – a so-called “CDO-squared”
- Ratings agencies, who often received huge portions of the cash flows from these CDOs, were incentivized to assign these CDOs much better ratings than they actually deserved, thereby misleading investors and encouraging more CDO packaging/buying and more lying
- A vicious cycle...  
*There are indicators that those involved in rating subprime related securities knew the rating process was faulty.*

# The 2008 Financial Crisis - The Black Swan I

- ...and then it happened
- In 2006, house prices peaked and then begun to decline
- The interest rates on the subprime mortgages shot up, which borrowers could not afford to pay
- Hundreds of thousands of mortgages went into default at once, leaving banks with the same number of empty houses as borrowers were evicted
- Practically the entire CDO market was severely downgraded *en masse*, plunging the CDOs values to almost nothing
- Investors who had borrowed to buy the CDOs and MBSs, expecting a steady stream of interest payments, suddenly owed *hundreds of billions* of dollars

# The 2008 Financial Crisis - The Black Swan II

- Non-mathematicians, driven by a lack of foresight (at best), made decisions based on the output of complicated probabilistic models which they did not understand, using statistical assumptions that were not valid (of course, many blamed the mathematicians)

*In addition the model – which postulated that the correlation of default risks among loans in securitization pools could be measured in a simple, stable, tractable number, suitable for risk management or valuation also purported to show that the mortgages in CDO pools were well diversified or “uncorrelated”. Defaults on mortgages in Orlando, for example, were thought to have no effect on – i.e. were uncorrelated with – the real estate market across the country in Laguna Beach. When prices corrected (i.e. the bubble collapsed), the resulting defaults were not only larger in number than predicted but far more correlated.*

*↳ used to estimate probability of defaults on the underlying mortgages based on only the previous decade of data (when prices were at their best)*

(Wikipedia)

# The 2008 Financial Crisis - The Great Recession I

- Large financial institutions (e.g., Lehmann Bros) – those believed “too big to fail” – went bankrupt and the entire United States financial system required a government bailout → ~\$100 billion.
- The United States’ credit rating was downgraded by S&P for the first time in history Still at AA+ today
- The economic stability of the United States, the central banks, and even the world economy were profoundly shaken → Eu was also affected.  
Domino effect.
- Result: the “Great Recession”
- A video summary of the whole thing (with slightly one-sided narration but good visuals)

# The 2008 Financial Crisis - The Great Recession II



# The 2008 Financial Crisis - Lessons Learned

\* Counting & Credit stuff.

- Governments of all political persuasions realized the need for a new framework for managing risk
- New regulations: Dodd-Frank Act (US, 2010), and the Basel Accords
- Financial institutions are legally required to hedge themselves
  - They can still buy and sell riskier financial products
  - But they must set aside funds to guard against the risk of collapse in case of default
    - ↳ "capital reserves"
  - The models that FIs use to assess these risks are heavily scrutinized by regulating bodies
  - The riskier the financial products, the higher are the **capital reserve requirements**

Canada  
OSFI

US  
OCC