Mortgages

Real estate finance

Basics

- Mortgages are loans secured by a real estate asset:
  1. Commercial vs. Residential
  2. Permanent vs. construction
  3. CMBS loans vs. portfolio loans

- Two parties: *mortgagor* (borrower), *mortgagee* (lender)

- Two basic components:
  1. Promissory note: stipulates payment obligations
  2. Mortgage deed: stipulates claims to collateral

Mortgage process

- If all stipulations are met, deed is returned to the borrower, claim to collateral expires, and the borrower is released from the note
- In *lien theory* states, lender holds a lien on the property until contract is terminated
- In *title theory* states, lender holds a title to the property until termination
- In *deed of trust* states, a trustee holds title to the property until contract is terminated
- Trustees or mortgagees can have *power of sale* in 29 states
- In other states, only courts can sell collateral in *judicial sales*

Liens

- Liens are claims against the property for payment of a payment obligation (taxes, account payables, mortgage debt…)

- Liens are organized by seniority:
  1. Taxes
  2. Mechanics' liens (construction services providers)
  3. Mortgage liens in the order in which they were recorded, barring explicit subordination clauses

Covenants/Clauses

- Specify the rights and responsibilities of each party
- Default: violation of <u>any</u> clause
- Default is typically the failure to make payments on time, or at all

A few typical clauses

- **Promise to Pay**: specifies principal, interest, penalties, etc…
- **Hazard Insurance**: borrower must insure value of the property (at least up to mortgage amount) against fire, storm, etc…
- **Mortgage Insurance**: borrower must hold mortgage insurance
- **Good Repair Clause**: Borrower must maintain property in good repair

Acceleration/Reinstatement clauses

- Acceleration clauses allow lender to make the entire outstanding loan balance due immediately under certain conditions such as default or sale
  - **Due-on-sale**: Lender may accelerate loan if borrower transfers a substantial beneficial interest in the property to another party
- Mortgages that can be passed on to a new owner are called *assumable*
- Reinstatement clauses stipulate borrower's possible responses to loan acceleration
  - **Borrower's Right to Reinstate:** Allows borrower to stop the "acceleration" of the loan under default, up to time of court decree/sale, by "curing" of the default

Recourse clause

- **Exculpatory Clause**: removes the borrower from responsibility for the debt, giving the lender "no recourse" beyond taking possession of the collateral which secures the loan

- Absent this clause, lender can pursue a *deficiency judgment* in most states and go after the owner's other eligible assets, or the eligible assets of any guarantor

Prepayment clause

- Provision giving the borrower the right (without obligation) to pay the loan off prior to maturity
- A call option
- Exercise price: outstanding loan balance plus prepayment penalties on the mortgage
- Value of the underlying asset: present value of all future payments at current market interest rate

Lockout/Yield Maintenance clauses

- Lockout clauses prohibit early prepayments regardless of borrower's ability to pay off the loan in its in entirety
- A yield maintenance clause requires the borrower to make a lump sum payment to cover the lender's potential loss from reinvesting prepaid sums.
- Typical on CMBS loans, making prepayment essentially a non-issue on those loans

Default

- When default occurs, lenders first pursue non-litigious actions:
  1. Grace period, with penalties
  2. Loan modification / workout (rare)
  3. Short sale
  4. Deed in lieu of foreclosure ("amicable" property transfer to lender)
  5. Loan transfer to a "White Knight"

- When that does not work, lenders turn to legal/litigious actions
  1. Warning shots: notice of intent, sue for specific performance, …
  2. Foreclosure: forced sale

Judicial foreclosure process

1. Notice of intent (60 days past due)
2. Foreclosure proceedings begin (lender serves borrower with a *Summons and Complaint*, announces *deficiency* intentions)
3. Borrower gets a right of response (15 to 30 days), and, typically, a right of reinstatement
4. Foreclosure judgment is issued
5. Borrower has right to redeem during redemption period
6. House is sold at judicial auction or becomes owned by the lender (REO: real estate owned)

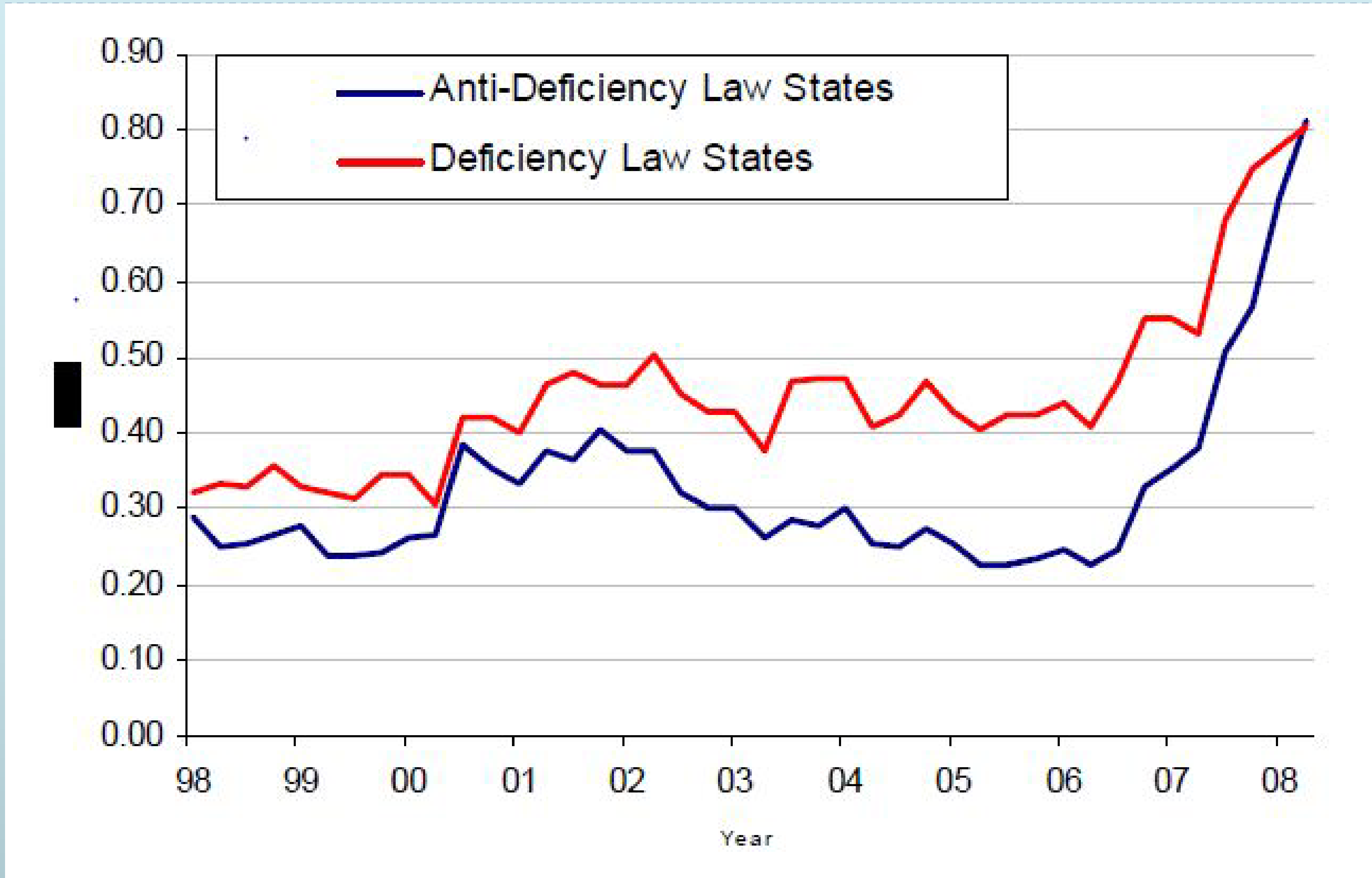
Power-of-sale foreclosure process

1. Notice of intent (60 days past due)
2. Notice of default
3. Notice of sale
4. Borrower may reinstate/cure the loan up to the sale date
5. House is sold at public auction or becomes REO
6. Borrower has right to redeem during redemption period, in some states

Deficiency judgments

- In anti-deficiency states, borrower’s liability is limited to collateral, even without an explicit exculpatory clause
- In most states, lender can pursue a deficiency judgment when foreclosure proceeds fall short of borrower’s total obligations
- Requires a judicial sale
- Court determines “fair value” of asset, lender can sue for difference between remaining obligation and fair value
- In principle, recourse should deter default
- In practice, conventional wisdom is that lenders seldom pursue deficiency judgments because they are money-losing propositions

Foreclosure rates by deficiency regime



- Source: Garriga and Schlagenhauf, 2009

Deficiency and default

- States where deficiency judgments are allowed do not seem to have systematically lower foreclosure rates
- Could be due to differences in the composition of the pool of borrowers, and differences in business conditions
- Research into the residual effect of deficiency status yields mixed results
- Perhaps this is not surprising:
  1. Expected returns to deficiency judgments are small
  2. Even if deficiency does deter default, lenders would set tougher standards in anti-deficiency states (selection)

Mortgage algebra

- Mortgage:
  1. Initial balance or principal (b_0)
  2. Maturity (T)
  3. Contract rate structure (r_t, for all t)
  4. Payment structure (m_t, for all periods t)
- Mechanics:
  1. At a given date, interest due is $b_{t-1}\, r_t$
  2. $b_t = b_{t-1} + b_{t-1}\, r_t - m_t$
  3. If $b_T > 0$, it is due in one *balloon payment*
  4. $b_T = 0$: full-amortization loan

Constant-amortization mortgages (CAMs)

- Each period, principal payment is b_0/T:
  - $b_t = b_{t-1} - b_0/T = b_0 - (t/T)\, b_0$
  - $m_t = b_0/T + b_{t-1}\, r_t$

- Popular for a while after great depression, rare today

- Possible advantages over traditional FRMs:
  1. Less default risk
  2. Less prepayment risk

Graduated-payment mortgages (GPMs)

- Low initial payment
- Fixed number of steps, fixed size of increment ("step-ups")
- Example: at the end of each of the first 4 years, payment goes up by 7.5%, fixed contract rate
- Can feature negative amortization initially

GPM math

- Guess initial payment m_1 and update guess until b_T=0
- Adjust m_1 until present value at contract rate is b_0
- Simple trick:
    1. Calculate PV of payments if first payment is $1
    2. Divide b_0 by resulting factor to get m_1
- Example: 30-yr GPM with 4 annual step-ups of 7.5% each, 12% contract rate, monthly payments
- If first payment is $1, PV of loan at 12% annual discount rate is $121.12
- Therefore, $m_1=b_0/121.12$, for any b_0

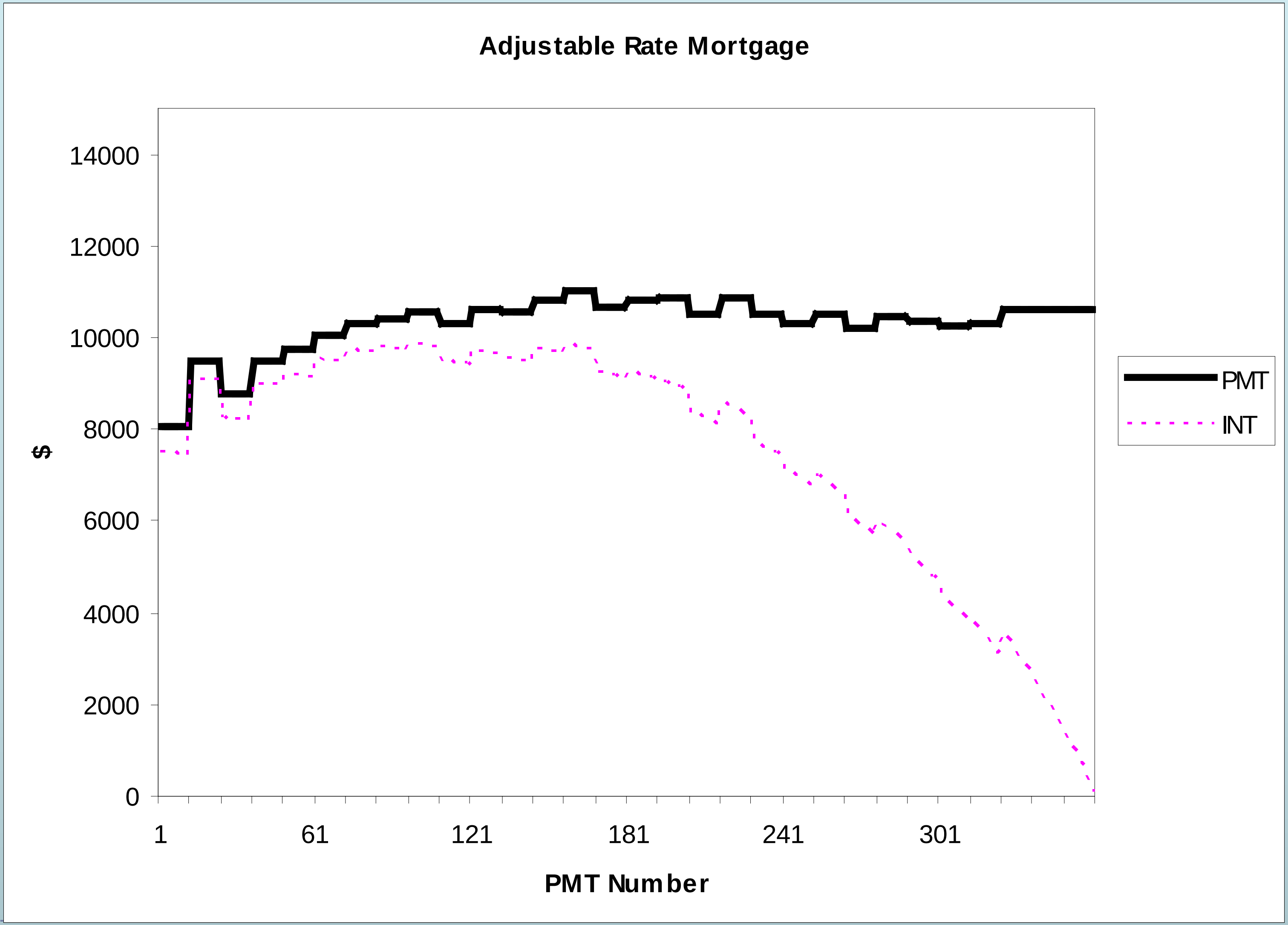
Adjustable rate mortgages (ARMs)

- Interest rate adjusts at fixed frequency as a function of a given market interest rate (1 year CMT rates, LIBOR…)
- Payment in a given period is calculated in FRM fashion assuming that the current rate will prevail to maturity
- ARM stipulations:
  1. r_1
  2. Adjustment interval: 1year, 3 years, 5 years
  3. Index: publicly observable market interest rate index
  4. Margin: $r_t = index_t + margin$
  5. Caps and floors (lifetime, or max adjustment)
  6. Full indexation: $r_1 = index_1 + margin$
  7. Teaser rate: $r_1 < index_1 + margin$

Mortgage schedules for ARMs

- Future rates on ARMs are not known
- **One** can produce a payment schedule based on index forecasts
- In practice, people use current value of index, assume it will remain where it is, and compute all contract rates
- If the loan is fully indexed, this gives you the same table as a standard FRM
- If the loan features teaser rates, rates and payments rise in full at first adjustment if there are no caps, in several steps if there are binding caps

Typical path for ARM payments



Annual Percentage Rate (APR)

- YTM from the lender's viewpoint
- Loan's IRR from the point of view of the lender if all payments are made as planned
- On any mortgage with fixed rates (whether or not payments are fixed) and no "points", YTM= contract rate

APRs on ARMs

- In principle, APR depends on expected path of market rates
- In practice, government regulations require that the "official" APR reported for ARMs be based on a flat forecast of market interest rates
- If there is a teaser rate, APR must be calculated under the fastest possible path to fully indexed rate

Example (homework 5)

- 5-year ARM, $100,000, 2% margin over a market index that can be either 8% or 10%
- Teaser rate of 6%, two resets (Months 13 and 25), no caps
- Index begins at 8%
- 40% chance that it will change value to 10% by first reset, 40% that it will change value again by second reset
- 4 possible histories for the index: high-high (10%-10%), HL, LL, LH
- Hence 4 possible histories for the payments

Points

- Payments from borrower to lender at origination
- 1 point = 1% of initial balance
- Does not reduce initial balance (not a down-payment)
- Effective loan size = $b_0(1-n)$, where n is the number of points at origination
- Raises lender's YTM (APR) above contract rate
- Indeed: b_0 = PV(payments, contract rate)

  while $b_0(1-n)$ = PV(payments, APR)
- APR>contract rate

Why do we see points?

- Points, all else equal, reduce the contract rate **(that the lender is willing to offer)**
- In PV terms, borrower only recovers their initial fees if they stick with the loan until maturity
- Points discourage prepayment
- Borrowers who know they are not going to prepay can use points to convey their type to lender, and secure better terms
- Alternative to prepayment penalty

YTM > lender's IRR (typically)

- APR (=YTM) is the mortgage's IRR if **and only if** all payments are made as planned
- In practice, borrowers default, fail to make payments on time, prepay when interest rates are low,…
- Causes transaction costs, and capital losses

Prepayment risk

- Borrowers prepay loans for a variety of reasons
- If prepayment occurs when market rates are below the contract rate, this causes losses for lender
- In fact, refinancing gains are one of the main reasons for prepaying
- Borrower's refinancing gains = Lender's prepayment loss
- This makes prepayment risk a very bad form of reinvestment risk

Refinancing

- Consider a borrower with (T-k) payments left
- Assume that refinancing carries a fixed cost c>0 for the borrower
- This cost includes transaction costs and penalties
- Assume the borrower's current (fixed) payment is m, and that rates fall in a way that she can make remaining payments m'<m
- The gain is the present value of m-m', to maturity
- Discount rate: new market rate on a loan of maturity T-k
- Refinancing is potentially beneficial if PV(m-m') > c

Refinancing example (part 1)

- Consider a 15-year FRM with initial balance $100,000 and contract rate 9%
- After 5 years, rates on 10-year FRMs are 8.5%
- Refinancing costs $1000
- Assuming that refinancing is a one-time only option in this case, should the borrower refinance?

Refinancing example (part 2)

- Assume that at origination the borrower could have picked a loan with two points and the same APR
- Would it make sense to refinance had the borrower taken that loan?

Timing

- Refinancing is a call option:
  1. Strike price: loan balance + refinancing costs (c)
  2. Value of underlying asset: PV of remaining payments at the new rate

- Exercising the option kills it

- "Refinance if PV(m-m') > c" may not be optimal decision

- It may make sense to wait until PV(m-m') rises further

Option value of refinancing

- A call option's value is high when:
  1. the strike price is low relative to the expected value of the underlying asset
  2. the value of the underlying asset is volatile

- The refinancing option is particularly valuable when:
  1. contract rate is high relative to market rates, mortgage is far from maturity, penalties are low…
  2. interest rates are volatile

The option to delay

- In previous refi example, assume that the lender has the option to wait another 24 hours
- Tomorrow, rates will be either 8.25% or 8.75%
- The risk free rate during that period is 0.005%
- What is the value of the option to delay? *(Binomial option pricing formula says $810 or so)*
- Should the borrower wait another 24 hours?

Prepayment from the lender's viewpoint

- Lenders need to forecast, for each period:
  1. Prepayment *hazard rate*
  2. Prepayment losses and/or *yield degradation*

- Date t hazard rate: likelihood of a prepayment at date t, given no prepayment prior to date t

- *Yield degradation*: Loss in IRR for lender if prepayment occurs

- Yield degradation conditional on prepayment at date t = APR- **IRR** conditional on prepayment event at a given date

Refinancing example (part 1)

- Consider a 15-year FRM with initial balance $100,000 and contract rate 9%
- After 5 years, rates on 10-year FRMs are 8.5%
- Refinancing costs $1000
- What is yield degradation if the borrower refinances after 5 years?

How lenders deal with prepayment

1. Prepayment penalties
2. Points
3. A contract rate premium (*fixed point problem*)

Lockout/Yield Maintenance clauses

- Lockout clauses prohibit early prepayments regardless of borrower's ability to pay off the loan in its in entirety
- A yield maintenance clause requires the borrower to make a lump sum payment to cover the lender's potential loss from reinvesting prepaid sums.
- Typical on CMBS loans, making prepayment essentially a non-issue on those loans

Default

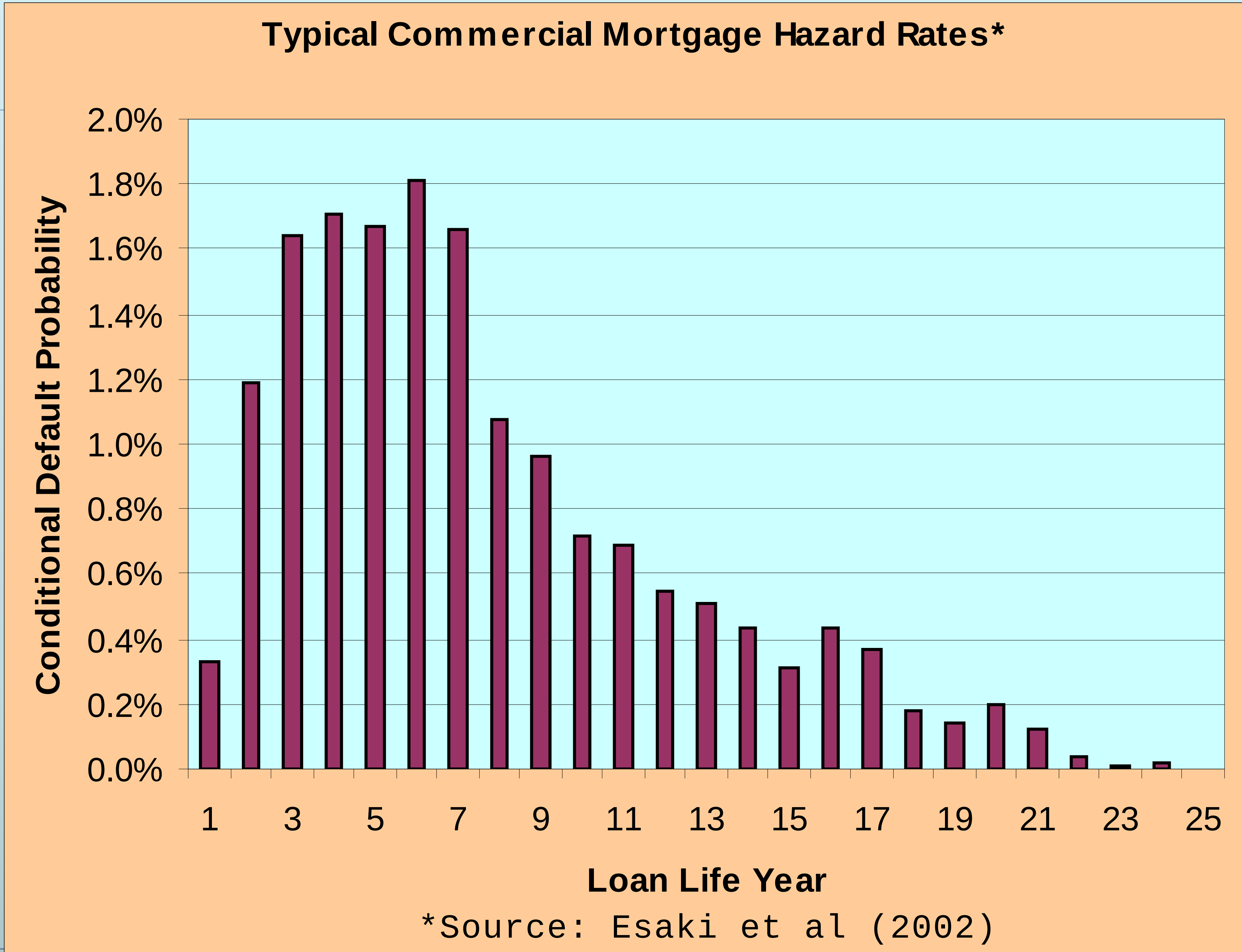
- On commercial loans, default is the primary concern
- Expected cash-flows depend on 1) the likelihood of default and 2) the likely size of losses in the event of default
- Lenders need to forecast both objects

Hazard rates

- h_t= probability that the loan will default in period t conditional on not having defaulted before
- Probability that the loan will default after exactly t periods is $(1-h_1)\ (1-h_2)\ (1-h_3)\ldots\ (1-h_{t-1})\ h_t$
- This gives T+1 mutually exclusive events, with associated probabilities that sum up to 1

How do lenders forecast hazard rates?

- Use industry standards (SDA: standard default assumptions, scaled up or down)
- Or use econometrics: h_t=f(loan characteristics, property type, location, borrower characteristics, economic conditions…)
- Loan characteristics: LTV, DCR (debt-coverage ratio)
- Borrower characteristics: ownership type
- Fit f to historical loan data and hope that past is informative for future


Typical Commercial Mortgage Hazard Rates*
Conditional Default Probability
2.0%
1.8%
1.6%
1.4%
1.2%
1.0%
0.8%
0.6%
0.4%
0.2%
0.0%
1
3
5
7
9
11
13
15
17
19
21
23
25
Loan Life Year
*Source: Esaki et al (2002)

Loss severity rates/Recovery rates

- Date t *loss severity rates* are expected losses if default takes place at date t, as a fraction of outstanding balance
- *Recovery rates* are the opposite: the fraction of the balance the lender expects to recover if default takes place at date t
- Forecast using the same two methods as hazard rates

Why is default so costly?

- Loss severity rates can exceed 50%, and typically range from 30 to 40% on commercial loans
- Many causes:
  1. Transaction costs
  2. Payment delays
  3. Low foreclosure proceeds
- It is estimated that residential properties sell at a 25% discount on average when foreclosed relative to observably similar properties that have not foreclosed

Conditional yield degradation

- Yield degradation if default occurs at date t =

  YTM – IRR if default at date t

- Consider a 3-year IOM loan with initial balance $100,000 and contract rate 10%

- Year 3 loss severity is 30%, so that the lender only expects to recover $77,000=$110,000 x (1-0.3) in year 3

- IRR in that case is -1.12%

- Yield degradation = 10% - (-1.12%)= 11.12%

Expected return

- Expected return $= \Sigma_t$ P(default at t) x (YTM-(Yield Degradation)$_t$)
  + P(no default) x YTM

- E(IRR(CFs))

- In IOM example, assume that default occurs with probability 10% in year 2 and year 3, with loss severity 30% in either case

- Expected return =.10 x (-17.11%) + .10 x (-1.12%) + .80 x10%
  = 7.18%

- Average Yield Degradation = YTM – Expected Return
  = E(Yield Degradation)

A better measure

- True IRR is IRR(Expected Cash Flows) which can differ greatly from expected return *(as you know from homework 2)*

- In IOM example, assume again that default occurs with probability 10% in year 2 and year 3, with loss severity 30% in either case

A better measure

- True IRR is IRR(Expected Cash Flows) which can differ greatly from expected return

- In IOM example, assume again that default occurs with probability 10% in year 2 and year 3, with loss severity 30% in either case

Year	0	1	2	3	IRR
Default at date 2 (10%)	-100000	10000	77000	0	-7.11%
Default at date 3 (10%)	-100000	10000	10000	77000	-1.12%
No default (80%)	-100000	10000	10000	110000	10.00%
Expected CF	-100000	10000	16700	95700	7.82%

Pricing mortgages with default

- Assume that lender wants to hit a given IRR on a loan
- Contract rate must exceed this IRR target because of default
- Problem: when contract rate increases, so do default probabilities
- There may be many solutions to this problem (which do we choose?) or no solution (exclusion)

Example

- 3-year FRM, yearly payments, initial balance of $100,000
- Default hazard rate on the mortgage in each year is:

  [3+ m/40,000] %
- Loss severity: 25%
- Target **IRR**: 10%
- Is there a contract rate that delivers the right **IRR**?
- Can the right **IRR** be delivered with a contract rate of 10% and positive points?

Example with no solution (exclusion)

- 3-year FRM, yearly payments, initial balance of $100,000
- Loss severity is 40%
- Default hazard rate on the mortgage in each year is:

  [2+ (m/10,000)^2] %
- Then, it is not possible to hit a target of 10%
- Hazard rates rise too fast as we try to raise the payment
- This borrower is too risky
- At lower targets, a different problem may arise: multiple solutions
- This second problem is an easy one to deal with

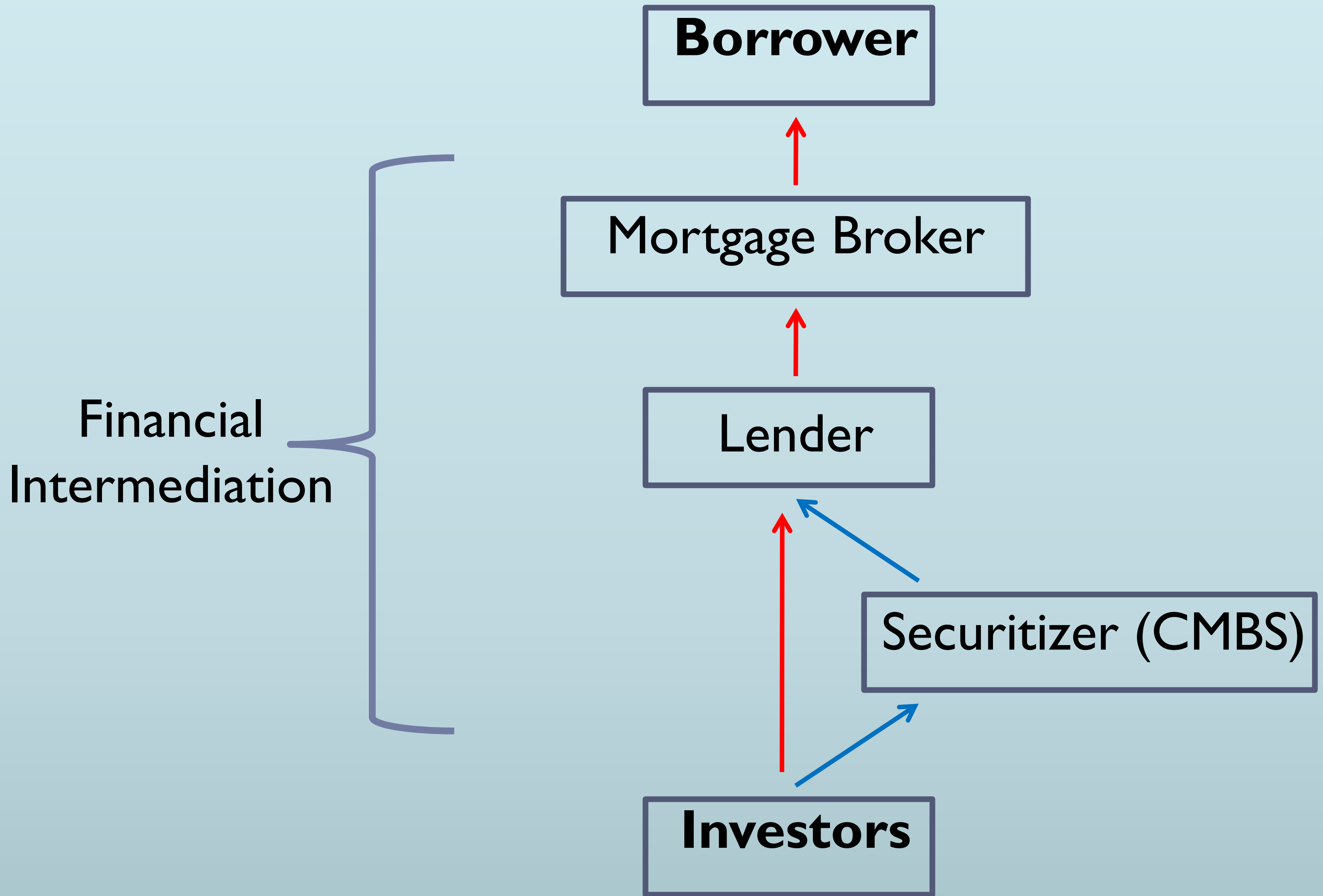
Underwriting

- Mortgage pricing and approval would be trivial absent default and prepayment risk:
  1. Measure opportunity cost of capital
  2. Make that the (minimum) contract rate, or more generally the APR for contracts with variable rates

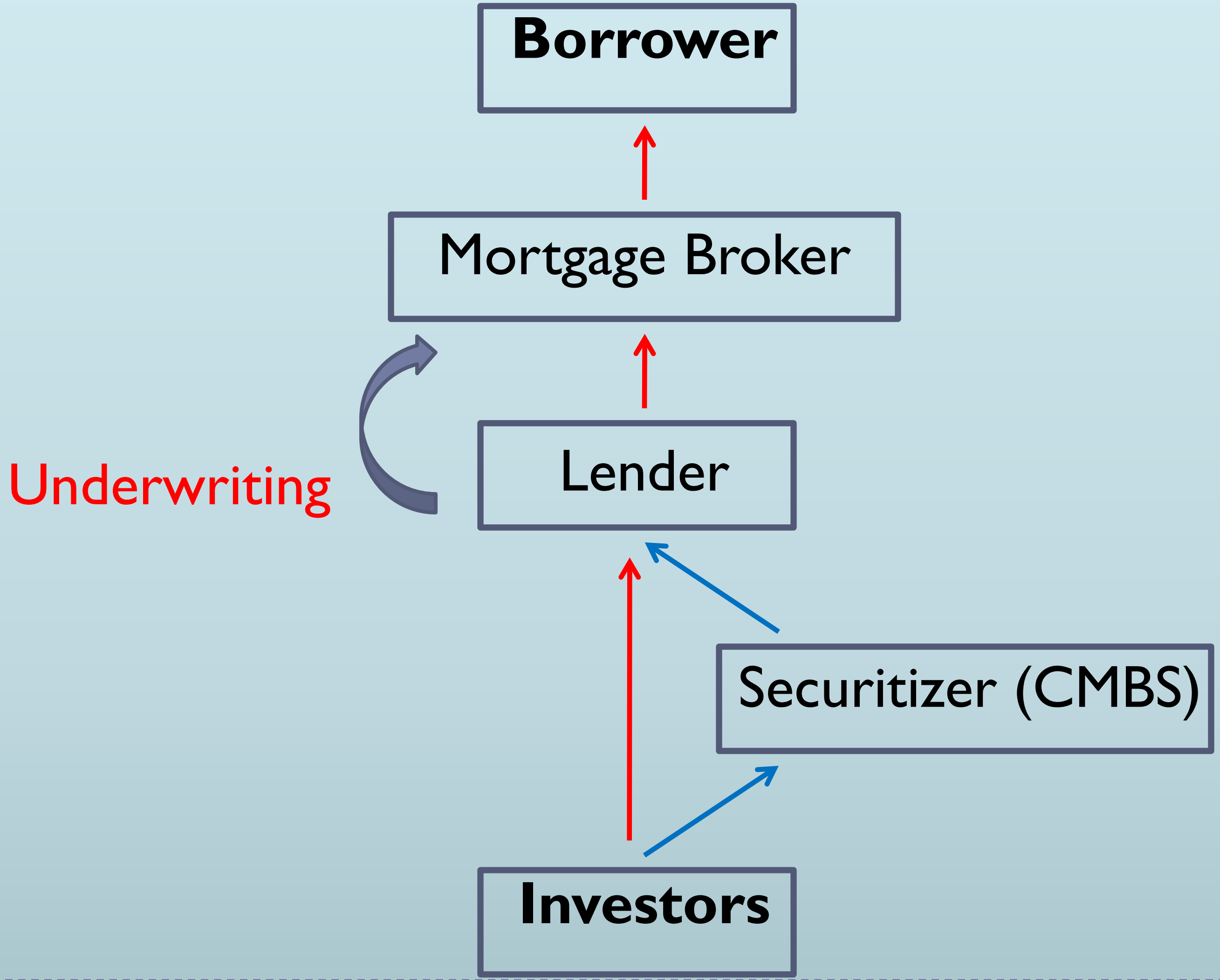
- *Underwriting*: process lenders go through to decide whether to issue a mortgage, and the terms of the loan

- Two typical steps:
  1. Does the loan meet standard criteria?
  2. If it doesn't, can we work things out?

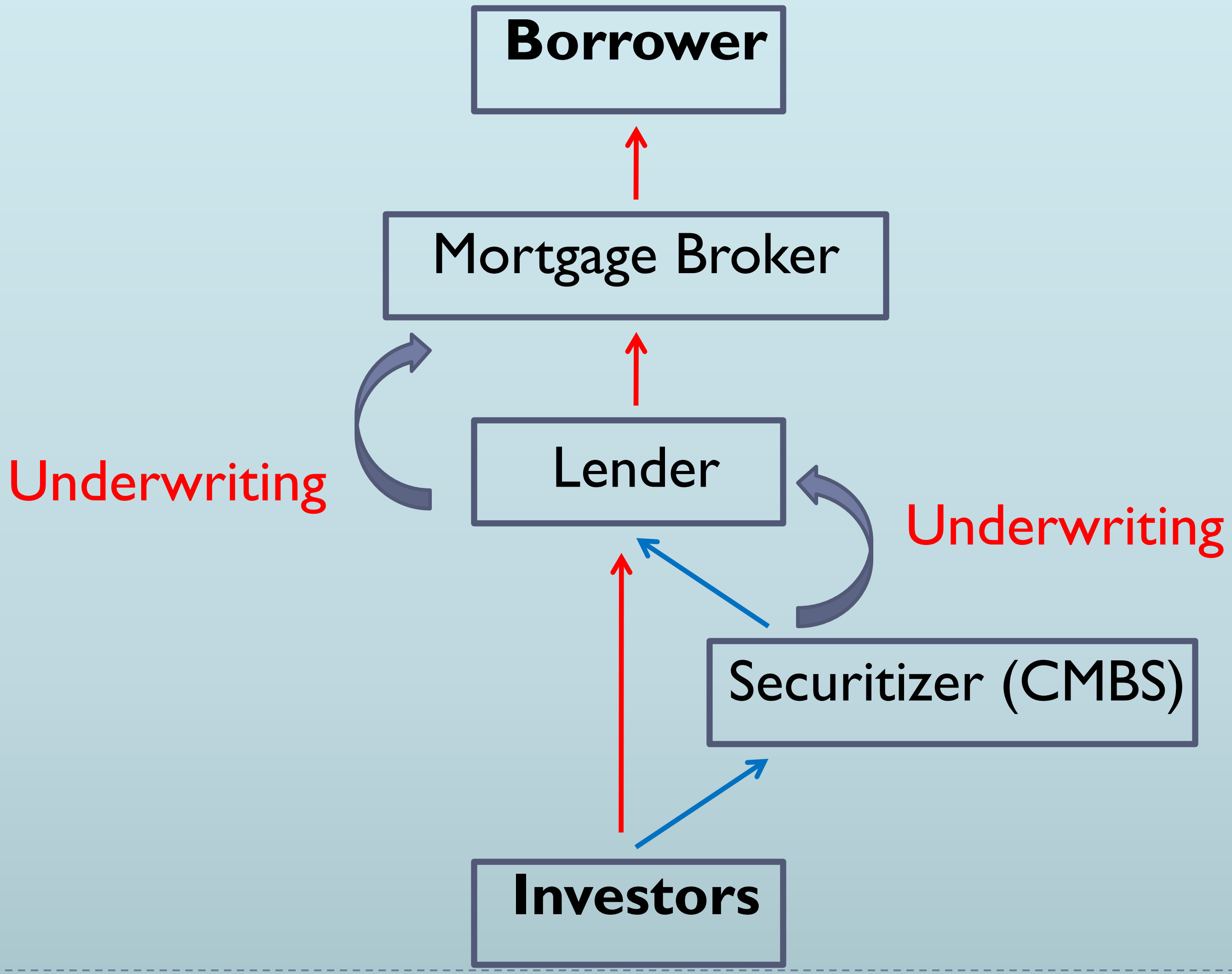
The mortgage process



Underwriting criteria



Underwriting criteria



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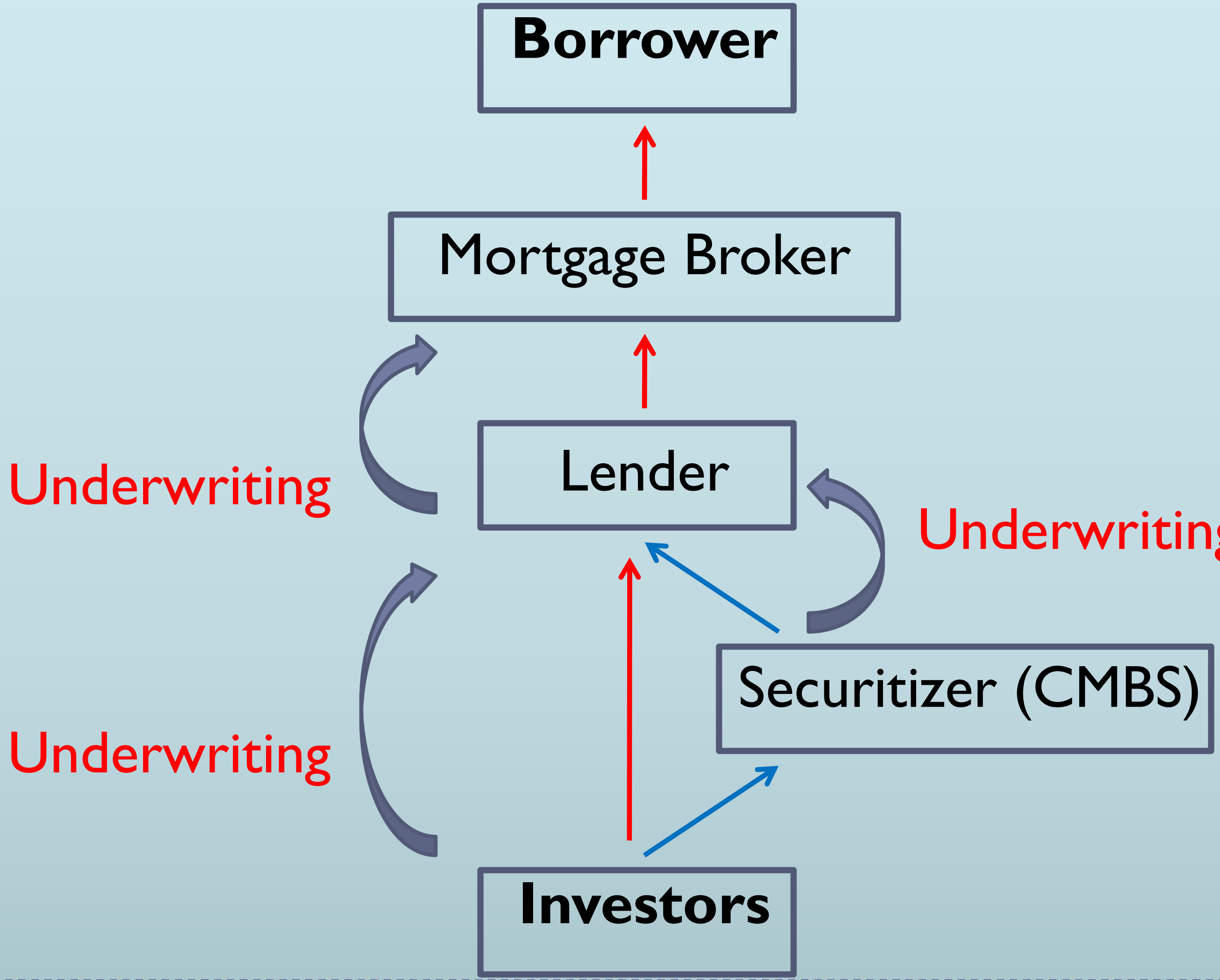


Underwriting criteria

- Lenders tell brokers what they'll fund:
  1. Leverage (loan-to-value ratio)
  2. Credit-worthiness of borrowers
  3. Proper documentation
  4. Ratio of projected cash-flows to debt-service
  5. …
- Likewise, securitizers tell lenders what they'll buy
- When secondary markets are involved, lenders pass underwriting standards on to brokers

Standard numerical criteria

- *Loan-to-value ratio (LTV)*= Loan size / Market value, at origination, and at termination
- *Debt Service Coverage Ratio (DCR)* = NOI / Debt service
- *Break-even ratio (BER)* = (DS + OE) / PGI
- Lower bound on EBTCF

Underwriting standards

- Besides specific numerical criteria, underwriting standards also specify:
  1. What information must be provided (type of financial statements horizon, borrower information…)
  2. Appraisal source and method
  3. How financial ratios need to be calculated

Example (GM, section 18.2.3)

- Borrower & seller claim property is worth $12,222,000
- Buyer wants to borrow 75% ($9.167 Million, or $91.67/SF)
- Wants non-recourse, 10-yr interest-only loan, monthly pmts
- Willing to accept "lock-out" (No prepayment)

Opportunity cost of capital

- Mortgages of this broad type are going for a “spread” of 200 basis points over10-year treasury yields, currently at 6%
- This mortgage should yield 6% + 2%, *in bond-equivalent yield (BEY) terms* **(see GM, chapter 8)**
- This means that the effective yield on loans of this sort is

$$(1+ 8\%/2)^2 - 1 \approx 8.17\%$$

- If i is contract rate on a monthly mortgage, effective annual rate is: EAR= (1+i/12)^12-1
- Contract rate must solve i = 12 x [(1.0817)^(1/12)-1]≈ 7.87%

Question

- Premium is a reward for liquidity differential vis-à-vis treasuries, and for default risk, for typical loan of this sort
- Why don’t we stop here? Why aren’t we done?

Underwriting criteria

- Max initial LTV at origination = 75%
- Max projected terminal LTV = 65%
- In computing LTV, use:
  - ✓ going-in NOI cap rate of 9% or more
  - ✓ terminal NOI cap rate of10% or more
  - ✓ multi-yr DCF with Disc. Rate of 10% or more applied to PBTCF
  - ✓ Lowest resulting value
- Min DCR = 120%.
- Max BER = 85%, or, if less, 5% less than market vacancy
- “Avoid” EBTCF < 0

Property information

- 100,000SF, fully occupied, single-tenant, office building.
- 10-yr lease signed 3 yrs ago.
- $11/SF net (NOI=EGI)
- "Step-ups" of $0.50 in lease yr.5 & 8
- Current mkt rents on new 10-yr leases are $12/SF net
- Expect mkt rents to grow @ 3%/yr. (same age)

Underwriting steps

1. Build a 10-year pro-forma
2. Calculate DCR, BER, EBTCF and ask if income criteria are met
3. Estimate initial and final property value and ask if value (LTV) criteria are met
4. If compliance fails, ask if loan modifications can be found that make loan acceptable

Pro-forma

- Assume:
  1. 1% rent growth
  2. Lease renewal probability is 75%, $2/SF commission if renew, 5$/SF otherwise, $10/SF in TI if renew, $20/SF otherwise
  3. 10% year 10 cap rate
- Then:

Pro-forma

- Assume:
  1. 1% rent growth
  2. Lease renewal probability is 75%, $2/SF commission if renew, 5$/SF otherwise, $10/SF in TI if renew, $20/SF otherwise
  3. 10% year 10 cap rate
- Then:

Year:	1	2	3	4	5	6	7	8	9	10	Year 11
Mkt Rent (net) /SF	$12.12	$12.24	$12.36	$12.49	$12.61	$12.74	$12.87	$12.99	$13.12	$13.26	$13.39
Property Rent(net)	$11.00	$11.50	$11.50	$11.50	$12.00	$12.00	$12.00	$12.99	$12.99	$12.99	$12.99
Vacancy Allow	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.81	$0.00	$0.00	$0.00
NOI/SF	$11.00	$11.50	$11.50	$11.50	$12.00	$12.00	$12.00	$12.18	$12.99	$12.99	$12.99
NOI	$1,100,000	$1,150,000	$1,150,000	$1,150,000	$1,200,000	$1,200,000	$1,200,000	$1,218,214	$1,299,428	$1,299,428	$1,299,428
Lease Comm	$0	$0	$0	$0	$0	$0	$0	-$275,000	$0	$0	
Ten.Imprv	$0	$0	$0	$0	$0	$0	$0	-$1,250,000	$0	$0	
Reversion@10%Cap										$12,994,280	
Less OLB										$9,167,000	
PBTCF	$1,100,000	$1,150,000	$1,150,000	$1,150,000	$1,200,000	$1,200,000	$1,200,000	-$306,786	$1,299,428	$14,293,709	
Debt Svc	-$721,443	-$721,443	-$721,443	-$721,443	-$721,443	-$721,443	-$721,443	-$721,443	-$721,443	-$9,888,443	
EBTCF	$378,557	$428,557	$428,557	$428,557	$478,557	$478,557	$478,557	($1,028,229)	$577,985	$4,405,266	
DCR	152%	159%	159%	159%	166%	166%	166%	169%	180%	180%	
BER @ Mkt	60%	59%	58%	58%	57%	57%	56%	56%	55%	54%	

Issues

1. Negative EBTCF in year 8 (minor)
2. At 9% cap rate, loans meets the ILTV criterion, but PV(PBTCF) @ 10% is $11,557,000, which makes ILTV 79%
3. Terminal LTV @ 10% NOI cap rate is too low

Solutions

1. Include a covenant in contract under which borrower commits to set funds aside for large CAPEX in year 8 (*sinking fund covenant*)
2. Lower loan size
3. Use a loan with some amortization, and debt service characteristics that remain compatible with income criteria

But seriously…

- On the residential side where loans are more or less standardized, standardized underwriting works fine (?)
- In fact, automated underwriting has come to dominate in the residential market
- On the commercial side, ok for boiler plate deals and when the seas are calm
- Big, unique deals require more serious calculations…
- … in the spirit of those you did on hw 6
- Those serious calculations are where underwriting criteria come from in the first place

Mortgage-backed securities

- Basic idea:
  1. Pool a large number of mortgages
  2. Sell the pool as a security, or use the pool as collateral for one or more debt instruments (bonds)
- Purpose:
  1. Allow more investors to invest in real estate debt instruments
  2. Make that investment more liquid
  3. Pool/fine tune risk

A machine to generate AAA paper

- Why did securitization take off after 2000?
- Among other things because AAA paper became scarce largely due to the global saving glut (US paper hogs)
- AAA paper lubricates many key markets, the repo market in particular
- Where to find it? There is, after all, only so many blue chip issuers
- Answer: CMOs
- Housing boom created endless supply of mortgages, only trick is to somehow issue safe bonds backed by unsafe assets
- Sounds crazy, but it "works": no AAA tranche of any CMO deal has defaulted to date (many have been downgraded, but none have formally defaulted)

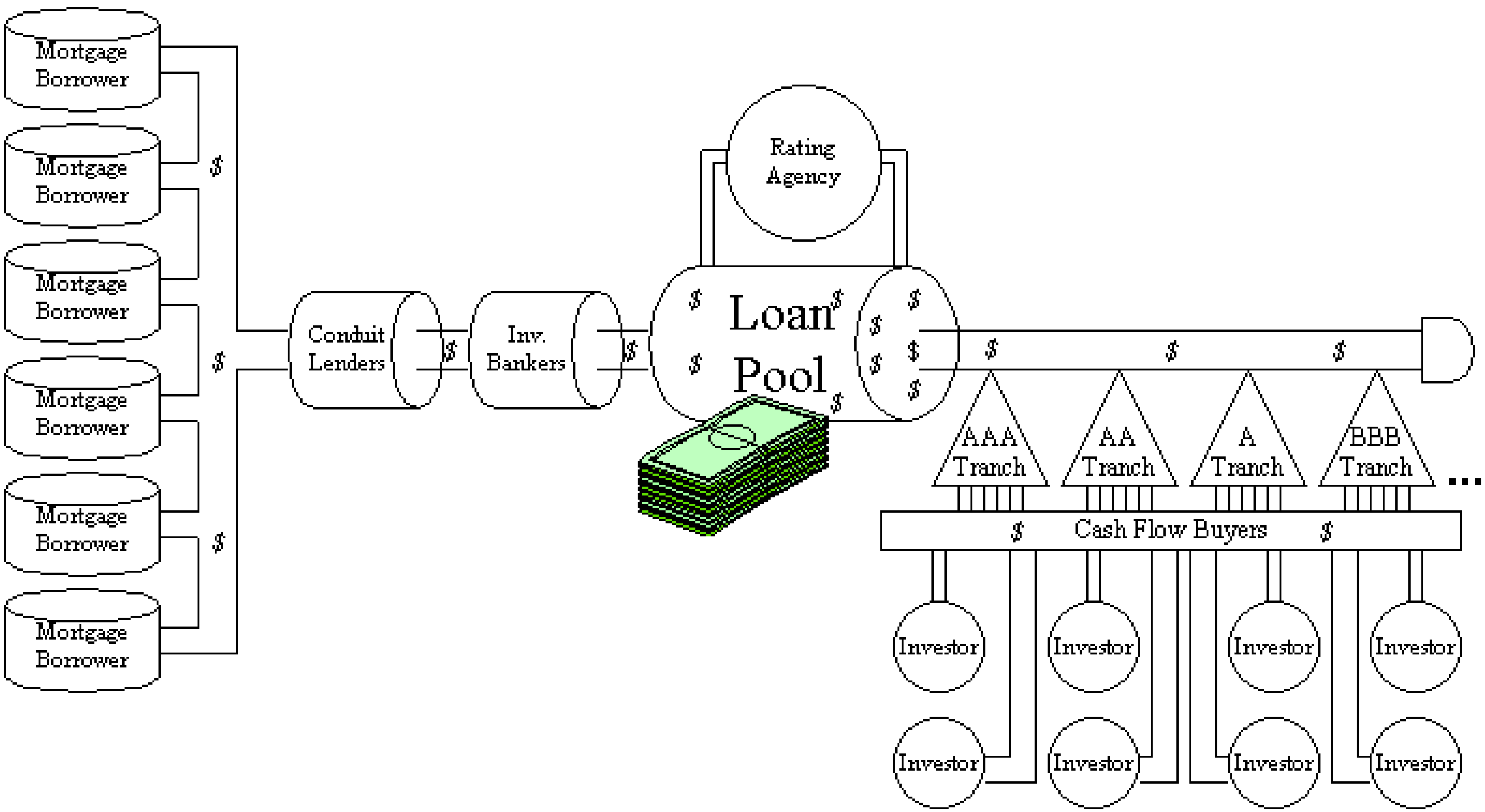
Mortgage securitization: a short history

- The US government wanted liquid secondary markets for mortgages after the great depression: FNMA (1938), GNMA (1968), FHLMC (1970)
- Ginnie issues first pass-through in 1968
- Bank of America issues first private label pass-through in 1977
- Solomon Brothers and First Boston create the CMO concept in 1983

Securitization process

1. Mortgages are originated
2. Sold to and pooled by investment banker
3. Pool is used to create one or several securities:
   i. Mortgage-backed bonds (MBBs)
   ii. Mortgage pass-through securities (MPTs)
   iii. Mortgage pay-through bonds (MPTBs)
   iv. Collateralized Mortgage Obligations (CMOs)

CMBS Securitization Process



More CMBS language

- Once pooled, mortgages are usually transferred to a trust
- *Real Estate Mortgage Investment Conduit* (REMIC) are untaxed, pass-through entities that:
  1. Hold a fixed pool of mortgages
  2. Distribute payments to investors
- *Pooling and servicing agreement (PSA):* specifies how loans will be serviced, and how proceeds and losses are to be distributed to investors
- *Servicers (Primary, Master, Special):* administer the loans

Basic example

- Consider a pool of 1,000 identical FRMs with initial balance $75,000 (each), contract rate 11%, and yearly payments
- If all goes according to the plan, $12,735,107 in P&I will be collected each year on these mortgages until maturity
- This pool can be securitized in at least 4 different ways

Mortgage-backed bond (MBB)

- Pool owner issues a bond collateralized by the pool
- Mortgages are placed in a trust
- Issuer retains ownership of the pool
- MBBs are usually issued at a face value below the face value of the bond (MBBs are *overcollateralized*)
- Overcollateralization represents the issuer's equity in the deal
- Usually, trustee must "mark all mortgage collateral to market" and issuer must replenish the pool if its value falls below a specified threshold

MBB example

- A bond with face value $60M and coupon payment 11% is issued against our pool of 1,000 FRMs
- All principal comes due at maturity
- Investors require a10% YTM from this sort of investment
- Bond will sell at a premium over face value (why?)
- Underwriting costs are 2.5% of issue price

Alternating cash flows

- IRR criterion cannot be applied for issuer in most MBB cases, because of the bond's balloon payment
- Use PV criterion instead:

1. Ask what the discount rate is on deals of similar risk level
2. Use that discount rate to discount cash flows

Mortgage pass-through security (MPT)

- Mortgage originator pools mortgages and sells equity (ownership) rights to investors
- Originator or an approved servicer services the pool
- Trustee assumes formal ownership of the pool and makes payments to security owners
- All cash flows net of fees are "passed through" to investors
- No overcollateralization necessary

Basic example of an agency MPTS

- Take same pool as before
- Investors purchase certificates (equity shares) in the $75M pool and receive payments in proportion to their initial investment
- 0.5% goes to GSE, 10.5% is passed through, along with the principal

Mortgage pay-through bond (MPTB)

- Mortgage originator pools mortgages and issues <u>one</u> bond collateralized by the pool
- Unlike in MBB deal, bond payments depend directly on pool's performance
- All principal payments are passed through
- Interest payments paid at a given coupon rate
- Overcollateralization provides some shelter against default
- Overcollateralization represents the issuer's equity in the deal

Basic example

- Consider a pool of 1,000 identical FRMs with initial balance $75,000 (each), contract rate 11%, and yearly payments
- If all goes according to the plan, $12,735,107 in P&I will be collected each year on these mortgages until maturity

MPTB example

- A bond with face value $72M and coupon payment 10.5% is issued against our pool of 1,000 FRMs
- All principal is passed through
- Investors require a10.5% YTM from this sort of investment, hence bond sells at par ($72M)
- Underwriting costs are 2.5% of issue price

Mortgage pay-through bond (MPTB)

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Collateralized Mortgage Obligations (CMOs)

- CMOs are debt instruments issued using a pool of mortgages as collateral, with the pass-through features of MPTBs
- *Ex Uno Plures*: several classes of securities are issued against the same pool of mortgage, ordered by priority
- Each class of security is called a *tranche* (slice)
- Each tranche has its own risk characteristics, and can be sold to investors with different objectives
- Completes the market: new sources of fairly safe fixed income instruments
- Sum of PV of the pieces > PV(Pool)

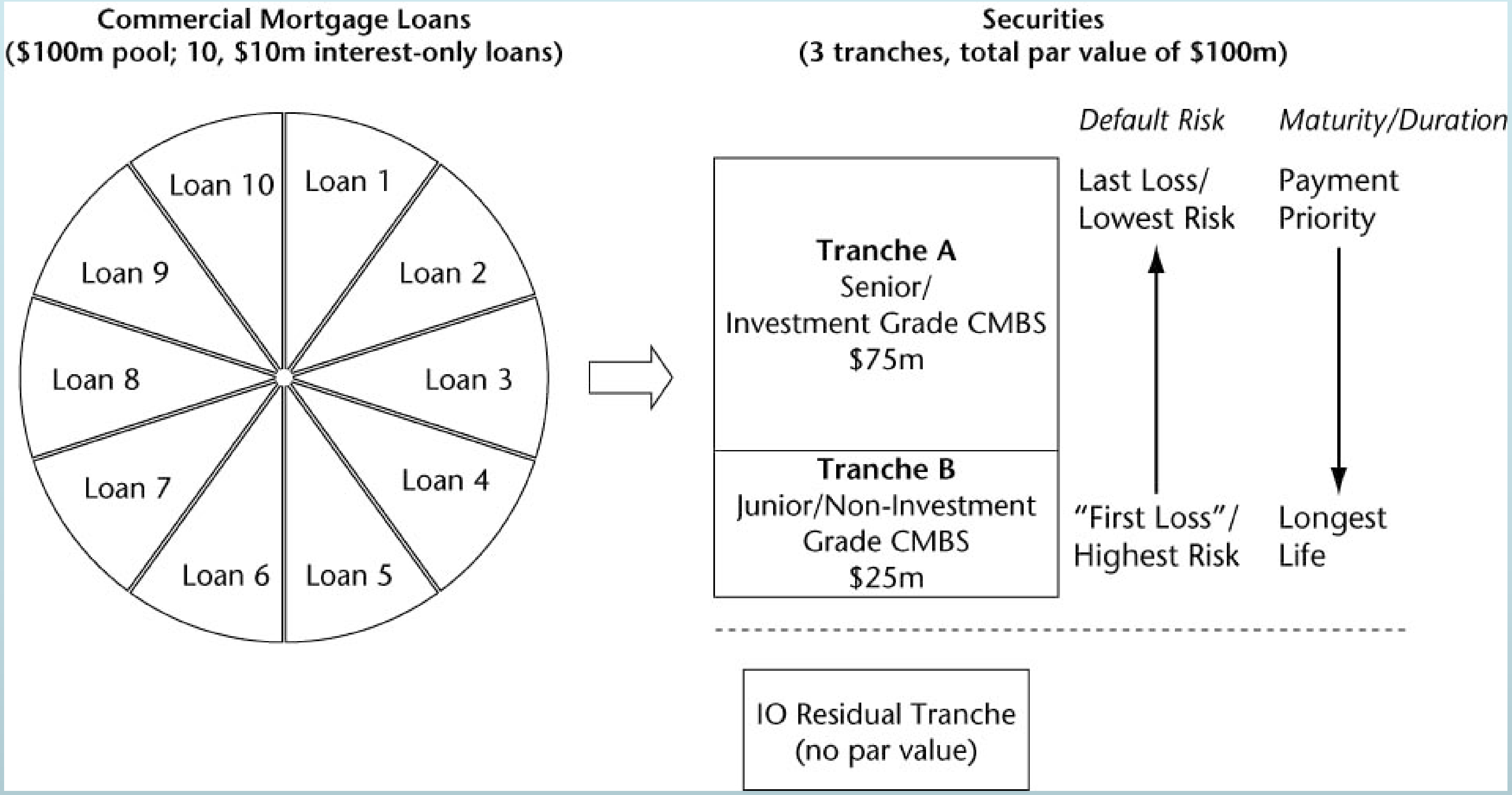
CMOs: example 1

- Back to our $75M pool of FRMs
- 3 tranches:
  1. A: 9.25% rate, $27M face value
  2. B: 10% rate, $15M face value
  3. Z: 11% rate, $30M face value
- Payments available for reduction of principal of A and B: Principal payments from pool + Interest Payments on Z
- Go to A first, then B
- Once A and B are retired, Z gets paid

Default

- Payments go to A first, then B, then Z, and then, finally to the equity tranche (*waterfall structure)*
- If anything is lost to default, equity tranche is the most likely to be affected
- This is why the IRR on the equity tranche must be high, and why subordinated tranches have to be rewarded
- Assume for instance that 20% of the last three principal and interest payments are lost to default

CMOs: example 2 (GM, section 20.2.1)



Value of deal to the issuer

- The value of the deal is the difference between the sum of issue prices for each tranche (net of underwriting costs) and the cost of funding the mortgages ($100M)
- This depends on the YTM various buyers require given the risk associated with each tranche:

Class	Par Value (millions)	WAM (yrs.)	Credit Support	Coupon	YTM	Value as CMBS* (millions)
A	$75	1.33	25%	8%	8%	$75.00
B	$25	2.00	0% (1st-loss)	10%	12%	$24.15
IO	NA	1.25	NA	NA	14%	$1.70
Pool	$100	1.50	NA	10%(WAC)	NA	$100.85

More CMBS language

- Since pools typically comprise very heterogeneous mortgages, summary statistics are useful:

1. Total par value
2. "Weighted average maturity" (WAM)
3. "Weighted average coupon" (WAC)
4. LTV ratio = Par value / Market value of underlying properties

Pool risk

1. Overall LTV and DCR, and their distribution
2. Quality of the documentation and appraisal
3. Property types
4. Loan maturities (WAM + distribution)
5. Loan types (terms, age,…)
6. Overcollateralization, credit enhancement

Tranche-specific risk

- Subordination of a given tranche =

  Par value of junior tranches / Par value of the Pool
- If a tranche has 25% subordination, the par value of the pool would have to fall by 25% for the tranche to begin experiencing losses
- Tranche's effective LTV = Pool LTV x (1-subordination)
- Tranche's effective DCR= Pool DCR / (1-subordination)

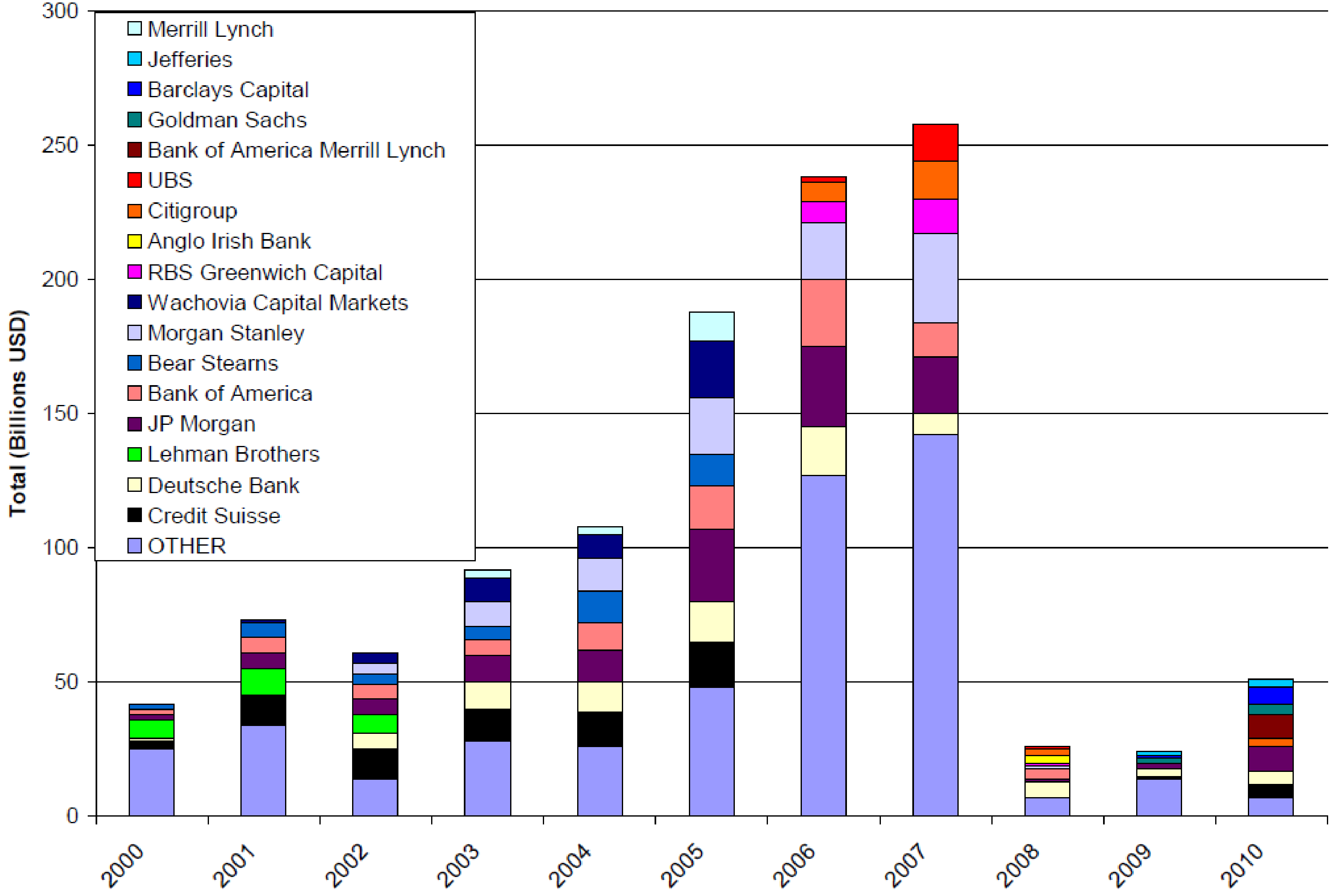
Credit rating and yield spreads

- Credit rating agencies assign risk ratings to tranches as function of the pool risk, subordination and WAM
- This helps investors decide what yield they should expect on various tranches relative to:
  1. Treasury yields at maturity ≈ tranche WAM
  2. The fixed rate component of LIBOR swaps at maturity ≈ tranche WAM

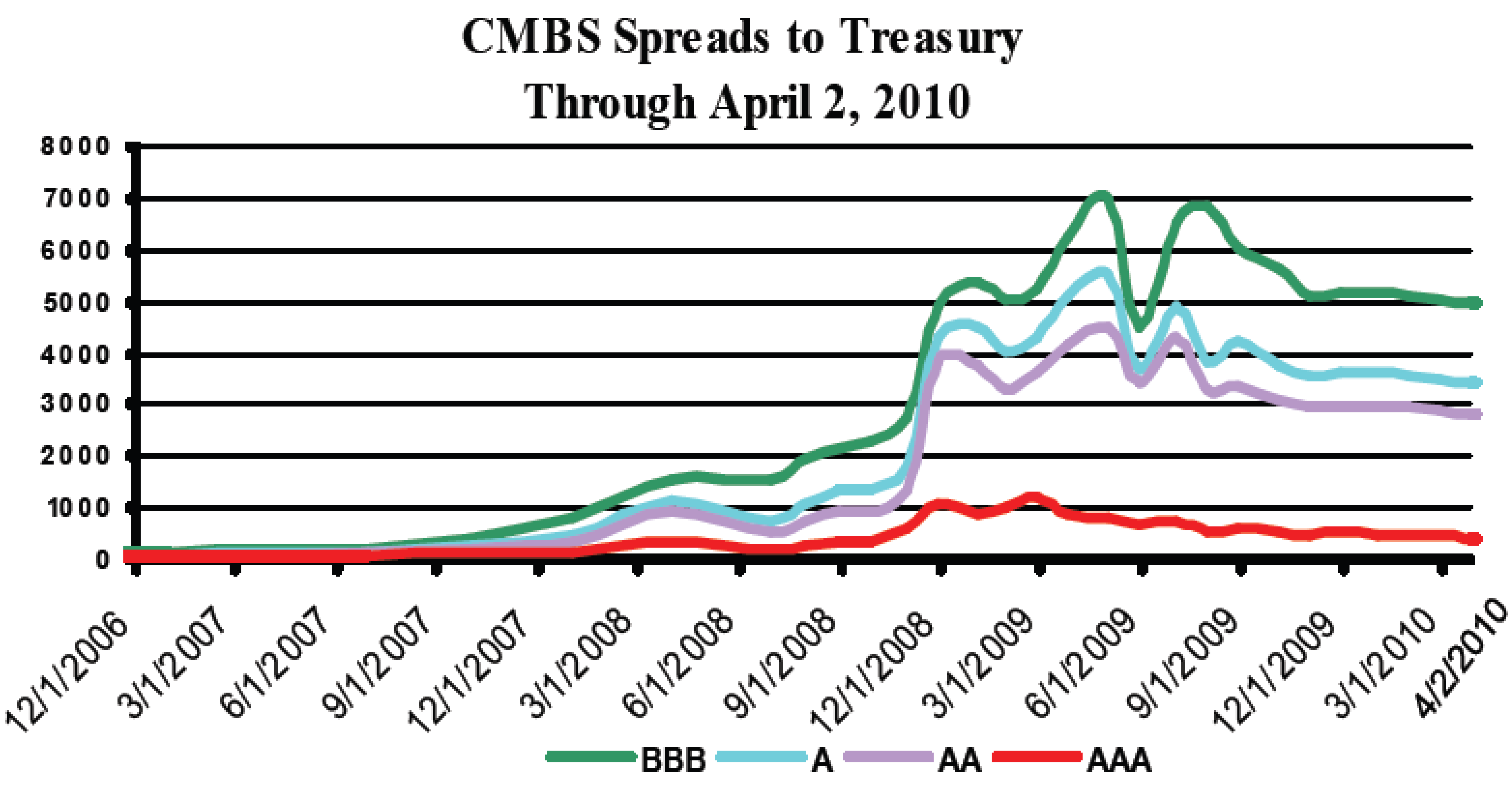
More financial engineering

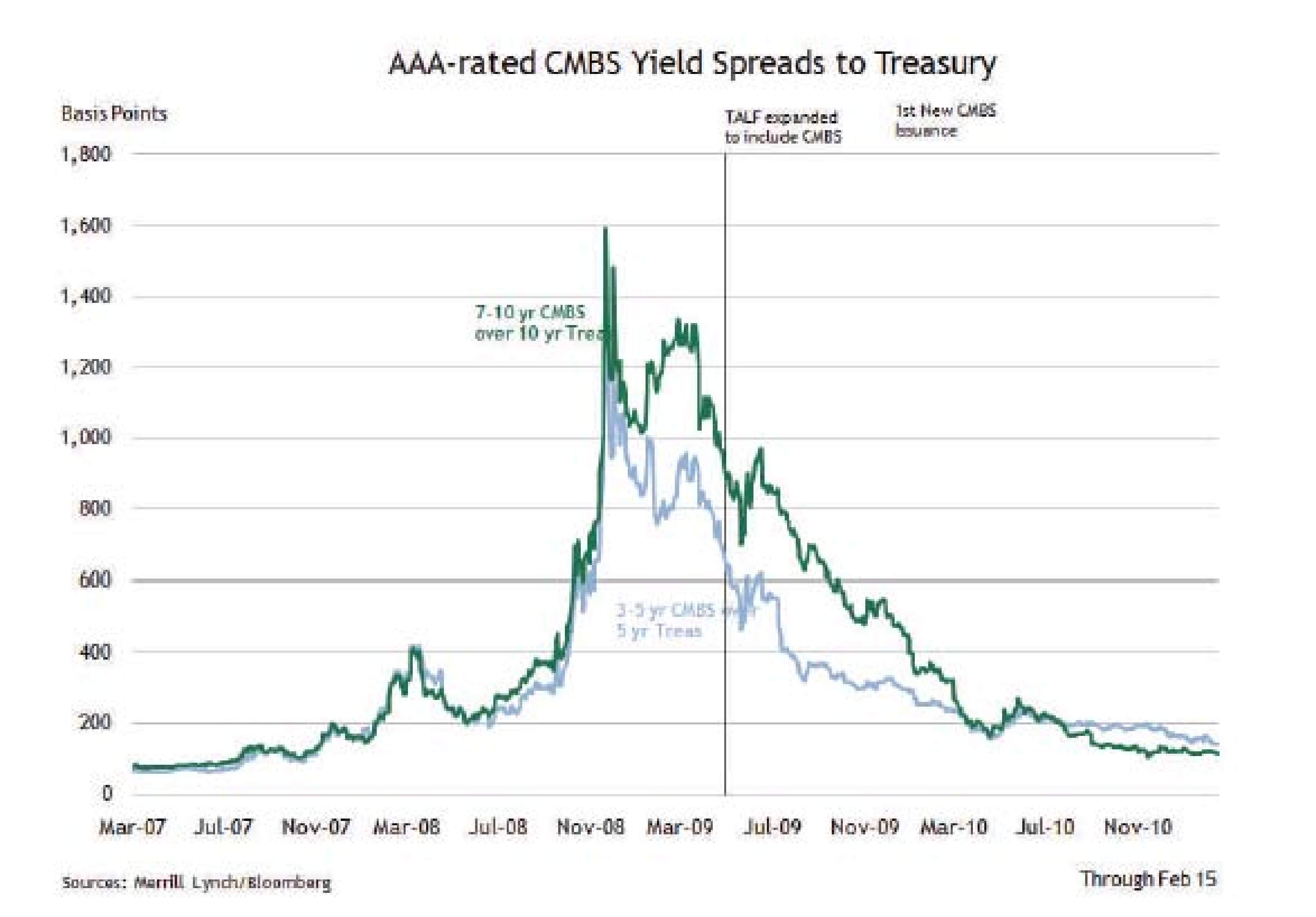
- CDOs (Collateralized Debt Obligations) are debt instruments backed by pools of assets
- CMOs are CDOs where the assets are mortgages
- But CDOs can be backed by CMOs, REIT debt, unsecured real estate loans (*mezzanine loans*), preferred equity…
- The risk inherent to those deals is often insured via CDS (credit-default swaps)
- This creates a web of interrelated financial products
- When housing crisis struck in June 2006, the whole arrangement came crashing down, and it has yet to recover

Figure 3: Total CMBS issuance by underwriter (Billions USD) from 2000 to 2010



Source: Bloomberg[2]


CMBS Spreads to Treasury
Through April 2, 2010
8000
7000
6000
5000
4000
3000
2000
1000
0
12/1/2006
3/1/2007
6/1/2007
9/1/2007
12/1/2007
3/1/2008
6/1/2008
9/1/2008
12/1/2008
3/1/2009
6/1/2009
9/1/2009
12/1/2009
3/1/2010
4/2/2010
BBB
A
AA
AAA


AAA-rated CMBS Yield Spreads to Treasury
Basis Points
TALF expanded to include CMBS
1st New CMBS Issuance
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
7-10 yr CMBS over 10 yr Trea
3-5 yr CMBS over 5 yr Treas
Mar-07
Jul-07
Nov-07
Mar-08
Jul-08
Nov-08
Mar-09
Jul-09
Nov-09
Mar-10
Jul-10
Nov-10
Sources: Merrill Lynch/Bloomberg
Through Feb 15