

Mortgage-Backed Securities

Mortgage-backed securities (MBS) are securities that are backed by pools (i.e., collection) of mortgage loans

Mortgage-backed securities include the following securities:

- (1) mortgage pass-through securities
- (2) collateralized mortgage obligations
- (3) stripped mortgage-backed securities

Basic product: **Mortgage Loan**

Fixed-rate level-payment mortgages

Has the following characteristics:

(1) term of the loan is fixed

(2) interest rate is fixed

(3) amount of the monthly mortgage payment is fixed for entire term of the loan (i.e., the mortgage requires "level payments")

Cash flow of a level-payment fixed-rate mortgage:

Each monthly mortgage payment for a level-payment fixed-rate mortgage is due on the first of each month and consists of:

- (1) interest of $\frac{1}{12}$ th of the fixed annual interest rate times the amount of the outstanding mortgage balance at the beginning of the previous month (interest "in arrears"), and
- (2) repayment of a portion of outstanding mortgage balance

The difference between the monthly mortgage payment and the portion of the payment that represents interest equals the amount that is applied to reduce the outstanding mortgage balance.

The monthly mortgage payment is designed so that after the last scheduled monthly payment of loan is made, amount of outstanding mortgage balance is zero (i.e. the mortgage is fully repaid)

This type of loan is said to be a **self-amortizing** loan.

Illustration:

A level-payment fixed-rate mortgage, 30-years (360 month), \$100,000 mortgage with a 10% mortgage rate.

Monthly mortgage payment would be \$877.57.

Prepayments And Cash Flow Uncertainty:

- assumed that the homeowner would not pay any portion of the mortgage balance off prior to the scheduled due date.
- homeowners do pay off all or part of their mortgage balance prior to the maturity date.
- payments made in excess of scheduled principal repayments are called **prepayments**.

➤ prepayments occur for one of several reasons:

1. prepay the entire mortgage when they sell their home
2. default
3. destruction of property
4. refinancing

➤ prepayment modeling discussed later

➤ effect of prepayments is that the cash flow from a mortgage is not known with certainty - true for all mortgages

Mortgage Pass-Through Securities

Cash flow characteristics

1. Depends on the cash flow of the underlying mortgages.
2. Consists of monthly mortgage payments representing interest, scheduled repayment of principal, and any prepayments.
3. Payments are made to security holders each month.
4. Amount and timing of cash flow from the pool of mortgages and cash flow passed through to investors, however, are not identical.

The monthly cash flow for a pass-through security is less than the monthly cash flow of the underlying mortgages by an amount equal to servicing and other fees

- the other fees are those charged by the issuer or guarantor of the pass-through security for guaranteeing the issue
- typically, coupon rate on a pass-through security is 0.5% less than the mortgage or coupon rate on the underlying pool
- timing of cash flow is also different
- monthly mortgage payment is due from each mortgagor on the first day of each month
- there is a delay in passing through the corresponding monthly cash flow to the security holders
- number of days that the payment is delayed varies by the type of pass-through security

Prepayment Conventions

A yield based on a forecasted cash flow is called a "cash flow" yield.

based on projected prepayments ----->
projected cash flow ---->
given price can get yield

1. Conditional prepayment rate (CPR)

- assumes some fraction of the remaining principal in the pool is prepaid each month for the remaining term of the mortgages.
- prepayment rate assumed for a pool, called the **conditional prepayment rate (CPR)** (or constant prepayment percentage), is based on the characteristics of the pool (including its historical prepayment experience) and the economic environment.

➤ advantage of this approach is its simplicity; what's more, changes in economic conditions that impact prepayment rates and changes in the historical prepayment pattern of a pool can be analyzed quickly.

➤ CPR is an annual prepayment rate

To estimate monthly prepayments, the CPR must be converted into a monthly prepayment rate, commonly referred to as the single monthly mortality rate (SMM). The following formula can be used to determine the SMM for a given CPR:

$$\text{SMM} = 1 - (1 - \text{CPR})^{1/12}$$

Example: suppose that the CPR used to estimate the prepayments is 6%. The corresponding SMM is:

$$\begin{aligned} \text{SMM} &= 1 - (1 - .06)^{1/12} \\ &= 1 - (.94)^{.083333} = .005143 \end{aligned}$$

An SMM of $W\%$ means that approximately $W\%$ of the remaining mortgage balance at the beginning of the month after subtracting the scheduled principal payment will prepay that month.

Prepayment for month = SMM x
(beginning monthly mortgage balance -
scheduled monthly principal)

2. PSA Standard Prepayment Model

The PSA standard prepayment model is expressed as a monthly series of annual prepayment rates.

The basic PSA model assumes that prepayments will occur less frequently for newly originated mortgages and then will speed up as the mortgages become seasoned.

More specifically, the PSA model assumes the following prepayment rates for 30-year mortgages:

- (1) a CPR of 0.2% for the first month, increased by 0.2% per annum per month for the next 30 months when it reaches 6% per year, and
- (2) a 6% CPR for the remaining years.

This benchmark referred to as "100% PSA" and can be expressed as:

$$\text{If } t \leq 30 \text{ then } \text{CPR} = \frac{6\% t}{30}$$

$$\text{If } t > 30 \text{ then } \text{CPR} = 6\%$$

Slower or faster speeds are then referred to as some percentage of PSA. For example, 50% PSA means one half the CPR of the PSA prepayment rate; 150% PSA means one and a half the CPR of the PSA prepayment rate.

CPR is converted to an SMM using the formula presented earlier.

The cash flow to the investor is the sum of

(1) the projected monthly interest net of the servicing fee,

(2) the projected monthly scheduled principal payment

(3) the projected monthly principal prepayment

Price Performance of Pass-Through Securities

- ⌘ price performance will depend on investors' expectations of the prepayment rate which, in turn, depend on investors' expectations about futures interest rates (mortgage rate)
- ⌘ discount pass-through: benefits from prepayments
- ⌘ premium pass-through: loses from prepayments
- ⌘ problem of negative convexity when interest rates decline
- ⌘ prepayment risk can be divided into:
 - (1) extension risk
 - (2) contraction risk

Yield Spread To Treasuries

Not possible to calculate a yield with certainty, it is often stated that pass-through securities offer a higher yield than Treasury securities.

Typically, the comparison is between Ginnie Mae pass-through securities and Treasuries, since both are free of default risk.

Difference between the two yields should therefore primarily represent prepayment risk

Problem of determining what is mean by "comparable Treasury"

Stated maturity of a mortgage pass-through security is inappropriate because of prepayments.

Features of passthroughs

Type of guarantee:

1. Timely payment of both interest and principal (**fully modified passthroughs**)
2. Guarantees both interest and principal payments, however, it only guarantees the timely payment of interest. The scheduled principal is passed through as it is collected with a guarantee that the scheduled payment will be made no later than a specified date after it is due -- called **modified passthroughs**.

Issuers of mortgage-pass-through securities

Three major types of pass-through securities guaranteed:

Government National Mortgage Association
(Ginnie Mae)

Federal Home Loan Mortgage Corporation
(Freddie Mac)

Federal National Mortgage Association
(Fannie Mae)

First is a wholly owned U.S. government corporation within the department of housing and urban development.

Last two are federally sponsored credit agencies.

Balance of mortgage pass-through securities are privately issued and called

Conventional Mortgage Pass-Through Securities
Or Private Label Pass-Throughs

Conventional pass-through securities
(private label)

Issued by thrifts, commercial banks and private conduits

Conventional mortgage pass-through securities are rated

Collateralized Mortgage Obligations

Prepayment risk:

consists of extension risk and contraction risk

Redistribution of risk: CMO creation

Window: interval over which scheduled principal payments are made to the bond holder.

Types of CMO classes

Sequential-pay structures

Accrual bonds

Floating rate CMOs

Inverse floater

Sequential CMO

CMOs are created by redistributing the principal (both scheduled and prepayments) to alter the prepayment risk profile.

Contraction risk

Extension risk

Simple CMO structure

Three classes of bonds - - A, B, C

Rule for distribution of cash flow

Class	Interest	Principal
A	Pay each month based on par amount outstanding	Receives all monthly principal until completely paid off.
B	Pay each month based on par amount outstanding	After Class A is paid off, B receives all monthly principal until completely paid off.
C	Pay each month based on par amount outstanding.	After Class B is paid off, C receives all monthly principal until completely paid off.

Hypothetical Four-Tranche Sequential-Pay Structure

Tranche	Par Amount	Coupon Rate (%)
A	\$194,500,000	7.5
B	36,000,000	7.5
C	96,500,000	7.5
D	73,000,000	7.5
Total	\$400,000,000	

Collateral Characteristics:

WAC = 8.125%

WAM = 357 months

PSA	Collateral	A	B	C	D
50	15.11	7.48	15.98	21.02	27.24
100	11.66	4.90	10.86	15.78	24.58
165	8.76	3.48	7.49	11.19	20.27
200	7.68	3.05	6.42	9.60	18.11
300	5.68	2.32	4.64	6.81	13.36
400	4.44	1.94	3.70	5.31	10.34
500	3.68	1.69	3.12	4.38	8.35
600	3.16	1.51	2.74	3.75	6.96
700	2.78	1.38	2.47	3.30	5.95

Plain vanilla sequential CMO could have four bonds - - A, B, C and Z.

The first three tranches receive interest payments starting in month 1.

Class A receives all the principal payments (scheduled and prepayments) until it is completely paid off.

Class B then receives all the principal payments until it is paid off.

Class C then receives all the principal payments and so on.

Class Z is an accrual bond.

Class Z does not receive current interest.

The interest for the Z accrues and is added to the balance.

The interest that would have been paid to the Z Bond is used to speed up pay down of the principal balance of the earlier tranches.

Once the earlier bonds have been paid off, bond Z receives the original principal balance plus accrued interest until completely paid off.

Floaters/Inverse Floaters

It is possible to create a floating-rate bond and an inverse floating-rate bond whose coupon equals the net coupon of the collateral.

We can create two floating rate bonds from the fixed payment of the underlying collateral.

Example

B1 = LIBOR + 50 basis points

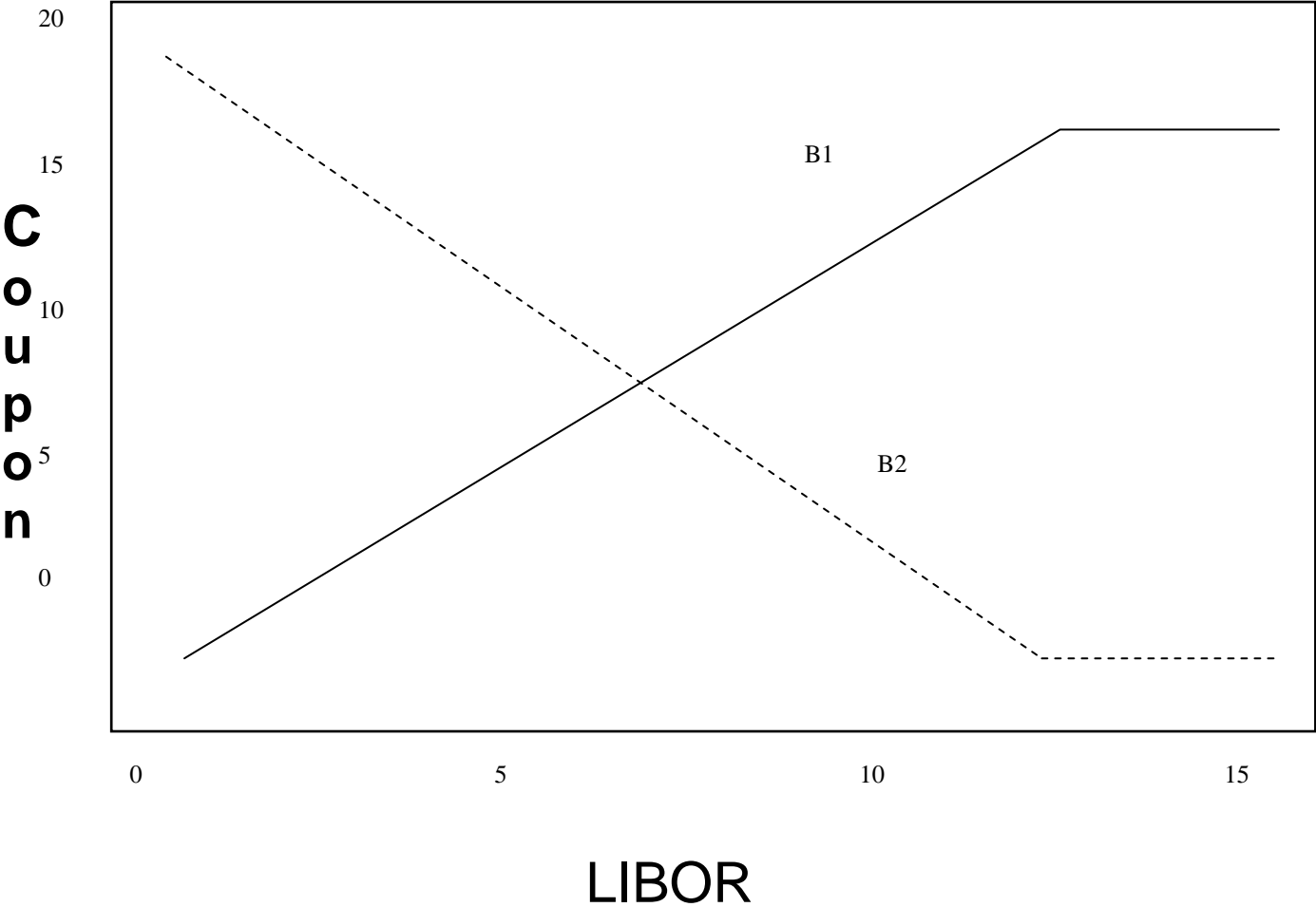
B2 = 19.25 - 1.5 x LIBOR

B1 = floats with LIBOR

B2 = moves inversely with LIBOR

They typically have a cap and a floor.

Floater and Inverse Floater Coupon



Source: Davidson/Herskovitz, Mortgaged Backed Securities, p. 104

Planned amortization class (PAC) bonds

Each PAC tranche has a specified principal payment schedule that is met as long as prepayment rates stay within a specified range.

Scheduled principal payments of PAC bonds are protected from varying prepayments by prioritizing the principal payments from the underlying collateral.

Presence of PAC produces greater cash flow uncertainty for "support" or "companion" classes

* if prepayments increase, support bonds receive additional principal -- ensures that there is not an overpayment on PAC

* if prepayments slow, principal redirected from support bonds to PAC to meet specified principal schedule

Many PACs also accrue all prior principal shortfalls.

As prepayment reach and sustain certain levels (either high or low) scheduled principal of PAC can be distributed.

Prepayment Collar: highest and lowest possible prepayment rates that could be sustained until maturity of PAC and not cause a disruption

Once outside doesn't mean:

1. Principal schedule automatically broken
2. Even if broken it is permanent condition

Prepayment collar determines degree of call protection and extension risk and therefore value.

The degree of protection is important in comparing PACs.

To assess prepayment risk, should know:

1. Current collar
2. How the collar could change in the future
3. The likelihood of the collar being violated

Targeted Amortization Class Bonds

Has a schedule of principal repayment.

The difference between a PAC bond and a TAC bond is that the former has a wide PSA range over which the schedule of principal repayment is protected against contraction risk and extension risk.

A TAC bond, in contrast, has a single PSA rate from which the schedule of principal repayment is protected.

As a result, the prepayment protection afforded the TAC bond is less than that of a PAC bond.

The creation of a bond with a schedule of principal repayments based on a single prepayment rate results in protection against contraction risk but not extension risk.

Stripped Mortgage-Backed Securities

Created by altering that distribution of principal and interest from a pro rata distribution to an unequal distribution.

By doing so, at least one of the securities created will have a price/yield relationship that is different from the price/yield relationship of the underlying mortgage pool.

Types of stripped MBS

(1) synthetic-coupon passthroughs

unequal distribution of coupon and principal resulted in a synthetic coupon rate that is different from the underlying collateral

(2) interest-only/principal only strips

all of the interest is allocated to one class
(called the **interest only** or IO class)

And

all of the principal to the other class (called
the **principal only** or PO class).

* IO class receives no principal payments

* PO security is purchased at a substantial
discount from par value

IO investor may not recover amount
invested if prepayments are fast

Yield an investor will realize depends on the
speed at which prepayments are made.

Both the IO and PO classes have
substantial price volatility.