CHAPTER TWELVE

Mortgage-backed Securities

Mortgage-backed securities (MBS) are securities backed by mortgages. MBS can be privately issued or issued by quasi-government agencies. The most liquid and active MBS market is in the US, where there are over US$1.2 trillion worth of MBS outstanding (in 1992), and over US$300 billion of new MBS and mortgage loan pools issued each year.

Mortgage pass-through securities

The traditional MBS are "mortgage pass-through" securities in which the lender bank pools mortgage loans with similar characteristics together, collects principal and interest payments every month, and passes through the principal and interest payments less the servicing and other fees to investors. Investors receive pro rata shares of the resultant cash flows.

Suppose an investor buys a pass-through MBS at par, backed by a pool of mortgage loans all with 10 percent interest rate fixed for 30 years. (30-year fixed rate mortgages are very common in the US.) Assume that interest rates drop by two percent after the purchase. A common misconception is that the market value of the MBS would go up just like other bonds. This is not the case for MBS. When rates drop, borrowers tend to refinance their mortgages. Instead of paying 10 percent mortgages fixed for 30 years, they can now refinance their loans at 8 percent. This is pretty bad for the MBS investor. Instead of seeing his investment goes up in value because of the rate drop, he gets his investment paid off at par. In addition, he has to reinvest his money at lower rates now. This is the "prepayment risk" of MBS.

On the other hand, if interest rates go up from 10 percent to 12 percent, borrowers would not rush to refinance their because they can enjoy paying lower rates (10 percent versus the market rate of 12 percent) for the remaining life of their mortgages. The investor, who was expecting to get some of his money back (the regular amortisations, and normal prepayments based on an assumed prepayment speed) to invest at a higher rate, is not getting back as much as he expected. And the original investment horizon becomes longer now. This is the "extension risk" of MBS.

Prepayment characteristics of MBS

The most important characteristic of MBS is prepayment. Prepayment is when borrowers prepay their mortgages before the maturity date. Although interest rate is the most important factor that influences prepayment pattern, prepayment always exists no matter how interest rates and other economic factors change. People tend to prepay their mortgages for various reasons: moving up to a bigger and better house, or

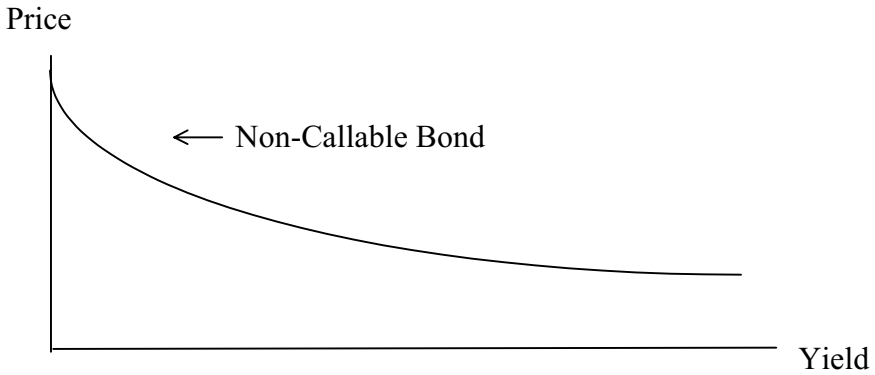
relocating to a different location, etc. In California, statistics show that people tend to move every 5 to 7 years. For the whole nation, the average life is 7 years for 15-year mortgage loans and 12 years for 30-year loans. Therefore, when an investor invests in a 10 percent coupon MBS backed by a pool of 30-year loans, his investment horizon is not 30 years but more or less 12 years under a normal situation.

The prepayment characteristic is so important that when a collateral mortgage obligation (CMO), a more complex form of MBS, is priced, the average life and the yield of the bond are quoted based on an assumed prepayment speed. There are two common methods for measuring prepayment speed: Conditional Prepayment Rate (CPR) method and Public Securities Association (PSA) method. CPR represents the annualised percentage of the outstanding balance that is prepaid during the period. For example, 6 percent CPR means that 6 percent of the outstanding balance, net of scheduled amortisations, will be prepaid each year. PSA, on the other hand, assumes that unseasoned loans tend to be prepaid at slower rates. The base PSA (100 percent PSA) assumes that prepayments rise linearly from 0.2 percent CPR to 6 percent CPR over 30 months from the origination of the mortgage, and then remain constant at 6 percent CPR. A 150 PSA means that prepayment speed will rise to 9 percent (1.50 x 6 percent) over 30 months and then remain at 9 percent.

Negative convexity

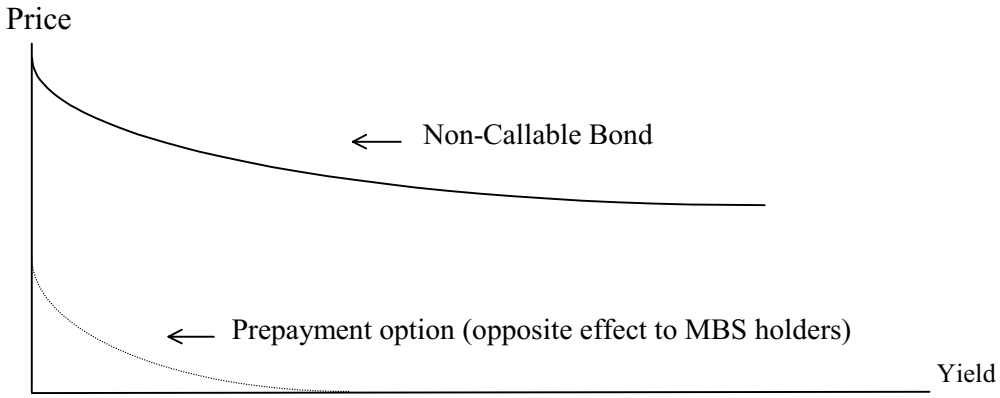
For MBS, there is something called *negative convexity*. In short, it says that when rates continue to drop, the value of the security decreases rather than increases.

For most non-callable securities, such as treasury bonds, the price-to-yield curve is convex with respect to the X axis (the following price-to-yield graphs are adapted from "The Evolution of Mortgage-backed Securities" by Jess Lederman):

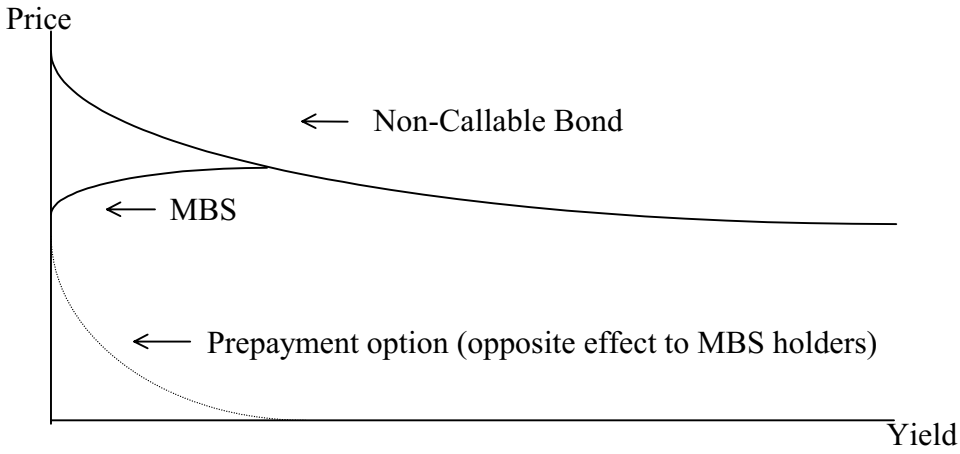


This means that as the yield decreases (moving from right to left in the above graph), price increases at a faster and faster rate, and as the yield increases, price decreases at a slower and slower rate. The price-yield curve is different for MBS. For MBS, there are two components. The first component is just like other non-callable bonds. The second component is actually an option transaction – the issuer of the security writes a prepayment option to the loan borrowers, and passes through the premium to the investor. This is one of the reasons that pass-through MBS are usually priced at more

than 100 basis points over treasuries. During the life of the mortgage, a borrower can *put* the mortgage back to the lender at an advantageous situation to him, such as when the market mortgage rates are two percent lower than his existing mortgage rate.



When the market mortgage rates are higher than the existing mortgage rates in the loan pool, the value of the borrower's prepayment option is not worth much (the right-hand side of the graph). Borrowers are unlikely to refinance their mortgages (or to exercise their options and put the mortgages back to the lender). But if rates (and hence the yield) continue to drop (moving from right to left in the above graph), the prepayment option is changing from out-of-the-money to in-the-money. This is because when the market mortgage rates are lower than the mortgage rates in the loan pool (by approximately 2 percent depending on the cost of refinance), there is an advantage for the borrowers to refinance their mortgages. The value of the prepayment option increases. The value of the MBS is the combination of these two values – the long position (positive value) of the non-callable bond minus the short position (negative value) of the prepayment option. Therefore, it is difficult to predict the cash flows of a simple pass-through MBS.



Multi-class MBS

In 1983, Freddie Mac introduced multi-class collateralised mortgage obligations (CMO). A CMO usually has several classes (or tranches). It divides mortgages into a

series of sequentially paying bonds with several different maturities. For instance, a $100 million CMO can be divided into many classes, four as in this example:

Class	Principal	Expected Average Life
Class A	$30 million	2 years
Class B	$40 million	5 years
Class C	$25 million	7 years
Class D (residual class)	$5 million	20 years

Class A is entitled to the first 30 percent of the principal repayment of the collateral. It means that the first $30 million principal repayment (including the scheduled amortisations and all prepayments) received on the pool will go to Class A investors. All other classes will receive interest only. After Class A is paid off, Class B starts to receive the principal repayment, and so on.

Class A has most of the prepayment risk and not much extension risk. On the other hand, Classes C and D have most of the extension risk but not much prepayment risk. This helps to solve, to a great extent, the unpredictable cash flow problem of pass-through MBS. Investors can target certain specific maturities. This inevitably broadens the investor base. Additionally, unlike single-class MBS which are priced at a spread of, say 125 basis points over 10-year treasury, multi-class MBS can be priced at different treasury maturities. These two factors indeed tighten MBS to treasury spreads.

The above example is just the simplest form of multi-class MBS. Others are quite complex and innovative. Some of the recent developments in MBS become more mathematical and probably steer the products out of the normal financial path. For example, for a multi-class MBS with total tranches of 250, it is impossible to analyse the cash flows of these tranches using fundamental financial principles. Everything was done mathematically. There are also the "kitchen-sink securities". They are those latest tranches of MBS where even the issuer cannot figure out their cash flow patterns because there are too many uncertainties. They are grouped together and sold at a deep discount to speculative investors. The value of these securities is everybody's guess. With no surprise, most of the "kitchen sink securities" investors lost big in 1994 when interest rates were rising.