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The securitization of mortgages has fundamentally changed home mortgage financing. In the past, the vast majority of home mortgages were originated and funded by depository institutions. Today about half of total home mortgage debt outstanding is held by a wide variety of financial institutions and investors in the form of mortgage-backed securities. The proliferation of these instruments is generally seen as improving access to mortgage financing by separating origination from funding, which integrates home mortgage financing into the overall capital market. To facilitate capital flows into this \$1.6 trillion market, financial engineers also have focused on unbundling the risks in these securities through collateralized mortgage obligations. Although these have been the fastest growing component of the mortgage-backed securities market for years, their issuance has dropped off substantially since 1993.

This Weekly Letter describes several major innovations in the market for mortgage-backed securities, including the risk characteristics of these instruments. In addition, it looks at some explanations for the recent decline in collateralized mortgage obligations. While this decline is related in part to the fall-off in mortgage origination, it also may be a response to the losses incurred by investors on some of the more exotic variations of this instrument.

Innovations in mortgage-backed securities

One of the simplest types of mortgage-backed securities is the "pass-through," which is created by pooling traditional fixed-rate, level payment mortgages. The payments made on the underlying mortgages are "passed through" unaltered to the security holders on a pro rata basis. This means that the cash flows of the pass-through match the cash flows of the underlying mortgages almost exactly

(after administrative expenses), including any prepayments (early paying down of principal). Pass-throughs, then, allow the securitization of the mortgages, but not necessarily the unbundling of risks.

Most pass-throughs do not expose their holders to credit risk because they are guaranteed by federal agencies; they do, however, expose their holders to prepayment risk that is, uncertainty over the prepayment of the underlying mortgages. The presence of prepayment risk greatly complicates the valuation of mortgage-backed securities. On the one hand, decreases in market interest rates would increase prepayment of existing mortgages as a result of refinancing, which forces the investor to reinvest the cash flows at the lower prevailing market interest rates. On the other hand, increases in interest rates would slow down prepayment. This reduces the cash flows available to the investor for reinvestment at the higher prevailing interest rates and simultaneously extends the maturity of the security.

To appeal to investors with different preferences for risk and return, a number of variations of collateralized mortgage obligations have been developed to redistribute the prepayment risk in pass-throughs. For example, a pass-through can be structured into a planned amortization class (PAC) and a non-planned amortization class. In order to achieve the planned amortization schedule in the PAC tranche, any excess or shortfalls in prepayment are first absorbed by the non-PAC tranche before affecting the PAC. As a result, while the PAC tranche has relatively low prepayment risk, the non-PAC tranche is loaded with it. However, it is possible that an unexpectedly high volume of prepayment could swamp the non-PAC tranche, in which case the PAC becomes busted and its amortization schedule cannot be met.

Another variation of the collateralized mortgage obligation strips the interest payments of the underlying mortgages to an interest-only class and the principal payments to a principal-only class. Both classes are very sensitive to prepayment of the underlying mortgages. In the interest-only class, prepayment wipes out future cash flows (interest payments), whereas in a principal-only class, a slowdown in prepayment redistributes a portion of current cash flows into the future, extending the instrument's maturity.

These instruments are attractive to investors because their cash flow patterns are not readily available from other debt instruments. For example, the value of interest-only instruments moves together with interest rates; that is, generally speaking, when interest rates rise, the value of an interest-only instrument rises due to decreases in prepayment that result in higher future interest payments from the underlying mortgages. The comovement between interest rates and an interest-only instrument's value is just the opposite of the relationship between interest rates and a conventional, fixed-rate bond; therefore, an interest-only instrument can provide a useful hedge against interest rate risk for bond portfolio managers.

In contrast, the value of a principal-only instrument responds to changes in interest rates much the way a conventional bond does, except the magnitude is greater. An increase in interest rates depresses the principal-only instrument's value because its cash flows will be realized later due to a slowdown in prepayment. This effect is compounded by a higher discount factor (as a result of higher interest rates) and the maturity extension of the instrument. This means the value of a principal-only instrument drops by relatively more than that of a comparable maturity conventional bond for a given interest rate rise. Similarly, as interest rates drop, a principal-only instrument appreciates relatively more in value than a conventional bond, since its cash flows are both realized sooner (due to prepayment) and discounted at lower rate (due to falling rates and a shortening of maturity). Hence, although a principal-only instrument moves with interest rates much the way a conventional bond does, it clearly has higher interest-rate risk.

Another variation of the collateralized mortgage obligation is the "floater," which refers to floating rates. For a floater, the coupon rate is reset periodically (usually quarterly) according to an interest rate index

(usually LIBOR) subject to some coupon caps. Due to the floating-rate structure, floaters have low price volatility and behave like money market instruments. Prepayment risk is less of an issue for floaters, since their coupon rates move in line with market interest rates and, hence, the reinvestment rate. Despite their floating-rate structure, floaters are collateralized by fixed-rate pass-throughs.

Using a fixed-rate payment stream to support floating-rate cash flows can expose the floaters to potential cash-flow shortfalls. This could occur if the required payments on the floater exceeded the cash flows from the underlying mortgages and the issuer of the collateralized mortgage obligation could not make up the difference. In order to guard against that, some floaters are supplemented by a letter of credit from a top-rated financial institution that guarantees their floating-rate cash flows. However, to avoid the rather expensive credit guarantee, most floaters are issued in conjunction with an inverse floater, with a simultaneous pay down schedule.

For an inverse floater, the coupon rate moves in the opposite direction of the companion floater's interest rate index to offset the movement in the floater's coupon rate, so that the weighted-average coupon rate matches the fixed-rate coupon rate of the supporting pass-through. While a floater's price by design is always close to its par value, the value of an inverse floater is very sensitive to interest rate movements and prepayments. If interest rates rise, the value of an inverse floater would be greatly depressed by four factors: a lower coupon rate and maturity extension, compounded by a high discount factor as a result of higher interest rates and longer maturity. Falling interest rates, on the other hand, would greatly lift an inverse floater's value when higher coupon rates, shrinking maturity, and a lower discount rate are all working in its favor.

Further magnifying an inverse floater's price volatility is coupon leveraging. It is quite common to have each dollar of an inverse floater accompany multiple dollars of a floater. This requires an inverse floater's coupon rate to move by a larger step to balance the movement in the floater's coupon rate. For example, suppose \$10 million of inverse floaters are issued in conjunction with \$40 million of floaters. In order for the weighted-average coupon on the floaters and the inverse floaters to remain fixed, the coupon rate of the inverse floaters must move in the opposite direction and four times as much as the coupon rate move of the floaters. Hence, even a small change in interest rates is translated into a big change in the inverse floaters' coupon rate, resulting in a sizable gain (or loss) in value when interest rates fall (or rise). Thus, although inverse floaters have minimal credit risk, their exposure to interest-rate risk can be huge, far greater than that of a conventional debt instrument.

In sum, mortgage-backed securities derive their cash flows from the payments of the underlying mortgage pool. Depending on how the underlying mortgage payments are distributed among various classes of security holders, different securities can have very different risk-return profiles. Although federal credit guarantees tend to make default risk of little concern for these securities, some mortgage-backed securities can be very vulnerable to interest rate movements.

Recent developments

Figure 1 illustrates the pattern of growth for mortgage-backed securities and collateralized mortgage obligations since 1985. During 1992-1993, issuance of mortgage-backed securities got a big boost as low interest rates triggered a refinancing boom. In 1993, when the 30-year fixed-rate mortgage rate dropped below 7 percent, mortgage originations reached \$1.01 billion, and the securitization rate rose to 66 percent, of which 32 percent were collateralized mortgage obligations.

In 1994, however, the picture changed dramatically as interest rates headed upward. With mortgage rates gradually climbing back to over 9 percent by the end of that year, refinancing dropped sharply. While the securitization rate in 1994 dropped slightly to 56 percent of originations, the percentage of mortgages that were turned into collateralized mortgage obligations plummeted to only 16 percent.

One reason for the disproportionate decline in collateralized mortgage obligation issuance in 1994 may

be to the sizable losses in some of the these securities, most notably principal-only instruments and inverse floaters, due to the reversal of interest rates. The well-publicized collapse of several hedge funds that specialized in collateralized mortgage obligations, the problems in a number of trust funds, including the Orange County debacle, as well as the charge against some financial firms that they improperly sold these products to individual investors, were severe blows to this market. These losses heightened the awareness of the interest rate risk underlying some types of collateralized mortgage obligation securities, despite their low credit risk.

As investors have become more sensitive to the potential losses in these securities, they have demanded greater compensation for bearing the risks in these securities, which has depressed their prices further. The change in demand for these securities thus brought the issuance of collateralized mortgage obligations almost to a halt. It remains to be seen whether the demand for these instruments will return, and if so, for which types.

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