# Travelers Mortgage Securities CMO

## Teaching Note

### Overview

The Travelers Mortgage Securities CMO case describes one of the early offerings of collateralized mortgage obligations, issued by the Travelers Corporation in February 1984. The case provides extensive institutional background on the life insurance industry and the mortgage securities market as well as technical detail on the pricing of mortgage securities. The case focuses on the following issues:

1. The structure and evolution of the mortgage securities market.
2. Alternative models of mortgage prepayment and mortgage securities pricing.
3. Arbitrage conditions driving innovation in the mortgage securities market, including the introduction of collateralized mortgage obligations.
4. Changes in the life insurance industry, and the implications of these changes for the role of life insurers as both issuers and investors in the capital markets.

Mortgage pass-through securities were one of the most important innovations in the domestic dollar debt markets in the 1970s. In addition, the (MBS) market was one of the most innovative debt markets as evidenced by collateralized mortgage obligations (CMO). This market provides liquidity to mortgage lenders, lower priced credit to mortgage borrowers and better structured securities to investors. One result has been a form of disintermediation where the pricing of fixed rate mortgage credit has been taken out of the hands of thrifts and commercial banks. Other results have been value creation through segmented markets and improved management of financial flexibility through security design.

*This note was prepared by Associate Fellows Sally E. Durdan, under the supervision of Professor Scott P. Mason for the sole purpose of aiding classroom instructors in the use of Travelers Mortgage Securities CMO, HBS No. 286-061. It provides analysis and questions that are intended to present alternative approaches to deepening students comprehension of business issues and energizing classroom discussion.*

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## Assignment

1. What is a GNMA? How would you price and model prepayments on mortgage securities?

2. Why did Travelers decide to trade out of GNMAs?

3. Travelers acted as both issuer and investor in this transaction. Why did Travelers choose to issue a CMO rather than selling their GNMAs in the secondary market and reinvesting in a five-year instrument?

4. Evaluate the pricing/trading behavior of each CMO class offered. What class of investor do you think purchased each CMO bond class?

5. What are the implications of increasing CMO issuance for the GNMA market? For the primary residential mortgage market?

## Class Discussion

Begin the class with a review of the early institutional structure of the mortgage securities market as described in the case. Pose such questions as

1. Prior to the securitization of mortgage assets, how did institutions invest in mortgages? Was this market mechanism efficient?

2. Who pioneered mortgage securitization? Why? Who has benefited from securitization? How? Ask students to list the most active issuers/guarantors of mortgage securities and describe the differences among them.

| Government Related | Private |
|---|---|
| GNMA | Commercial banks |
| FNMA | Thrifts |
| FHLMC | Mortgage bankers |

3. Describe the first four basic MBS structures.

Students should realize that the key factor differentiating these securities is the allocation of prepayment risk between the investor and issuer:

| Instruments | Bearer of Prepayment Risk |
|---|---|
| Mortgage-backed bonds | Issuer |
| Pay-through bonds | Principally the investor; a small % retained by issuer |
| CMOs (Segmented pay-through bonds) | Principally the investor; a small % retained by issuer |
| Pass-throughs | Investor |

In the case of pay-throughs and CMOs, all collateral prepayments flow through to investors on the bond payment date following receipt of the prepayment. As a result, most of the prepayment risk is transferred to the bond investor. However, to the extent that the periodicity of the pay-through bond differs from that of the underlying collateral, the issuer retains a degree of reinvestment risk.



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While the issuer typically receives *monthly* mortgage cash flows (principal and interest) on the collateral, he is obligated to pay a fixed percentage interest on the principal balance outstanding throughout each quarterly, semiannual or annual payment period on the pay-through bond.

## Pricing Mortgage-Backed Securities

### Modeling Prepayment

As explained in the case, several models of mortgage prepayment had been developed to project cash flows on mortgage securities. Current coupon pass-through securities, whose yields are relatively insensitive to prepayment assumptions, were usually priced on the basis of yield to a 12-year fully prepaid life. Pass-throughs traded on the basis of constant prepayment rates, and CMOs were usually priced on the basis of some proportion of FHA experience. It should be noted that in June 1985, a new prepayment rate benchmark was adopted by the CMO market. The model, known as the PSA model, combined the features of the FHA experience and constant prepayment rate methods.

Although students cannot be expected to develop a formal model of prepayment, they should observe the following:

- At any given time, prepayment rates will vary among issues depending on the coupon, age, geographic concentration, and terms (e.g., assumable vs. "due on sale") of the collateral mortgages.

- The homeowner's right to prepay all or part of his mortgage principal at par on any monthly payment date prior to maturity resembles a call option written by the mortgage security holder to each of the homeowners in the pool underlying his security.

- These call options differ from conventional calls in that the actual exercise depends on factors other than the difference between the strike price (par) and the market value of the security at the call exercise date. Prepayments can be segmented into two classes: those motivated by rational financial decision making and those reflecting nonfinancial decisions and events, such as home sales resulting from job transfers, retirements, or upgrading of homes, or the destruction of property. Note that prepayments related to these demographic variables will be lower if the collateral mortgages are assumable.

Given these observations, it is clear that the mortgage prepayment models described in the case (FHA, yield to a 12-year life, and CPR) are inadequate:

- The FHA model describes the prepayment rate as a simple function of mortgage age. "FHA experience" represents an average of observed prepayment behavior over the period 1957–1981, without regard for differences in the economic/financial environment among sample dates. It seems unlikely that the rates of prepayment on one-year-old mortgages were similar in 1957 and 1981.

- Each of the existing models failed to capture explicitly the interaction between prepayment rates and coupon-yield differentials as interest rates move over time. Instead, the CPR or % of FHA were merely adjusted periodically in response to changes in interest rates. In addition, none of these methods adequately



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described the "demographic" portion of prepayment described above. Improvements on these methodologies could be achieved by

1. modeling the "demographic" and "refinancing" portions of prepayments separately, and

2. using dynamic programming to model the refinancing decision at each monthly payment date, given the probability distribution of future interest rates.

- Regardless of the model used, the prepayment assumptions implicit in the pricing of CMOs and the pass-through securities collateralizing them should be identical at any point in time. In reality, changes in the prepayment assumptions underlying CMO prices generally lagged those in the pass-through market.

### Discounting MBS Cash Flows

As mentioned in the case pass-through prices were computed by discounting the estimated cash flows from the security at a rate equal to the yield on a comparable maturity Treasury plus a spread. The yield spread could be interpreted as compensation for the prepayment risk in mortgage securities (or, alternatively, the value of the call options described above).

Students should recognize that the use of a single yield to discount all of the pass-through cash flows could result in a mispricing of the security. The appropriate discounting method requires the use of a series of yields, each equaling a spread off the strip Treasury curve. The use of a single discount rate could result in a significant *underpricing* of the pass-through when the yield curve's slope is steeply positive (as was the case at the time of the Travelers offering) because payments received before year 10 will be discounted at excessive rates.

## Collateralized Mortgage Obligations

underlying it. If time permits, work through the mechanics of the collateralization process as described in Appendix A of the case. It should be noted that the complexities of the collateralization process and the valuation of the issuer's "spread" are not critical to understanding the arbitrage driving CMO issuance. They merely arise from the legal restrictions imposed on the structure of grantor trusts (i.e., the requirements that the periodicity of the CMO be different from that of the collateral, and that 2% equity must be contributed to the issuing subsidiary). As a result, it may be useful to begin the discussion of CMOs by considering a CMO issue in which the collateral coupon is equal to the CMO coupon, both instruments pay interest monthly, and no contribution of equity is required. In this case, there is no reinvestment risk to the issuer and any arbitrage profits earned on the CMO issue can be measured directly (as CMO proceeds minus the cost of the collateral) on the issue date.

Given this simplified structure, ask students to identify the sources of the arbitrage profit on CMOs:

1. As illustrated in the section on MBS pricing (see above), the issuer is purchasing collateral valued by the market at the 10-year rate and reselling it in four segments priced off the 2, 5, 10, and 20-year Treasuries. If the yield curve is positively sloped at the short end and flat at the long end (as was the case in



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February 1984), the value of the four segments will exceed that of the collateral. The impact of this arbitrage on the GNMA market is evident in **Exhibit 7** in the case: GNMA spreads versus Treasuries dropped 80 basis points between June 1983, when CMOs were introduced, and the date of the Travelers offering.

2. In addition, CMOs fit the investment objectives of many investors who had not traditionally participated in the mortgage-backed market. The introduction of CMOs broadened the range of MBS maturities available and, at the long end, added securities with improved call protection to the mortgage market. The resulting increase in investor interest in the mortgage sector improved liquidity and contributed to the decline in GNMA-Treasury spreads.

## The Travelers CMO

1. What are GICs? Why is Travelers managing pension assets?

A GIC offers a potential purchaser, such as a pension fund, an opportunity to purchase a fixed future payment (or stream of payments) for a specified price. Because GIC obligations are senior to an insurer's other liabilities, they are very secure instruments (the equivalent of AAA paper). GICs enable a pension manager to match assets and liabilities precisely by eliminating reinvestment risk.

Students should recognize that writing GICs is analogous to spread banking. Many insurance companies have run into trouble because their pension departments write huge volumes of GICs which their investment departments are unable to invest at positive spreads. Note the 50% per year increase in "pension deposit funds" on Travelers' balance sheet (see **Exhibit 12**) over the period 1981–1983. [In addition, many insurance companies had begun to manage short-term money for small (25 b.p.) fees. Although this is less risky than the GIC business, it balloons the balance sheet without contributing to earnings. Over time, operating ratios will deteriorate as asset growth outstrips growth in net income. (See "Separate and Variable Account Liabilities" on the Travelers' balance sheet, **Exhibit 12**.)]

2. Should Travelers have used GNMAs to back GIC obligations?

No. Although the durations of the GNMA and GIC were matched on the GNMA purchase date, the durations were certain to become mismatched over time:

- Because prepayment rates slow as rates increase, GNMA durations decline more slowly than GIC durations in response to increases in interest rates (and the reverse for rate declines).

- GNMA durations decline more slowly over time given their longer maturity. At the end of five years, when the GIC matures, Travelers would still hold a long maturity GNMA.

In addition, the pattern of cash flows on GNMAs exposed Travelers to substantial reinvestment risk over the five-year GIC life. Apparently, Travelers originally chose to invest in GNMAs in an effort to shore up 1984 earnings. They were trying to maximize yield without sacrificing credit quality. When rates began to rise in 1984, prepayments slowed and Travelers' assets and liabilities became mismatched.



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3. Why did Travelers issue a CMO rather than selling the GNMAs and reinvesting in a five-year instrument?

- CMO issuance enabled Travelers to structure a security which met their investment objectives (a five-year discount bond) and returned a yield greater than yields available on other five-year instruments. By adding the arbitrage profits on the CMO (i.e., the estimated value of Travelers' "spread") to the ~12% yield Travelers was to earn on the Z-1 piece, Salomon Brothers estimated Travelers' total return at 12.758% (see Exhibit 10 for yields on other fixed income securities at 2/17/84). [Note: Given the complexity of CMO cash flows, students will not be able to replicate the 12.758% return estimate.]

- In addition, Travelers' GNMA position was large relative to the market: it represented 18% of the daily trading volume in pass-through securities. As a result, it would have been difficult for Travelers to sell its GNMAs into the secondary market at an attractive price.

- Although it is virtually impossible for students to value Travelers' "spread," students should be able to identify the sources of arbitrage profits. As noted above, the legal restrictions imposed then on the structure of CMOs forced CMO issuers to accrue arbitrage profits over time (and recognize collateral assets and CMO debt on their balance sheets) rather than receiving a single arbitrage payment at issue. Following is a summary of the cash flows to the issuer of a CMO over the life of the issue:

| Item | | Timing |
|---|---|---|
| - | Purchase price of collateral securities | At Issue |
| + | Net proceeds of the CMO offering | At Issue |
| + | Positive interest spread (difference between collateral and CMO coupons over the life of the Class A bonds) | Semiannually |
| + | Excess reinvestment earnings (due to difference in periodicity of collateral/CMO cash flows and differences between assumed reinvestment rates and money market yields) | Monthly |
| + | Return of excess collateral | At Maturity |

Note that Travelers' "spread" is reduced if rates drop and prepayments accelerate, reducing the number of years over which they accrue positive coupon/reinvestment spreads. Salomon Brothers calculated the 12.758% yield cited above by modeling the spread cash flows using reasonable assumptions of prepayment rates, reinvestment rates, and Travelers' borrowing costs.

In the spring of 1986, investment bankers developed a secondary market for the CMO spread (sometimes referred to as the CMO residual). Because sale of the residual allowed the issuer to remove the CMO debt from its balance sheet and replace an uncertain stream of arbitrage profits with a single cash payment, residual sales facilitated the issuance of pure arbitrage CMOs by intermediaries.

4. Pricing of the Travelers CMO:

The yields offered to investors were generous. The Travelers CMO was priced assuming prepayment at 75% FHA, although conventional collateral was prepaying at 100% FHA at the time of the offering. Because approximately one-third of the Travelers collateral was conventional, investors



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in the discount accrual bond classes will probably realize returns greater than the 12.00% (Z-1) and 13.04% (Z-2) yields indicated in **Exhibit 8B**.

5. Who buys CMOs?

| Tranche | Weighted Average-Life | Investors |
|---|---|---|
| 1 | 1–3 years | Thrifts, commercial banks (for portfolio), insurance companies |
| 2 | 4–6 years | Insurance companies |
| 3 | 7–10 years | Insurance companies, trust departments, pension funds, money managers, other total rate of return investors |
| 4 | 17–22 years | Pension funds, bank trust departments, insurance companies |

This CMO investor profile provides evidence of market segmentation—each investor class seems to exhibit a preference for a specific maturity structure. While thrifts are interested in extremely short maturities, pension funds need assets with long duration to match their long-term liabilities.

## Wrap-Up Points

1. Ask students how the volume of Adjustable Rate Mortgage (ARM) originations should affect the GNMA/CMO markets. From **Exhibit 3**, you can see that pass-through issuance fell in 1984, when ARMs dominated mortgage originations. When rates fell in 1985, causing a rebound in fixed rate originations, pass-through issuance jumped to $110 billion from $60 billion in 1984.

2. Cumulative CMO issuance grew to $31.1 billion by the end of 1985. Home builders and thrifts surpassed investment banks as the largest issuers of CMOs.

3. Soon CMOs collateralized by commercial and multifamily mortgages, and a Eurodollar CMO issued by FHLMC followed.



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