FEDERAL RESERVE BANK
OF CHICAGO

PRODUCT SUMMARY

ADVANCED CMO ANALYTICS

FOR BANK EXAMINERS

PRACTICAL APPLICATIONS USING BLOOMBERG

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Financial Markets Unit
May 1995

Product Summaries

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Introduction

All mortgage backed securities (MBS) have a derivative component — the embedded option to prepay the mortgage loan in full or in part. This prepayment feature can have a profound effect on the value and performance of the security. The incremental spread to a given benchmark (ie Treasuries), which should act to adequately compensate the investor for added risk, often times fails to do so due to fluctuations in the value of the embedded prepayment option sold to the mortgage holder. This paper takes a critical look at that option in an effort to ascertain its value and its relationship to the total return of a security. To that end, topics such as option-adjusted spread (OAS) analysis and effective duration will be presented. These issues, while somewhat technical, will lay the foundation for the paper's remaining, more practical body.

This paper takes an analytical and practical look at some of the more common CMO tranche types found in a bank investment portfolio from the perspective of the examiner charged with assessing the risk profile of the portfolio. Performance under varying interest rate scenarios will be discussed for each tranche type utilizing BLOOMBERG analytics[1]. The analysis is meant to illustrate the reallocation of prepayment risk via the various tranche types through the use of examples. The Federal Financial Institution's Examination Council's (FFIEC) high risk securities test will be presented in the same illustrative vein. The discussion of the FFIEC test is intended to give the reader an appreciation for the test that goes beyond just looking for the "thumbs up" sign offered by BLOOMBERG when a security passes the high risk test.

The material is presented from a "hands on" perspective, and is interspersed with insights and methodology designed to be of more practical value to bank examiners than other discussions grounded in theory. By acquiring knowledge of additional terminology in the MBS arena, examiners will be better equipped to conduct a more thorough and efficient examination when addressing safety and soundness issues regarding an institution's investment portfolio.

The reader is highly encouraged to refer to the Financial Markets Unit Product Summary on Collateralized Mortgage Obligations that was first published in August 1987 and revised in July 1990. That text defines a CMO and attendant terminology, outlines benefits and risks of the product, and offers examiner guidance. This paper will build on that framework. It will not redefine terminology and it assumes a fundamental working knowledge of mortgage backed securities, especially CMOs. Rather, it will expound upon some issues that have become more significant as the MBS market itself has evolved.

[1] The author wishes to thank Rob Landauer at BLOOMBERG for his technical editing and suggestions. The author also thanks fellow FMU members for their editorial assistance.

Option-Adjusted Spread

The Prepayment Option

A popular approach to analyzing and valuing a callable bond involves breaking it down into its component parts — a long position in a non-callable bond and a short position in a call option written to the issuer by the investor. An MBS investor owns a callable bond, but decomposing it is not as easy as it is for more traditional callables. The MBS investor has written a series of American options[2] to each homeowner or mortgagor. The analytical challenge facing an examiner is to determine the value and risk profile of these options and their contribution to the overall risk profile of the portfolio. Compounding the problem is the fact that mortgagors do not exercise these prepayment options at the same time when presented with identical situations. Most prepayment options are exercised at the least opportune time from the standpoint of the MBS investor. In a falling rate environment, a homeowner will have a greater propensity to refinance (or exercise the option) as prevailing mortgage rates fall below the homeowner's original note (ie as the option moves deeper into the money). Under this scenario, the MBS investor receives a cash windfall (principal payment) which must be reinvested in a lower rate environment. Conversely, in a high or rising rate environment, where the prevailing mortgage rate is higher than the mortgagor's original term rate, the homeowner is less apt to exercise the option to refinance. Of course, the MBS investor would like nothing more than to receive his or her principal and be able to reinvest that principal at the prevailing higher rates. Under this scenario, the MBS investor holds an instrument with a stated coupon that is below prevailing market rates and relatively unattractive to potential buyers.

Clearly, human behavior complicates the analysis and valuation of MBS and raises uncertainty about the timing of principal payments and the amount of interest to be paid. Examiners should always view an MBS as a security with varying, uncertain cash flows. Financial software, such as that available through BLOOMBERG Financial Markets terminals, can model this stream of uncertain cash flows under varied assumptions. BLOOMBERG uses hypothetical interest rate scenarios ($\pm$ 300 basis points) as a starting point. Inputs such as coupon, weighted average remaining term to maturity, current factor, etc. are applied to the BLOOMBERG model. Prepayment rates generated by econometric models are used to project future MBS cash flows. The cash flows are discounted using riskless (Treasury) rates plus a spread, resulting in a price for each cash flow stream. However, this analysis does not take into account the path dependency of the cash flows. In other words, MBS cash flows contain embedded options, resulting in any number of future cash flow possibilities not captured by the initial prepayment assumptions. The OAS approach evaluates the security's cash flows along each path, thereby incorporating the optionality and/or path dependency of cash flows into the analysis.[3]

OAS Model Assumptions

Most OAS models contain the following features:

- An **interest rate path generator** which creates numerous potential Treasury yield curve scenarios. Popular modelling techniques such as Monte Carlo simulation or binomial trees are employed to generate yield curves. Key input factors may include current rate levels, volatility levels, and regression limits.
- A **prepayment model** which incorporates consideration of seasonality, geographic location, weighted average maturity, and general economic conditions. Using an algorithm, the model will quantify how these factors are expected to ultimately affect a particular interest rate path. It is here that critics of OAS analysis for MBS voice their loudest dissent. Typically, an OAS model does not capture the effects of non interest rate dependent (idiosyncratic) events. Examples of these include death, divorce, or relocation of the homeowner. Ideally, with regard to MBS analysis, a more probabilistic model should be used in repeated trial phases at this point to capture the effects of those events.

[2] An American option can be exercised any time prior to expiration, as opposed to a European option, which can be exercised only on its expiration date. For a more detailed reading on options, refer to the Financial Markets Unit Product Summary entitled *Options – Beginning and Intermediate Issues* published in November 1994 and written by Karen McCann.

[3] Kopprasch, Robert W., "Option Adjusted Spread Analysis: Going Down the Wrong Path?", *Financial Analyst Journal*, May/June 1994.

OAS Methodology

The present value (PV) of a future cash flow (A) is calculated as follows:

$$A/[1+r_1][1+r_2]....[1+r_t]$$

where $r_1,r_2,...r_t$ represent appropriate discount rates for time periods 1,2,...t and A represents the absolute dollar amount of the future cash flows. Assume those discount rates represent riskless (ie Treasury) rates. Any incremental return above a Treasury security involves an additional degree of risk, represented as a spread over Treasuries, or S. Thus, the appropriate discount factor for a cash flow containing incremental risk is $1/[1+r_1+S]$ and the present value (PVS) of this cash flow is:

$$A/[1+ r_1+S_1][1+r_2+S_2]....[1+r_t+S_t]$$

Statistical methods used in the path generator and prepayment model will derive a number of possible interest rate paths that can occur over the security's term. The security's current value (PVS) for each path is calculated. The average of these values is the "fair", or model derived, value for the security. This is compared to a current market price to determine the incremental spread, or S, that causes the model-derived price to equal the market price. The model is iterative; that is, it will re-calculate until it computes that spread which equates the model derived value to the market value under all interest rate scenarios. Viewed another way, this spread validates the model's input assumptions. The effect of deriving a large number of possible interest rate paths and calculating a fair value for each path is to capture the impact of changing rates on the security. Therefore, the resulting spread over Treasuries is adjusted for the impact of embedded options, hence the term OAS. As a rule, the higher the OAS, the greater the incremental return associated with a given security versus its risk free benchmark counterpart.

Limitations of OAS Methodology

Many MBS offerings include disclosure of the estimated OAS; a constant, theoretically calculated spread. It represents, in essence, the incremental yield referred to earlier that an investor may receive in return for assuming the risks inherent in MBS investing. Because it is the result of an averaging process, one must be mindful that OAS merely represents what the future *may* hold, and not a guaranteed profit over Treasuries. There is much evidence of investors with varying degrees of sophistication who have relied on the OAS reported to them as a "locked in" spread to Treasuries.[4] A major drawback to OAS is that it is not a straightforward, easy calculation. It is a model derived result based on numerous assumptions. While an offering may disclose the OAS, it typically will not include its underlying assumptions. As of this writing (February 1995) BLOOMBERG is in the process of developing an OAS model for MBS to integrate into their financial software network.

Effective Duration/Convexity

Definitions

As we have seen, the cash flow uncertainty associated with MBS greatly complicates the valuation process. Nonetheless, traditional tools such as duration and convexity offer insight into an MBS' risk profile.[5] BLOOMBERG uses the term modified duration in most of its analytical screens. Modified duration measures a security's price sensitivity to changes in interest rates. It is derived from standard Macaulay duration as follows: Macaulay duration is the time weighted average maturity of a security's discounted cash flows. Modified duration is calculated by dividing a security's Macaulay duration by (1+Y/K), where K is the number of times interest is compounded per year and Y is the security's yield to maturity. By adjusting the basic duration formula for the frequency of the coupon payment, one can better capture the effects of interest rate changes on the value of fixed income securities.

[4] The May/June 1994 Financial Analysts Journal reports of a $1.6 billion hedge fund, heavily invested in MBS inverse floaters, that was forced to liquidate. The portfolio's objective was to remain market neutral, with advertised returns of between 15% and 18%. The fund's managers supposedly relied to a very large extent on OAS models to measure the viability and attractiveness of the securities in the portfolio. As the inverse floater market collapsed, so did the fund.

[5] Refer to the August 1987 Product Summary on CMO's for a supplemental discussion on duration and convexity.

Effect of the Prepayment Option — Theoretical Discussion

Where MBS are involved, a large portion of cash flow uncertainty is interest rate related due to the prepayment option. The presence of embedded options renders the Macaulay formula obsolete. To compute the duration of an MBS, otherwise known as effective duration, the examiner must ascertain the extent to which prepayments affect the security's price sensitivity. According to BLOOMBERG, duration as calculated for MBS on their DURA screen (to be presented shortly) is an effective duration.

When prevailing interest rates are high relative to a security's weighted average coupon and volatility is low, one can reasonably conclude that the rate dependent component of a prepayment option is of little value to the mortgagor. Except for the idiosyncratic variables described earlier, the high rate, low volatility climate typically is not conducive to an increase in prepayments. In this environment, MBS cash flows are *for the most part* insulated from changes in rates, and the bond behaves in many respects like any fixed income instrument. Standard Macaualy duration calculations using static prepayment assumptions will capture an MBS' price sensitivity in this case reasonably well.

In an environment where prevailing interest rates are low relative to the weighted average coupon and volatility is high or increasing, standard duration calculations are not always optimal. In this case, effective duration is better applied to capture MBS price sensitivity. Effective duration takes into account the influence of the prepayment option. It captures the cash flow sensitivity of a security as rates and prepayments change. All other things being equal, the less valuable the prepayment option is, the longer the duration. If the prepayment option is valuable, duration will typically shorten as rates fall and lengthen as rates rise.

Most fixed income securities have positive duration; that is, price increases as rates fall and decreases as rates rise. (Negative duration refers to securities whose value declines as rates decline). The prepayment option inherent to an MBS may act to reduce its duration as rates fall due to the increased likelihood of unanticipated principal payments. By the same token, the presence of the option may act to lengthen a security's duration as rates rise due to the increasing disincentive to make any unscheduled principal payments.

Duration measures price sensitivity with respect to interest rate changes, and convexity measures change in duration with respect to interest rate changes. In other words, convexity measures the *speed* with which duration changes. Most non callable bonds have positive convexity; that is, a given decrease in rates will cause the bond's price to rise more than it would fall for the same size increase in rates. With regard to MBS, however, as interest rates fall the upside price potential typically is reduced by the increased likelihood that the prepayment option will be exercised. This concept, known as negative convexity, is crucial to one's understanding of mortgage backed securities and their risk profiles.

BLOOMBERG Applications

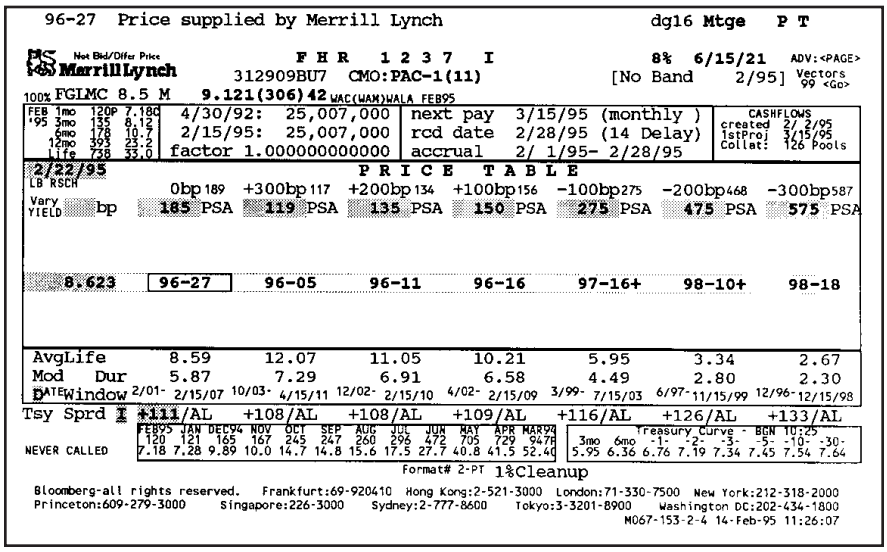
As noted, this paper will offer a pragmatic look at various CMO issues using BLOOMBERG, a broadly based analytical software package. The analytics presented here will offer the examiner direction on how to evaluate the risk/return profile of CMO investments found in bank portfolios. The most common screens used to analyze and compare tranches are the **PT** and **YT** screens. Both screens consist of a matrix which calculates either prices (PT) or yields (YT) under 7 prepayment scenarios. Those assumptions can be viewed either from a current prepayment speed, a parallel rate shift up and down 300 basis points (the most common scenario used for analysis), or any customized rate/prepayment scenario desired. Prepayment speeds are measured using either PSA, CPR,[6] or vector analysis. Vector analysis goes beyond traditional PSA measurement by incorporating multiple PSA speeds at varying time intervals. A forthcoming tranche example will incorporate vector analysis.

Impact of the Underlying Collateral

Exhibit 1 utilizes the PT screen to illustrate the FHLMC 1237 I tranche, an 8 year average life PAC tranche which has an 8% stated coupon and a weighted average coupon (WAC) of around 9%. The difference between the stated coupon and the collateral coupon (in this case 8.50%) is the fee (typically 50 or 75 basis points) retained by the institution servicing the mortgages. The WAC reflects the composition of all remaining mortgages underlying the deal. Even though this deal is "backed" by 8.50 mortgages, the actual WAC of the loans *subject to prepayments* is really closer to 9.00%. Thus, it is important to compare the WAC of a given tranche to prevailing mortgage market rates when gauging the propensity to prepay principal.

[6] Refer to the August 1987 Product Summary on CMO's for a supplemental discussion on PSA and CPR measurements.

Exhibit 1



Effect of the Prepayment Option — Practical Applications

Exhibit 2 highlights the **DURA** function, showing the impact of the prepayment option on the tranche's average life as compared to a conventional Treasury issue in varying rate scenarios. FNMA 1994-31 VB, with an average life of 4.8 years, is compared to its conventional 5 year Treasury benchmark. The tranche's duration moves between 3.00 to 3.93 within a 200 basis point range, with the Treasury moving very little as well, from 4.19 to 4.05 in the same range. Because the WAC of the underlying collateral (7.10%) is well below current mortgage rates (around 9%), the incentive to prepay is very small. The option is considered to be out of the money, or of little value to the homeowner. In this environment, the tranche behaves much like a conventional Treasury. The WAL or weighted average life column reflects a very stable 4.82 average life despite the interest rate movements. It is only when rates fall 300 basis points (or mortgage rates fall to 6%) that the prepayment option begins to have an effect on the tranche's average life.

Exhibit 2

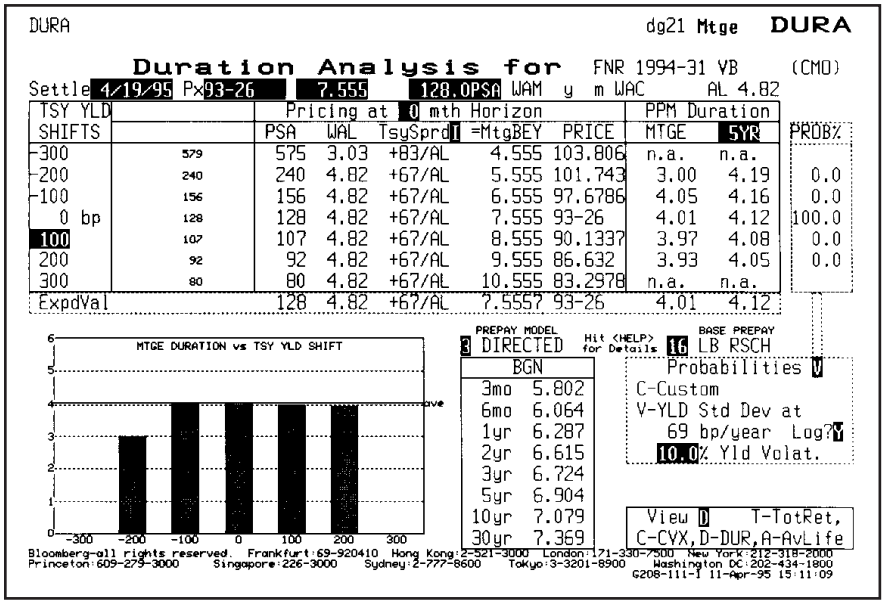
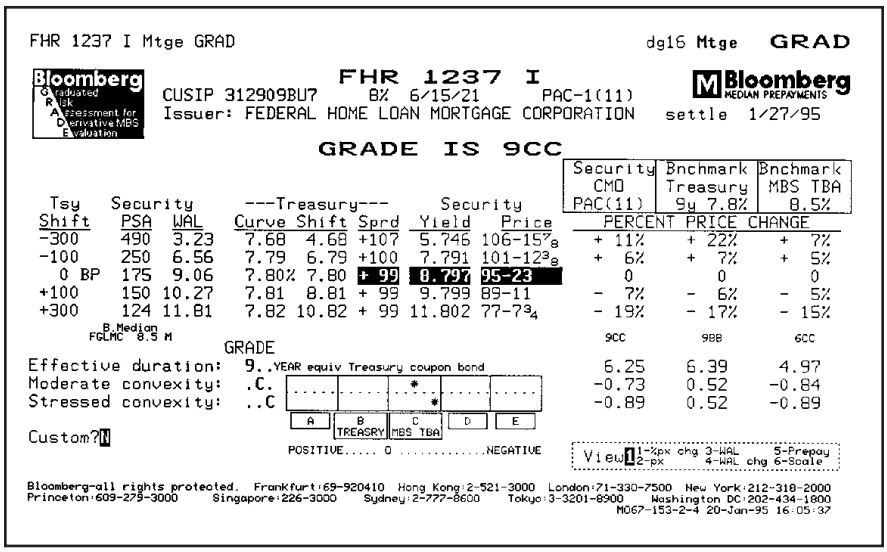


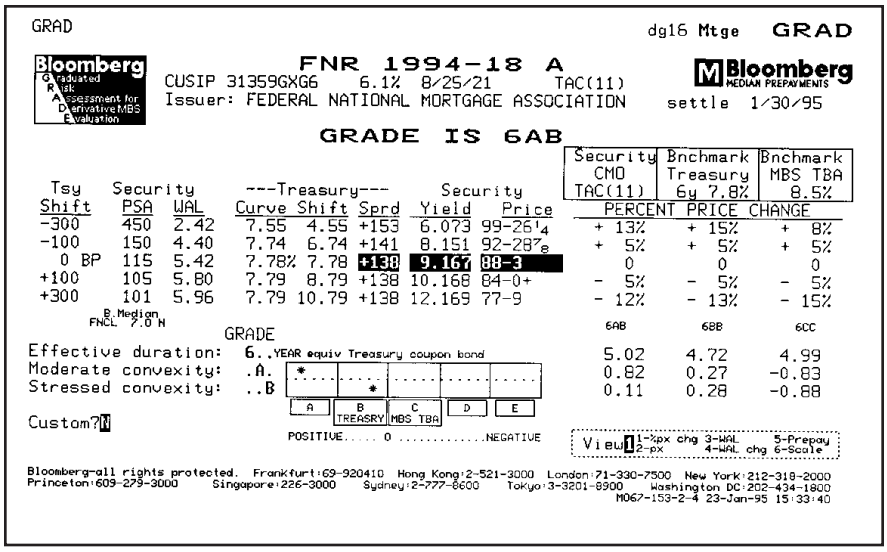
Exhibit 3 illustrates convexity using the **GRAD** (Graduated Risk Assessment for Derivative MBS) function. GRAD compares the convexity of a given security to 2 highly recognizable benchmarks — a Treasury security of comparable duration and a current coupon mortgage TBA passthrough. The analysis is meant to convey the relative risk/reward tradeoff.

Exhibit 3



Turning once again to FHLMC 1237 I, note the attributes of negative convexity present in the tranche — in a falling rate environment, its price *appreciation* is less than its price *depreciation* in a rising rate environment of equal proportion. A "Grade" of 9CC means that 1237 I's modified duration most closely resembles that of a 9 year Treasury security. The second and third letters indicate the level of positive or negative convexity (A through E respectively) associated with the security under a moderate rate change (± 100 basis points) and a more stressed rate change (± 300 basis points). A "C" grade under both stress scenarios denotes negative, though not "worst case" convexity.

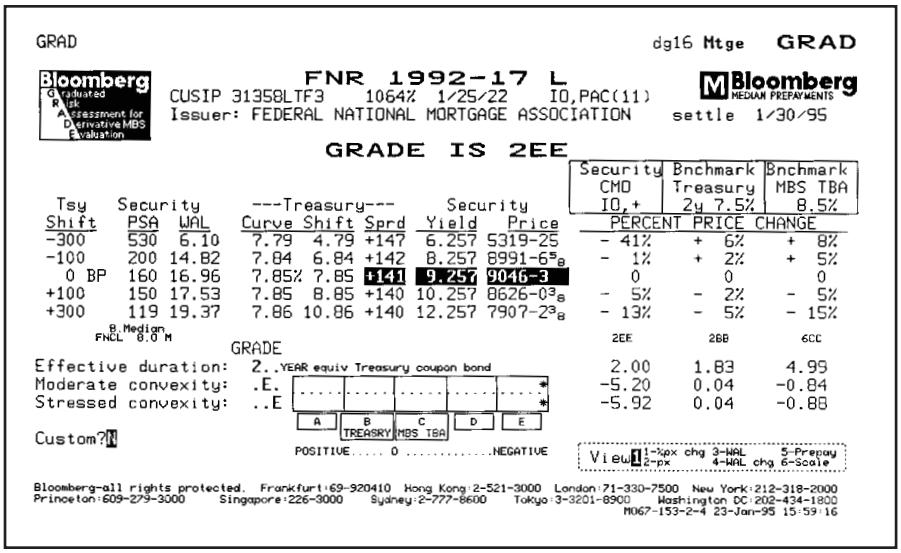
Exhibit 4



GRAD is useful also in highlighting the extremes when it comes to MBS analysis, as shown in Exhibits 4 and 5. FNMA 1994-18 A is a 5 1/2 year TAC tranche. Note the consistency in convexity under all rate scenarios and their close approximation to the other benchmark securities. In effect, the tranche behaves very much like a non callable (or "bullet") security. This is the easiest scenario in which to evaluate an MBS security — when the prepayment

option is not (at a particular point in time) a factor in valuing the security. Conversely, FNMA 1992-17 L is a PAC IO. Not only is this security's convexity extremely negative versus the other benchmarks, its percentage price change is also negative in *any* rate environment!

Exhibit 5



MBS Analytics

Arguably, few fixed income securities demand the level of analytical scrutiny that MBS do. The cash flow uncertainties posed by the inherent prepayment possibilities require that one not only assess the outcomes under varied rate scenarios, but also make a determination as to the relative likelihood of a scenario's occurrence and the inevitable price to pay if one is incorrect. Fortunately, the analytics available to an examiner using BLOOMBERG are refined and sophisticated enough to adequately address these issues. Indeed, most "street" MBS traders utilize BLOOMBERG to illustrate a bond's performance to their prospective counterparties. In a sense, this represents more of a "level playing field" than the structured notes arena, where analytics are typically restricted to an underwriting firm's proprietary models.[7] By further inspecting some basic analytical screens, one will gain more of an appreciation for the cash flow uncertainties and degrees of risk associated with the various types of CMO tranches.

Tranche Examples

PAC

Cash Flow Priority

A PAC bond is structured to offer cash flow stability and predictability as long as principal prepayments occur with a stated "band". BLOOMBERG further subdivides PAC bonds in hierarchical categories based on cash flow priorities within the deal as per the format

PAC - a (bc) where:

a = the PAC group as identified on the prospectus by the issuer. In terms of cash flow priority, PACs are segregated as PAC I, II, or III. The difference typically lies in the width of the band and priority of cash flows at issuance, with a PAC I offering the widest band and highest priority, etc.

b = the order in which this PAC group will receive principal up to its stated band, as determined by BLOOMBERG. A 1 denotes the highest likelihood to meet its original cash flow schedule when prepayments decline and less cash is available for distribution, providing protection from extension risk. A 2 receives cash only after the 1 tranches have met their cash flow schedule.

[7] Refer to the Financial Markets Unit Product Summary entitled *Structured Notes* published in November 1994 and written by Karen McCann and Joseph Cilia for an in-depth discussion on structured notes.

c = the order in which *excess* principal above the amount stated in the PAC band is distributed. A 1 in this position receives cash *after* tranches with higher numbers, thus providing protection against prepayment risk. A 2 receives cash *before* 1 in this case and will be the first recipient of any unscheduled principal payments in a falling rate environment, hence 2 has higher prepayment risk than 1.

Changing Role of a PAC

It stands to reason that a PAC bond classified as PAC 1- (11) has the highest cash flow priority in a deal and the best protection from both extension and prepayment risk. Deals in the past have also included Super PACs, another high protection, lower risk type tranche distinguished by extremely wide bands. Bear in mind that the mechanisms that protect a PAC tranche within a deal may diminish, and so its status may shift more towards the support end of the spectrum. The extent of a support-type role that a PAC might play depends in part on its original cash flow priority status and the principal balances of the other support tranches embedded within the deal. Indeed, as prepayments accelerated in 1993 and support tranches were asked to bear the brunt, many disappeared. A PAC III, for instance, became a pure support tranche, foregoing any PAC-like characteristics in that case.

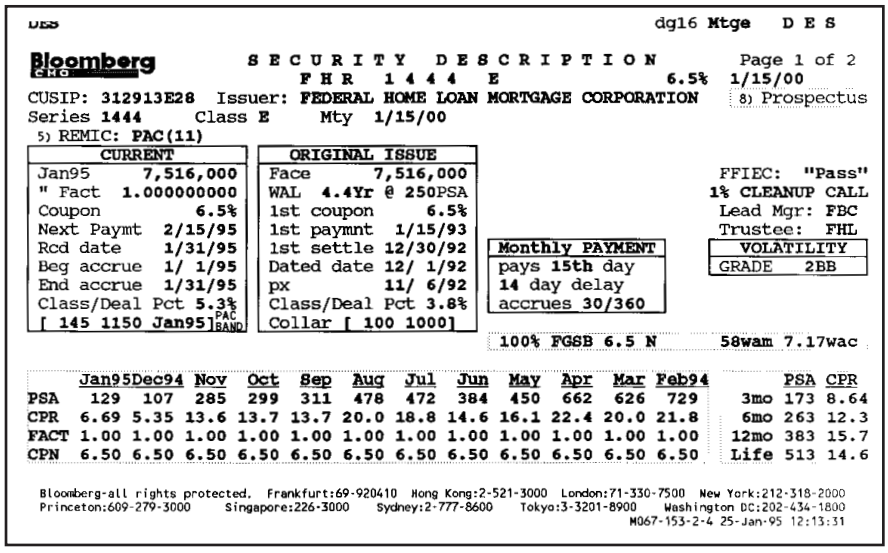
A variation on the PAC theme has emerged in the Scheduled tranche (SCH). Like a PAC, a SCH has a predetermined cash flow collar, but it is too narrow even to be called a PAC III. A SCH tranche is also prioritized within a deal using the above format, but understand that its initial priority status is usually below even that of a PAC III. These narrower band PAC-type bonds were designed to perform well in low volatility environments, and thus were popular in late 1992 and early 1993. At that time, many investors failed to realize what would happen to the tranche when prepayments violated the band.

Understanding PACs Through Poker

A poker analogy might prove helpful in further understanding the PAC hierarchy within a deal. In poker, a royal flush beats a straight flush, which beats 4 of a kind, which beats a full house, which beats a flush, which beats a straight, which beats 3 of a kind, which beats 2 pair, which beats a pair. In a CMO deal, a Super PAC "beats" (in this case defined as providing more cash flow stability) a PAC I, which beats a PAC II, which beats a PAC III, which beats a Scheduled tranche, which beats a support tranche. Moreover, a sub-hierarchy exists in poker; that is, two people can declare that they hold a straight, but a high straight beats a low straight or a full house of kings over sevens beats one of jacks over tens. With regard to PACs, the analogy carries through with the PAC band attendant to the deal. There may be two PAC tranches in a deal, but the tranche with the wider band typically beats the other. Unlike poker, though, there *may* be some variation to these rules depending on the complexity of a particular deal. As we'll see in more detail later, it is imperative to look at the entire deal in an effort to understand an individual tranche's relationship to it.

Average Life Variability

FHLMC 1444 E is an example of a high priority PAC 1. Exhibit 6 is the DES page, an excellent source of overall information about the tranche. Note the original structure in December 1992 called for this tranche to have a weighted average life of 4.4 years at a 250 PSA speed. As long as speeds stayed within a band of 100 to 1000, this average life would hold true. Note also the tranche's collateral — 100% FGSB 6.5 — BLOOMBERG's terminology for 7 year balloon loans. As a


DES dg16 Mtge D E S

Bloomberg CMO SECURITY DESCRIPTION Page 1 of 2

FHR 1444 E 6.5% 1/15/00

CUSIP: 312913E28 Issuer: FEDERAL HOME LOAN MORTGAGE CORPORATION 8) Prospectus

Series 1444 Class E Mty 1/15/00

5) REMIC: PAC(11)

CURRENT		ORIGINAL ISSUE	
Jan95	7,516,000	Face	7,516,000
" Fact	1.000000000	WAL	4.4Yr @ 250PSA
Coupon	6.5%	1st coupon	6.5%
Next Paymt	2/15/95	1st paymnt	1/15/93
Rcd date	1/31/95	1st settle	12/30/92
Beg accrue	1/ 1/95	Dated date	12/ 1/92
End accrue	1/31/95	px	11/ 6/92
Class/Deal Pct	5.3%	Class/Deal Pct	3.8%
[145 1150 Jan95] PAC BAND		Collar [100 1000]	

FFIEC: "Pass"
1% CLEANUP CALL
Lead Mgr: FBC
Trustee: FHL

Monthly PAYMENT
pays 15th day
14 day delay
accrues 30/360

VOLATILITY
GRADE 2BB

100% FGSB 6.5 N 58wam 7.17wac

	Jan95	Dec94	Nov	Oct	Sep	Aug	Jul	Jun	May	Apr	Mar	Feb94
PSA	129	107	285	299	311	478	472	384	450	662	626	729
CPR	6.69	5.35	13.6	13.7	13.7	20.0	18.8	14.6	16.1	22.4	20.0	21.8
FACT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CPN	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50

	PSA	CPR
3mo	173	8.64
6mo	263	12.3
12mo	383	15.7
Life	513	14.6

Exhibit 6

result, the stated final maturity of the tranche (upper right hand corner) is 1/15/00. The distinction between *stated final maturity* and *average life* cannot be stressed enough. A tranche backed by 30 year collateral may have an advertised 5 year average life, but the propensity (however remote) does exist for the deal to extend way beyond or contract to far less than its touted average life. Shorter maturity type collateral (15 year loans and 5 or 7 year balloon loans) greatly mitigates extension risk and enhances stability and predictability. All MBS are valued on a spread to a Treasury security based on the security's average life, and therein lies a major challenge in MBS analytics: because of the prepayment option, an MBS' cash flows are inherently uncertain, whereas no such option or uncertainty exists with a Treasury. Therefore, it is not always fair (or accurate) to compare a potentially variable maturity to a certainly static maturity. Characteristics such as a wide PAC band, shorter maturity collateral, or a favorable principal window (forthcoming) act to bridge the disparity between the securities, affording a more "apples to apples" type of comparison.

Tranche Performance

What has happened to this tranche since December 1992? A look at the bottom of the DES page shows how high PSA speeds were in early 1994 (and probably higher still in late 1993) as prepays accelerated, and how much they have fallen since then. A PAC's collar is subject to variation each month as prepayment speeds change. In volatile times, the collar may disappear completely, hence the evolution of the Busted PAC in 1994. A Busted PAC tends to take on more of the characteristics of a plain vanilla type tranche that is, its cash flow stability lies somewhere between a PAC and a support tranche. As rates stabilize, the tranche may revert back to its PAC band. With regard to FHLMC 1444 E, while its cash flows may be affected in volatile rate environments, the tranche won't experience wild swings in average life due to its *priority* within the deal and its generous collar.

Exhibit 7

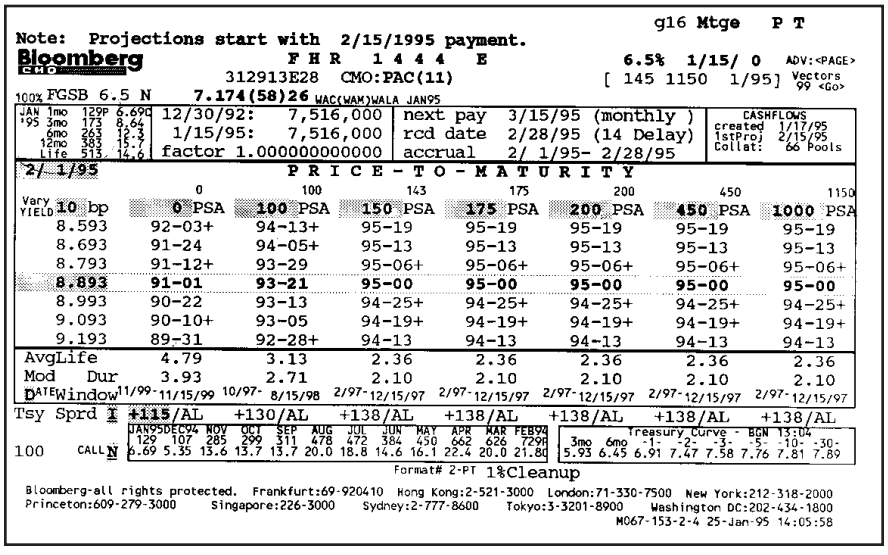


Exhibit 7, the PT screen, illustrates the tranche's stability. Note that average life (the AvgLife line toward the bottom of the screen) remains extremely stable within the band of 145-1150 as related to the PSA columns shown. The 0 PSA column illustrates a situation where *absolutely no* prepayments occur; that is, the underlying collateral that backs the deal will pay principal and interest according to its regular amortization schedule throughout its life. While this is a highly unlikely scenario, it is often used in practice as an "extreme" what-if scenario. The 100 PSA column shows the effects on the tranche as PSA speeds slightly break the band on the downside. It is always useful to "shock" the screen using speeds of varying tolerance levels to observe the magnitude of effect they have on the tranche.

The box toward the upper left of the exhibit (with JAN '95 in its left corner along with 1 mo, 3 mo, etc.) is a summary of average PSA and CPR speeds. As of January, 1995, the latest monthly PSA speed for this tranche is 129. PSA speeds for the last 3 months have averaged 173, the last six months they've averaged 263, and so on. This data is derived from the box along the middle bottom portion of the screen, showing the actual PSA speeds each month historically for about a year. A CMO is typically "offered" to an investor in one of two ways — either at a fixed

dollar price, usually in 32nds (eg 98-16 or 98 and 16/32, which is the same as saying 98.50) or on a spread to a comparable Treasury based on the tranche's current average life (eg +100 to the 5 year). The former method is relatively straightforward; one uses the 98-16 price to analyze the tranche currently and prospectively. The latter method, as stated above, is missing a piece of critical information: what PSA assumption does one use to model the security? A spread offering should always include a PSA (or CPR) assumption. The challenge to one examining an MBS portfolio is to determine the relevance of that prepayment barometer in light of past, present, and future conditions. By utilizing available data on PSA speeds past and present, one can make a determination as to the "appropriate" prepayment speed for the tranche currently and prospectively. The importance of scenario analysis incorporating various speeds and their effects is once again underscored. BLOOMBERG provides some statistical guidance here in its calculation of a median speed (the median speed is discussed in detail within the forthcoming FFIEC Test section of this paper). PSA pricing speeds are among the most subjective issues involved in valuing MBS. Astute application of available data (past and present) and a keen understanding of the market's dynamics are imperative to the examiner's analytical process.

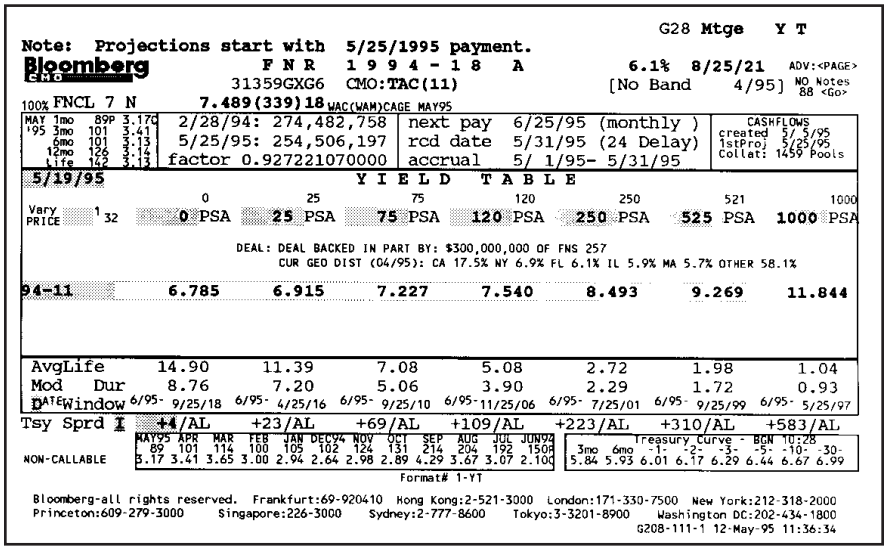
Note the principal window (the Window line below ModDur). One can view the window as dates or years between payments; in either case, the amount of time between first and last principal payments. Within the PAC band, principal is expected to be paid out starting in 2/97 and ending in 12/97. This "narrow window" feature is another measure of the tranche's predictability. As its first principal payment is not expected until 2/97, the tranche receives only monthly interest until that time. Thus, it will "roll down the curve" much like a non callable bond from its inception (12/92) until its first principal payment of 2/97, or about 4 1/2 years. The tranche's average life is currently a little over 2 years; it has rolled down about 2 years since issuance. This rolldown feature, coupled with its narrow window, allows this tranche to resemble a more "non-MBS" type bond, affording a more meaningful comparison to a Treasury security when offered on a spread basis.

TAC

Understanding Principal Window as a Pac's

A TAC or targeted amortization tranche typically offers protection from prepayment risk but not from extension risk. Much as a PAC's cash flow schedule is built around a collar, a TAC's schedule is built around a single pricing speed, and the average life of the tranche is "targeted" to that speed. Any excess principal paid typically has little effect on the TAC; its targeted speed acts as a line of defense. Investors in TACS, however, pay the price of a lack of protection when rates increase, subjecting the tranche to potential extension risk. FNMA 1994-18 A is a TAC with an original weighted average life of 3.5 years at a targeted PSA of 250. Exhibit 8 illustrates its relatively stable average life in a falling rate environment (even at 1000 PSA) and how the protection breaks down in a rising rate environment.

Exhibit 8



Let's observe the principal window in this tranche. At 120 PSA (the median), the average life is a little over 5 years. Principal is expected to begin paying out in 6/95 and to cease in 11/06. After 6/95, the tranche relinquishes any "roll down" characteristics. Principal payments will affect its average life, and the wider the window, the more uncertainty and instability associated with that average life assumption. The WALW screen (Exhibit 9) compares the principal window with the tranche's average life over a 0 to 1000 PSA spectrum. Note the high degree of dispersion near 120 PSA in terms of principal payment versus weighted average life. By contrast, Exhibit 10 shows the WALW screen for FHLMC 1444 E, the stable PAC examined earlier. The symmetry of the average life/principal payment graph and the narrower degree of dispersion is further testimony to that bond's stability.

Exhibit 9

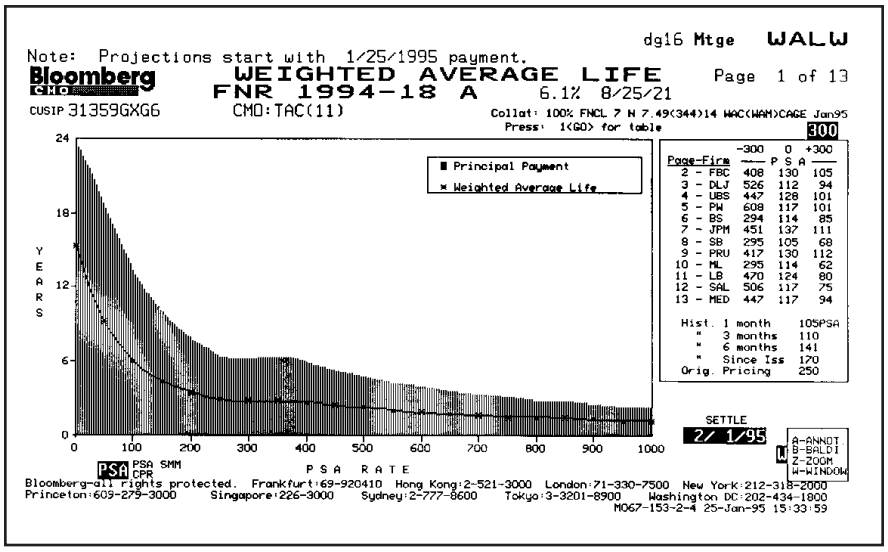
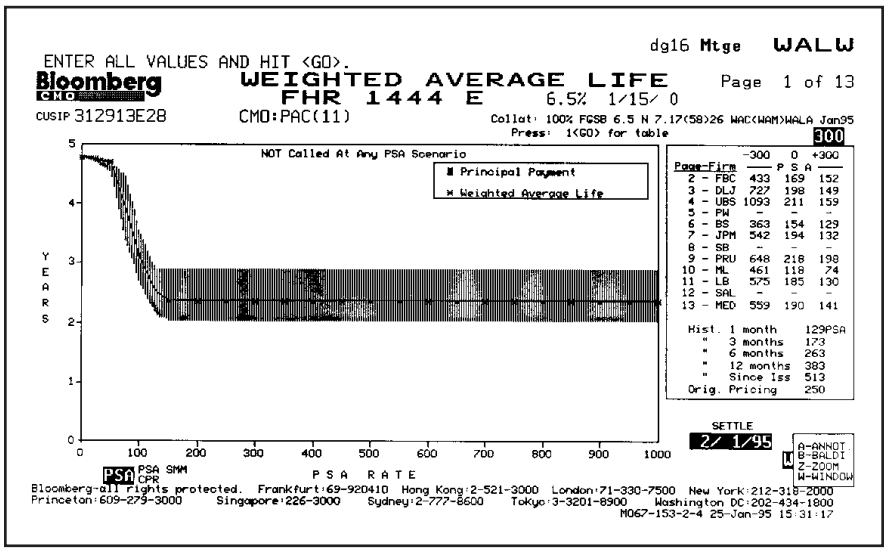


Exhibit 10



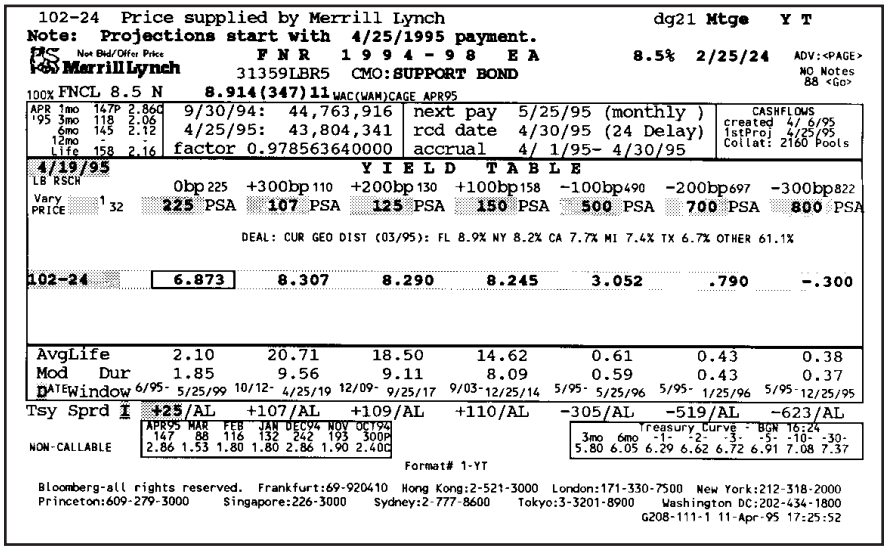
Support

Volatility Illustrated

Support tranches, by definition, assume excess risk from other, higher priority tranches like PACs. By deflecting some or all of the average life volatility away from these tranches, they effectively take on that volatility themselves. While the investor is seemingly compensated for this added risk, a quantitative profile of the tranche serves to highlight the often widely diverse cash flows and severe movements in average life vis-a-vis prepayment changes characteristic of support tranches.

FNMA 1994-98 EA (Exhibit 11) illustrates the volatility associated with a support tranche. At a PSA of 225, the tranche has an average life of about 2 years. The matrix is constructed to reflect a 300 basis point (bp) movement in 100 basis point increments, first up then down. The 0bp designation on the matrix is the starting point, in this case 225. (Note that it *does not* correspond to a 0 PSA assumption. You can input any desired PSA assumption, including 0, in the interactive boxes to override the matrix' pre-designated PSA values). Thus, 107 PSA corresponds with

Exhibit 11



a +300 bp move, 125 with a +200 move, 700 with a -200 move, etc. Note not only how average life changes, but also by how much the principal windows and corresponding security yields vary with each PSA scenario. One is presumably compensated for this cash flow uncertainty in the form of a higher spread to Treasuries. It is only through the use of analytics that take a comprehensive look at the tranche's performance in *multiple* rate environments that a determination can be made as to the adequacy of that compensation. The dynamics of MBS performance — a marked decrease (increase) in average life as rates fall (rise) — especially manifest themselves and are exaggerated most often in support tranches.

Using Vector Analysis to Assess Risk

Our support tranche example will also serve to introduce and illustrate vector analysis. BLOOMBERG provides the ability to analyze future prepayment rates dynamically by using vectors. Vectors go beyond a static PSA assumption to incorporate multiple speeds into the analysis, hoping to more closely mimic an actual, more volatile rate environment.

The RVC screen, Exhibit 12, shows the pre-packaged vectors currently available on BLOOMBERG. These same paths or "ramps" are identical for each deal backed by a specific collateral and coupon type, with PSA speeds changing appropriately as per the deal structure. The BASE case for the vector paths always corresponds to the BLOOMBERG

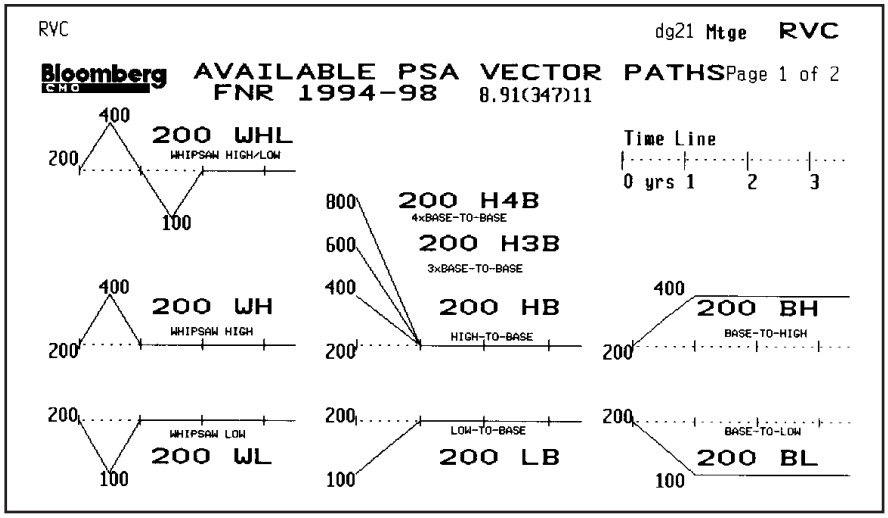
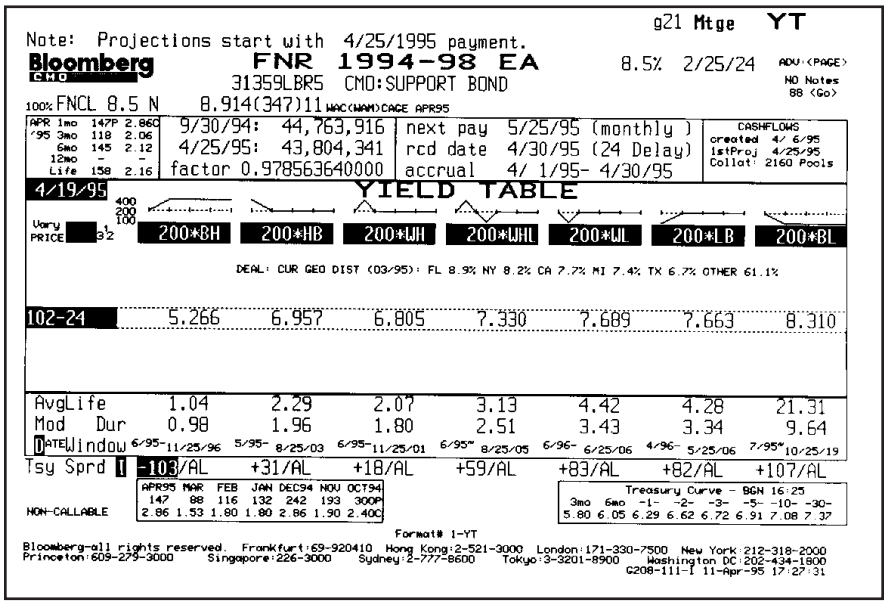


Exhibit 12

median speed (200), the HIGH speed (400) is always double the BASE value, and the LOW speed (100) is always half the BASE value. Some deals may incorporate a speed of 3 or 4 times the BASE as well. In the WHL or whip-saw high/low vector, the underlying collateral prepays at 200 PSA in the first month, gradually increases to 400 PSA in a straight line fashion over the first 6 months, decreases (again in a straight line fashion) to 100 PSA by the year and a half mark, then increases back up to 200 at the two year mark. After two years, prepayments are held constant at 200 PSA. The same logistics apply when interpreting the other paths. Vectors offer an extremely effective way to stress or shock the interest rate environment, affording the examiner a more comprehensive analysis. Exhibit 13 illustrates how these vectors portray the tranche's cash flows.

Exhibit 13



Floating Rate

Pertinent Issues

Intuitively, floaters are viewed as a hedge against rising rates. As rates rise, so too will the coupon rate paid on the floater. In a low volatility environment, they shouldn't experience the same type of price behavior as fixed rate bonds (as rates go up, price goes down). However, when interest rate volatility comes into play other unique issues need to be considered by an examiner which will greatly impact performance and value.

FHLMC 1744 F's coupon floats at 1 month LIBOR + 45 basis points, and has a life cap of 9.5%. It resets and pays principal and interest monthly. When it was issued in August 1994 at a price of par, it had an average life of 5 years at 200 PSA. Exhibit 14 shows the deal in a matrix format. The tranche was priced at 98.8125 (in February 1995) and had an average life of just

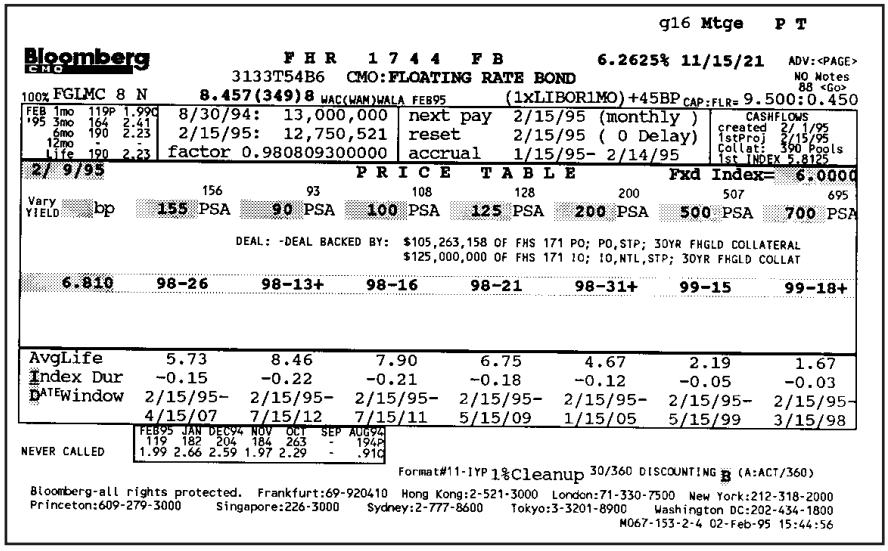


Exhibit 14

over 5 1/2 years. The median PSA was 155. What happened to cause this tranche to lose over a point in value in just 6 months time? An examination of some key items found in Exhibit 14 will provide some answers.

Recall the earlier discussion on principal window. Once any MBS (including a floater) begins paying principal, it ceases to roll down the curve like a Treasury. As rates had risen in the 6 month period this tranche, which should have rolled down to a 4 1/2 year bond, actually *extended out* to about 5 1/2 years. Moreover, as rates continue to rise, the window becomes even wider, further evidence of the tranche's cash flow volatility.

The tranche suffers life cap risk to some degree. In August 1994 when the tranche was issued, 1 month LIBOR was 4.50% — a 500 basis point differential to the life cap. As of February 1995, 1 month LIBOR was 6.125% — a 337 basis point differential. Once a floater reaches its cap, it becomes extremely difficult to value. Is it a fixed rate bond or a floater that can only float down? As a result of this uncertainty, demand for a capped or near-capped floaters is typically very scarce.

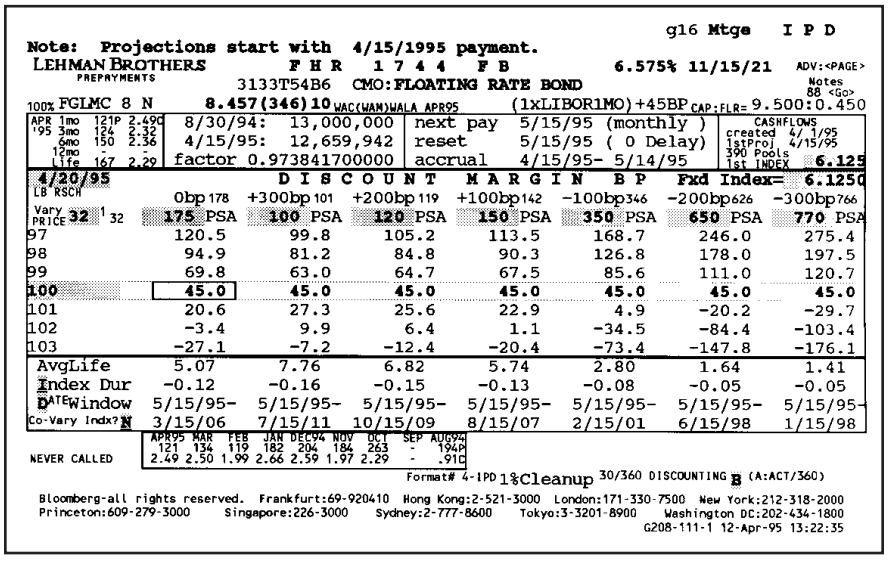
A positive attribute associated with this particular tranche is its index. LIBOR is typically perceived as a good short term index, as it is quick to respond to market movements. In a rising rate environment, it is preferred to, say, COFI — a lagging index. Of course the opposite also holds true; COFI would have been a preferred floater choice in 1993 as rates were falling (assuming one even wanted to be in floaters at that time).

Discount Margin

In practice, discount margin (DM) is often used as a means to compare floating rate issues. Discount margin is defined as the spread (in basis points) between the cash flow yield of a security and its underlying index. Much like OAS, DM analysis provides for a common ground from which to compare securities with differing spreads to an index. The higher the DM, the greater the return one receives over a given index. Further analysis is needed, however, to observe the tranche's performance and potential volatility as the rate environment changes.

Exhibit 15 highlights DM analysis for this floating rate tranche. Note the Fxd Index box in the upper right hand corner of the matrix. The index (1 month LIBOR) is held constant at 6.125% in this analysis. One can vary the index with shifts in the yield curve (up and down 300 basis points) by typing "Y" next to the Co-Vary Indx? box in the lower left hand corner of the matrix.

Exhibit 15



g16 Mtge I P D

Note: Projections start with 4/15/1995 payment.

LEHMAN BROTHERS PREPAYMENTS — FHR 1744 FB — 6.575% 11/15/21 — ADV:<PAGE> Notes 88 <Go>

3133T54B6 CMO:FLOATING RATE BOND

100% FGLMC 8 N — 8.457(346)10 WAC(WAM)WALA APR95 — (1xLIBOR1MO)+45BP CAP:FLR= 9.500:0.450

APR '95	1mo	121P	2.49	8/30/94:	13,000,000	next pay	5/15/95 (monthly)	CASHFLOWS
	3mo	124	2.32	4/15/95:	12,659,942	reset	5/15/95 (0 Delay)	created 4/ 1/95
	6mo	150	2.36	factor	0.973841700000	accrual	4/15/95- 5/14/95	1stProj 4/15/95
	12mo	-	-					390 Pools
	Life	167	2.29					1st INDEX 6.125

4/20/95 — **D I S C O U N T M A R G I N B P** — **Fxd Index= 6.1250**

LB RSCH	0bp 178	+300bp 101	+200bp 119	+100bp 142	-100bp 346	-200bp 626	-300bp 766
Vary PRICE **32** 32	**175** PSA	**100** PSA	**120** PSA	**150** PSA	**350** PSA	**650** PSA	**770** PSA
97	120.5	99.8	105.2	113.5	168.7	246.0	275.4
98	94.9	81.2	84.8	90.3	126.8	178.0	197.5
99	69.8	63.0	64.7	67.5	85.6	111.0	120.7
100	**45.0**	**45.0**	**45.0**	**45.0**	**45.0**	**45.0**	**45.0**
101	20.6	27.3	25.6	22.9	4.9	-20.2	-29.7
102	-3.4	9.9	6.4	1.1	-34.5	-84.4	-103.4
103	-27.1	-7.2	-12.4	-20.4	-73.4	-147.8	-176.1
AvgLife	5.07	7.76	6.82	5.74	2.80	1.64	1.41
Index Dur	-0.12	-0.16	-0.15	-0.13	-0.08	-0.05	-0.05
DATE Window	5/15/95-	5/15/95-	5/15/95-	5/15/95-	5/15/95-	5/15/95-	5/15/95-
Co-Vary Indx? N	3/15/06	7/15/11	10/15/09	8/15/07	2/15/01	6/15/98	1/15/98

	APR95	MAR	FEB	JAN	DEC94	NOV	OCT	SEP	AUG94
	121	134	119	182	204	184	263	-	194P
NEVER CALLED	2.49	2.50	1.99	2.66	2.59	1.97	2.29	-	.91C

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Several key points can be inferred from the analysis. DM is inversely related to price at any given PSA assumption; that is, as price rises, DM falls, and vice versa. As price declines from par and prepayments accelerate, the DM will increase because accelerated return of principal enhances the yield on a discount MBS. Ultimately, DM becomes negative at premium price levels, when faster prepayments are detrimental to the security's yield. By understanding these relationships, DM analysis can offer meaningful insights into a floating rate tranche's value in different interest rate environments.

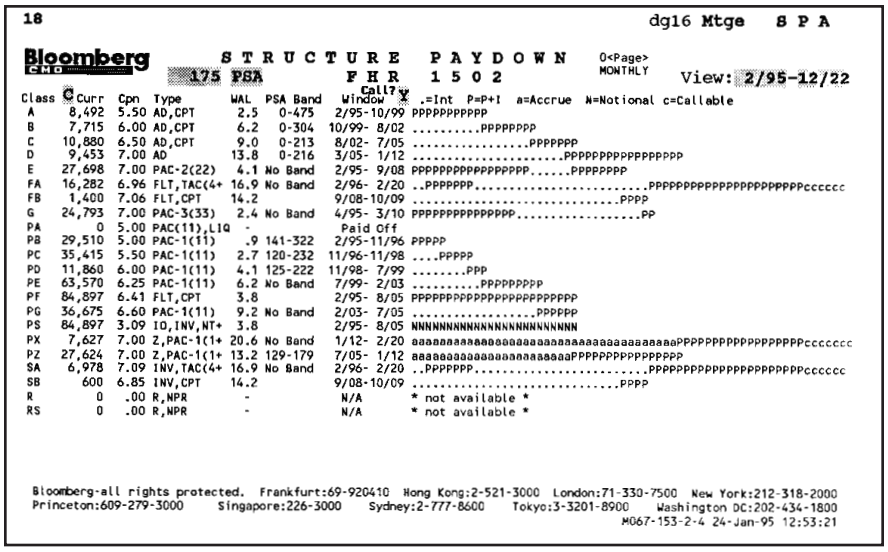
Deal Structure Paydown

The Big Picture

In the preceding sections on tranche types, the relationship between a particular tranche and the entire deal was discussed. In the case of a PAC, we learned that its priority status and number of other support tranches within the deal are directly related to its cash flow stability. In the case of a lower priority PAC II or III, when does it forgo some of its stability (if it even had any in the first place) and take on more support-like characteristics? A BLOOMBERG screen called SPA or structure paydown offers the answer to these and other questions.

FHLMC 1502 is a deal that was originally priced at 175 PSA. The structure paydown page (Exhibit 16) at that speed shows all the tranche types that make up the deal. The principal paydown window at that PSA speed is shown, along with detail on whether a class will pay interest, pay principal and interest, accrue principal balances (in the case of Z bonds), or whether notional principal will be paying down (in the case of IO's) for the date range selected. There are 5 PAC I, or higher priority type tranches, and no support tranches in the deal.

Exhibit 16



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18                                                              dg16 Mtge   S P A

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                          175 PSA          F H R   1 5 0 2   MONTHLY      View: 2/95-12/22
                                                  Call?
Class  Curr   Cpn  Type          WAL  PSA Band  Window      .=Int P=P+I a=Accrue N=Notional c=Callable
 A      8,492  5.50 AD,CPT        2.5   0-475  2/95-10/99 PPPPPPPPPP
 B      7,715  6.00 AD,CPT        6.2   0-304  10/99- 8/02 ..........PPPPPPPP
 C     10,880  6.50 AD,CPT        9.0   0-213  8/02- 7/05 ..................PPPPPP
 D      9,453  7.00 AD           13.8   0-216  3/05- 1/12 ......................PPPPPPPPPPPPPPPP
 E     27,698  7.00 PAC-2(22)     4.1 No Band   2/95- 9/08 PPPPPPPPPPPPPPPPP.....PPPPPPPP
 FA    16,282  6.96 FLT,TAC(4+ 16.9 No Band    2/96- 2/20 ..PPPPPPP.........................PPPPPPPPPPPPPPPPPPPPPPcccccc
 FB     1,400  7.06 FLT,CPT      14.2           9/08-10/09 ..................................PPPP
 G     24,793  7.00 PAC-3(33)    2.4 No Band    4/95- 3/10 PPPPPPPPPPPPPP.....................PP
 PA         0  5.00 PAC(11),LIQ   -             Paid Off
 PB    29,510  5.00 PAC-1(11)     .9 141-322    2/95-11/96 PPPPP
 PC    35,415  5.50 PAC-1(11)    2.7 120-232    11/96-11/98 ....PPPPP
 PD    11,860  6.00 PAC-1(11)    4.1 125-222    11/98- 7/99 .........PPP
 PE    63,570  6.25 PAC-1(11)    6.2 No Band    7/99- 2/03 ..........PPPPPPPPP
 PF    84,897  6.41 FLT,CPT      3.8            2/95- 8/05 PPPPPPPPPPPPPPPPPPPPPPP
 PG    36,675  6.60 PAC-1(11)    9.2 No Band    2/03- 7/05 ....................PPPPPP
 PS    84,897  3.09 IO,INV,NT+   3.8            2/95- 8/05 NNNNNNNNNNNNNNNNNNNNNNN
 PX     7,627  7.00 Z,PAC-1(1+ 20.6 No Band    1/12- 2/20 aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaPPPPPPPPPPPPPPPPPcccccc
 PZ    27,624  7.00 Z,PAC-1(1+ 13.2 129-179    7/05- 1/12 aaaaaaaaaaaaaaaaaaaaaaaPPPPPPPPPPPPPPPP
 SA     6,978  7.09 INV,TAC(4+ 16.9 No Band    2/96- 2/20 ..PPPPPPP.........................PPPPPPPPPPPPPPPPPPPPPPcccccc
 SB       600  6.85 INV,CPT     14.2           9/08-10/09 ..................................PPPP
 R          0   .00 R,NPR        -             N/A       * not available *
 RS         0   .00 R,NPR        -             N/A       * not available *

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Princeton:609-279-3000     Singapore:226-3000     Sydney:2-777-8600     Tokyo:3-3201-8900     Washington DC:202-434-1800
                                                                  M067-153-2-4 24-Jan-95 12:53:21
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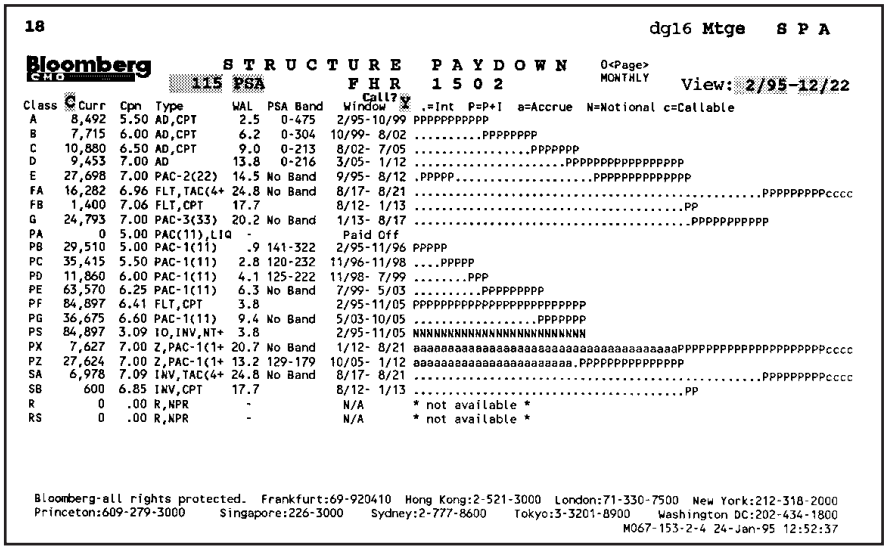
Examination of the deal at 115 PSA, a more current level, reveals some interesting insights, as Exhibit 17 points out. The E class, a PAC II, had an original WAL of 4 years. As rates have risen, this tranche is asked to assume a support-type role, *despite being labeled a PAC*. Its average life extends from 4 to 14 years. A more telling example is the PAC III G class, whose average life extends from 2 to 20 years, and whose principal window changes dramatically.

The SPA screen allows one to observe the cash flow components of a particular tranche as an integral part of the whole deal structure. It is a useful tool that, when used in conjunction with other available analytics, further reveals the risk dynamics associated with MBS investing.



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18                                                              dg16 Mtge   S P A

Bloomberg CMO        S T R U C T U R E   P A Y D O W N      0<Page>
                          115 PSA          F H R   1 5 0 2   MONTHLY      View: 2/95-12/22
                                                  Call?
Class  Curr   Cpn  Type          WAL  PSA Band  Window      .=Int P=P+I a=Accrue N=Notional c=Callable
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 B      7,715  6.00 AD,CPT        6.2   0-304  10/99- 8/02 ..........PPPPPPPP
 C     10,880  6.50 AD,CPT        9.0   0-213  8/02- 7/05 ..................PPPPPP
 D      9,453  7.00 AD           13.8   0-216  3/05- 1/12 ......................PPPPPPPPPPPPPPPP
 E     27,698  7.00 PAC-2(22)    14.5 No Band   9/95- 8/12 .PPPPP.....................PPPPPPPPPPPPPP
 FA    16,282  6.96 FLT,TAC(4+ 24.8 No Band    8/17- 8/21 ..................................................PPPPPPPPcccc
 FB     1,400  7.06 FLT,CPT      17.7           8/12- 1/13 ..........................................PP
 G     24,793  7.00 PAC-3(33)   20.2 No Band    1/13- 8/17 ..........................................PPPPPPPPPP
 PA         0  5.00 PAC(11),LIQ   -             Paid Off
 PB    29,510  5.00 PAC-1(11)     .9 141-322    2/95-11/96 PPPPP
 PC    35,415  5.50 PAC-1(11)    2.8 120-232    11/96-11/98 ....PPPPP
 PD    11,860  6.00 PAC-1(11)    4.1 125-222    11/98- 7/99 .........PPP
 PE    63,570  6.25 PAC-1(11)    6.3 No Band    7/99- 5/03 ..........PPPPPPPP
 PF    84,897  6.41 FLT,CPT      3.8            2/95-11/05 PPPPPPPPPPPPPPPPPPPPPPP
 PG    36,675  6.60 PAC-1(11)    9.4 No Band    5/03-10/05 ..................PPPPPP
 PS    84,897  3.09 IO,INV,NT+   3.8            2/95-11/05 NNNNNNNNNNNNNNNNNNNNNNN
 PX     7,627  7.00 Z,PAC-1(1+ 20.7 No Band    1/12- 8/21 aaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaaPPPPPPPPPPPPPPPPPPPcccc
 PZ    27,624  7.00 Z,PAC-1(1+ 13.2 129-179    10/05- 1/12 aaaaaaaaaaaaaaaaaaaaaaa.PPPPPPPPPPPPPP
 SA     6,978  7.09 INV,TAC(4+ 24.8 No Band    8/17- 8/21 ..................................................PPPPPPPPPcccc
 SB       600  6.85 INV,CPT      17.7           8/12- 1/13 ..........................................PP
 R          0   .00 R,NPR        -             N/A       * not available *
 RS         0   .00 R,NPR        -             N/A       * not available *

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Princeton:609-279-3000     Singapore:226-3000     Sydney:2-777-8600     Tokyo:3-3201-8900     Washington DC:202-434-1800
                                                                  M067-153-2-4 24-Jan-95 12:52:37
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Exhibit 17

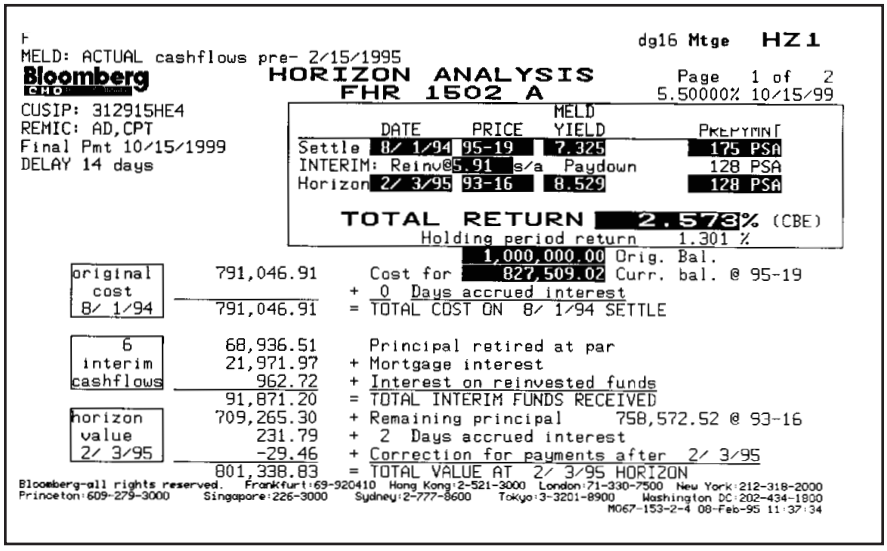
Total Return Analysis

How am I Doing?

The analyses presented thus far highlight the cash flow uncertainty inherent in MBS investing. It is essential for the examiner to be able to quantify the effects of interest rate movements and the impact the prepayment option has on a given tranche. It is also important to be able to quantify, in real dollars, the results of an investment decision. BLOOMBERG offers the ability to calculate historical total return, taking into account actual prepayments and reinvestment rates. This type of analysis offers a "status quo" snapshot, affording the opportunity to vindicate oneself for a prior decision or to acknowledge defeat. A prospective total return can also be calculated, showing the future impact in dollar terms of a given scenario.

Exhibit 18 is the HZ1 screen, an horizon analysis for FHLMC 1502 A for a six month time period. Total return reflects the price differential during the horizon period (including accrued interest), coupon payments, and reinvestment income. Principal paid (whether scheduled or prepaid) is always valued at par. Because the security was initially valued at a discount, prepayments at par act to enhance overall total return. The slowdown in prepayment speeds during the holding period, however, results in less cash being returned at par. The fact that interim funds are being reinvested at a favorable rate greater than the security's coupon rate acts to enhance total return. The security's price decline from 95-19 to 93-16 reflects the loss in value that a discount security would typically experience as prepayments decline. Collectively, these factors are reflected in the total return of the tranche, which in this case is slightly positive for the horizon period.

Exhibit 18



FFIEC Test

Security Risk Defined

A policy statement, developed by the Federal Financial Institutions Examination Council (FFIEC) in December 1991, was adopted by the Board of Governors of the Federal Reserve System, effective February 10, 1992. A section of *Supervisory Policy Statement on Securities Activities* (SR 92-01) assesses risks associated with MBS, and disallows banks from acquiring and owning high risk mortgage securities for their investment accounts. A bank can only own a high risk mortgage security for interest rate risk reduction purposes in accordance with safe and sound practices. The institution must be able to demonstrate its understanding and effective management of the risks associated with the security. It must be able to show, prior to purchase, how the security will reduce overall interest rate risk. Subsequent to purchase, the institution must evaluate at least quarterly whether the security has in fact actually reduced interest rate risk. An examiner may request the divestiture of a high risk security that does not act to reduce interest rate risk. The policy, however, is not meant to preclude an institution with strong capital, adequate liquidity, and a closely supervised and sophisticated trading area from acquiring high risk securities for *trading* purposes.

The policy statement defines "high risk" securities as mortgage derivative products that contain more risk than a 30 year "benchmark" MBS pass through security. The FFIEC test quantitatively defines a high risk CMO mortgage security. Three tests are applied to the tranche:

1. Its weighted average life must be less than 10 years
2. Its weighted average life cannot lengthen by more than 4 years or shorten by more than 6 years for a ± 300 basis point movement in rates
3. Its price cannot fluctuate by more than 17% for the same above stated rate movements

A tranche must pass *all three* tests to be considered non high risk. It is the bank's responsibility to determine and document prior to purchase and at least annually thereafter that a non high risk security remains classified as such. Standard industry calculators (like BLOOMBERG) are appropriate independent sources which can be used in making this determination. If an institution cannot make this assessment through internal analysis, outside sources are acceptable, provided they are independent of the firm who sold the securities to the bank.

An interim revision to *Supervisory Policy Statement* 92-01 released in April 1994 removed a provision that non high risk mortgage securities that later become high risk must be categorized as available for sale or placed in the trading portfolio. Further, examiners are to consider any unrecognized net depreciation in held to maturity high risk securities when the institution's capital adequacy is evaluated. The revision also clarifies that an examiner should request the divestiture of a high risk security only in a case where continued holding of the security would pose undue risk to the institution's overall safety and soundness.

Siskel or Ebert?

BLOOMBERG has developed a screen called **FMED** which details the results from each test. After a valuation is input for the tranche (either a current market price, yield, or spread to Treasury), the results are displayed. The screen will display a "thumbs-up PASS" or a "thumbs down FAIL" hand as a final "answer", so to speak. A critical overview of the process follows.

Is a PASS Always a PASS?

As noted, the FMED screen allows one to input a current valuation for the tranche. The prepay base and resulting 300 basis point movement up and down are not interactive, but rather depend on the assumption selected for the analysis. Those dealers who contribute prepayment and other MBS information to BLOOMBERG are listed along the bottom of the screen. By virtue of the FMED screen, BLOOMBERG has developed a median prepayment base and basis point movement profile based on these contributor's information. Indeed, many institutions and dealer firms utilize these median assumptions in the interest of statistical objectivity. Additional examiner consideration, however, should focus on *consistency* with regard to the assumptions used. If a portfolio manager chooses to use BLOOMBERG's median (or any other dealer's for that matter) assumptions to reflect statistical objectivity, those same assumptions should be utilized on a consistent basis in future analyses.

A FFIEC test was run for FHLMC 1624 KL, as illustrated in Exhibit 19. Note the tranche fails the test under the BLOOMBERG median prepayment assumption as its price change at +300 basis points exceeds the required 17%. The test was rerun for the tranche using the prepayment assumptions of 4 contributing dealers. The results reveal a mixed bag, as two dealers show the tranche passing the test while two show it failing. In each case, including the BLOOMBERG median, a different price change at +300 basis points was

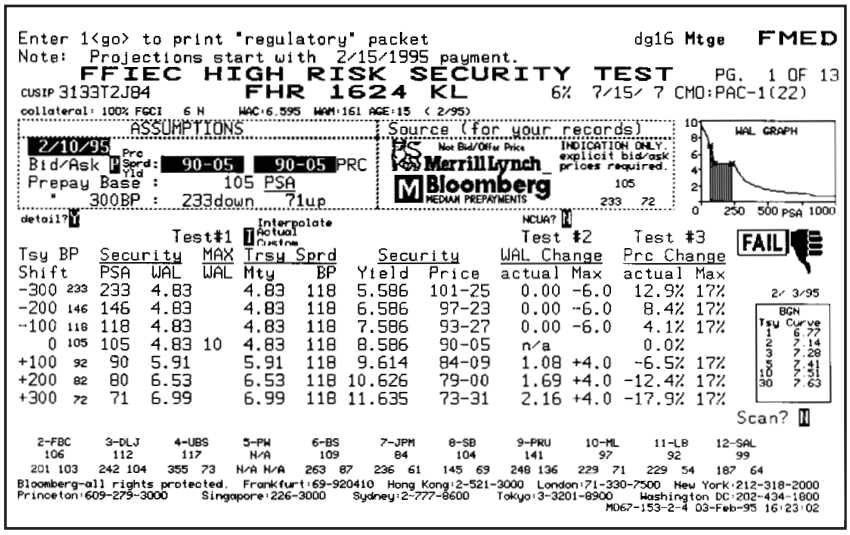
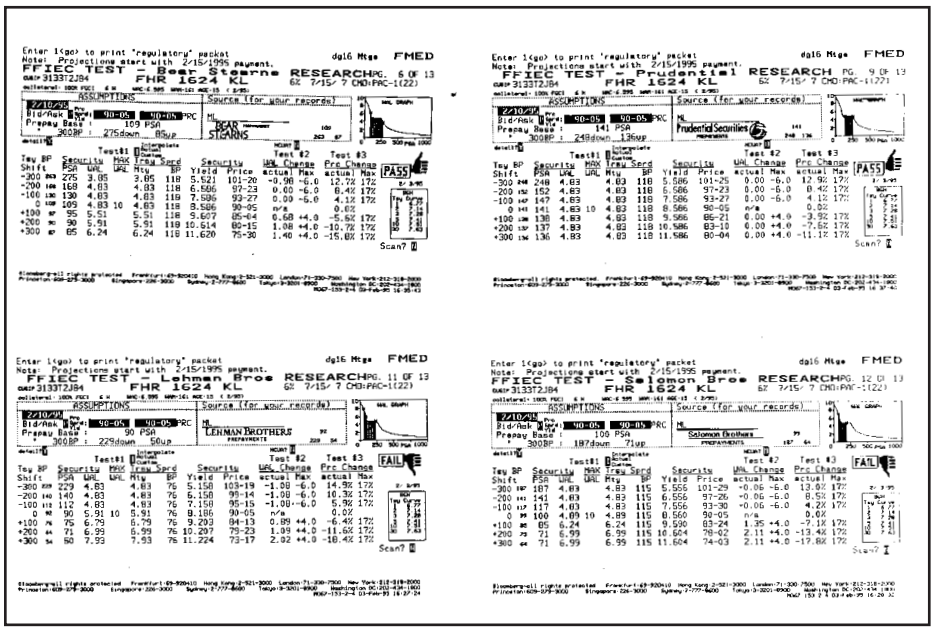


Exhibit 19

derived. Exhibit 20 illustrates how assumptions contributed by different dealers can produce different results, making it conceivable to "fine tune" one's determination of whether a tranche passes the test on a dealer by dealer basis. As noted, the assumptions used don't necessarily have to be BLOOMBERG's median. However, if median PSAs are not utilized, examiners should expect justification for the alternate selection as well as its consistent use.

A companion to the FMED screen exists in the HRST screen. The screens are identical except that the HRST screen affords the ability to input, in addition to a valuation, a prepayment assumption and a ± 300 basis point movement. Examiners are encouraged to use HRST to stress test the tranche under a variety of scenarios.

Exhibit 20



Additional Analyses

Both the FMED and HRST screens offer the ability to determine pass/fail tolerance levels for the tranche. When a "Y" is invoked in the SCAN box at the lower right hand corner, another box appears. A range of prepayments from 0 to 1000 is listed, and the tranche is subjected to the test criteria at the base case and ± 300 basis points for each speed. A - indicates that the tranche passes the test at that assumed PSA speed. An "F" indicates where the tranche would fail the test, enabling one to compare those results to the tranche's initial assumptions. An FMED test was run for FNMA 1994-18 A with the SCAN function invoked. Note on Exhibit 21 that while the tranche passes the test using BLOOMBERG's median PSA of 120, if the base case speed were to slow down to 50 or lower or increase to 200 PSA or higher, it would fail. In a manner of speaking, using SCAN allows one to "cheat" the test and look ahead for the answer that would invalidate the current result.

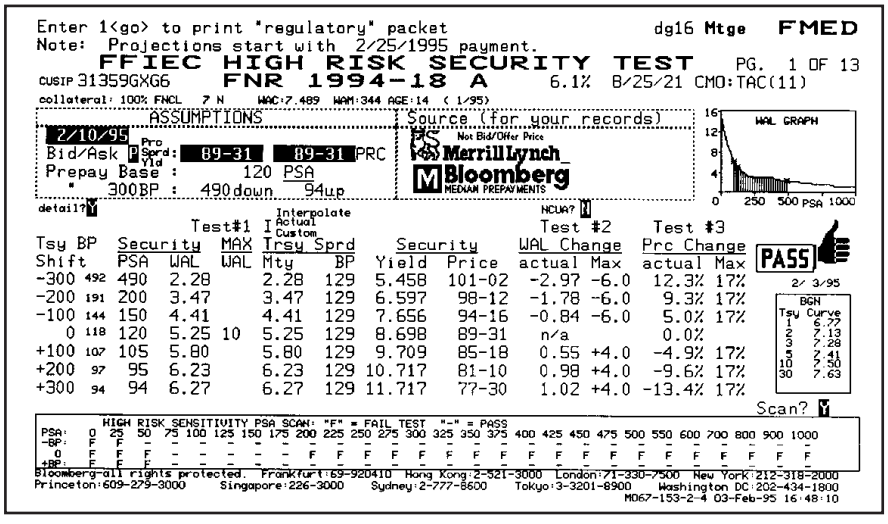
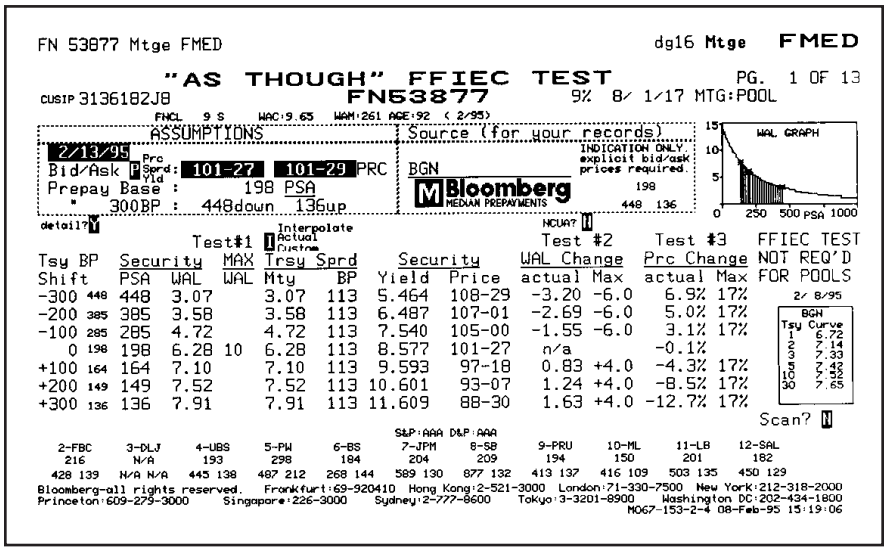


Exhibit 21

The FFIEC test can also be applied to other MBS products like specified pools. While the test is not required of those securities, its analytics are useful in assessing the risk profile of the pool. When the FMED command is invoked for a pool, ie FNMA 53877, the same screen appears as previously discussed (Exhibit 22). Note the "as though" FFIEC Test description at the top of the screen.

Exhibit 22



Conclusion

This paper has focused on the prepayment option inherent to MBS (specifically CMOs) and how it affects security valuation and performance. Discussions of OAS and effective duration were presented in an effort to convey the significance of that embedded option and advance a greater understanding of its behavioral patterns. These issues were discussed strictly in an introductory vein. A more detailed explication of these topics is available from the sources listed in the bibliography as well as *The Handbook of Mortgage Backed Securities* by Frank J. Fabozzi (Probus Publishing, 1995) and *Managing Institutional Assets* (Harper and Row, 1990). Various types of CMO tranches were presented with a critical, analytical theme overriding the discussions. Examples were selected to address a diverse range of topics, from PAC tranches to the FFIEC test. The intent of the presentations was to develop an appreciation for the magnitude and breadth of the analytical tools available to the examiner via BLOOMBERG.

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