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INTEREST RATE RISK, PREPAYMENT RISK, DURATION RISK, AND A NEW MORTGAGE

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ABSTRACT

Interest rate risk is a key factor in the pricing of fixed-income (debt) securities. When interest rates rise, the value of a fixed-income security falls; when interest rates fall, the value of a fixed-income security rises. However, when interest rates fall, many issuers of fixed-income securities "call" their outstanding debt securities in order to refinance at lower rates of interest. Buyers seek to protect against this event by demanding a "call premium" or other penalty should the debt be "called."

In the US, a very high percentage of conventional residential fixed-rate mortgages (FRMs) and virtually all government insured and guaranteed residential FRMs are sold into the secondary mortgage market (SMM) where these mortgages are bundled together and mortgage-backed securities, such as collateralized mortgage obligations, are issued against them. Unfortunately for the buyers of US FRMs, virtually all these mortgages may be prepaid in whole or in part at any time without penalty.

The problem of interest rate risk is exacerbated by the asymmetry in prepayments given a change in interest rates. When interest rates fall, US mortgagors' prepayments tend to accelerate as refinancings and house sales increase; when interest rates rise, prepayments decline as US mortgagors seek to hold on to "below market rate" financing for as long as possible. Thus, buyers of US residential mortgages face an uncertain expected duration of their investments – realizing a longer-than-desired duration when interest rates rise and a shorter-than-desired duration when interest rates fall. This uncertainty manifests itself in a risk premium that lowers the price SMM buyers are willing to pay for US residential FRMs, and, by translation, raises the interest rate charged on newly issued FRMs.

Beginning two decades ago, adjustable-rate mortgages (ARMs) became the preferred solution to this problem. ARMs allow the mortgagee to periodically adjust the rate of interest charged in response to changes in the general level of interest rates. Although ARMs are popular when interest rates are at historically high levels (and thus likely to decline), ARMs are thoroughly unpopular with mortgagors when interest rates are low. And, in a rising interest rate environment, default rates on ARMs tend to be higher than on FRMs.

This paper presents an alternative mortgage which retains the fixed-rate feature of an FRM, but accelerates the principal amortization when interest rates rise, exposing the buyer to less duration risk in a rising interest rate environment. This mortgage, labeled the Adjustable Amortization Mortgage (or AAM), is shown to have lessened interest rate risk for the buyer as well as lower default risk, suggesting that it should be priced higher (at a lower rate of interest) than the typical FRM. It is also shown that mortgage-backed securities collateralized by an AAM have much less price volatility than mortgage-backed securities backed by FRMs.

KEYWORDS:

Mortgages, real estate finance, secondary mortgage market

Interest Rate Risk, Prepayment Risk, Duration Risk, and a New Mortgage

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Introduction

A very large percentage of intermediate-to-long-term (15 years and longer) residential and commercial mortgages in the United States are sold into the secondary mortgage market (SMM). These mortgages are then bundled together, usually by credit quality, interest rate and term, and securities are sold using the cash flow from the bundled mortgages as the basis for payment. Although a variety of securities may be sold, one of the most common is the collateralized mortgage obligation (CMO) which is divided into separate slices or tranches – each with a different priority on the cash flow from the underlying mortgages.

Buyers of CMO tranches face a variety of risk factors – among them interest rate risk, prepayment risk, and duration risk. Although CMO writers may take a variety of steps to attempt to reduce these risk factors, such as creating planned amortization class (PAC) tranches, pooling adjustable-rate mortgages, and the like, these risk factors cannot be eliminated entirely. In fact, prepayment risk (the risk that prepayments by mortgagors will differ from what is expected) remains a telling problem for CMO writers since virtually all residential mortgages may be prepaid in whole or in part at any time without penalty.

Prepayment risk is exacerbated by the fact that prepayments tend to accelerate as interest rates decline (home sales and refinancings increase), and to decelerate as interest rates rise (home sales and refinancings decrease). Thus, the duration of a CMO tranche investment tends to move in the same direction as interest rates. This is an especially acute problem when interest rates rise. In this environment, CMO investors see a decline in the value of their investments in two ways: the increase in interest rates reduces the present value of future interest and principal cash flows; and, as prepayments decline, duration increases – further diminishing the value of expected cash flows.

In this paper, a new type of fixed-rate mortgage – the adjustable amortization mortgage (AAM) – is proposed as a partial solution to the prepayment risk/duration risk problem faced by CMO investors. Like a standard fixed-rate mortgage, the interest rate on an AAM is fixed for the term of the mortgage; unlike a standard fixed-rate mortgage, the payments (and, hence, the amortization of principal) increase in response to a rise in the general level of interest rates.

It is shown that CMOs (and their respective tranches) which are written against pools of adjustable amortization mortgages have much lower levels of prepayment risk and duration risk

in a rising interest rate environment. Thus, owners of AAMs and the securities written against them have less downward price volatility. Ceteris paribus, AAMs and securities written against them should command premium prices (lower yields) than corresponding standard fixed-rate mortgages and securities written against them.

Prior Research

The effects of interest rate changes, prepayments and duration on the pricing of mortgages has been the subject of widespread research. Kau, Keenan, Muller and Epperson (1990, 1993) develop a contingent claims model for mortgage pricing based on the interest rate model of Cox, Ingersoll and Ross (1985). Kau, et al., show that the prepayment option may be of great value to the borrower under a fixed-rate mortgage and, hence, an important component in the pricing of FRMs. Hendershott and Shilling (1985), Ott (1986) and Tucker (1991) all look at various interest rate risk pricing issues while Haensly, Waller and Springer (1993) focus on duration and price behavior in fixed-rate mortgages.

Thode (1991) develops a fixed payment, adjustable-rate mortgage and demonstrates that it has less default risk and less interest rate risk than a standard ARM. Thode and Kish (1993, 1994) construct a fixed-rate mortgage that uses a prepaid zero coupon treasury bond for principal repayment. They show that this mortgage has less prepayment (and duration) risk than a standard FRM.

Numerous studies have explored the prepayment patterns of ARMs and FRMs and the effects of prepayments on the valuation of mortgage-backed securities. These include Anderson, Barber and Chang (1993) who focus on the effects of prepayments on duration, and McConnell and Singh (1991), and Richard and Roll (1989) who evaluate interest-dependent prepayments and their effects on risk. McConnell and Singh, and Richard and Roll note that interest-dependent prepayments are most significant in the early years of a mortgage, and more significant in the pricing of fixed-rate mortgages than in adjustable-rate mortgages.

Duration

Measurement of the price elasticity of a stream of fixed cash flows can be accomplished through the statistic known as duration, which was first proposed by Macauley (1938). Fundamentally, duration seeks to measure the effective maturity of a stream of cash flows. In Macauley's formulation, the weight of each receipt is related to the importance of the receipt in a present value context.

Although Macauley's original formulation has been refined and modified through time (e.g., Anderson, Barber and Chang [1993]), authors such as Bierwag, Kaufman and Toevs (1983) show that Macauley's measure performs quite well against latter formulations.

The general formulation of Macauley duration is given by:

N N

$$DUR = \sum_{t=1}^{N} \frac{t*CF_t}{(1+r)^t} \Big/ m \sum_{t=1}^{N} \frac{CF_t}{(1+r)^t} \quad (1)$$

Where: CF_t = Payment (cash flow) the security will make in time period t;
N = Number of time periods until the maturity of the security;
r = Security's required return (per period); and,
m = Number of periods per year.[1]

If we define modified duration (DUR_{mod}) as DUR/(1+r), then modified duration multiplied by a given change in (annualized) yield (or required return) approximates for the negative of the expected percentage price change or return on a security:

$$DUR_{mod} * \frac{\Delta r}{m} \approx -\frac{\Delta PRICE}{PRICE} \quad (2)$$

Duration is an absolute measure of interest-rate risk and is particularly applicable to fixed-payment securities. It can then be applied to compare the price sensitivity of different securities. However, as will be noted later, equation 2 approximates for the negative of the expected percentage security price change only if there is no change in the expected cash flows each period (CF_t) as a result of a change in interest rates (required returns).[2]

CMO Valuation and Risk

For any given CMO backed by a pool of fixed-rate mortgages, the market value of a particular tranche j (V_j) may be modeled as:

$$V_j = f(C_j, F_j, r_j, T_j) \quad (3)$$

Where: C_j = Periodic coupon interest paid to tranche j;
F_j = Face value principal amount of tranche j;
r_j = Required rate of return on investment for tranche j; and,
T_j = Expected term to maturity for tranche j.

The value of tranche j at any given point time t (t=0) is equal to the present value of the future cash flows received over N time periods, or:

N

[1] Note that the summation in the denominator on the right-hand side of equation 1 is the PRICE of the security.

[2] As in the case of a fixed coupon, non-callable, default-free security such as a US government bond. Where cash flows each period may change as yields change (e.g., callable debt, floating rate debt, or where principal prepayments may also change), it is more appropriate to place an expectations operator (E) in front of the periodic cash flows variable (CF_t) in equation 1.

$$V_j = \sum_{t=0}^{N} \frac{(C_{j,t} + P_{j,t})}{(1+r_j)^t} \quad (4)$$

Where: $P_{j,t}$ = Principal payments to tranche j during time period t ($\sum P_{j,t} = F_j$); and,

$(C_{j,t} + P_{j,t})$ = $CF_{j,t}$.[3]

In a typical flow-through CMO, principal payments to the tranche consist of the normal, amortizing principal paid by mortgagors each period plus principal prepayments made in whole (as in the sale of the home or a refinancing), or in part (as in the case of a mortgagor who elects to make an additional, partial principal payment).

If the coupon payments ($C_{j,t}$) and principal payments ($P_{j,t}$) are divided into separate claims, then the value of the interest-only stream to tranche j (IO_j) is given by:

$$IO_j = \sum_{t=0}^{N} \frac{C_{j,t}}{(1+r_j)^t} \quad (5)$$

And the value of the principal-only stream to tranche j (PO_j) is given by:

$$PO_j = \sum_{t=0}^{N} \frac{P_{j,t}}{(1+r_j)^t} \quad (6)$$

Thus, $V_j = IO_j + PO_j$.

Therefore, the total value of the cash flows to a CMO tranche depends on the timing and amount of the interest (coupon) and principal payments, and the discount rate applied to these cash flows. In turn, the discount rate (required rate of return) may be modeled as a function of the riskless rate of interest (r_f) plus a risk premium (RP), or:

$$r_j = r_f + RP_j \quad (7)$$

Where: RP_j = risk premium appropriate for the cash flows to tranche j.

[3] To broaden the duration across tranches, so-called "companion" CMOs permit the longest maturity tranche to accrue interest as long as any other tranche is still "alive." This accrued interest is paid in cash to earlier-maturing tranches as a principal allocation, reducing their duration. The accrued interest is credited to the later-maturing tranche as marked-up principal.

The risk premium is a function of a variety of risk factors including the default risk of the underlying mortgages, and the expected duration of the cash flows to the tranche (which is affected by the expected rate of principal prepayments on the underlying mortgages).

Prepayment Rates on Fixed-Rate Mortgages

Unlike other forms of debt, the vast majority of residential mortgages may be prepaid in whole or in part by the mortgagor at any time without penalty. In the absence of penalties, the main factors affecting the rate of prepayments are: 1) housing turnover (home sales); 2) refinancings; and, 3) involuntary prepayments due to death, divorce, foreclosure, etc. [see Bartlett, 1994]. Home sales are the prime factor in prepayments when an existing mortgage is selling at a discount; refinancings are the prime factor in prepayments when an existing mortgage is selling at a premium.

Of critical importance to the mortgagee and the owners of securities written against mortgages is the effect of prepayments on the market values of their holdings. In general, prepayments tend to moderate the increase in mortgage and mortgage-backed security prices when interest rates fall. Falling interest rates tend to accelerate prepayments both because housing turnover tends to increase (more prospective homebuyers qualify for mortgages, increasing housing demand) and because refinancing activity increases (existing mortgagors refinance at lower rates of interest)[4]. Thus, the upward price movement in a mortgage due to a drop in interest rates is constrained by a decrease in the anticipated duration of the cash flows.

When interest rates rise, prepayments decline because housing turnover decreases, and fewer refinancings occur. As a result, the anticipated duration of the cash flows increases, placing additional downward price pressure on mortgages and mortgage-backed securities.[5]

Thus, the *rate of prepayment* may be modeled as a function of several variables:

$$PPR = f(I, HT, RE, DF, Other) \quad (8)$$

Where: PPR = Prepayment rate;
I = General level of interest rates
HT = Housing turnover
RE = Level of refinancing activity;
DF = Defaults on mortgages; and,
Other = Other factors (such as divorce, death, etc.) which are assumed to be constant.

[4] Refinancings are dampened by what is known as "burnout." Even though it may be financially attractive to refinance, some mortgagors do not refinance for a variety of reasons: inability to qualify for a new mortgage; ignorance of the benefits of refinancing; transactions costs, etc.

[5] Foreclosures also tend to increase in a rising interest rate environment that may accelerate prepayments and dampen price declines. However, foreclosures may not permit mortgagors and security holders to recover the entire principal value of their investments.

In general, ∂PPR/∂I < 0; ∂PPR/∂HT > 0; ∂PPR/∂RE > 0;and, ∂PPR/∂DF > 0. Since housing turnover, refinancings and defaults are also affected by changes in interest rates, the partial derivatives are: ∂HT/∂I < 0; ∂RE/∂I < 0; and ∂DF/∂I > 0.

Finally, the duration (DUR) of the cash flows to the mortgagees and owners of mortgage-backed securities is inversely related to the rate of prepayment, hence ∂DUR/∂PPR < 0. As a result, duration can be expected to *decrease* when: interest rates fall; refinancings rise; and, defaults rise. Conversely, duration can be expected to *increase* when: interest rates rise; refinancings fall; and, defaults decline.

The Adjustable Amortization Mortgage

For a typical constant monthly payment, fixed-rate mortgage with a term of N months, annual interest rate i (monthly interest rate = i/12), and original loan balance P_0, the monthly payment R which will amortize the mortgage to a \$0 balance at the end of time period N is given by:

$$R = P_0 \Big/ \boxtimes_{t=1}^{N} \frac{1}{(1+[i/12])^t} \qquad (9)$$

Where the divisor on the right-hand side of equation 9 is the present value of an annuity factor. The remaining principal balance on the mortgage after n payments have been made (P_n) is given by:

$$P_n = R * \boxtimes_{t=n+1}^{N} \frac{1}{(1+[i/12])^{t-n}.} \qquad (10)$$

Under most fixed-rate mortgage contracts, if the borrower makes additional principal payments (prepayments) at any point in time (PP_n) so that the remaining principal balance ($P^*_n = P_n - PP_n$) is lowered, subsequent monthly payments remain at R, but the term of the mortgage is reduced. However, the borrower is not compelled, at any point in time, to make a payment larger than R.

In a rising interest rate environment, the market values of fixed-rate mortgages (and the securities written against them) decline as the cash flows are discounted at higher rates. Exacerbating the decline in values due to rising interest rates is the likelihood that prepayments (in whole, or in part) will also decline for the reasons stated in the previous section. A decline in prepayments increases the duration of the mortgage, placing additional downward pressure on prices.

For example, given a change in the required rate of return on a CMO tranche j from r to r*, the change in the market value of tranche j can be modeled as:

$$\Delta V_j = \sum_{t=0}^{N} \frac{(C_{j,t,r^*} + P_{j,t,r^*})}{(1+r^*)^t} - \sum_{t=0}^{N} \frac{(C_{j,t,r} + P_{j,t,r})}{(1+r)^t} \qquad (11)$$

If it is assumed that the prepayment rate on the underlying mortgages is unaffected by the change in required return, then $C_{j,t,r^*} = C_{j,t,r}$ and $P_{j,t,r^*} = P_{j,t,r}$.[6]

However, if the prepayment rate changes along with a change in required return, then $C_{j,t,r^*} \gamma C_{j,t,r}$ and $P_{j,t,r^*} \gamma P_{j,t,r}$. As a result, $CF_{j,t,r^*} \gamma CF_{j,t,r}$. Therefore, since duration (and, by translation, modified duration) is affected by the change in the prepayment rate, then the left-hand side of equation 2 will understate the magnitude of the security price change if changes in prepayment rates decline with an increase in required return. The additional change in the price of the security, over and above the approximation given by equation 2, can be referred to as prepayment risk.

Constructing an AAM

It is possible to design a fixed-rate mortgage that reduces the buyer's exposure to prepayment risk in a volatile interest rate environment. Such a fixed-rate mortgage is one where the amortization of principal is accelerated in response to an upward change in interest rates.[7] Similar in construct to an adjustable-rate mortgage (ARM), the adjustable amortization mortgage (AAM) is a fixed-rate mortgage with a (possibly) variable payment. That is, like an ARM, the monthly payment on an AAM is adjusted periodically to reflect changes in the general level of interest rates. However, unlike an ARM, the interest rate on the AAM remains constant throughout its life *so that any adjustments in the monthly payment are credited directly against the remaining principal balance of the mortgage*.

Rather than transferring *interest rate risk* (in part or in whole) from the lender to the borrower as is done with an ARM, the AAM transfers *prepayment risk* from the lender to the borrower. As a result, AAMs (and AAM-backed securities) render some price volatility protection to their owners that fixed-rate mortgages do not offer.

A fairly straightforward AAM is similar in construct to an ARM. The payment on the AAM is adjusted periodically (perhaps annually); there is a well-defined underlying index rate of

[6] If prepayments decline, then principal payments to all tranches occur over a longer period of time. As a result, coupon interest payments continue for a longer period of time. Similarly, if prepayments increase, principal payments to all tranches occur over a shorter period of time. Thus, coupon interest payments are made over a shorter time period.

[7] Similarly, amortization is decelerated in response to a downward change in interest rates. However, as mortgage interest rates decline, home sales and refinancings will accelerate, mitigating the deceleration in amortization.

interest upon which changes in the payments are benchmarked; there is a defined margin over the index rate; and, the AAM may have periodic as well as life of loan caps and floors on the amount the monthly payment may be changed.

Table 1 illustrates an example of an AAM. The term of the mortgage is 30 years, carrying an interest rate of 7.0%. That interest rate is based on the index rate at the time of origination (5.0%)[8] plus a margin over the index rate (2.0%). If this were a standard fixed-rate mortgage, the borrower would make monthly, constant payments of $665.30 throughout the entire 360-month term of the mortgage.

With an AAM, each year, on the anniversary date of the mortgage, the current value of the index is read and the margin added to this value. Monthly payments on the AAM are then adjusted via equation 9 using the sum of the current index rate plus the margin as the interest rate. However, since the interest rate is fixed, any increase (or decrease) in the monthly payment represents an adjustment to principal amortization, not an adjustment to interest.

For example, in Table 1, the index rate rises by one percentage point by the end of the first year (month 12). As a result, the monthly payment for months 13-24 is reset based on the $98,984.19 remaining principal balance, 29 year (348 month) remaining term and an interest rate of 8.0% (current index rate plus margin). As is seen in Table 1, the payment rises to $732.43. All of the incremental payment is credited against principal, not interest, since the interest rate is fixed.

Likewise, at the end of 24 months, the index is again observed and the payment adjusted using index plus margin as the interest rate i in equation 9.

It should also be noted that, unlike a standard fixed-rate mortgage, the *term* of the AAM is not affected by accelerated payments to principal. This is because the payment is adjusted annually based on retaining the original term of 30 years.[9]

Valuing AAM-Backed Securities

A typical sequential payment CMO is illustrated in Tables 2 through 6. The owner of a portfolio of $420 million (face value) 30-year term, 8% APR fixed-rate mortgages has created a 4-tranche CMO (A,B,C and Z) – with each tranche carrying a face value of $100 million. The residual $20 million represents overcollateralization in the event of defaults or late payments by mortgagors.

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[8] Analogous to an ARM, the underlying index could be a US Treasury security rate, for example, the rate on 10-year US Treasury bonds.

[9] As a result, the AAM may provide some modest duration risk protection for the mortgagee as interest rates fall since the mortgagor's monthly payment also declines. Some mortgagors, who might otherwise refinance as interest rates fall, may elect, instead, to continue making the (now lower) monthly payments on the AAM. This is aptly illustrated in Table 1 beginning in month 49. The index rate plus margin has returned to its original level (7.0%). However, because principal payments were accelerated in months 13 through 48, the total monthly payment beginning in month 49 is lower than the original total monthly payment ($642.93 v. $665.30).

To create claims with different maturities, the principal cash flow from the mortgage payments is sequential, i.e., all principal payments first go to Tranche A, then Tranche B, etc. Further, to create a fairly long-lived tranche, Tranche Z not only does not receive any principal payments until all the other tranches have been completely repaid, Tranche Z's coupon interest is credited as an additional principal payment against the remaining tranches, in sequence. Thus, Tranche Z receives no cash flow whatsoever until all other tranches have been completely paid off.

Assuming a positively- sloped yield curve, the required rate of return on each tranche is an increasing function of the tranche's expected duration. Hence, Tranche A, with the shortest duration, carries the lowest coupon interest rate; Tranche Z, with the longest duration, carries the highest coupon interest rate. The assumed rate of principal prepayments (in whole or in part) on the pool of underlying mortgages approximates the Public Securities Association (PSA) prepayment rate curve.[10]

Tables 4, 5 and 6 illustrate the sequence of principal and coupon interest payments to the various tranches as well as the expected durations and component values of the claims (interest-only and principal-only claims). Since the example assumes all tranches are sold at par, the total value of each tranche is the par value. Because Tranche Z receives no payments of any kind until all the other tranches have been extinguished, it has a substantially longer duration than tranches A, B, and C. This difference is magnified by the application of accrued interest cash flows to the other tranches.

Tables 8 through 13 illustrate the dual effects of a structural shift increase in interest rates by 2 percentage points (causing the required return on all tranches to increase by 2 percentage points) and a simultaneous reduction in the anticipated level of prepayments by one-third (66.667% of PSA). For every tranche, duration increases (most dramatically for tranche Z where it increases by almost one-and-a-half years) and the PO values decline significantly. For tranches A, B and C, the IO values increase marginally since the decline in prepayments results in larger and longer coupon interest payments. For tranche Z, the IO value declines since the (now more heavily discounted) coupon interest payments are further in the future.

In toto, the market value of the claims to tranches A, B, C and Z have declined by approximately $51 million from $400 million to roughly $349 million before adjusting for the effects of changes in expected duration on required returns.[11]

Applying the AAM

[10] The PSA prepayment rate curve ("100% of PSA") assumes prepayments of 0.2 percent per month the first year, then increases by 0.2 percent per month through month 30, then levels off at 0.5 percent per month (6 percent annually) for the remaining stated maturity. See, for example, Brueggeman and Fisher (1997). Because the example used here assumes annual payments, the assumed prepayment rate that corresponds to "100% of PSA" is 2 percent the first year, 4 percent the second year, and 6 percent in all subsequent years.

[11] The reported market values for tranches A, B, C, and Z in Tables 10 through 12 overstate the "true" market values if required returns are positively correlated with expected duration.

Suppose now that the underlying mortgage pool backing the CMOs is composed of fixed-rate, adjustable amortization mortgages of the type described previously. In this case, if interest rates were to rise by two percentage points, the total monthly payments on the underlying mortgage would be adjusted upward (based on a 10% interest rate rather than an 8% interest rate) with all of the additional cash inflows credited to principal.

As illustrated in Table 15, the total cash flow available for distribution to tranche holders rises significantly as the amortization is accelerated. In fact, the adjustment in the speed of amortization substantially offsets the decline in prepayments as a result of interest rates increasing. As is shown in Tables 16, 17 and 18, the expected durations of tranches A, B, C and Z return almost exactly to the expected durations of these tranches before an increase in interest rates occurred (Tables 4, 5 and 6). And the total payments to each of the tranches each period returns to roughly the same values as they were before the rise in interest rates. Thus, increasing "involuntary" payments of principal ameliorates the decline in "voluntary" prepayments.

The overall effect of the application of the AAM is best illustrated in Table 20 which summarizes the PO, IO and Total values, as well as the duration and modified duration of each tranche under all three scenarios. With the increase in interest rates, the use of the accelerated amortization mortgage increases the PO values of all four tranches significantly. Despite a decline in IO values across all four tranches (the time period over which coupon interest is paid is now shortened for all four tranches), the overall effect is to raise the cumulative market values of the four tranches by about $5 million to $354 million.

Future Research

The offering of adjustable amortization mortgages as a substitute for traditional fixed-rate mortgages represents an opportunity to insulate owners of these mortgages (and the securities backed by these mortgages) from duration risk, especially in a rising interest rate environment. To more clearly identify the potential benefits, a number of issues must be addressed:

1) The relationship between required returns and expected duration. If required returns are positively correlated with expected duration, then the previous example understates the potential effect of an AAM on duration risk and mortgage-backed security prices. If securities buyers demand a premium as expected duration increases, the results will be more dramatic;

2) Would there be a secondary market for AAMs? Although the potential benefits of AAMs as opposed to standard fixed-rate mortgages could be easily articulated to investors, it is likely that AAMs would require a high level of standardization in order to be bundled together to create pools against which securities are written;

3) If there were a secondary market for AAMs, would there be a primary market? For what types of borrowers would an AAM be a suitable alternative? Since mortgage payments could rise with an AAM, some

borrowers may be reluctant to expose themselves to that risk, even though their interest rate is fixed;

4) If there were both a primary and secondary market for AAMs, to what extent should the duration risk be shared between mortgagor and mortgagee? Specifically, what would be the appropriate caps and floors on amortization adjustments – both periodically and over the life of the loan?; and,

5) Assuming a standardized AAM could be created, what is the appropriate interest rate reduction for a borrower taking out an AAM as opposed to a standard fixed-rate mortgage?

Summary

This paper has proposed a new fixed-rate mortgage where the amortization is adjusted to reflect changes in the level of interest rates. Conceptually, the objective is to create a mortgage that has less duration risk for mortgage buyers and for buyers of securities backed by those mortgages. It is shown that such a mortgage has the potential to effectively insulate mortgagees and securities owners from changes in expected duration as a result in changes in principal prepayment patterns arising from changes in the general level of interest rates.

Table 1

Adjustable Amortization Mortgage Example

Mortgage Amount	**$100,000**	
Term	**30**	**years**
Index Rate	**5.000%**	
Margin	**2.000%**	
Interest Rate	**7.000%**	

Month	Beginning Principal	Interest Payment	Principal Payment	Total Payment	Ending Principal	Index Rate +Margin
1	$100,000.00	$583.33	$ 81.97	$665.30	$99,918.03	7.000%
.	.	.	.	.	.	.
.	.	.	.	.	.	.
12	99,071.58	577.92	87.38	665.30	98,984.19	
13	98,984.19	577.41	155.02	732.43	98,829.17	8.000%
.	.	.	.	.	.	.
.	.	.	.	.	.	.
24	97,228.34	567.17	165.26	732.43	97,063.07	
25	97,063.07	566.20	226.12	792.33	96,836.95	9.000%
.	.	.	.	.	.	.
.	.	.	.	.	.	.
36	94,501.87	551.26	241.06	792.33	94,260.81	
37	94,260.81	549.85	161.14	710.99	94,099.67	8.000%
.	.	.	.	.	.	.
.	.	.	.	.	.	.
48	92,435.70	539.21	171.78	710.99	92,263.92	
49	92,263.92	538.21	104.72	642.93	92,159.20	7.000%
.	.	.	.	.	.	.
.	.	.	.	.	.	.
360	639.20	3.73	639.80	642.93	0.00	

Table 2

A Typical Collateralized Mortgage Obligation
(000s omitted)

Assumes Prepayment Rate of:	**100% of PSA**	
Pool Amount	**$420,000**	
Interest Rate	**8.000%**	
Term	**30 Years**	
Overcollateralization	**$20,000**	
Tranche A	**Required Return**	**7.000%**
	Coupon	**7.000%**
	Amount	**$100,000**
Tranche B	**Required Return**	**7.250%**
	Coupon	**7.250%**
	Amount	**$100,000**
Tranche C	**Required Return**	**7.500%**
	Coupon	**7.500%**
	Amount	**$100,000**
Tranche Z	**Required Return**	**8.500%**
	Coupon	**8.500%**
	Amount	**$100,000**

Notes: CMO is a sequential payment CMO, i.e., Tranche A receives all mortgage principal payments first, then Tranche B, then Tranche C, then Tranche Z. Tranches A, B, and C receive coupon interest beginning at the end of year 1. Tranche Z receives no coupon interest until all other tranches have been completely paid off. In the interim, Tranche Z is credited with accrued interest and the interest that would normally be paid to Tranche Z is paid to the other tranches (in sequence) as additional principal payments.

The overcollateralization creates a residual equity class, which receives the residual cash flow each year after the claims of all tranches have been paid.

PSA stands for the Public Securities Association. A prepayment rate of “100% of PSA” translates to a prepayment rate of approximately 2% the first year; 4% the second year; and, 6% in all subsequent years.

Table 3

Summary Cash Flow Information
(000s omitted)

EOY	Pool Amount	Prin & Int Payments	Principal Prepmts	Total Amort	Interest	Amount Owed CMO Holders	Total Avail for Dist
0	$420,000					$400,000	
1	407,892	$37,308	$8,400	$3,708	$33,600	387,892	$45,708
2	387,653	36,555	16,316	3,923	32,631	367,653	52,870
3	360,328	35,078	23,259	4,066	31,012	340,328	58,338
4	334,583	32,951	21,620	4,125	28,826	314,583	54,571
5	310,324	30,951	20,075	4,185	26,767	290,324	51,026
6	287,459	29,071	18,619	4,245	24,826	267,459	47,690
7	265,906	27,302	17,248	4,306	22,997	245,906	44,550
8	245,585	25,639	15,954	4,367	21,273	225,585	41,594
9	226,422	24,075	14,735	4,428	19,647	206,422	38,810
10	208,346	22,604	13,585	4,490	18,114	188,346	36,189
11	191,292	21,220	12,501	4,553	16,668	171,292	33,721
12	175,199	19,919	11,478	4,615	15,303	155,199	31,396
13	160,009	18,694	10,512	4,678	14,016	140,009	29,206
14	145,668	17,542	9,601	4,741	12,801	125,668	27,142
15	132,124	16,457	8,740	4,804	11,653	112,124	25,197
16	119,330	15,436	7,927	4,866	10,570	99,330	23,363
17	107,243	14,474	7,160	4,928	9,546	87,243	21,634
18	95,819	13,569	6,435	4,989	8,579	75,819	20,003
19	85,021	12,715	5,749	5,049	7,666	65,021	18,464
20	74,812	11,909	5,101	5,108	6,802	54,812	17,011
21	65,159	11,149	4,489	5,164	5,985	45,159	15,638
22	56,031	10,431	3,910	5,218	5,213	36,031	14,340
23	47,402	9,750	3,362	5,268	4,483	27,402	13,112
24	39,245	9,105	2,844	5,312	3,792	19,245	11,949
25	31,541	8,489	2,355	5,350	3,140	11,541	10,844
26	24,272	7,900	1,892	5,376	2,523	4,272	9,792
27	17,429	7,328	1,456	5,386	1,942	0	8,785
28	11,015	6,763	1,046	5,369	1,394	0	7,809
29	5,058	6,177	661	5,296	881	0	6,838
30	0	5,463	0	5,058	405	0	5,463

Notes: Mortgage payments are made annually at the end of each year. Payments to tranches are made annually at the end of each year. There is no prepayment penalty on the underlying mortgages.

Table 4

Tranche A
(000s omitted)

Coupon	**7.000%**	**PO Value**	**$ 85,078**
Required Return	**7.000%**	**IO Value**	**$ 14,922**
Duration	**2.281 years**	**Total Value**	**$100,000**
Modified Duration	**2.132**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	79,392	$20,608	$7,000	$27,608
2	49,931	29,462	5,557	35,019
3	12,599	37,332	3,495	40,827
4	0	12,599	882	13,481
5	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Tranche B
(000s omitted)

Coupon	**7.250%**	**PO Value**	**$69,603**
Required Return	**7.250%**	**IO Value**	**$30,397**
Duration	**4.497 years**	**Total Value**	**$100,000**
Modified Duration	**4.193 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	100,000	$0	$7,250	$7,250
2	100,000	0	7,250	7,250
3	100,000	0	7,250	7,250
4	75,998	24,002	7,250	31,252
5	39,958	36,039	5,510	41,549
6	4,313	35,645	2,897	38,542
7	0	4,313	313	4,625
8	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Table 5

Tranche C
(000s omitted)

Coupon	**7.500%**	**PO Value**	**$56,067**
Required Return	**7.500%**	**IO Value**	**$43,933**
Duration	**6.297 years**	**Total Value**	**$100,000**
Modified Duration	**5.858 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	100,000	$0	$7,500	$7,500
2	100,000	0	7,500	7,500
3	100,000	0	7,500	7,500
4	100,000	0	7,500	7,500
5	100,000	0	7,500	7,500
6	100,000	0	7,500	7,500
7	68,892	31,108	7,500	38,608
8	33,525	35,367	5,167	40,534
9	0	33,525	2,514	36,039
10	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Table 6

Tranche Z
(000s omitted)

Coupon	**8.500%**	**PO Value**	**$49,405**
Required Return	**8.500%**	**IO Value**	**$50,595**
Duration	**14.458 years**	**Total Value**	**$100,000**
Modified Duration	**13.325 years**		

EOY	Amount Owed	Accrued Interest	Accum Accrued Int	Principal Payments	Interest Payments	Total Payments
0	$100,000					
1	108,500	$8,500	$8,500	$0	$0	$0
2	117,723	9,223	17,723	0	0	0
3	127,729	10,006	27,729	0	0	0
4	138,586	10,857	38,586	0	0	0
5	150,366	11,780	50,366	0	0	0
6	163,147	12,781	63,147	0	0	0
7	177,014	13,867	77,014	0	0	0
8	192,060	15,046	92,060	0	0	0
9	206,422	14,361	106,422	(14,361)	16,325	1,964
10	188,346	(18,076)	88,346	18,076	17,546	35,622
11	171,292	(17,054)	71,292	17,054	16,009	33,063
12	155,199	(16,093)	55,199	16,093	14,560	30,653
13	140,009	(15,190)	40,009	15,190	13,192	28,382
14	125,668	(14,342)	25,668	14,342	11,901	26,242
15	112,124	(13,544)	12,124	13,544	10,682	24,225
16	99,330	(12,794)	(670)	12,794	9,531	22,324
17	87,243	(12,088)	(12,757)	12,088	8,443	20,531
18	75,819	(11,424)	(24,181)	11,424	7,416	18,839
19	65,021	(10,798)	(34,979)	10,798	6,445	17,243
20	54,812	(10,209)	(45,188)	10,209	5,527	15,736
21	45,159	(9,653)	(54,841)	9,653	4,659	14,312
22	36,031	(9,127)	(63,969)	9,127	3,838	12,966
23	27,402	(8,630)	(72,598)	8,630	3,063	11,692
24	19,245	(8,157)	(80,755)	8,157	2,329	10,486
25	11,541	(7,704)	(88,459)	7,704	1,636	9,340
26	4,272	(7,269)	(95,728)	7,269	981	8,250
27	0	(4,272)	(100,000)	4,272	363	4,635
28	0	0	0	0	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0

Table 7

Residual Equity Class
(000s omitted)

Prepayment = 100.000% of PSA
IRR to Residual Equity Class 8.621%

EOY	Total Cash Flow to Pool	Total Payments to A,B,C & Z Tranches	Residual Cash Flow to Equity
0			($20,000)
1	$45,708	$42,358	3,350
2	52,870	49,769	3,101
3	58,338	55,577	2,761
4	54,571	52,234	2,337
5	51,026	49,049	1,977
6	47,690	46,042	1,648
7	44,550	43,233	1,317
8	41,594	40,534	1,059
9	38,810	38,003	807
10	36,189	35,622	568
11	33,721	33,063	658
12	31,396	30,653	744
13	29,206	28,382	824
14	27,142	26,242	900
15	25,197	24,225	972
16	23,363	22,324	1,039
17	21,634	20,531	1,103
18	20,003	18,839	1,164
19	18,464	17,243	1,221
20	17,011	15,736	1,275
21	15,638	14,312	1,326
22	14,340	12,966	1,374
23	13,112	11,692	1,420
24	11,949	10,486	1,463
25	10,844	9,340	1,504
26	9,792	8,250	1,542
27	8,785	4,635	4,149
28	7,809	0	7,809
29	6,838	0	6,838
30	5,463	0	5,463

Table 8

Interest Rates Rise by 2.0%; Prepayments Decline

Assumes Prepayment Rate of:	**66.667% of PSA**
Pool Amount	**$420,000**
Interest Rate	**8.000%**
Term	**30 Years**
Overcollateralization	**$20,000**

Tranche A	**Required Return**	**9.000%**
	Coupon	**7.000%**
	Amount	**$100,000**
Tranche B	**Required Return**	**9.250%**
	Coupon	**7.250%**
	Amount	**$100,000**
Tranche C	**Required Return**	**9.500%**
	Coupon	**7.500%**
	Amount	**$100,000**
Tranche Z	**Required Return**	**10.500%**
	Coupon	**8.500%**
	Amount	**$100,000**

Table 9

Summary Cash Flow Information
(000s omitted)

EOY	Pool Amount	Prin & Int Payments	Principal Prepmts	Total Amort	Interest	Amt Owed CMO Holders	Total Avail for Dist
0	$420,000					$400,000	
1	410,692	$37,308	$5,600	$3,708	$33,600	390,692	$42,908
2	395,790	36,806	10,952	3,950	32,855	375,790	47,757
3	375,807	35,815	15,832	4,151	31,663	355,807	51,646
4	356,473	34,367	15,032	4,302	30,065	336,473	49,399
5	337,755	32,976	14,259	4,458	28,518	317,755	47,235
6	319,625	31,641	13,510	4,620	27,020	299,625	45,151
7	302,053	30,357	12,785	4,787	25,570	282,053	43,142
8	285,010	29,125	12,082	4,960	24,164	265,010	41,207
9	268,471	27,940	11,400	5,139	22,801	248,471	39,341
10	252,407	26,802	10,739	5,324	21,478	232,407	37,541
11	236,795	25,708	10,096	5,516	20,193	216,795	35,805
12	221,610	24,657	9,472	5,713	18,944	201,610	34,129
13	206,828	23,646	8,864	5,917	17,729	186,828	32,511
14	192,427	22,674	8,273	6,128	16,546	172,427	30,948
15	178,384	21,740	7,697	6,346	15,394	158,384	29,437
16	164,679	20,841	7,135	6,570	14,271	144,679	27,976
17	151,291	19,975	6,587	6,801	13,174	131,291	26,562
18	138,201	19,142	6,052	7,038	12,103	118,201	25,193
19	125,391	18,339	5,528	7,283	11,056	105,391	23,867
20	112,842	17,564	5,016	7,533	10,031	92,842	22,580
21	100,539	16,817	4,514	7,789	9,027	80,539	21,330
22	88,466	16,094	4,022	8,051	8,043	68,466	20,116
23	76,610	15,394	3,539	8,317	7,077	56,610	18,933
24	64,960	14,715	3,064	8,586	6,129	44,960	17,779
25	53,507	14,052	2,598	8,855	5,197	33,507	16,650
26	42,246	13,401	2,140	9,121	4,281	22,246	15,541
27	31,181	12,755	1,690	9,375	3,380	11,181	14,445
28	20,329	12,099	1,247	9,605	2,494	329	13,346
29	9,742	11,400	813	9,773	1,626	0	12,213
30	0	10,522	0	9,742	779	0	10,522

Table 10

Tranche A
(000s omitted)

Coupon	**7.000%**	**PO Value**	**$79,691**
Required Return	**9.000%**	**IO Value**	**$15,796**
Duration	**2.483 years**	**Total Value**	**$95,487**
Modified Duration	**2.278 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	82,192	$17,808	$7,000	$24,808
2	58,068	24,125	5,753	29,878
3	28,078	29,989	4,065	34,054
4	0	28,078	1,965	30,044
5	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Tranche B
(000s omitted)

Coupon	**7.250%**	**PO Value**	**$58,666**
Required Return	**9.250%**	**IO Value**	**$32,397**
Duration	**5.036 years**	**Total Value**	**$91,063**
Modified Duration	**4.610 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	100,000	$0	$7,250	$7,250
2	100,000	0	7,250	7,250
3	100,000	0	7,250	7,250
4	97,887	2,113	7,250	9,363
5	67,390	30,497	7,097	37,594
6	36,478	30,911	4,886	35,797
7	5,039	31,440	2,645	34,084
8	0	5,039	365	5,404
9	0	0	0	0
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Table 11

Tranche C
(000s omitted)

Coupon	**7.500%**	**PO Value**	**$43,563**
Required Return	**9.500%**	**IO Value**	**$44,556**
Duration	**6.777 years**	**Total Value**	**$88,119**
Modified Duration	**6.189 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	100,000	$0	$7,500	$7,500
2	100,000	0	7,500	7,500
3	100,000	0	7,500	7,500
4	100,000	0	7,500	7,500
5	100,000	0	7,500	7,500
6	100,000	0	7,500	7,500
7	100,000	0	7,500	7,500
8	72,950	27,050	7,500	34,550
9	40,085	32,865	5,471	38,336
10	6,309	33,776	3,006	36,782
11	0	6,309	473	6,782
12	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Table 12

Tranche Z
(000s omitted)

Coupon	**8.500%**	**PO Value**	**$37,760**
Required Return	**10.500%**	**IO Value**	**$36,870**
Duration	**15.851 years**	**Total Value**	**$74,630**
Modified Duration	**14.345 years**		

EOY	Amount Owed	Accrued Interest	Accum Accrued Int	Principal Payments	Interest Payments	Total Payments
0	$100,000					
1	108,500	$8,500	$8,500	$0	$0	$0
2	117,723	9,223	17,723	0	0	0
3	127,729	10,006	27,729	0	0	0
4	138,586	10,857	38,586	0	0	0
5	150,366	11,780	50,366	0	0	0
6	163,147	12,781	63,147	0	0	0
7	177,014	13,867	77,014	0	0	0
8	192,060	15,046	92,060	0	0	0
9	208,386	16,325	108,386	0	0	0
10	226,098	17,713	126,098	0	0	0
11	216,795	(9,303)	116,795	9,303	19,218	28,521
12	201,610	(15,185)	101,610	15,185	18,428	33,613
13	186,828	(14,782)	86,828	14,782	17,137	31,919
14	172,427	(14,401)	72,427	14,401	15,880	30,282
15	158,384	(14,043)	58,384	14,043	14,656	28,699
16	144,679	(13,705)	44,679	13,705	13,463	27,168
17	131,291	(13,388)	31,291	13,388	12,298	25,686
18	118,201	(13,090)	18,201	13,090	11,160	24,250
19	105,391	(12,811)	5,391	12,811	10,047	22,858
20	92,842	(12,549)	(7,158)	12,549	8,958	21,507
21	80,539	(12,303)	(19,461)	12,303	7,892	20,195
22	68,466	(12,073)	(31,534)	12,073	6,846	18,919
23	56,610	(11,856)	(43,390)	11,856	5,820	17,675
24	44,960	(11,650)	(55,040)	11,650	4,812	16,462
25	33,507	(11,453)	(66,493)	11,453	3,822	15,275
26	22,246	(11,261)	(77,754)	11,261	2,848	14,109
27	11,181	(11,065)	(88,819)	11,065	1,891	12,956
28	329	(10,852)	(99,671)	10,852	950	11,802
29	0	(329)	(100,000)	329	28	357
30	0	0	0	0	0	0

Table 13

Residual Equity Class
(000s omitted)

Prepayment = 66.667% of PSA
IRR to Residual Equity Class 8.662%

EOY	Total Cash Flow to Pool	Total Payments to A,B,C & Z Tranches	Residual Cash Flow to Equity
0			($20,000)
1	$42,908	$39,558	3,350
2	47,757	44,628	3,129
3	51,646	48,804	2,842
4	49,399	46,907	2,492
5	47,235	45,094	2,141
6	45,151	43,297	1,854
7	43,142	41,584	1,558
8	41,207	39,954	1,253
9	39,341	38,336	1,004
10	37,541	36,782	758
11	35,805	35,303	501
12	34,129	33,613	516
13	32,511	31,919	592
14	30,948	30,282	666
15	29,437	28,699	738
16	27,976	27,168	808
17	26,562	25,686	877
18	25,193	24,250	944
19	23,867	22,858	1,009
20	22,580	21,507	1,073
21	21,330	20,195	1,136
22	20,116	18,919	1,197
23	18,933	17,675	1,258
24	17,779	16,462	1,317
25	16,650	15,275	1,375
26	15,541	14,109	1,432
27	14,445	12,956	1,489
28	13,346	11,802	1,544
29	12,213	357	11,856
30	10,522	0	10,522

Table 14

Interest Rates Rise by 2.0%; Principal Amortization Accelerated

Assumes Prepayment Rate of:	**66.667% of PSA**
Pool Amount	**$420,000**
Interest Rate	**8.000%**
Term	**30 Years**
Overcollateralization	**$20,000**

Tranche A	**Required Return**	**9.000%**
	Coupon	**7.000%**
	Amount	**$100,000**
Tranche B	**Required Return**	**9.250%**
	Coupon	**7.250%**
	Amount	**$100,000**
Tranche C	**Required Return**	**9.500%**
	Coupon	**7.500%**
	Amount	**$100,000**
Tranche Z	**Required Return**	**10.500%**
	Coupon	**8.500%**
	Amount	**$100,000**

Table 15

Summary Cash Flow Information
(000s omitted)

EOY	Pool Amount	Prin & Int Payments	Principal Prepmts	Total Amort	Interest	Amt Owed CMO Holders	Total Avail for Dist
0	$420,000					$400,000	
1	403,447	$44,553	$5,600	$10,953	$33,600	383,447	$50,153
2	381,905	43,059	10,759	10,783	32,276	361,905	53,818
3	356,145	41,036	15,276	10,484	30,552	336,145	56,312
4	331,835	38,555	14,246	10,064	28,492	311,835	52,801
5	308,886	36,223	13,273	9,676	26,547	288,886	49,496
6	287,212	34,029	12,355	9,318	24,711	267,212	46,385
7	266,734	31,967	11,488	8,990	22,977	246,734	43,455
8	247,376	30,027	10,669	8,688	21,339	227,376	40,696
9	229,069	28,202	9,895	8,412	19,790	209,069	38,097
10	211,746	26,486	9,163	8,160	18,326	191,746	35,649
11	195,344	24,872	8,470	7,932	16,940	175,344	33,341
12	179,805	23,353	7,814	7,725	15,628	159,805	31,167
13	165,074	21,924	7,192	7,539	14,384	145,074	29,116
14	151,098	20,579	6,603	7,373	13,206	131,098	27,182
15	137,829	19,313	6,044	7,225	12,088	117,829	25,357
16	125,221	18,121	5,513	7,095	11,026	105,221	23,634
17	113,232	16,998	5,009	6,981	10,018	93,232	22,007
18	101,821	15,941	4,529	6,882	9,059	81,821	20,470
19	90,950	14,944	4,073	6,798	8,146	70,950	19,016
20	80,585	14,003	3,638	6,727	7,276	60,585	17,641
21	70,693	13,115	3,223	6,668	6,447	50,693	16,338
22	61,246	12,275	2,828	6,620	5,655	41,246	15,103
23	52,216	11,480	2,450	6,581	4,900	32,216	13,930
24	43,579	10,725	2,089	6,548	4,177	23,579	12,814
25	35,316	10,006	1,743	6,520	3,486	15,316	11,749
26	27,412	9,316	1,413	6,491	2,825	7,412	10,729
27	19,861	8,648	1,096	6,455	2,193	0	9,744
28	12,669	7,986	794	6,398	1,589	0	8,781
29	5,876	7,300	507	6,286	1,014	0	7,807
30	0	6,346	0	5,876	470	0	6,346

Table 16

Tranche A
(000s omitted)

Coupon	**7.000%**	**PO Value**	**$82,459**
Required Return	**9.000%**	**IO Value**	**$13,643**
Duration	**2.139 years**	**Total Value**	**$96,102**
Modified Duration	**1.962 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	74,947	$25,053	$7,000	$32,053
2	44,182	30,764	5,246	36,011
3	8,416	35,766	3,093	38,859
4	0	8,416	589	9,005
5	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Tranche B
(000s omitted)

Coupon	**7.250%**	**PO Value**	**$63,545**
Required Return	**9.250%**	**IO Value**	**$28,573**
Duration	**4.423 years**	**Total Value**	**$92,128**
Modified Duration	**4.049 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	100,000	$0	$7,250	$7,250
2	100,000	0	7,250	7,250
3	100,000	0	7,250	7,250
4	73,249	26,751	7,250	34,001
5	38,520	34,729	5,311	40,040
6	4,065	34,455	2,793	37,248
7	0	4,065	295	4,360
8	0	0	0	0
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Table 17

Tranche C
(000s omitted)

Coupon	**7.500%**	**PO Value**	**$48,266**
Required Return	**9.500%**	**IO Value**	**$40,843**
Duration	**6.195 years**	**Total Value**	**$89,109**
Modified Duration	**5.568 years**		

EOY	Amount Owed	Principal Allocation	Coupon Interest	Total Payments
0	$100,000			
1	100,000	$0	$7,500	$7,500
2	100,000	0	7,500	7,500
3	100,000	0	7,500	7,500
4	100,000	0	7,500	7,500
5	100,000	0	7,500	7,500
6	100,000	0	7,500	7,500
7	69,720	30,280	7,500	37,780
8	35,316	34,404	5,229	39,633
9	684	34,632	2,649	37,281
10	0	684	51	735
11	0	0	0	0
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
30	0	0	0	0

Table 18

Tranche Z
(000s omitted)

Coupon	**8.500%**	**PO Value**	**$42,141**
Required Return	**10.500%**	**IO Value**	**$34,567**
Duration	**14.361 years**	**Total Value**	**$76,708**
Modified Duration	**12.996 years**		

EOY	Amount Owed	Accrued Interest	Accum Accrued Int	Principal Payments	Interest Payments	Total Payments
0	$100,000					
1	108,500	$8,500	$8,500	$0	$0	$0
2	117,723	9,223	17,723	0	0	0
3	127,729	10,006	27,729	0	0	0
4	138,586	10,857	38,586	0	0	0
5	150,366	11,780	50,366	0	0	0
6	163,147	12,781	63,147	0	0	0
7	177,014	13,867	77,014	0	0	0
8	192,060	15,046	92,060	0	0	0
9	208,386	16,325	108,386	0	0	0
10	191,746	(16,639)	91,746	16,639	17,713	34,352
11	175,344	(16,402)	75,344	16,402	16,298	32,700
12	159,805	(15,539)	59,805	15,539	14,904	30,443
13	145,074	(14,731)	45,074	14,731	13,583	28,315
14	131,098	(13,976)	31,098	13,976	12,331	26,307
15	117,829	(13,269)	17,829	13,269	11,143	24,412
16	105,221	(12,608)	5,221	12,608	10,015	22,623
17	93,232	(11,989)	(6,768)	11,989	8,944	20,933
18	81,821	(11,411)	(18,179)	11,411	7,925	19,336
19	70,950	(10,871)	(29,050)	10,871	6,955	17,825
20	60,585	(10,365)	(39,415)	10,365	6,031	16,396
21	50,693	(9,891)	(49,307)	9,891	5,150	15,041
22	41,246	(9,448)	(58,754)	9,448	4,309	13,756
23	32,216	(9,030)	(67,784)	9,030	3,506	12,536
24	23,579	(8,637)	(76,421)	8,637	2,738	11,375
25	15,316	(8,263)	(84,684)	8,263	2,004	10,267
26	7,412	(7,904)	(92,588)	7,904	1,302	9,205
27	0	(7,412)	(100,000)	7,412	630	8,042
28	0	0	0	0	0	0
29	0	0	0	0	0	0
30	0	0	0	0	0	0

Table 19

Residual Equity Class
(000s omitted)

Prepayment = 66.667% of PSA
IRR to Residual Equity Class 8.488%

EOY	Total Cash Flow to Pool	Total Payments to A,B,C & Z Tranches	Residual Cash Flow to Equity
0			($20,000)
1	$50,153	$46,803	3,350
2	53,818	50,761	3,057
3	56,312	53,609	2,703
4	52,801	50,506	2,296
5	49,496	47,540	1,956
6	46,385	44,748	1,637
7	43,455	42,140	1,315
8	40,696	39,633	1,064
9	38,097	37,281	816
10	35,649	35,087	561
11	33,341	32,700	641
12	31,167	30,443	723
13	29,116	28,315	801
14	27,182	26,307	875
15	25,357	24,412	945
16	23,634	22,623	1,011
17	22,007	20,933	1,074
18	20,470	19,336	1,134
19	19,016	17,825	1,191
20	17,641	16,396	1,245
21	16,338	15,041	1,297
22	15,103	13,756	1,347
23	13,930	12,536	1,394
24	12,814	11,375	1,439
25	11,749	10,267	1,482
26	10,729	9,205	1,523
27	9,744	8,042	1,702
28	8,781	0	8,781
29	7,807	0	7,807
30	6,346	0	6,346

Table 20

Summary Statistics

Tranche		Scenario: Original	Scenario: Interest Rates Rise by 2% — FRM	Scenario: Interest Rates Rise by 2% — AAM
A	PO Value	$ 85,078	$ 79,691	$ 82,459
	IO Value	14,922	15,796	13,643
	Total Value	100,000	95,487	96,102
	Duration	2.281	2.483	2.139
	Modified Duration	2.132	2.278	1.962
B	PO Value	69,603	58,666	63,545
	IO Value	30,397	32,397	28,573
	Total Value	100,000	91,063	92,128
	Duration	4.497	5.036	4.423
	Modified Duration	4.193	4.610	4.049
C	PO Value	56,067	43,563	48,266
	IO Value	43,933	44,556	40,843
	Total Value	100,000	88,119	89,109
	Duration	6.297	6.777	6.195
	Modified Duration	5.858	6.189	5.568
Z	PO Value	49,405	37,760	42,141
	IO Value	50,595	36,870	34,567
	Total Value	100,000	74,630	76,708
	Duration	14.458	15.851	14.361
	Modified Duration	13.325	14.345	12.996

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