Bank of America

Hybrid ARM MBS: Valuation and Risk Measures

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- Hybrid ARMs have emerged as a popular investment alternative for investors who seek better extension protection and/or wider spreads than those offered by fixed-rate mortgages. Institutional investors participating in the Hybrid ARM MBS sector include banks, REITS, insurance companies, money managers and hedge funds.
- Prices of Agency hybrid ARMs are generally quoted in terms of Z-spread, which is a cash flow spread to the implied spot Treasury curve. The two exceptions to this quoting convention are 10/1 and seasoned hybrids ARMs. We present a detailed discussion on the different quotation systems used in the ARMs market.
- The subject of tail valuation in hybrids has received significant attention recently due to an unprecedented level of discount seasoned hybrids resetting in 2006 and 2007. We present a detailed discussion of several factors that impact tail valuations.
- The Z-spread, OAS to reset and Bond Equivalent Effective Margin (BEEM) measures have some significant limitations for the relative value analysis of ARMs. OAS to maturity is a much better relative value metric since it accounts for the fact that the tail is not worth par, cap structures have a non-zero value, and that prepayment speeds are not independent of rates.
- We provide a detailed discussion on the risk exposures of hybrid and fixed-rate MBS. Hybrid ARM MBS provide a better hedge against extension risk relative to fixed-rate products. In addition, short reset hybrids are a good hedge against housing slowdown.
- Unlike fixed rate pass-throughs that have a fixed coupon and a variable servicing fee, the vast majority of hybrid ARMs pay a weighted average coupon (WAC) to security holders and have a fixed servicing fee. The presence of a fixed servicing fee in hybrid pools has the effect of allowing their WACs to change over time depending upon how the individual loans within a pool pay down. An in-depth analysis of the factors that influence WAC drift and the implications from the valuation standpoint are presented in this primer.

I. INTRODUCTION

Hybrid ARMs have emerged as a popular investment alternative for investors who seek better extension protection and/or wider spreads than those offered by fixed-rate mortgages. A wide range of choices in selecting the length of the initial reset period in hybrids allows investors to tailor their investments according to their duration preferences. Furthermore, as discussed in our earlier publication on hybrid ARMs,[1] because of the shorter tenure horizons of the underlying borrowers in hybrid ARM pools, hybrid ARM MBSs possess better convexity characteristics than fixed-rate MBSs. Consequently, hybrid ARMs not only provide excellent extension protection when rates backup, they also provide better prepayment protection than fixed-rate MBSs in a heavy refinancing environment. Recently, Lehman Brothers announced their intention to include more than $300 billion Agency Hybrid ARMs in their U.S. Aggregate index starting April of next year. This is expected to deepen the participation of institutional investors in the ARMs market even further.

In view of the growing popularity of hybrid ARMs, this primer details some of the nuances in Hybrid ARM MBS valuations, analyzes the risk profiles of ARMs, and provides some perspective on relative value issues. First, we define and discuss the standard quoting convention for hybrids and address some of the issues with using nominal spreads to gauge relative value in hybrids. This section also includes a brief discussion on why OAS is a superior relative value tool and presents an example to demonstrate how nominal spreads can give quite different (and often wrong) relative value signals than OAS.

In the next section, we review the fundamentals of tail valuation in hybrids. To simplify the discussion on tail valuation, we break down the problem into two parts by first considering tail valuation of hypothetical securities without any caps and then focusing on the valuation of embedded caps.

The discussion then segues into an analysis of the risk exposures of hybrid ARMs in relation to fixed rate mortgage products. We highlight the key differences between hybrid ARMs and 15-year and 30-year fixed rate MBSs in terms of duration, convexity, curve and volatility exposures.

Next, we present an overview of hybrid ARM investors and their motivations for investing in the hybrid ARM sector. Wider spreads make hybrid ARMs appealing to a wide range of market participants. In addition, investors who are concerned about extension risk or a housing slowdown also prefer hybrids over fixed-rate MBS.

Our primer concludes with an Appendix, presenting a detailed discussion on the issue of WAC drift in hybrid ARMs. The presence of a fixed servicing fee in hybrid pools has the effect of allowing their WACs to change over time depending upon how the individual loans within a pool pay down. An in-depth analysis of the factors that influence WAC drift and its implications from the valuation standpoint is presented in this primer.

[1] Please see the primer titled *Prepayments on Agency Hybrid ARM MBS* published on November 13, 2006.

II. PRICING CONVENTIONS

Agency hybrid ARMs are generally quoted in terms of a Z-spread, which is a cash flow spread to the implied spot Treasury curve. The two exceptions to this quoting convention are 10/1 hybrid ARMs which are quoted in terms of a price drop relative to dwarfs and highly seasoned hybrid ARMs which can be quoted in terms of bond equivalent effective margin (BEEM) relative to the underlying index.[2]

A typical quotation for a 5/1 hybrid ARM MBS is: "$25mm FNMA 5/1 5.50% 1yr LIB + 170 5/2/5 60 MTR[3] Oct Settle 99-29+ 70/Z". This means that $25 million current face of a 5.50% net coupon 5/1 hybrid ARM, resetting in 60 months to 1-year LIBOR + 170 bps, is offered for October settle at 99-29+ or 70/Z at 15% CPB. Similarly, a quote for a 10/1 hybrid might look like: "$25MM FNMA 10/1 5.75% 1yr CMT + 220 5/2/5 120 MTR Oct Settle 99-24$^{1/4}$ or 101/Z or 17 back of interpolated 15-yr". This means that $25million current face of a 5.75% net coupon 10/1 hybrid ARM, resetting in 120 months to 1-year CMT + 220 bps, is being offered for October settle at 99-24$^{1/4}$ or 101/Z at 15% CPB or 17/32's behind the price of an interpolated 15-year MBS with the same coupon rate.

Z-Spreads

The standard quoted Z-spread is calculated assuming that the underlying collateral will prepay at 15% CPR during the initial fixed-rate period of the security and that the borrowers will make a balloon payment of the remaining principal balance at the end of the fixed-rate period. The pricing convention that a hybrid pays off all its remaining outstanding balance at its first reset date is called the CPB assumption. In reality, not all hybrid borrowers prepay the remaining principal balance at the end of the fixed-rate period. Because of this, a hybrid security holder continues to receive a series of principal and interest cash flows after the first reset instead of receiving all the remaining principal back at the time of the first reset. From a valuation perspective, the CPB assumption implies that the value of the series of cash flows received after the first reset (called the "tail") is equal to the face value of the security at the time of the first reset (i.e., the tail is worth par).

Although the Z-spread is a commonly quoted number, investors need to be aware that it is not a good relative value tool because of the following reasons:

- The Z-spread is calculated assuming that the tail is worth par. In practice, not all Hybrid ARM borrowers prepay their mortgages before or at the reset date.
- The Z-spread is calculated at a 15% CPR prepayment speed regardless of the coupon or age or type (3/1; 5/1; 7/1; or 10/1) of the underlying security. Actual prepayment speeds on pools with different coupons or loan sizes can be substantially different from 15% CPR.
- The Z-spread does not capture the value of different cap structures. The Z-spread values a 2/2/5 cap the same as a 5/2/5 cap or a 2/2/6 cap.
- Z-spreads are not good relative value indicators because they change with the level of interest rates and volatility. Note that Z-spread calculations use a 15% CPB assumption while actual prepay speeds change with the level of interest rates.

[2] Recently, dealers have started quoting Agency 10/1 hybrids on a Z-spread basis to allow for more consistent pricing.
[3] Months-to-Roll.

Similarly, prepayment and cap risks involved in a hybrid ARM pool change when implied volatilities move. Consequently, the same Z-spread indicates different levels of risk premium at different rate and volatility levels.

Bond Equivalent Effective Margin (BEEM)

The BEEM is defined as the difference between the bond-equivalent yield on a hybrid security and a constant value of its underlying index.[4] Unlike Z-spread calculations which are based on a prepayment assumption of 15% CPB, BEEM calculations assume a constant prepayment speed of 15% CPR for life. Hence, depending upon the value of fixed coupon of a hybrid security in relation to the spot value of the underlying index and its periodic/life caps, its tail could be worth above or below par.

Prices of highly seasoned hybrids are generally quoted using BEEM rather than Z-spreads. The reason is that a significant portion of the value in a highly seasoned hybrid pool comes from the tail. Because the Z-spread pricing always assigns par value to tail, highly seasoned bonds look unattractive in Z-spread terms. For example, FNMA 3/1 4.00% 1yr LIB+170 2/2/6 6 MTR Oct Settle 100-00+ bond would be quoted at -174/Z in Z-spread terms. On the other hand, the bond would be quoted as 115 BEEM at 15% CPR, which means that the bond-equivalent yield on the bond is 115 bps higher than the assumed value of 1-yr LIBOR.

Like the Z-spread, BEEM is also a poor relative value tool due to its unrealistic constant prepayment assumption for seasoned hybrids. However, it is quite popular among investors who use it to stress test the tail value under very fast prepayment assumptions. For example, investors use BEEM calculations to find out at what prepayment speed level a seasoned hybrid will yield zero spread over its underlying index or some other benchmark. Although BEEM represents a significant improvement over Z-spreads if used with some realistic prepayment assumptions, it is still a static measure and fails to capture the cost associated with the prepayment option and the caps.

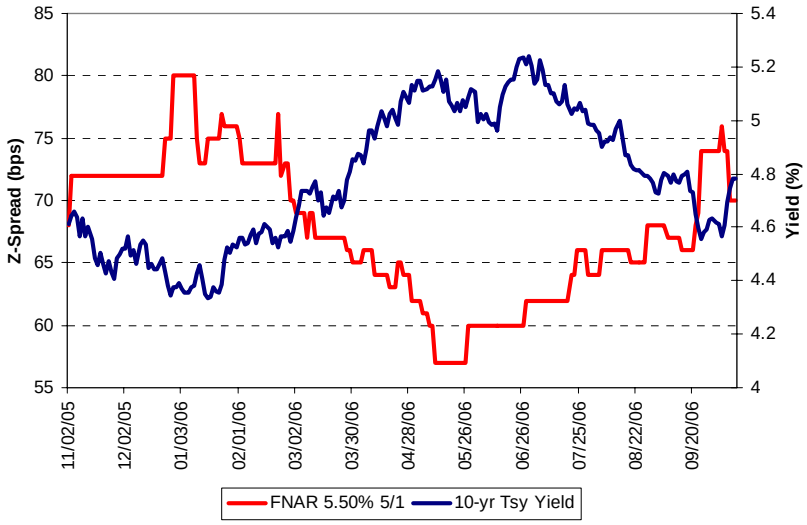
Option Adjusted Spreads (OAS)

Both the Z-spread and BEEM have some significant limitations for relative value analysis for the reasons mentioned above. A pricing measure that could account for the fact that the tail is not worth par, cap structures have a non-zero value, and that actual prepayment speeds could be different from 15% CPR would be a lot better relative value tool. The option adjusted spread (OAS) can account for these features.

Note that the Z-spread can give quite different (and often misleading) relative value signals compared to the OAS because of the former's dependency on the level of rates and volatility. For example, consider the strong directionality between Z-spreads on 5.50% 5/1 hybrid security and the level of rates in (Figure 1). On the other hand LOAS of the same 5/1 hybrid coupon bears no correlation with the level of rates (Figure 2).

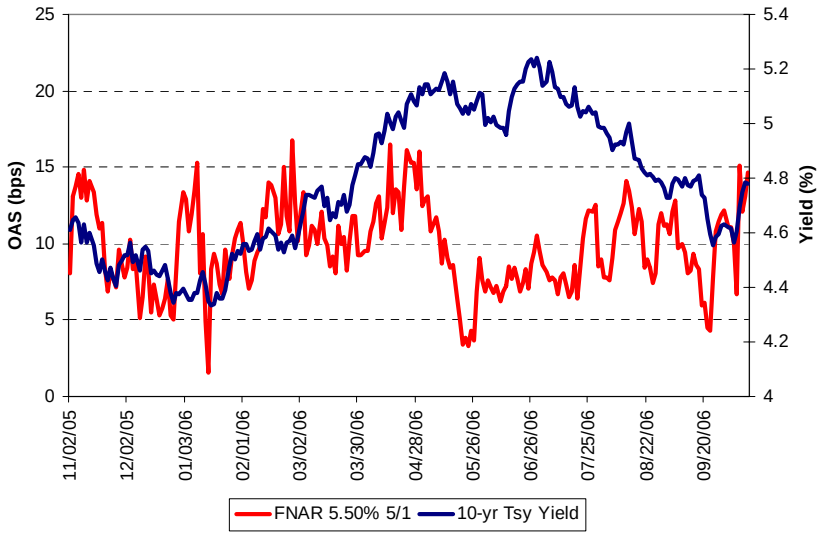
[4] Bond-equivalent yield on a pass-through security is computed so that it is comparable to a yield computed on a coupon security paying semi-annual interest, calculated to the settlement date.

Figure 1: Z-Spreads of Benchmark 5/1 Hybrid ARM Security vs. Level of Rates



Source: Banc of America Securities

Figure 2: OAS of Benchmark 5/1 Hybrid ARM Security vs. Level of Rates



Source: Banc of America Securities

Recent Valuations of Hybrid ARMs under Different Metrics

As discussed above, standard relative value metrics used in the market for hybrid valuations include Z-spread; BEEM; OAS to reset; and OAS to maturity. OAS to reset and BEEM are especially very popular amongst investors for gauging relative value in seasoned hybrids. Figure 3 compares relative value between different hybrids based on these relative value metrics.

From the figure we see that seasoned hybrids trade through new hybrids in terms of Z-spread. This however, does not reflect any relative value opportunity. The tighter spread on the seasoned hybrid merely reflects the fact that a higher percentage of its value is coming from its tail, which the Z-spread fails to capture due to its construction. The Z-spread is based on 15% CPR to balloon date and hence, completely overlooks the tail contribution.

Figure 3 also shows the BEEM for the selected bonds based on a 15% CPR for life as well as prepayment projections from our model. Notice how significantly the BEEM declines as we use a more realistic prepayment vector in place of 15% CPR for life. From a relative value perspective, the inability of BEEM to account for the option cost results in securities with lower option cost appearing rich relative to those with higher option cost (all else being equal). For example, the 5.5% seasoned 5/1 hybrid ARM (36 MTR) with a 5/2/5 cap structure looks a few bps tighter than the corresponding bond with a 2/2/5 cap structure in terms of BEEM.

Finally, OAS to reset has similar limitations as the Z-spread since it ignores the contribution of the tail. The seasoned 5/1 hybrid ARMs (36 MTR) with a 5/2/5 cap have a tighter OAS to reset than the corresponding 5/1s with a 2/2/5 cap across the three coupons, even though all of them have same OAS to maturity. This occurs as a result of the higher tail valuation for the former group due to a favorable cap structure. In this case, the tighter OAS to reset on the 5/1 ARMs with a 5/2/5 cap structure does not imply richer valuations; it simply reflects the limitation of OAS to reset in reflecting the higher tail value on the 5/2/5 cap.

Similarly, the 5.5% seasoned 5/1 hybrid ARM (36 MTR) has a tighter OAS to reset than the newly issued 3/1 hybrid ARM in spite of having a wider OAS to maturity. Again, the tighter OAS to reset compensates for the higher tail valuations on the 5/1s and is not an indicator of richer valuations. A more fundamental question while analyzing the tail valuations of these securities is the reason behind the higher tail value on the 5/1s. Even though both securities have 36 months-to-roll, they have a different prepayment profile. Seasoned 5/1s will initially prepay faster than the new 3/1s; however, as the 3/1s season, their prepayment speeds will be faster than the 5/1s resulting in a smaller factor at reset. The combination of higher baseline speeds and the smaller factor at reset on 3/1s reduces its tail value when compared to seasoned 5/1s. This difference in the tail value between the 3/1s and the seasoned 5/1s fades from 4 ticks on the 5.5% coupon to 2 ticks on the 4.5% coupon. The reduction in tail value difference as we move down from the 5.5% coupon to the 4.5% coupon occurs because the likelihood of the 3/1 and seasoned 5/1 ARMs hitting their cap increases (since they both have a 2% initial cap). Both these securities may become a discount if their rates hit the cap and because the factor on the 5/1 ARM is more than that on the 3/1, it hurts the 5/1 tail valuations more. The likelihood of hitting the cap reduces if the cap structure changes to a 5/2/5 cap. This is why the 5/1 ARM with the 5/2/5 cap structure has a fairly stable tail value across different coupons.

To summarize, a tighter OAS to reset does reflect a *higher* tail valuation but not necessarily a *richer* tail valuation. OAS to maturity is a more comprehensive measure of relative value and we recommend using it over Z-spread, BEEM and OAS to reset - all of which fail to fully capture the tail value in a hybrid ARM.

Figure 3: Hybrid Tail Valuations
As of 10/12/06 close for 10/23/06 settle

Hybrid	Coupon	Caps	MTR	Z-Spread	BEEM (15% CPR)	BEEM (BOA 6.0)	Price	Price to Reset	OAS to Maturity	OAS to Reset	Tail Value (ticks)	Tail Value (bps)
5/1	5.5%	5/2/5	60	71	60	25	99-28+	99-16	15	0	12+	15
5/1	5.5%	5/2/5	36	47	80	27	100-08+	99-17+	25	-17	23	42
5/1	5.5%	2/2/5	36	50	82	30	100-06	99-17+	25	-12	20+	37
3/1	5.5%	2/2/6	36	52	84	24	100-05	99-20+	22	-6	16+	28

Hybrid	Coupon	Caps	MTR	Z-Spread	BEEM (15% CPR)	BEEM (BOA 6.0)	Price	Price to Reset	OAS to Maturity	OAS to Reset	Tail Value (ticks)	Tail Value (bps)
5/1	5.0%	5/2/5	60	63.4	55	20	98-20+	98-06	15	-1	14+	16
5/1	5.0%	5/2/5	36	35.9	75	24	99-14	98-21+	25	-16	24+	41
5/1	5.0%	2/2/5	36	42.6	77	29	99-09+	98-21+	25	-9	20	34
3/1	5.0%	2/2/6	36	42.5	78	20	99-09	98-23+	20	-9	17+	29

Hybrid	Coupon	Caps	MTR	Z-Spread	BEEM (15% CPR)	BEEM (BOA 6.0)	Price	Price to Reset	OAS to Maturity	OAS to Reset	Tail Value (ticks)	Tail Value (bps)
5/1	4.5%	5/2/5	60	62	54	15	97-07	96-23+	14	-3	15+	17
5/1	4.5%	5/2/5	36	31	72	21	98-15+	97-22	25	-16	25+	41
5/1	4.5%	2/2/5	36	44	72	26	98-08	97-22	25	-4	18	29
3/1	4.5%	2/2/6	36	44	73	18	98-07	97-23	20	-5	16	25

Note: Tail value (ticks) refers to the above par value of the tail at the time of reset discounted back to the time of purchase of the security. It is computed by pricing the hybrid at constant OAS to maturity and to reset and then taking the difference in the two prices. Tail value (bps) is the difference between OAS to maturity and OAS to reset. More on this follows in the next section.
Source: Banc of America Securities

III. TAIL VALUATION

The subject of tail valuation in hybrids has received significant attention recently. This has happened primarily due to an unprecedented level of discount seasoned hybrids resetting in 2006. With the recent prepayment data showing higher than 20% factors at reset on seasoned 3/1 hybrids, investors have been forced to take a hard look at hybrid tails. Currently, market participants are not only trying to explore relative value opportunities between seasoned and new origination pools, but are also evaluating relative value between different cap structures and coupons. In this section, we review the fundamentals of tail valuation in hybrids and highlight some of the common pitfalls that investors need to be aware of from a relative value standpoint.

Tail Valuation without Caps

To get some insight into the value of the tail, consider the following two securities: 1) a hybrid security indexed off 1-year LIBOR with zero net margin; and 2) a hybrid security indexed off 1-year LIBOR with 170 bps net margin. Let us also assume that there are no caps or floors and that prepayment speeds are identical on both the hybrid securities. The only difference between these two securities comes from the additional 170 bps interest that the holder of the second security receives during the floating rate period of the hybrid security.

If the appropriate discount rate for the cash flows of these two securities is equal to the 1-year LIBOR rate, the tail of the first security should be worth par on the first reset date as well as on every annual reset date (ignoring small deviations resulting from payment delays), since it represents a pure floater. The owner of the second security, in addition to receiving all the cash flows received by the owner of the first security, receives 170 bps of interest during the floating rate period. Conceptually, this is equivalent to the second security owner holding the first security and an IO strip with a coupon payment of 170 bps. The notional principal of the IO strip will be equal to the remaining principal balance of the security at the time of the first reset. In this example, the incremental value of the tail above par at first reset is simply equal to the value of this IO strip.

A number of factors influence the present value of this IO strip when an investor is considering buying a hybrid security.

- First, the outstanding principal balance at the first reset and how it reduces over the remaining life of the underlying mortgage through scheduled and unscheduled principal payments will naturally influence the total cash flows due to this IO strip. All else being equal, the higher the outstanding balance at the first reset and the slower subsequent prepayment speeds, the higher will be the value of the IO strip.
- Second, the size of the net margin is obviously important. All else equal, the higher the net margin, the higher the total cash flows due to the IO strip. However, the tail value generally increases by less than what one would expect for a given increase in the net margin because a higher margin usually leads to faster prepayments on the collateral.
- Third, although we ignored caps and floors in this simplified example, they will impact the value of the IO strip in actual hybrid securities because caps and floors can effectively alter the cash flows due to the IO strip.

So far, we have considered the value of the IO strip at first reset. i.e., how far above par is

the tail worth at the time of first reset? Now, let us consider the value of all the tail cash flows at the time of buying a hybrid security. The tail cash flows on the hybrid security may be thought of as consisting of two components: a security paying back the remaining outstanding principal on the first reset date and a forward IO strip which starts generating cash flows after the first reset. Usually, market participants refer to the value of the IO strip discounted to the time of the purchase of a security as the "tail value".

The tail value, as defined above, usually decreases as the length of the first reset period increases. This is largely because of the lower remaining balances of longer hybrids at first reset. The discounting of tail cash flows over a longer period of time also reduces the value of the tail on longer hybrids relative to the value of the tail on comparable short hybrid products. Thus, 3/1s usually have higher tail values than 5/1s and 7/1s, and 5/1s have higher tail values than 7/1s.

Figure 4 shows our estimates of the value of the tail of several hybrid securities. Note that the "tail value" here simply means the above par value of the tail at first reset discounted to the time of purchase of the security. It can be estimated using either of the following two approaches: a) the difference between the OAS computed with and without the balloon payment assumption at first reset; or, b) the difference between the constant OAS prices of a hybrid security with and without the balloon payment assumption at first reset. In the first approach, the dollar price of the security is kept constant and two OAS values referred to as "OAS to reset" and "OAS to maturity" are calculated. The "OAS to reset" is calculated using model determined prepay vectors for the time until the first reset followed by a balloon payment at the first reset. The "OAS to maturity" is calculated using model projections of prepayment speeds until final maturity of the security. The tail value can then be obtained by taking the difference between the "OAS to maturity" and the "OAS to reset". In the second approach, the "OAS to maturity" of a hybrid security is calculated first at market price of the security and then the price of the security is recalculated at the same OAS, but assuming that the remaining outstanding balance will be prepaid at first reset ("Price to reset"). The difference between the market price and the price to reset represents the "tail value".

Figure 4: Tail Value of Selected Hybrid ARM Securities
As of 10/12/06 close for 10/23/06 settle

Hybrid	Coupon	OAS to Maturity (bps)	OAS to Reset (bps)	Tail Value (bps)	Tail Value (ticks)
3/1	5.25	18	-12	30	18+
	5.50	20	-10	30	18
	5.75	21	-10	31	17+
	6.00	21	-10	31	17+
5/1	5.25	14	-3	17	14+
	5.50	15	-2	17	13+
	5.75	16	1	15	12+
	6.00	18	4	14	11
7/1	5.25	13	3	10	11+
	5.50	15	5	10	10
	5.75	18	9	9	8+
	6.00	19	11	8	7+

Source: Banc of America Securities

Valuation of Embedded Caps in Hybrid ARMs

An important component of tail valuations involves valuing the caps embedded in the floating leg of a hybrid security. There are three types of caps in hybrids: the first reset cap, the periodic cap and the life-time cap. These caps not only determine the magnitude of the cash flows received by investors during the tail or the floating leg of the hybrid, but also add some duration to the underlying hybrid security.

Several factors work together in determining the value of the caps. They include: 1) outstanding balance of the hybrid security during the period when caps are effective; 2) implied volatility levels; 3) level of interest rates and the shape of the yield curve; 4) length of the fixed-leg of the security; and, 5) the actual cap structure.

The value of the caps embedded in a hybrid security clearly depends on the outstanding balance of the underlying security when caps are hit. To understand why, let us consider a 0 WALA, 5/1 hybrid security issued today. Over the fixed-rate period of 5-years, the face value of the hybrid security decreases because of both the scheduled and unscheduled amortizations of underlying mortgages. Because caps are applicable on the outstanding balance of principal at any point of time, the value of caps declines when the outstanding balance of the security decreases. The faster amortization schedule of higher coupon securities implies that caps on these securities should usually have less value than those on lower coupon securities

The value of caps can also change based on the implied volatility levels in the market even when outstanding balance of the underlying security remains the same. For instance, a first reset cap on a 5/1 hybrid is nothing but a payer swaption on a 1-year rate with an option expiration of 5 years. As discussed above, the notional value of the swaption depends on the scheduled and unscheduled principal payments. The mortgage holder (borrower) has effectively purchased this payer swaption, while the investor in hybrids is short this swaption. Naturally, the value of this swaption is higher when volatility is higher. Thus, all else equal, the value of embedded caps increases with a rise in implied volatilities in the market.

The first reset cap is set based on the interest rates at the time of origination. If rates rise after hybrid loans are originated, caps will be more in-the-money. In addition, prepayments are likely to decline with the rise in rates, which results in higher principal balances at reset dates. Both of these effects boost the value of embedded caps. On the other hand, when rates decline, caps will be less in-the-money and prepayment speeds rise resulting in lower principal balances at reset dates, which together decrease the value of embedded caps. The steepness of the curve also impacts the value of caps. When the curve is steep, the implied 1-year forward rates at different reset dates will be higher which indicates that there is a higher probability that caps will be in-the-money.

The length of the fixed-leg of the hybrid also impacts the value of a cap because of the complex relationship between prepayments over the fixed-leg, implied 1-year forward rates at reset dates and the time value of the embedded cap. Hybrids are likely to have less outstanding balance with a longer fixed-rate leg, which decreases the value of embedded caps. On the other hand, embedded caps are similar to swaptions with different maturities and expirations as discussed above. As the length of the fixed-rate leg of the hybrid increases, the time to expiration of options implied by the embedded caps lengthens which

increases the value of embedded caps. Similarly, implied 1-year forward rates at the time of reset also change when length of the fixed-rate leg changes, which in turn has an impact on the value of embedded caps.

Finally, the actual cap structure itself affects the value of a cap. Clearly, a 2/2/5 cap will have higher value than that of a 5/2/5 cap on the same collateral. In other words, a security with a 2/2/5 cap will be worth less than a security with a 5/2/5 cap. Note also that the difference between the values of the two cap structures keeps changing as interest rates move. Figure 5 shows our model based pay up for different coupon 5/1 hybrids with a 5/2/5 cap structure vs. their 2/2/5 counterparts. Note that the pay up for higher initial cap decreases as the coupon increases.

Figure 5: Impact of Cap Structure on the Hybrid Value
As of 10/12/06 close for 10/23/06 settle

Hybrid	Coupon	OAS to Maturity (bps)	5/2/5 vs. 2/2/5 Tail (ticks)
5/1	5.25	14	5
	5.50	15	4
	5.75	16	3
	6.00	18	2

Source: Banc of America Securities

IV. RISK EXPOSURES OF HYBRID ARMs

Figures 6 and 7 show different risk characteristics of hybrid and fixed-rate MBS products. There are some substantial differences between the risk exposures of hybrid and fixed-rate products as noted below.

1. **Effective Duration:** Effective duration is a measure of the price sensitivity of a security to interest rate changes. For the same coupon rate, the effective duration of hybrid securities increases with time to reset and hybrids usually have less duration than that of 15-year and 30-year securities. The effective duration of 3/1s is about 2 years and relative value players frequently compare their valuations with the valuations of 2-year agency debentures and 2-year AAA bonds backed by credit cards, CMBS and home equity loans. 5/1 hybrids have effective durations that are comparable to the effective durations of short PACs and premium 15-year pass-throughs. 7/1 and 10/1 hybrids have effective durations that are similar to the effective durations of equal coupon 15-year pass-throughs.

2. **Negative Convexity:** For the same coupon, short to medium reset hybrids have much better convexity characteristics than 15-year and 30-year fixed-rate mortgages (i.e., hybrids are less negatively convex than 15-year and 30-year pass-throughs). This is a direct consequence of the prepayment behavior of hybrid securities. Prepayment speeds on hybrids are much faster than those of fixed-rate products in a discount environment. However, peak prepayment speeds of hybrids are slower than prepayments on fixed-rate mortgages in a heavy refinancing environment. Thus, hybrids provide both extension and refinancing risk protection, which is reflected in their lower negative convexity. The lower negative convexity of hybrids also results in their lower option costs (equal to the difference between ZVOAS and OAS) relative to the option cost of fixed rate mortgages. The negative convexity of hybrids is also improved by the absence of an active forward market in hybrid ARMs, which makes hybrid mortgage rates stickier than those on fixed rate mortgages.

3. **Exposure to the Curve Shape:** An important risk factor embedded in investing in hybrids over fixed-rate products is the relative impact of curve shape on these products. Figure 7 shows the key rate partial durations with respect to swap rates for selected hybrids and fixed rate MBS. The bracketed terms are the normalized partial durations (partial duration/effective duration) and indicate the relative percentage contribution of each key rate to the overall price change. A few salient observations from this figure are as follows:

   - Hybrids are generally more price sensitive to the shorter end of the yield curve than are fixed rate MBS.
   - While 3/1s have more exposure to the 2-year rate, 5/1s and 7/1s are more sensitive to the 5-year rate.
   - Usually, higher coupons have more exposure than lower coupons to the short end of the yield curve.

   Since hybrids have more exposure to the shorter end of the curve, in a bear-flattening scenario, all else equal, their prices are hurt more relative to equal duration 15-year securities. On the other hand, in a bull-steepener scenario (where

the short term rates decline more than the long term rates), hybrids appreciate more in price relative to15-years.

4. **Volatility Exposure:** Figure 6 shows volatility durations of hybrids and fixed-rate products. The volatility duration shown here is defined as the change in the price of a security (in cents) per 1 bp change in the implied volatility of a representative swaption. The volatility exposure of hybrids is strongly dependent on the length of the initial reset period and usually increases with the length of the reset period. The volatility exposure of hybrids also differs from that of 15-year and 30-year fixed-rate products because they are exposed to different parts of the volatility surface. For instance, the volatility exposure of current coupon 30-year fixed-rate mortgages is frequently hedged using 3yr*7yr, 3yr*10yr or 5yr*10yr swaptions. The appropriate swaptions to use for hedging a hybrid security will have shorter expiration and maturities than the swaptions used for hedging fixed-rate mortgages. The presence of caps adds an additional complexity to hedging the volatility exposure of hybrids. For instance, a first reset cap on a 5/1 hybrid is nothing but a payer swaption on a 1-year rate with an option expiration of 5 years (i.e., 5yr*1yr swaption) as explained before.

Figure 6: Risk Measures for Hybrids and Fixed-rate MBS (10/12/06)

	Coupon	Price	OAS	ZVOAS	Option Cost	Effective Duration	Effective Convexity	Volatility Duration
3/1	5.00	99.34	18	32	14	1.9	-0.6	0.8
	5.50	100.23	20	34	14	1.6	-0.7	0.8
	6.00	101.04	21	34	13	1.3	-0.8	0.8
5/1	5.00	98.67	15	34	19	2.6	-0.9	1.5
	5.50	99.93	15	38	23	2.1	-1.2	1.5
	6.00	100.86	18	42	23	1.6	-1.2	1.4
7/1	5.00	97.86	13	38	25	3.3	-1.1	2.2
	5.50	99.39	15	47	33	2.7	-1.4	2.3
	6.00	100.55	19	55	36	2.1	-1.5	2.1
10/1	5.00	96.95	2	38	36	4.2	-1.3	3.3
	5.50	98.89	3	50	47	3.3	-1.8	3.4
	6.00	100.32	8	61	53	2.5	-2.0	3.0
15 Year	5.00	97.77	-16	17	33	3.6	-1.2	2.5
	5.50	99.53	-17	28	46	3.0	-1.7	2.9
	6.00	101.13	-15	39	54	2.2	-2.1	3.0
30 Year	5.00	95.47	-9	39	49	5.3	-1.4	3.9
	5.50	97.94	-11	50	62	4.3	-2.0	4.5
	6.00	100.00	-11	66	77	3.2	-2.5	4.5

Source: Banc of America Securities

Figure 7: Key Rate Partial Durations of Hybrids and Fixed-rate MBS (10/12/06)

	Coupon	Price	Partial Duration							
			2 Year		5 Year		10 Year		30 Year	
3/1	5.00	99.34	1.42	(74%)	0.61	(32%)	-0.04	-(2%)	-0.08	-(4%)
	5.50	100.23	1.42	(86%)	0.44	(27%)	-0.10	-(6%)	-0.11	-(7%)
	6.00	101.04	1.39	(101%)	0.29	(21%)	-0.16	-(11%)	-0.15	-(11%)
5/1	5.00	98.67	1.01	(38%)	1.73	(65%)	0.04	(2%)	-0.14	-(5%)
	5.50	99.93	1.09	(51%)	1.35	(63%)	-0.12	-(5%)	-0.20	-(9%)
	6.00	100.86	1.12	(68%)	0.99	(60%)	-0.24	-(15%)	-0.23	-(14%)
7/1	5.00	97.86	0.84	(25%)	1.85	(55%)	0.83	(25%)	-0.17	-(5%)
	5.50	99.39	0.97	(36%)	1.52	(56%)	0.45	(17%)	-0.23	-(9%)
	6.00	100.55	1.04	(50%)	1.15	(56%)	0.14	(7%)	-0.27	-(13%)
10/1	5.00	96.95	0.72	(17%)	1.34	(32%)	2.26	(54%)	-0.11	-(3%)
	5.50	98.89	0.88	(26%)	1.15	(34%)	1.52	(45%)	-0.20	-(6%)
	6.00	100.32	0.99	(39%)	0.91	(36%)	0.86	(34%)	-0.25	-(10%)
15 Year	4.50	95.91	0.64	(15%)	1.53	(37%)	1.87	(46%)	0.07	(2%)
	5.00	97.77	0.75	(20%)	1.41	(38%)	1.50	(41%)	0.02	(0%)
	5.50	99.53	0.87	(29%)	1.21	(40%)	0.99	(33%)	-0.07	-(2%)
	6.00	101.13	0.97	(43%)	1.01	(45%)	0.45	(20%)	-0.16	-(7%)
30 Year	5.00	95.47	0.56	(11%)	1.20	(23%)	2.57	(48%)	0.97	(18%)
	5.50	97.94	0.72	(17%)	1.12	(26%)	1.93	(44%)	0.59	(14%)
	6.00	100.00	0.90	(28%)	0.94	(29%)	1.18	(36%)	0.25	(8%)
	6.50	101.58	0.99	(52%)	0.65	(34%)	0.38	(20%)	-0.12	-(7%)

Source: Banc of America Securities

V. HYBRID ARM INVESTORS

Recently, the investor base in hybrids has expanded substantially because of the natural extension protection and wider spreads offered by hybrids relative to fixed-rate mortgage products. Hybrid ARM securities are a popular investment vehicle for banks, REITS, insurance companies, money managers and hedge funds. Figure 8 shows a list of typical investors in agency hybrid ARM sector for different reset hybrids along with the investors' rational to invest in these securities. Further, Hybrid ARMs are expected to gain more visibility among the index trackers after their inclusion in the Lehman Brothers' U.S. Aggregate Index in April 2007.

Figure 8: Buyers of Agency Hybrid ARMs

Hybrid ARM	Investor	Rationale
3/1	REITs	If they are whole pool but not exclusively. Provide good yield for a short duration asset. Many buy higher coupons w/less duration w/the thought that if the market sells off that dollar prices are more protected. Also, the profile of the borrower is more short term than other hybrids implying that market rates would have to move significantly in order for the borrower to change his financing horizon.
	Banks	Good short duration asset if it looks attractive vs. their funding.
	Money Managers	Will play if a good short duration alternative to CMOs and the like.
	Hedge Funds	
5/1	REITs	If they are whole pool but not exclusively. Provide good yield for a short duration asset. Many buy higher coupons w/less duration w/the thought that if the market sells off that dollar prices are more protected. Also, the profile of the borrower is more short term than other hybrids implying that market rates would have to move significantly in order for the borrower to change his financing horizon.
	Banks	Good short duration asset if it looks attractive vs. their funding.
	Money Managers	Will play if a good short duration alternative to CMOs and the like.
	Hedge Funds	
7/1	Banks	Good short duration asset if it looks attractive vs. their funding. Not all banks go out this far but there are some that do.
	Money Managers	
	Insurance Companies	
	Hedge Funds	

Hybrid ARMs for Extension Protection

Generally, investors with well-defined liabilities are very sensitive about managing the interest rate exposure of their assets. An important concern for these investors about fixed-rate mortgages is that they carry substantial extension and prepayment risks. Hybrid ARMs provide an excellent hedge against extension risk because the time horizon of hybrid borrowers is typically shorter than that of 30-year fixed-rate mortgage borrowers. In addition, empirical data show that prepayment speeds on hybrid pools pickup around the first reset providing natural extension protection. The pay-up for extension protection is usually cheaper in the hybrid market relative to that in the CMO market as well. Finally, hybrid ARMs also provide better prepayment protection in a heavy refinancing environment.

Figure 9 shows the effect of instantaneous rises in rates (holding the OAS constant) on the

effective duration and the weighted average life (WAL) of close to par-priced hybrid ARMs and 15-year pass-throughs. As expected, the effective durations of hybrids extend a lot less than those of 15-years. For example, for a 100 bps increase in the rates, the effective durations of 3/1 and 5/1 par coupon hybrids extend by 0.5 years and 0.9 years respectively, while a comparable 15-year pass-through extends by 1.2 years.

Figure 9: Effect on Instantaneous Rate Rises on Hybrids and 15-years (10/12/06)

		0 bps	+25 bps	+50 bps	+75 bps	+100 bps
FNAR 5.25% 3/1	WAL	2.71	2.80	2.88	2.96	3.04
(Price = 99-26+)	Eff. Dur	1.80	1.90	2.10	2.20	2.30
FNAR 5.50% 5/1	WAL	3.52	3.76	3.98	4.15	4.27
(Price = 99-29+)	Eff. Dur	2.10	2.40	2.70	2.90	3.00
FNAR 5.75% 7/1	WAL	4.04	4.52	4.89	5.17	5.35
(Price = 99-31)	Eff. Dur	2.40	2.80	3.10	3.40	3.60
FNCI 5.50%	WAL	5.49	5.75	5.89	5.96	6.11
(Price = 99-17)	Eff. Dur	3.00	3.40	3.80	4.00	4.20

Source: Banc of America Securities

In addition to providing extension protection in rates back up scenarios, short reset hybrids are a good hedge against housing slowdown which in turn can lead to slower turnover speeds. In Figure 10, we show the impact of 20% and 40% slower housing turnover relative to our model projections on the prices of some discount hybrids and 15-year fixed rate securities. To put things into perspective, a 20% and 40% drop in housing turnover relative to our model projections correspond to a slowdown of 1% - 1.2% and 2.1% - 2.4% respectively in long term prepayment speeds of 15-years; while, the corresponding numbers for hybrids range from 0.9% - 1.2% and 1.8% - 2.5% respectively.

If realized turnover speeds are 40% lower than our model turnover speeds, 15-year discounts will be worth 3+ to 11 ticks less (on an equal OAS basis). In contrast to fixed rate MBS, short reset hybrids actually appreciate in value at slower turnover speeds. For example, 4.5% to 5.0% 3/1 hybrids gain 4-5 ticks corresponding to a 40% drop from our model turnover speeds. The intuition behind this price gain is as follows. As in the case of fixed rate MBS, the impact of slower turnover speeds on hybrids is negative during their fixed rate period. However, slower prepayment speeds in the fixed rate period also lead to a larger pool factor at reset and also implies slower post reset speeds, both of which enhance the value of the hybrid tail. Overall, the impact of slower turnover speeds is positive for short reset hybrids. However, the positive impact of slower turnover speeds on a hybrid value fades as the length of initial reset increases. This is due to combined effect of longer fixed rate period and reduced tail contribution in longer reset hybrids.

Figure 10: Impact of Slower Turnover Speeds on Hybrids and 15-years

			Constant OAS Prices at Slower Turnover		Constant OAS Price Change	
MBS	OAS	Price	20% Less Turnover	40% Less Turnover	20% Less Turnover	40% Less Turnover
FNCI 4.5%	-16	95-29	95-23+	95-18	-0-5+	-0-11
FNCI 5.0%	-16	97-24+	97-21	97-17+	-0-3+	-0-7
FNCI 5.5%	-17	99-17	99-15+	99-13+	-0-1+	-0-3+
4.50% 3/1	18	98-09	98-11	98-13+	0-2	0-4+
4.75% 3/1	19	98-26	98-28	98-31	0-2	0-5
5.00% 3/1	18	99-11	99-13+	99-16+	0-2+	0-5+
4.75% 5/1	14	98-00	98-00	98-00+	0-0	0-0+
5.00% 5/1	15	98-21+	98-22	98-23	0-0+	0-1+
5.25% 5/1	14	99-11	99-12	99-13	0-1	0-2

Source: Banc of America Securities

Hybrid ARMs for Relative Value Players

From a relative value perspective, investors consider hybrids as an alternative to short agency debentures, premium 15-year MBS, short PACs and other AAA rated structured bonds (Figure 11). The effective duration of current coupon and premium 3/1s is less than 2 years and relative value players frequently compare the valuations of 3/1s with the valuations of 2-year agency debentures, short PACs and 2-year AAA rated structured bonds backed by credit cards, CMBS and home equity loans. The 5/1 hybrids have effective durations that are comparable to the effective durations of short PACs and premium 15-year pass-throughs, while 7/1 hybrids have effective durations that are similar to the effective durations of equal coupon 15-year pass-throughs.

Figure 11: Spreads of Hybrid ARMs and Alternative Investments

	Nominal Spread to Swaps (bps)	LOAS (bps)
FNAR 5.5% 3/1	42	24
2yr Agency Debenture	-18	-18
2yr Agency PAC (FHR 3098 KB)	9	-6
2yr AAA HEL	25	
2yr AAA Credit Cards	-9	
FNAR 5.5% 5/1	43	16
3yr Agency Debenture	-17	-17
3yr Agency PAC (FHR 3165 JA)	17	-4
FNCI 6.0	45	-13
FNAR 5.75% 7/1	58	19
FNCI 5.5	34	-15

Source: Banc of America Securities

In addition, more sophisticated investors also express views on tail valuations through trades involving seasoned vs. new origination and 5/2/5 vs. 2/2/5 cap structure. However, to a large extent, success of these trades depends upon the ability to accurately project outstanding factors at the reset and post reset speeds.

Finally, a large fraction of the ARM investor base invests in Agency as well as Non-Agency ARMs. These investors employ different tools including price drops, nominal spread pickup, and OAS pickup to gauge relative value between these two sectors.

APPENDIX A: COUPON DRIFT IN HYBRID ARMs

Unlike fixed rate agency pass-throughs that have a fixed coupon and variable servicing fee, a vast majority of hybrid ARMs pay a weighted average coupon (WAC) to security holders and have a fixed servicing fee. A fixed servicing fee in hybrid pools means that their WACs can change over time depending upon how the individual loans within a pool pay down. We first discuss the factors that influence WAC drift followed by an analysis of historical data. We conclude by discussing the implications of WAC drift from a valuation standpoint.

Drivers of WAC Drift

The direction of WAC drift over time is generally downwards. This is because loans with higher mortgage rates ("note rate") tend to prepay faster due to greater incentive to the underlying borrowers. All else being equal, higher WAC drift can be expected for pools with higher note rate dispersion.

The WAC drift of a pool is also affected by changes in the overall rate environment that the pool experiences as it seasons. For a given note rate dispersion, the WAC drift of a pool is highest when it stays close to par and can be expected to slow down when it becomes a deep discount or a deep premium.

Another factor that can affect WAC drift is the dispersion in loan age. For newly originated pools, the effect of loan age dispersion on WAC drift may be in either direction depending upon the interest rate environment at the time of creating a pool. For a given age dispersion, a pool created in a rising rate environment will have seasoned loans with lower note rates. These seasoned loans, despite having lower note rates, may prepay faster as they are further along the seasoning ramp and thus cause the WAC to drift upwards. In contrast, if a pool is created in a declining rate environment, it will have more seasoned loans with higher note rates causing the WAC to drift downwards. For pools close to reset, the drift could be in either direction depending upon whether the reset rates are higher or lower than the initial rates of the resetting loans.

Empirical Evidence on WAC Drift

WAC drift and its standard deviation at selected WALAs before reset are shown in Figure 12 for the entire population of FNMA and FHLMC 5/1 and 3/1 hybrid pools[5]. All summary statistics are computed as weighted averages. We can summarise our key conclusions from the data as follows:

- For both 3/1 and 5/1 pools, on average, WAC drift tends to be downwards and its magnitude increases with age[6]. The increase in the magnitude of downward drift with age is caused by an increase in cumulative prepayments.
- The standard deviation of WAC drift increases gradually with time. However, in the case of FNMA 5/1s, the standard deviation increases significantly at WALA 48 months.
- In general, FNMA 5/1s have higher weighted average WAC drift and standard deviation

[5] Note that we use gross WAC to carry out drift calculations. Since the servicing fee on the ARM pools is constant, there will be a one to one correspondence between the gross WAC drift and net WAC (coupon being passed to security holders) drift.

[6] Note that the populations across selected WALAs are overlapping but not identical. For example, all WALA 48 pools are part of WALA 36 and lower WALA populations but the converse is not true. Our conclusion does not change even when we compare the same pools across different WALAs.

than FHLMC 5/1s. However, FNMA/FHLMC differences are less pronounced in case of 3/1 hybrids.

The higher weighted average standard deviation of WAC drift at WALA 48 months in FNMA 5/1s relative to FHLMC 5/1s can be explained by relatively higher loan age dispersion in the former. Here we measure the weighted average loan age dispersion in a pool as the difference between the maximum and minimum loan age (see Figure 13). At WALA 48, FNMA 5/1s have a weighted average loan age dispersion of 16.3 months compared to 5.4 months for FHLMC. The higher loan age dispersion at WALA 48 means that some of the loans have already reset in the FNMA pools or are approaching reset (i.e., generally experiencing faster prepayments). Both these effects could cause the standard deviation of WAC drift to increase. However, loan age dispersion for newer 0agency production is actually very comparable between the two agencies.

Figure 12: WAC Drift in Agency Hybrids (Issue WAC – Current WAC)

FNMA 5/1s

WALA	Average WAC Drift (bps)	Std. Dev of WAC Drift (bps)
12	2	2.4
24	3	4.8
36	4	7.4
48	5	20.7

FHLMC 5/1s

WALA	Average WAC Drift (bps)	Std. Dev of WAC Drift (bps)
12	0	4.2
24	2	5.1
36	3	6.4
48	3	9.0

FNMA 3/1s

WALA	Average WAC Drift (bps)	Std. Dev of WAC Drift (bps)
6	1	1.9
12	2	3.7
18	3	5.0
24	4	8.4
30	4	12.2

FHLMC 3/1s

WALA	Average WAC Drift (bps)	Std. Dev of WAC Drift (bps)
6	0	4.1
12	1	5.3
18	2	6.4
24	2	7.4
30	3	9.4

Source: Banc of America Securities

Figure 13: Loan Age Dispersion in Agency Hybrids (months)

5/1 Hybrids

WALA	FNMA	FHLMC
12	4.0	1.9
24	6.9	2.0
36	10.3	2.4
48	16.3	5.4

3/1 Hybrids

WALA	FNMA	FHLMC
6	3.1	1.2
12	3.3	1.2
18	3.8	1.3
24	5.2	1.6
30	6.1	1.8

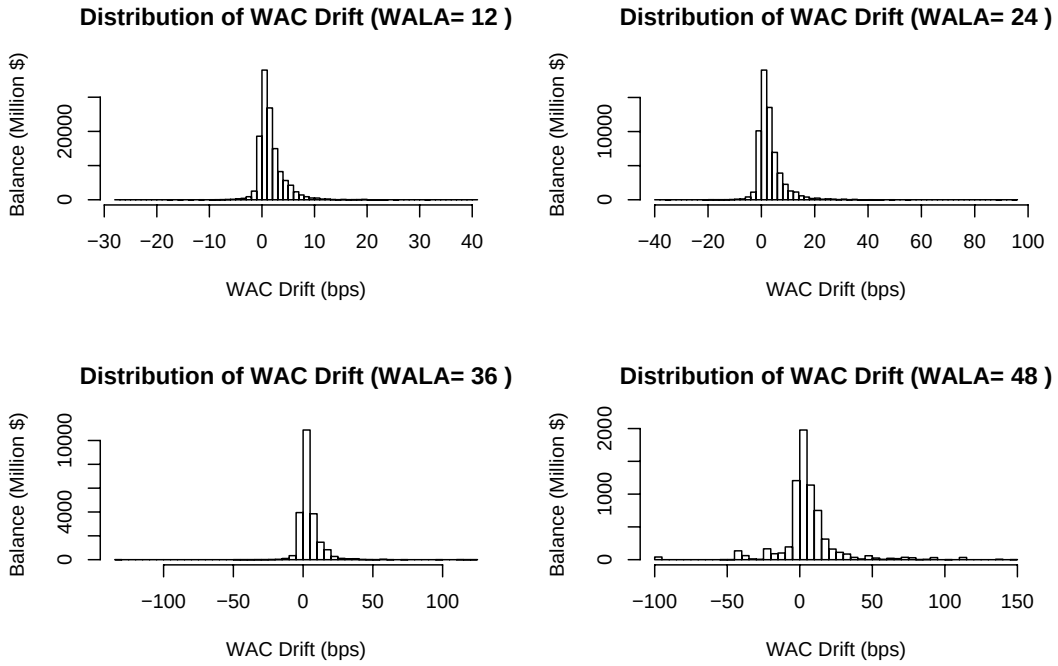
Source: Banc of America Securities

Another interesting observation regarding WAC drift can be seen in Figure 14, which shows that WAC drift distribution has a very high skew towards the right. This implies that it is more likely for the WAC to drift downwards than upwards.

To conclude, empirical data suggest that on an average WAC of hybrids decreases steadily with time by up to 4 bps to 5 bps over a three to four year period. While the average drift is quite small, the increasing standard deviation of the drift with time and the presence of right-

skewed WAC distributions in ARM pools imply that the risk of receiving lower payments than the payments indicated by initial coupon on individual pools can be significant. For instance, using the WAC drift data of FNMA 5/1s from Figure 12, if a hybrid pool is one standard deviation away from the mean value of WAC drift, its coupon will be lower by 4.4 bps; 7.8 bps; 11.4 bps and 25.7 bps at WALA 12; 24; 36; and 48 respectively from its initial value. Further, in a normal distribution the probability of being off from the mean by one standard deviation in one direction is approx. 16%. However, in this case due to a highly skewed distribution, this probability will be higher. We estimate the loss on the value of the pool to be 6.25 ticks if the coupon drifts in the above manner.

Figure 14: WAC Drift Distribution of FNMA 5/1 Hybrids at Selected WALAs



Source: Banc of America Securities

The Magic of Diversification

The potential risk of WAC drift implies that investors should expect some extra compensation for holding hybrids or other ARM products. However, the risk of WAC drift as highlighted above is an overstatement of the true risk. This is so because the risk of WAC drift is diversifiable and can be reduced significantly through increasing exposure to more number and/or larger sized pools. Hence, for large investors the risk is much lower than what the above analysis suggests. To illustrate this point, we repeat our calculations to estimate standard deviation of WAC drift at selected WALAs after grouping the same pools as used before into hypothetical mega pools of size $100MM[7]. We compare the new results with our original estimates of standard deviation in Figure 15. The diversification has reduced the standard deviation of WAC drift significantly across all selected WALAs. For example, at WALA 48,

[7] Creating mega pools reduced our sample sizes significantly across all selected WALAs. However, the reduced sample sizes were still large enough from a statistical standpoint. For example, in case of WALA 48 FNMA 5/1s, the sample size reduced from 2,441 to 69 when we grouped the pools to create $100 MM sized mega pools.

the standard deviation has reduced from 20.7 bps to 10.5 bps for FNMA pools. Similarly, for FHLMC pools the standard deviation has reduced from 9.0 bps to 3.1bps.

With these new risk measures if a hybrid pool is one standard deviation away from the mean value of WAC drift, its coupon will be lower by 3.3 bps; 5.5 bps; 6.5 bps and 15.7 bps at WALA 12; 24; 36; and 48 respectively from its initial value. In this case, we estimate the impact on the pool value to be approximately 4 ticks. If we consider a scenario in which coupon is lower from the mean by two standard deviations throughout, then the impact on the pool value is 6 ticks. Hence, a 4-6 ticks range represents an upper bound on the impact of WAC drift based on the empirical evidence. A couple of corollaries of the above result are as follows:

- The maximum pay-up for LA prefix hybrids (FNMA hybrids with a fixed coupon) should be 4-6 ticks.
- Since most models price hybrids based on a fixed coupon, they would overstate the price by 4-6 ticks. Assuming that the market prices in WAC drift by demanding wider spreads, we can attribute 5-7 bps of the OAS pickup that hybrids offer over fixed rates to this WAC drift.

Figure 15: Impact of Diversification on WAC Drift

FNMA 5/1s

WALA	Original Std. Dev (bps)	Std. Dev after Diversification (bps)
12	2.4	1.3
24	4.8	2.5
36	7.4	2.5
48	20.7	10.5

FHLMC 5/1s

WALA	Original Std. Dev (bps)	Std. Dev after Diversification (bps)
12	4.2	2.9
24	5.1	3.0
36	6.4	3.1
48	9.0	3.1

Source: Banc of America Securities

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