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Special Report

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A Primer on The Convexity Trade: What Is It, Who Does It and Why

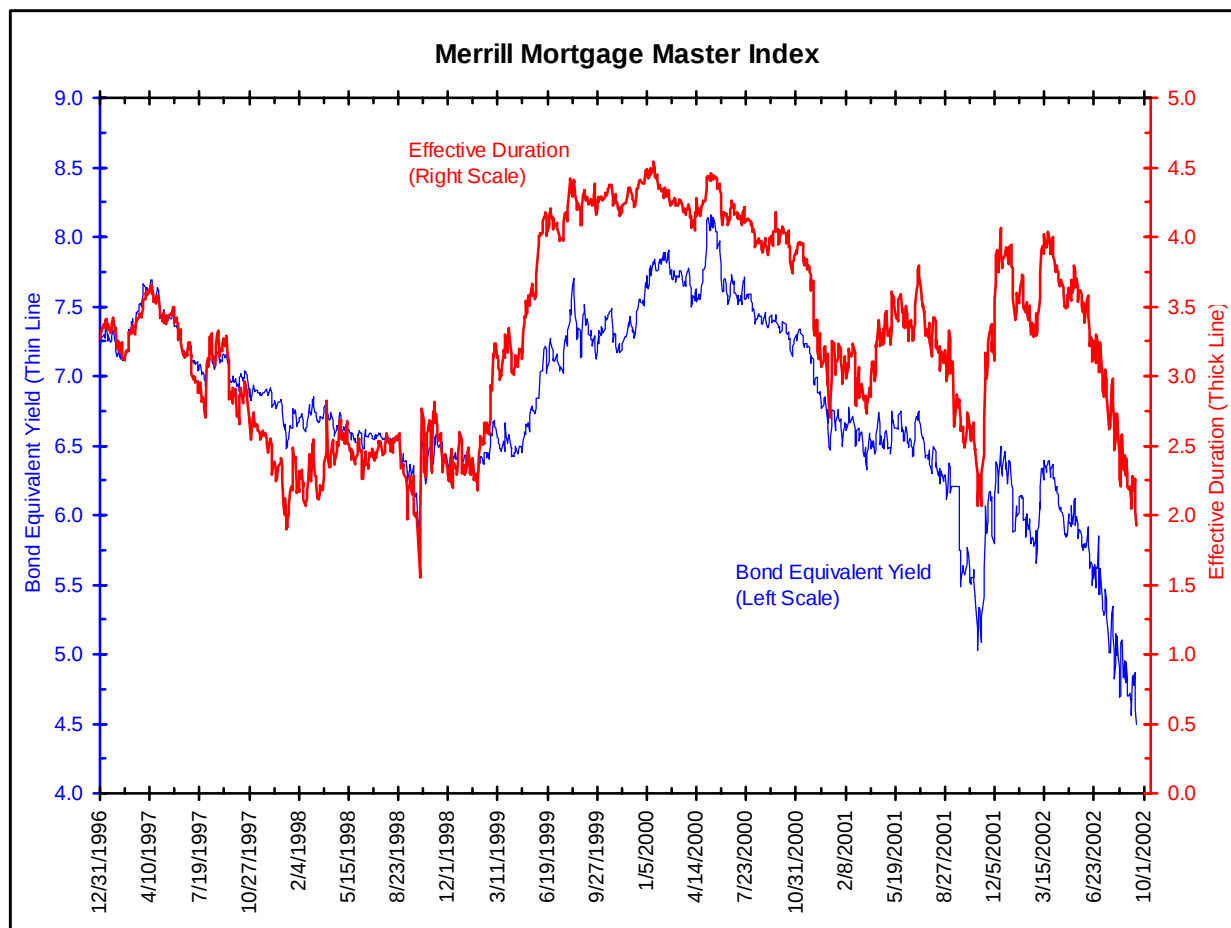
What is the Convexity Trade?

The convexity trade gets its name from a defining characteristic of the mortgage market – “negative convexity.” This means as overall market yields fall, the duration of the mortgage index falls (shortens) as well. This relationship is shown on the next page.

Duration has many measures and meanings. For the purposes of this discussion, the “modified duration” definition works best. **It measures how**

sensitive price movements are to changes in interest rates.

The fact mortgage prices become less sensitive to falling interest rates (rising prices) is not a good thing for the owners of mortgage securities. This is why they are said to be “negatively convexed.” Conversely, when yields rise (falling prices), mortgage prices become more sensitive to changes in yields -- also not a good thing.



This negative convexity is due primarily to mortgage refinancing. When yields fall, homeowners rush to refinance their mortgages. Since mortgage securities "pass-through" refinancing to their investors, this has the effect of speeding up mortgage prepayments, thus shortening duration and causing prices to rise less as rates fall. In extreme cases, an investor who bought a mortgage security believing he would get interest payments over **many** years might wind up with significantly fewer payments than anticipated and receive his money back in a **few** years. If this investor paid a price significantly over par (100) for this security (he would do this believing the security would pay interest for many years), a loss will occur. This is why mortgage investors often run into problems when rates fall as opposed to when they rise.

So what exactly is the convexity trade? Simply, it is an effort to keep the overall duration of a bond portfolio stable.

For instance, an insurance company that tries to match their bond portfolio's asset duration to their liability's duration may have a significant portion of that portfolio in mortgage securities. When yields fall, the negative convexity of the mortgages will cause the duration of the portfolio to decline faster than the duration of the liabilities. When this happens, many of these managers who have a goal of keeping the duration of the portfolio asset and liabilities equal will seek to replace this lost duration by purchasing other long-dated fixed-income assets, such as Treasuries (which have "positive convexity") or interest rate swaps. The opposite holds true when rates rise -- the duration of the portfolio (the company's assets) lengthens faster than the liabilities' duration, causing the manager to sell long-dated duration assets to reduce the portfolio's duration.

The chart on the previous page shows the close relationship between the duration and the yield of the Mortgage Index. This means the convexity trade is a market-directional trade. The direction of interest rates largely "explain" the change in duration of the Mortgage Index.

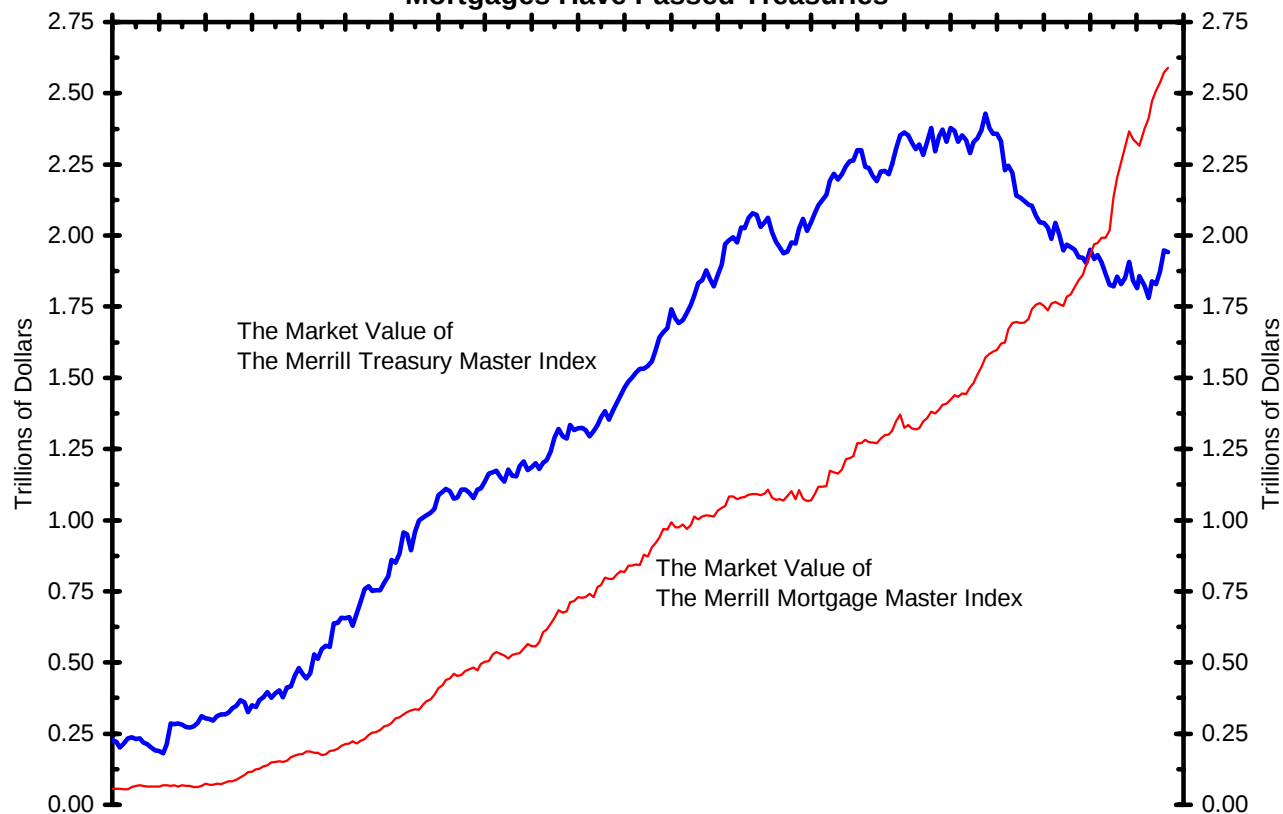
Furthermore, anyone engaged in the convexity trade is often selling long-dated assets **after** rates rise (prices fall) and buying **after** rates fall (prices rise). Therefore, the convexity trade **cannot** create a new trend in yields by itself. It will only exaggerate an existing trend. This trade is neither bullish nor bearish, rather a strategy that increases volatility in the bond market.

Measuring The Convexity Trade

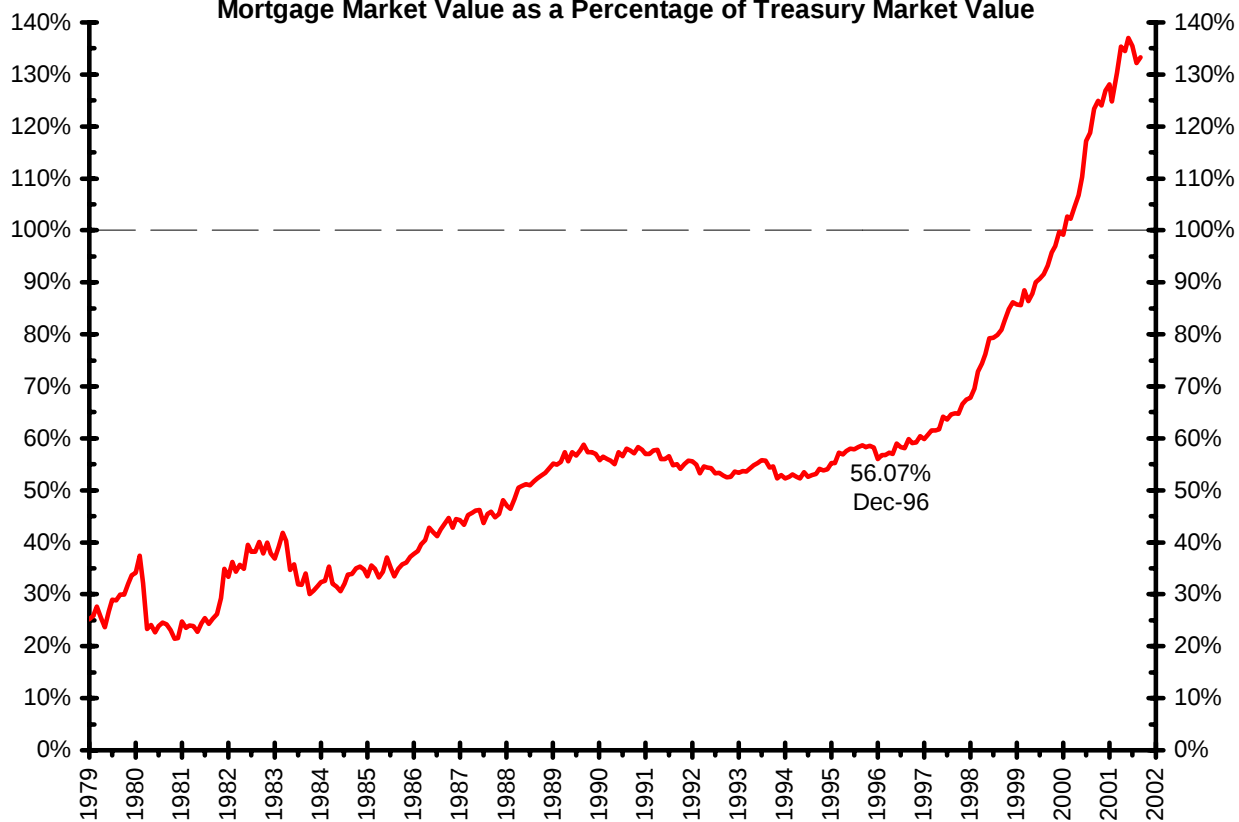
How big is the convexity trade? One way to measure it is to look at the size of the mortgage market in relation to other markets. The chart on the next page shows that the market value of the Merrill Mortgage Master Index has handily surpassed the market value of the Merrill Treasury Master Index. This is the first time since the Merrill Domestic Master Index (or the Lehman Aggregate) was invented that the Treasury market is **not** the largest sector of this index.

The growth of mortgage securities has been parabolic in recent years. The size of the mortgage index was only 60% of the Treasury Index as late as January 1998. Now it is over 130%. To achieve this relative growth since the beginning of 1998, the market value of the mortgage index has **increased** by \$1.151 trillion while the market value of the Treasury index has **decreased** by \$430 billion.

Mortgages Have Passed Treasuries



Mortgage Market Value as a Percentage of Treasury Market Value



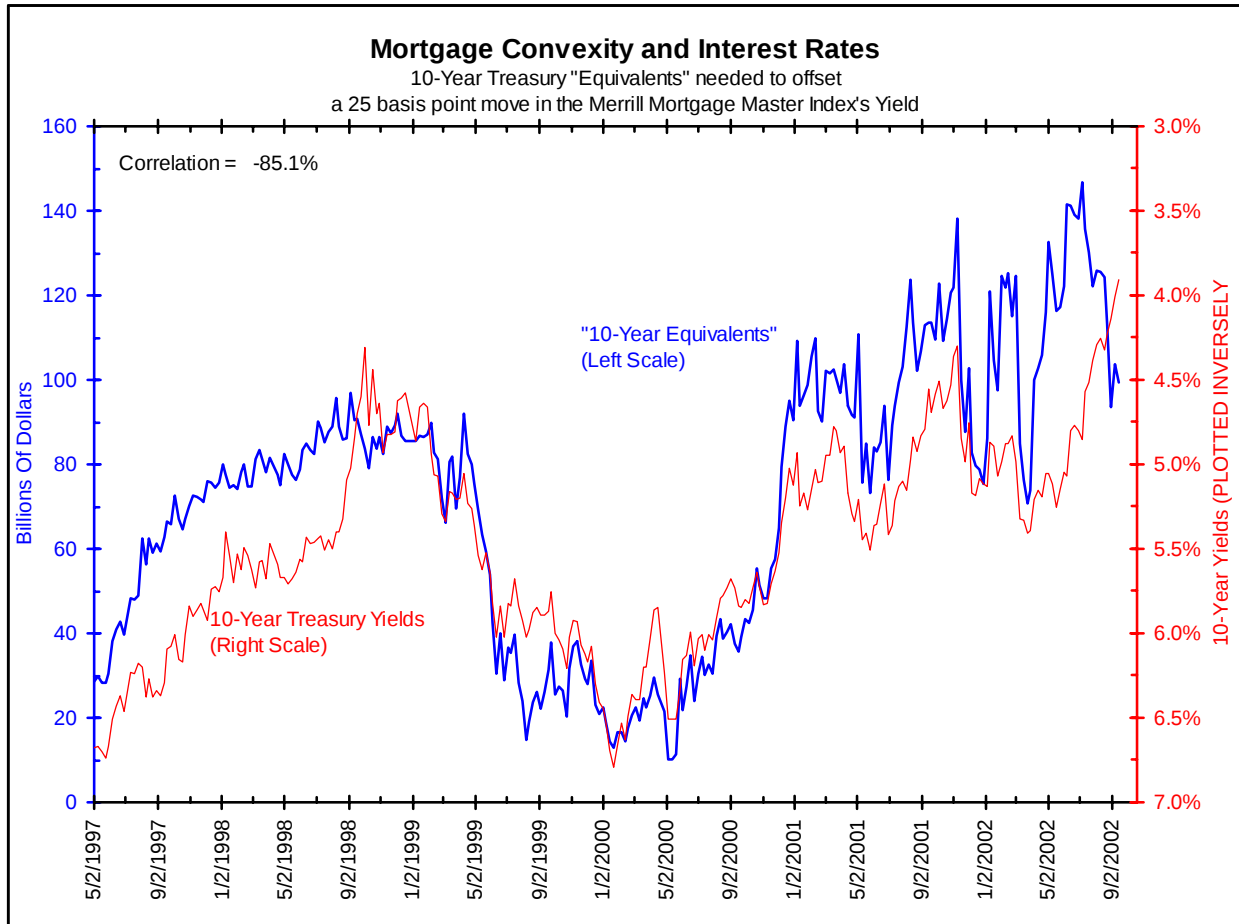
Measuring Lost/Gained Duration

Another way to measure the size of the convexity trade is to measure changes in duration and how they impact the bond market. In other words, how active are the convexity traders?

To illustrate this concept, we created the chart below. It shows the equivalent amount of 10-year Treasury Notes needed to offset a 25 basis point

move in the yield of the Merrill Mortgage Master Index. This chart is re-calculated weekly.

If mortgage rates were to drop 25 basis points right now, this chart suggests about \$100 billion of "10-year equivalents" would be needed to replace the lost duration.



This chart may come as a surprise to some bond professionals. Their understanding of mortgage securities is that convexity becomes a bigger issue when yields make extreme moves. This chart shows that the 10-year equivalents needed to replace the lost duration on a 25 basis drop in yields peaked well above the amounts needed in 1998 when 10-year Treasury rates were at similar levels.

Why is the necessary amount of 10-year equivalents so much higher given similar yields on the 10-year Treasury note? Two reasons:

1. The size and growth of the mortgage market, as detailed previously, has been so large that the need to replace lost duration is greater now than it has been in the past.

2. The mortgage market has become highly concentrated in recent years. As the table on the next page shows, 32.1% of all 30-year fixed mortgages were issued in 2001 (a record) and another 18% already through July 2002. This means that 50.1% of the outstanding 30-year fixed mortgages are less than 18 months old. 30-year fixed mortgages make up 85% of the overall mortgage index.

As a result of this burst in mortgage activity, 92.8% of all 30-year fixed mortgages are now in a tight coupon range of 6.0% to 7.5%!

Selected Mortgage Data

As of July 31, 2002

	30-Year Fixed Mortgages				
	FNMA	GNMA 1	FHLMC	GNMA 2	Total
	\$ Billions				
Total Issuance	891.84	349.80	672.57	130.77	2,044.97
2002 Issuance YTD	178.21	45.26	126.14	18.82	368.42
2001 Issuance	306.94	83.97	213.35	53.03	657.29
2000 Issuance	48.79	17.78	35.35	11.77	113.68
1999 Issuance	106.43	50.78	89.20	17.58	263.98
6.0% to 7.5% Coupons	837.90	299.65	638.00	121.59	1,897.14
All Other Coupons	53.94	50.15	35.31	9.18	148.58
	Percentage of Total				
2002 Issuance YTD	20.0%	12.9%	18.8%	14.4%	18.0%
2001 Issuance	34.4%	24.0%	31.7%	40.6%	32.1%
2000 Issuance	5.5%	5.1%	5.3%	9.0%	5.6%
1999 Issuance	11.9%	14.5%	13.3%	13.4%	12.9%
6.0% to 7.5% Coupons	94.0%	85.7%	94.9%	93.0%	92.8%
All Other Coupons	6.0%	14.3%	5.2%	7.0%	7.3%

Data Source: Bloomberg L.P.

The chart above uses “effective duration,” which means it incorporates assumptions about mortgage activity and the movement of interest rates. Given the huge size of the mortgage market and the high concentration of coupons in a tight 150 basis point range, now even small moves in interest rates cause millions of homeowners to consider re-financing options. This causes the convexity traders to become more active even if rates do not move much. If their activity moves rates, it triggers even more re-financing consideration. When this happens, rates can rocket up and down on seemingly benign economic news.

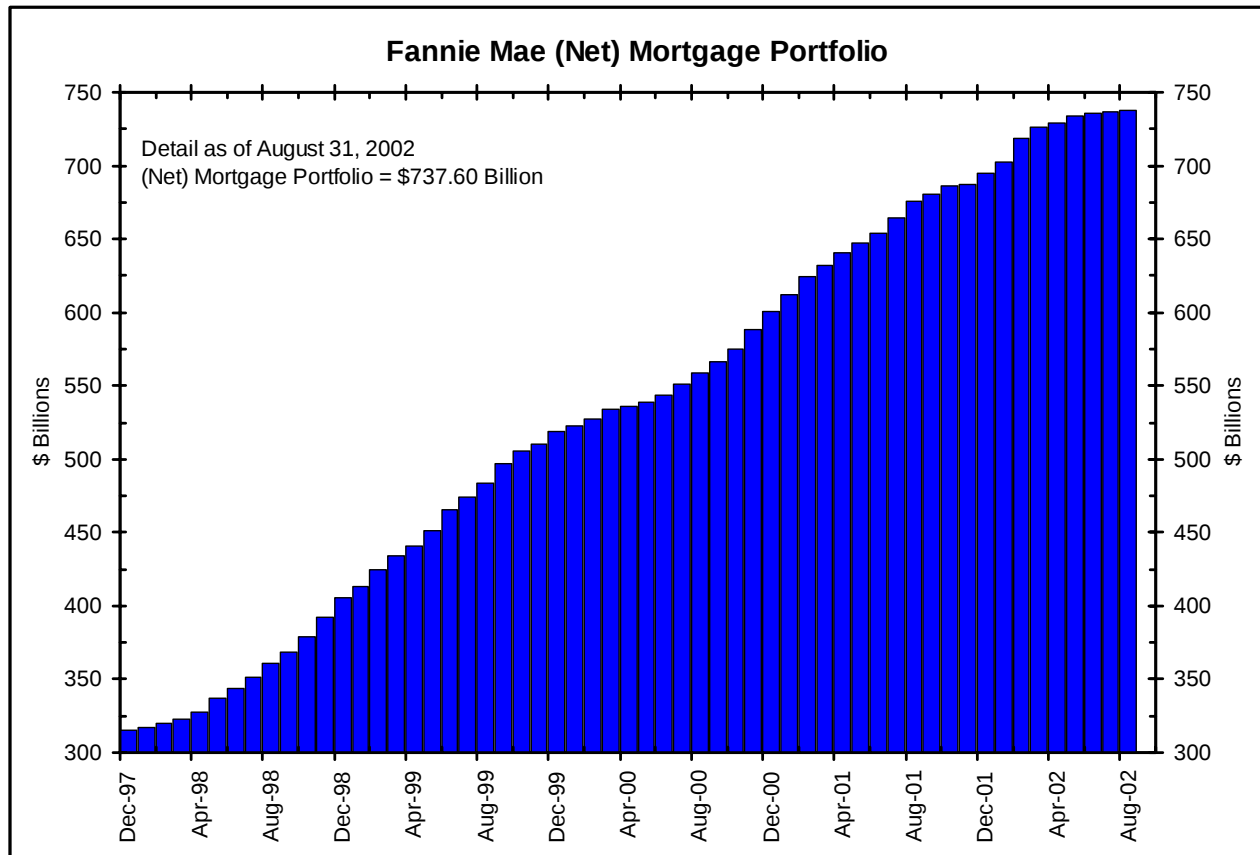
Who Does The Convexity Trade?

Two huge accounts actively engage in the convexity trade and might single-handedly be the most important forces in the fixed-income markets – Fannie Mae and Freddie Mac.

Fannie Mae and Freddie Mac both actively manage huge portfolios of mortgage securities. These portfolios consist of mortgage securities they issue. This means they manage mortgage portfolios of their *own* securities.

As of August 31, 2002, Fannie Mae's portfolio was \$737.60 billion (see the chart below) and Freddie Mac's portfolio was \$521.17 billion. Together, these two portfolios account for over \$1.25 trillion or 49% the size of the mortgage index. **That's right, these two portfolios are almost half the size of the mortgage index!**

Do these two portfolios actively engage in the convexity trade? Fannie Mae's information statement (Freddie Mac has a similar statement which essentially says the same thing) clearly states that Fannie Mae is “exposed to interest rate risk” and then states they actively manage this risk – the convexity trade. In fact, this information statement goes on for pages explaining how Fannie Mae manages its interest rate risk, suggesting the importance of this issue is to them.



How Does Fannie and Freddie Make Money?

The majority of Fannie and Freddie's money is made from holding a mortgage portfolio (shown on the previous page) and financing it with agency securities that yield less than their portfolio. That is, Fannie enjoys a "positive carry" with its mortgage portfolio.

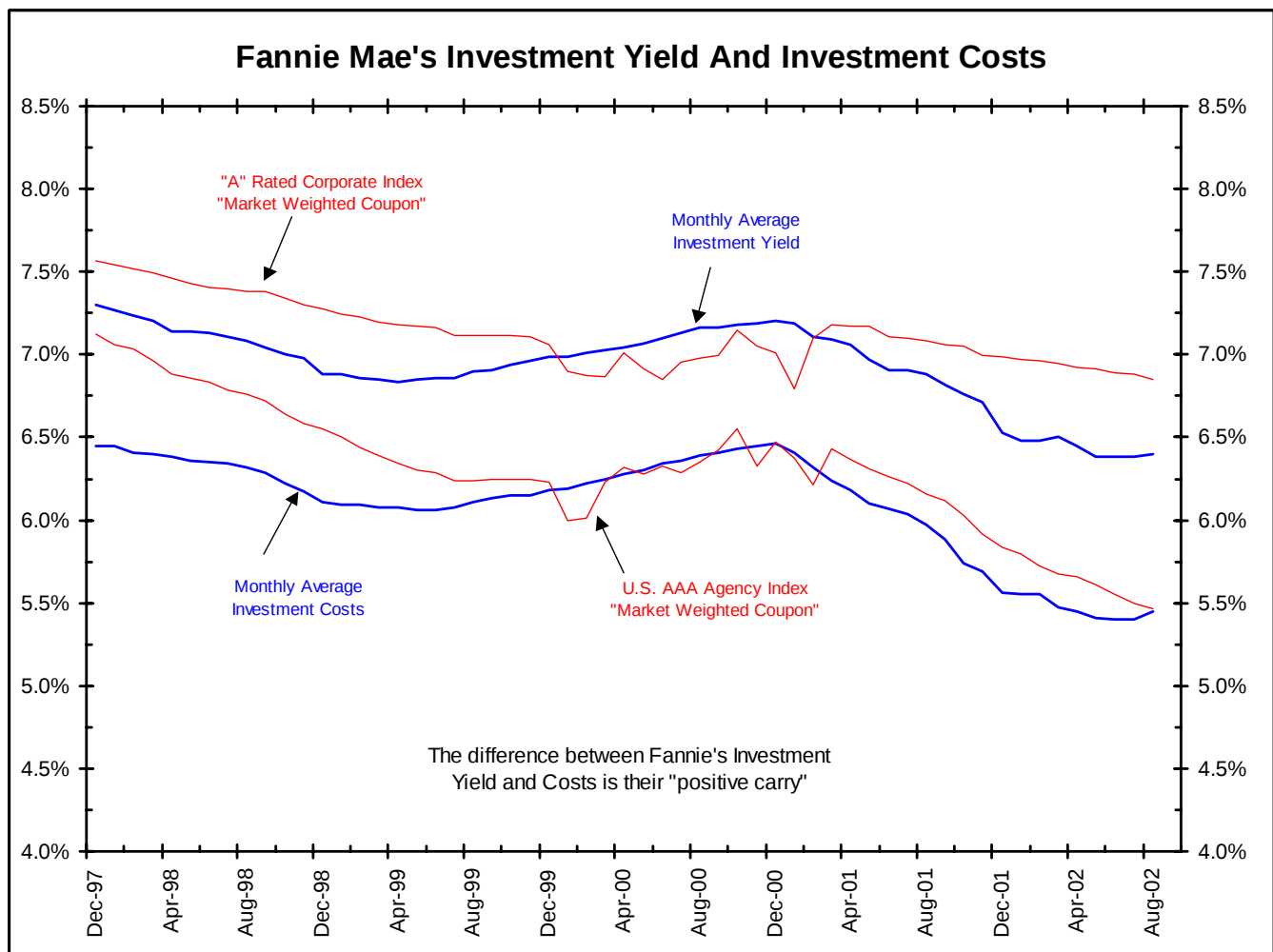
To this end Fannie releases detailed statistics on its monthly average investment yield (the yield of its mortgage portfolio) and its monthly average investment cost (the yield of the bonds it has issued). These numbers are shown below (in blue).

Also shown below is the market weighted yield of all "A" rated corporate bonds as well as the market weighted yield of the AAA Agency Index.

Not surprisingly, Fannie Mae's monthly average investment yield and the AAA Agency Index are nearly the same. Considering Fannie is one of the larger issuers, this makes sense.

Fannie is able to borrow at this reduced yield because of their implied Government guarantee. No one doubts this, but "what if" the Government guarantee was removed?

Many have argued that if Fannie Mae was truly independent of the implied Government guarantee, their borrowing costs would be similar to an "A" rated corporate borrower. As the chart below shows, this would effectively end the "convexity trade" for them, as "A" rated yields are higher than mortgage yields. Borrowing at this rate would put them at a "negative carry."



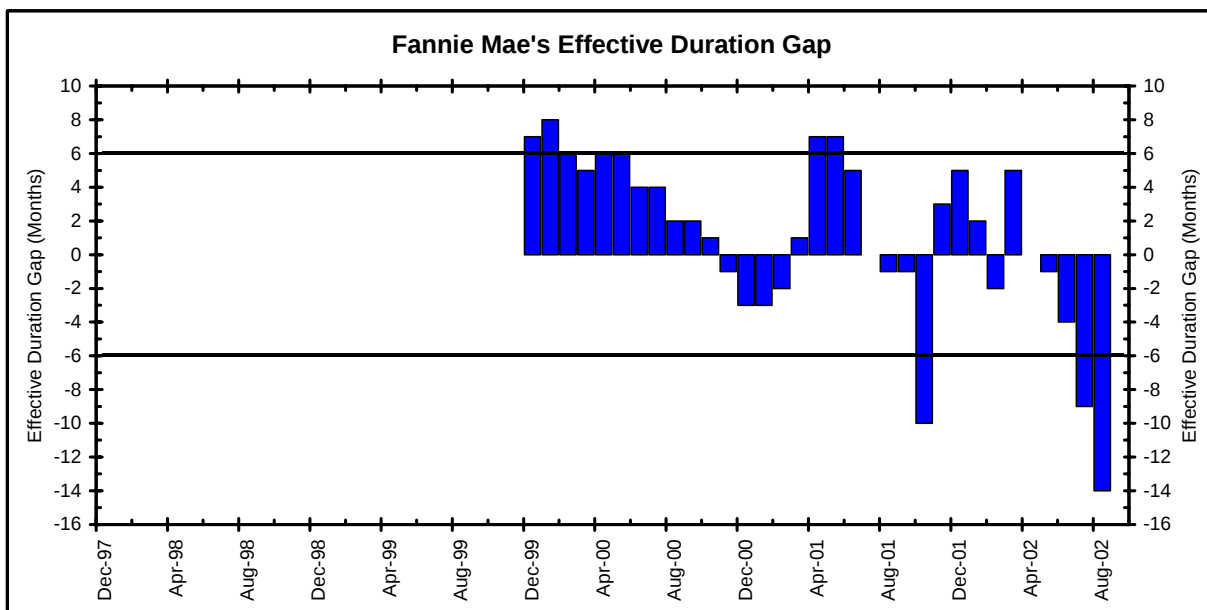
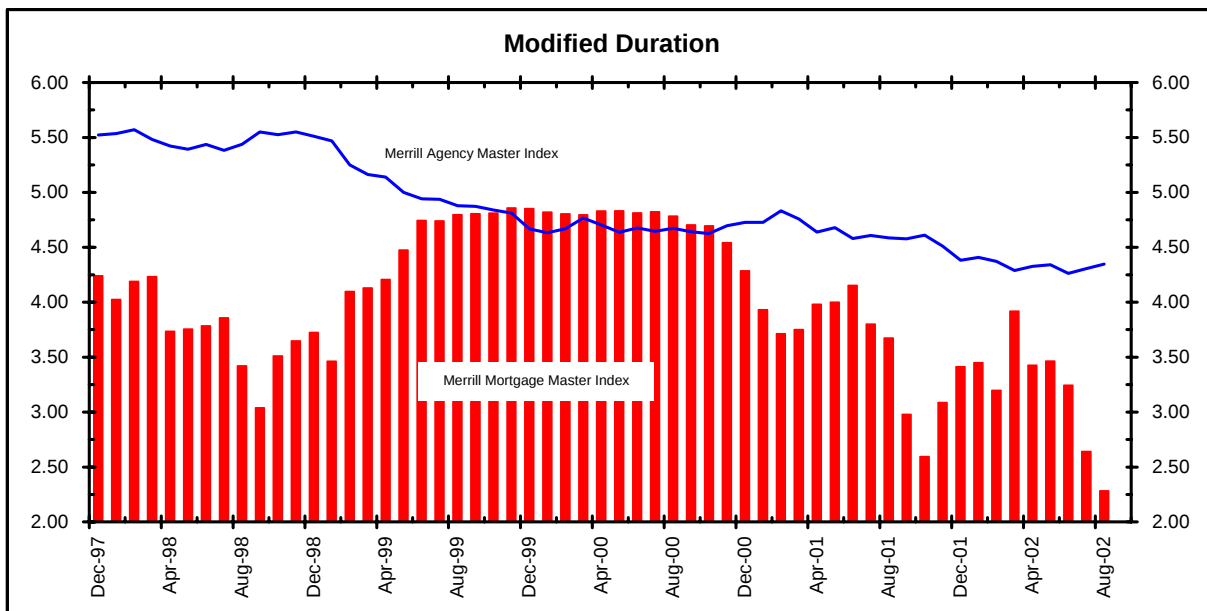
How Does Fannie Protect Itself?

It sounds like Fannie has a great business. It is able to borrow at rates below mortgage yields enabling them to enjoy a positive carry. What could go wrong?

Fannie's business model has one serious flaw – the duration of its assets (mortgage portfolio) and its liabilities (the bonds its issued) are not the same. If interest rates were to move, the spread between these two series would change (shown on the chart on the previous page). If, however, the duration of Fannie's assets and its liabilities were the same, the spread between these two series would not change as interest rates move.

Therefore, Fannie Mae issues a measure called its "duration gap." This is shown in the second chart below. The top chart shows the duration of the Merrill Agency Master Index (a proxy for their borrowing cost) and the duration of the Merrill Mortgage Index (since their mortgage portfolio in near \$740 billion, it is reasonable to assume its characteristics is similar to this index).

The sharp-eyed reader will note that the difference between the duration of the Merrill Agency Master Index (4.35) and the Merrill Mortgage Master Index (2.28) is roughly -25 months (2.07 years). Yet, Fannie's duration gap is -14 months. Why the difference?



The World's Largest Derivative Player

To balance the difference between its assets and liabilities, Fannie and Freddie are arguably the world's largest non-dealer players in the derivative

market. The tables below detail the enormous size of their derivative portfolios.

Fannie Mae

In Billions of Dollars

	1999	2000	2001	00/01 Chg.
Total Swaps	\$ 139.40	\$ 153.74	\$ 213.68	38.99%
Pay Variable/Received Fixed Swaps	\$ 31.62	\$ 59.17	\$ 39.07	-33.98%
Basis Swaps	\$ 19.54	\$ 14.56	\$ 47.05	223.20%
Caps & Swaptions	\$ 48.12	\$ 82.53	\$ 219.94	166.51%
Other (i.e., futures)	\$ 12.22	\$ 14.74	\$ 13.39	-9.15%
Total Notional Derivatives	\$ 250.90	\$ 324.74	\$ 533.14	64.17%
Net Mortgages	\$ 518.84	\$ 600.47	\$ 694.86	15.72%
Other Investments	\$ 45.27	\$ 61.72	\$ 77.18	25.06%
Total Net Investments	\$ 564.11	\$ 662.19	\$ 772.04	16.59%
Total Portfolio	\$ 815.01	\$ 986.93	\$ 1,305.18	32.25%

Source: Fannie Mae's 2001 Voluntary Information Statement, Table 15, Page 42

Freddie Mac

In Billions of Dollars

	1999	2000	2001	00/01 Chg.
Interest-rate swaps				
Pay-fixed	n.a.	\$ 141.64	\$ 249.20	75.95%
Receive-fixed	n.a.	\$ 129.21	\$ 186.96	44.69%
Basis (floating-to-floating)	n.a.	\$ 7.04	\$ 6.61	-6.16%
Options, Swaptions, Caps, Floors	n.a.	\$ 125.53	\$ 408.19	225.18%
Futures	n.a.	\$ 25.07	\$ 174.64	596.58%
Foreign Currency	n.a.	\$ 10.21	\$ 24.00	135.06%
Forward Sales	n.a.	\$ 35.84	\$ 2.80	-92.18%
Totals Notional Derivatives	n.a.	\$ 474.54	\$ 1,052.39	121.77%
Retained (Net) Mortgage Portfolio	322.86	385.12	494.30	28.35%
Total Portfolio	n.a.	\$ 859.65	\$ 1,546.69	79.92%

Source: Freddie Mac's 2001 Voluntary Information Statement, Table 13, Page A-18

Conclusion

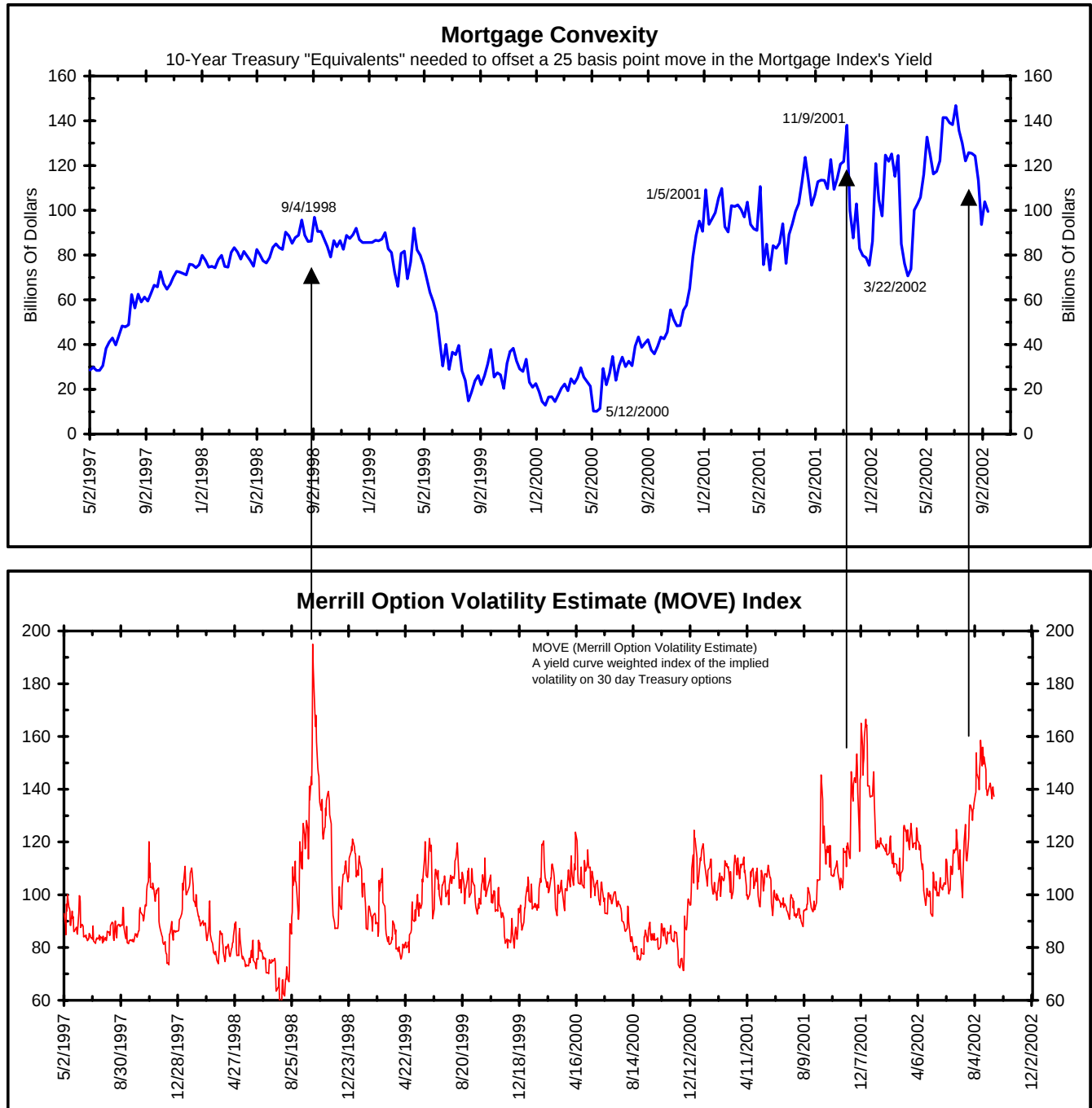
If you don't trade in mortgages or agency securities, why should you care about what Fannie or Freddie is doing?

Simply, we believe the convexity trade is the primary driver of volatility in the bond market. This trade is neither bullish nor bearish. Rather, it enhances volatility – **in both directions**. Why? Fannie and Freddie are far and away the two largest players in the bond market and when the convexity trade forces them to get active, they affect the entire market.

See the charts on the next page. They show that the amount of convexity in the bond market (shown as the amount of 10-years needed to offset a 25

basis point move in the mortgage index yield) in the top chart and volatility (shown as the Merrill Move Index) in the bottom chart. We believe their activity in rebalancing their portfolios is a primary driver behind increased volatility in the bond market.

Often this activity gets mistaken with more "fundamental" explanations, (i.e., slowing economy, deflation, falling stock market) when it is actually the "technical" result of a large player trying to rebalance their portfolio. So, it is important to understand the state of the convexity trade, even if you are not a player in these securities.



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