

The Interest Rate Risk of Fannie Mae and Freddie Mac

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1. Introduction

This paper evaluates the exposure of Fannie Mae and Freddie Mac (hereafter F&F) to interest rate risk, and develops public policy proposals for disclosing and controlling this risk. F&F merit special attention because (1) their potential exposure to interest rate risk is very large, and (2) their status as US government sponsored enterprises (GSEs) creates special concerns.

The Policy Perspective

Since this paper formulates policy proposals, it is important to be clear on my vantage point. Put most simply, the perspective is that of a “representative” American, meaning a US citizen (who benefits from an improved society), a taxpayer, a homeowner, a mortgage borrower, and a F&F shareholder (at least through a market-indexed pension fund). On this basis, a more efficient mortgage market—meaning a lower “all-in” mortgage interest rate—is always a good thing. F&F should be applauded to the extent they contribute to this efficiency, and public policy should attempt to expand this efficiency wherever possible.

The US Congress has chosen F&F to deliver a major subsidy to mortgage borrowers. I take as given, and in fact endorse, the will and wisdom of the US Congress to create such subsidies, as indicated in the F&F charter acts and related legislation.¹ To be specific, as GSEs, the liabilities of F&F trade in financial markets at interest rates that are approximately 50 basis points (bp) below those of similarly structured private firms.² It seems fair to presume that Congress intends this subsidy to be passed through to mortgage borrowers.

¹ These materials are readily available on the web page of the Office of Federal Housing Enterprise Oversight, <http://www.ofheo.gov/docs/#Regulations>

² See Brent Ambrose and Arthur Varga [2002], W. Scott Frame and Larry D. Wall [2002], and other papers cited therein. The 50 basis point number is just an example, and our main points hold as long as F&F maintain some significant funding advantage.

The Market Power of F&F

The US Congress has also conferred on F&F the power to operate as a duopoly in the market for conforming mortgages, since no private sector competitors have access to the federal subsidy. In a paper prepared for the multi-agency study of F&F mandated by Congress, Hermalin and Jaffee [1996] further concluded that F&F do, in fact, exercise this duopoly power.³ While our study considered many factors, including the structure of the entire mortgage industry, one fact stands out as definitive.

This fact is that only approximately 25 bp of the 50 bp subsidy available to F&F reaches the destination of lower mortgage interest rates.⁴ The remaining federal subsidy, logically, must end up as income for F&F. This is confirmed by the fact that the annual rate of return on equity for F&F has systematically ranged from 20% to 25%, approximately double that of any other large financial institutions in the world.⁵ Of course, the high profit rates of F&F may also include the effects of their own efficiency. But the conclusion seems inescapable that some of the federal subsidy is leaking into F&F profits, and this would occur only if they possessed market power.⁶

I raise the subsidy and duopoly issues at the outset because F&F duopoly power also has important ramifications in formulating policy proposals for disclosing and controlling their interest rate risk. At the same time, I note that any increases in competition, for example through

³ To be clear, I have no information to suggest that F&F are violating US antitrust laws, or any other laws for that matter. Indeed, the US Congress created the duopoly status for F&F and thus bears responsibility for controlling it.

⁴ See Congressional Budget Office [2001a], Congressional Budget Office [2001b], and other papers cited therein. The 25 basis point number is just an example, and our main points hold as long as F&F retain some part of their funding advantage (see also footnote 2).

⁵ See Fannie Mae [2002] and Freddie Mac [2002].

⁶ In a competitive market, the supply of loans would continue to rise until the full subsidy was passed through to borrowers.

the entry of GNMA or the Federal Home Loan Banks into F&F mortgage markets would cause more of the subsidy to pass through to mortgage borrowers, and might mitigate some of the concerns regarding interest rate risk that I discuss below.

The Business Lines of F&F

F&F operate in two distinct, but related, lines of business. One line is mortgage securitization, the other is the retained mortgage portfolio. They are illustrated in the flow diagram of Figure 1. In both cases, the process begins with the purchase of residential mortgages from independent mortgage originators. The vast majority of purchased mortgages are securitized in the form of F&F mortgage backed securities (hereafter F&F-MBS), which in turn are issued into the capital markets and form the basis for their mortgage securitization business.⁷ The small remainder of non-securitized mortgages are retained and represent one component of the retained mortgage portfolio. The greater part of the retained mortgage portfolio, however, is created by F&F repurchasing a significant share of the F&F-MBS immediately after they are issued. Figure 2 shows that since 1991, F&F have repurchased a growing percentage of their outstanding MSB, that percentage reaching about 33% by 2001. Figure 3 shows that since about 1991, the F&F retained mortgage portfolio (which also includes other mortgage related securities) has also been generally growing relative to investor held F&F-MBS, reaching the value of about 80% as of 2001. This also illustrates that while Freddie Mac used to hold a relatively small retained mortgage portfolio, the strategies of the two firms are now converging.

The business lines of the investor-held F&F-MBS and the retained mortgage portfolio differ significantly in their profit structure and potential. Profits on investor held F&F-MBS basically

⁷ F&F officials have orally represented to me that “essentially all” MBS created by F&F are initially issued into the capital markets, and that the only whole mortgages not securitized represent “odds and ends” that would not fit well with publicly issued MBS.

arise from the annual guarantee fee that F&F receive as guarantor of the securities against default risk. F&F bear no interest rate risk from investor held F&F-MBS, since the cash flows on the underlying mortgages belong to the investors, not F&F. Profits on the retained portfolio, in contrast, arise basically as the spread between the interest return on the mortgage assets and the interest cost of the funding liabilities. Conceptually, this spread can be separated into two components:

Retained Portfolio Rate Spread = Default Risk Premium + Liquidity Premium.

The risk premium represents the default risk of the mortgage portfolio, and conceptually is measured by the same guarantee fee F&F charge on their investor held F&F-MBS. The remaining component I call the liquidity premium, and it represents that part of the rate spread that is not accounted for by default risk.

Figure 4 shows the allocation of total F&F income between guarantee fee income on investor held F&F-MBS and the net interest income on the retained portfolio. F&F income is now dominated by the retained portfolio component, due to the rapidly expanding size of the portfolio and, at least currently, its large interest rate spread. Furthermore, the vast majority of the portfolio spread is attributed to the liquidity component. For example, for the year 2001, F&F had a total net interest income of about \$14 billion, but only about \$1.3 billion could be attributed to the risk component.⁸ Figure 5 shows the rapid increase in the liquidity component of the overall retained portfolio net income.

⁸ The credit risk component of the rate spread was computed by applying to the retained mortgage portfolio the effective rate for guarantee fee income as actually earned on issued F&F-MBS.

2. Interest Rate Risk on a Mortgage Portfolio

I define a mortgage portfolio as the mortgage assets held together with the bonds (or other debt instruments) and equity used to finance these assets. Derivative securities that may be used to hedge mortgage portfolio interest rate risk will be treated separately below. Also putting aside other (relatively minor) asset and liability items, we have:

Mortgage assets = Bond liabilities + Equity

Book values for each of these three items can be readily found on the balance sheet of financial firms such as F&F. Current financial market prices can also be used to compute market values for the mortgage assets and bond liabilities, from which the market value of equity can be directly derived. This gives us:

Market value of equity = Market value of mortgage assets – Market value of bond liabilities.

F&F financial reports provide data on the market value of their assets, liabilities, and equity.

Sources and Measurement of Interest Rate Risk

Changes in interest rates are among the most important factors leading to changes in the market value of mortgage assets and bond liabilities, and thus in the market value of the portfolio's equity. Interest rate risk arises because future changes in interest rates may cause mortgage asset values to fall relative to liability values, thus leading to a decline in the market value of equity. In an extreme case, the market value of equity can become negative, leading to the possible bankruptcy and liquidation of the financial firm.

This is exactly what happened to a significant part of the S&L industry in the early 1980s. The S&L industry was prone to interest rate risk because many firms were financing their long-

term, fixed-rate, mortgages with short-term deposit liabilities. When interest rates escalated rapidly starting in 1976, the market value of their mortgage portfolios fell sharply relative to the market value of their deposit liabilities, leading to very negative values for the market value of equity. The pattern of 1-year and 10-year Treasury security interest rates over the last 50 years is shown in Figure 6, and the interest rate peak in 1981 is a clear landmark.

A mismatch between the maturity of mortgage assets and bond or deposit liabilities is not the only source of interest rate risk on a mortgage portfolio. At least in the US, most mortgages allow the borrower to prepay the debt at any point, an option that allows borrowers to refinance their homes when interest rates decline. Unexpected prepayments will generally create a decline in the market value of equity for a mortgage portfolio. A key offset occurs, however, if the portfolio manager has used callable bonds to finance the mortgage portfolio. In this case, the manager can exercise the call options on the bonds at the same time that the mortgage borrowers exercise their prepayment options, leaving the market value of equity unaffected.

In summary, interest rate risk can arise on a mortgage portfolio for two fundamental reasons:

- 1) There is a mismatch in maturity between the mortgage assets and the bond liabilities;
- 2) The prepayment options on the mortgage assets are not matched by bond call options.

In either case, the amount of interest rate risk would be properly measured by the potential loss in the market value of equity that could arise from any future change in interest rates.

A Perfect Balance Sheet Hedge of Interest Rate Risk

It is useful as a benchmark for our analysis to recognize that financial firms such as F&F can perfectly eliminate all their interest rate risk. The procedure requires two quite direct steps:

- (1) the date and amount of each scheduled mortgage cash inflow must match with a corresponding liability cash outflow.
- (2) each optional mortgage cash inflow (i.e. prepayment) must match with an optional debt cash outflow (call option).

F&F can readily achieve this position by issuing a suitable array of long-term and callable bonds.

I will refer to this as a perfect balance sheet rate hedge. Similarly, I will refer to any interest rate risk that arises because the balance sheet hedge is imperfect as balance sheet rate risk.

F&F do not carry out perfect balance sheet hedges. This is evident in Figure 7, which shows some of the key balance items for both firms. Two balance sheet features stand out:

- 1) More than 40% of F&F outstanding debt is due in one year or less, making their debt much shorter term than their mortgage assets.
- 2) Less than 20% of F&F debt is callable, whereas essentially their entire retained mortgage portfolio is at risk with respect to borrower prepayment.

In short, F&F maintain substantial balance sheet rate risk.

F&F fail to create a perfect balance sheet hedge because it would be costly to achieve, reducing their profits. The costs arise in two firms:

- 1) Long-term debt is more costly than short-term debt. For example, as shown in Figure 6, as of April 2002, the 10-year Treasury rate was more than 250 bp above the 1-year Treasury rate.
- 2) Callable debt is always more costly than non-callable debt.

To be clear, most banking institutions fail to achieve a perfect balance sheet rate hedge. The F&F position, however, merits special attention because (a) mortgage portfolios are particularly prone to balance sheet rate risk, (b) F&F are huge institutions on any scale, and (c) they are GSEs. I will consider these factors in our policy proposals below. It is also important to

recognize that there is nothing intrinsically wrong with maintaining balance sheet rate risk, since the risk can be hedged, even perfectly hedged, with interest rate derivative securities. Figure 8 shows the amounts and types of interest rate derivatives in which F&F participated at year-end 2001. The two primary categories used to hedge interest rate risk are interest rate swaps and option-based derivatives (also called swaptions). I now consider how these derivatives are used to hedge balance sheet rate risk, beginning with interest rate swaps.

Hedging Balance Sheet Rate Risk with Interest Rate Swaps

F&F use interest rate swaps to convert some of their short-term debt into synthetic long-term debt. Short-term balance sheet debt commits F&F to make a sequence of interest rate payments based on future short-term interest rates. The swap contracts commit F&F to make contractually fixed long-term rate payments (the equivalent of long-term debt) and to receive short-term interest rate payments (offsetting the future volatility of the interest payments on their short-term debt). If properly organized, interest rate swaps can eliminate all the interest rate risk arising from balance sheet maturity imbalances.

The Profitability of Rate Swaps

Interest rate swaps are a cost-effective mechanism for F&F to hedge their balance sheet rate risk if the yield curve in the swap market is flatter than the yield curve in the agency market for F&F securities. This is usually the case. Table 1 shows, for example, that these two yield curves met the necessary condition as of June 6, 2002. To demonstrate why the swap market is profitable, assume that F&F need to issue 10-year debt to complete a perfect balance sheet hedge for their mortgage portfolio. The cost of directly issuing 10-year agency debt is shown as 5.59% in Table 1. The swap alternative is to issue 1-year agency debt at a cost of 2.45% and then enter

into a swap (receive 1-year, pay 10-year) at a net cost of 2.92% ($= 5.51\% - 2.59\%$), resulting in a total cost of 5.37% ($= 2.45\% + 2.92\%$), and a saving of 22 bp ($= 5.59\% - 5.37\%$).

Table 1: Yield Curves for Agency and Swap Markets			
Interest Rates as of June 6, 2002			
Source: Fannie Mae web page			
Maturity	F&F Agency	Swap Market	Difference
1 year	2.45%	2.59%	-14 bp
2 year	3.32%	3.47%	-15 bp
5 year	4.68%	4.72%	-4 bp
10 year	5.59%	5.51%	+8 bp
30 year	6.38%	6.12%	+26 bp

The Arbitrage Basis of Rate Swap Profitability

The transactions that F&F use to create synthetic long-term debt are equivalent to interest rate arbitrage. Indeed, the yield curves in Table 1 provide an attractive arbitrage market for any investor with access to these markets. Specifically:

- borrow for 1-year in the agency market (-2.45%)
- invest for 10-years in the agency market (+5.59%)
- swap, receive 1-year (+2.59%) and pay 10-year (-5.51%).

Overall the transaction has a net spread of the same 22 bp we saw in the F&F example.

We normally do not find such arbitrage opportunities in active financial markets, since the very act of carrying out the arbitrage tends to eliminate it. Exceptions occur if the arbitrage involves risks, or if access to the arbitrage opportunity is otherwise limited. Both possibilities appear to be relevant for the case of F&F swap hedges.

Risks Associated with F&F Swap Hedging

Counterparty default risk has received a great deal of attention recently with respect to F&F activities. Most of the attention has been directed to the possibility that a counterparty would fail to fulfill the terms of a contract, thus subjecting F&F to a loss. In my opinion, the danger due to this form of counterparty risk is exaggerated. The key point is that F&F require all their counterparties to post collateral on a weekly basis to offset all losses in value that arise in the counterparty's position. Thus, the maximum direct financial loss that could be sustained by F&F is limited to the amount that would be created by a one-week movement in interest rates. A significant loss for F&F from this source is highly unlikely.

However, there is another, potentially larger, form of counterparty risk, what I call counterparty rollover risk. This risk arises when and if a counterparty does fail, let us even say without any direct loss to F&F (because, for example, there was sufficient mark to market collateral). F&F must then replace the failed swap positions. The problem is that this may be very costly to do, partly because the original counterparty failure is likely to coincide with a time of disrupted financial markets, and partly because other counterparties will be aware of the open F&F positions and will try to take advantage of this in their pricing.

There is one other form of rollover risk, what I will call short-term debt rollover risk. The source of this risk is the outstanding short-term debt that F&F must issue and roll over annually to take advantage of interest rate swaps. Specifically, we saw in Figure 7 that F&F must roll over more than 40% of their total debt positions each year. Debt rollover risk occurs if financial markets become severely disrupted, for a reason that may not even be related to F&F, causing investors to refuse to purchase any new F&F debt. In this case, F&F would be unable to pay the principal on their maturing short-term debt, creating a major financial crisis.

To be sure, F&F recognize this risk and both firms maintain sufficient liquidity to survive for some time (perhaps 4 months) without access to rollover markets. Beyond that time span, serious problems arise. An interesting perspective on this issue is provided by Scholes [2000], in which Myron Scholes, a principal in Long Term Capital Management (LTCM), discusses how the 1998 liquidity crisis led to the downfall of LTCM.

F&F Market Power in Swap Arbitrage

Beside the risk factors just discussed, market power can also play a significant role in allowing F&F to profit from carrying out swap arbitrage. Arbitrage, and certainly risk-free arbitrage, generally cannot be sustained for very long because competitors will carry out similar transactions, quickly eliminating the mispricing that created the opportunity. F&F, however, have a highly privileged status based on their ability to issue short-term agency debt. In contrast, a private capital market firm would have to issue commercial paper to carry out a similar arbitrage, and the higher cost of commercial paper would eliminate the profit opportunity. Thus, as long as F&F limit the extent to which they create synthetic swap positions, the process of doing so can remain profitable.

Hedging Interest Rate with Swaps: Conclusions

Profits provide F&F a strong incentive to substitute swap positions for perfect balance sheet rate hedges in hedging their interest rate risk. The profitability of these transactions is due partly to the risks they entail, and partly to the market power that F&F enjoy in issuing short-term agency debt. The policy question is whether F&F should be allowed to operate in this manner. I will offer policy proposals below, after considering other aspects of F&F interest rate risk and the associated hedging.

Hedging Prepayment Risk with Swaptions

I now consider prepayment risk as the second fundamental form of interest rate risk facing F&F. I noted earlier that while F&F could perfectly hedge prepayment risk by financing their mortgage portfolio with callable debt, F&F actually issue a relatively small amount of callable bonds. Instead, a large part of their prepayment risk is hedged using a financial interest rate derivative instrument called a swaption. A swaption is an option on a swap contract. Since F&F are using swap contracts as a substitute for directly issued long-term debt, it makes sense that call options on swap contracts—that is, swaptions—can substitute for the call option that would otherwise be used on directly issued debt. This is exactly what F&F are doing. I could carry out an analysis of the profitability and risks of using swaptions in lieu of callable bonds, as I just did for interest rate swaps. However, the issues raised by swaptions are virtually the same as for swaps, while the technical details necessary to discuss swaptions become very complex. Therefore, I will integrate our policy proposals for swaptions with those for interest rate swaps.

The Use of Interest Rate Derivatives by F&F: Summary

Figure 8 shows the extensive use F&F make of interest rate derivatives. At year-end 2001, Freddie Mac participated in over \$1 trillion of derivative instruments (though this includes double accounting due to offsetting positions). Fannie Mae participated in about half that amount of derivatives, suggesting that the firms may differ in their derivative strategies. In any case, the bottom line question is how much interest rate risk do the firms retain after taking into account the amount of their balance sheet and interest rate derivative hedging positions. I now consider how to measure this retained risk.⁹

⁹ The new FAS 133 reporting rules for hedging positions are not directly germane to the topics of this paper and therefore are not discussed here.

3. Measuring the Retained Interest Rate Risk of F&F

The retained interest rate risk of F&F is the amount of such risks that remain after taking into account all of their interest rate hedging activity. Due to the overwhelming complexity of the interest rate derivative positions, there are no simple and direct means to measure this risk. Instead, most major financial firms, including F&F, measure their retained rate risk with a valuation model based on value-at-risk methods. Briefly put, these model compute the change in the market value of equity that occurs as the result of any specific hypothetical change in interest rates.

Freddie Mac Retained Interest Rate Risk

Figure 9 shows the primary information released by Freddie Mac, called its Portfolio Market Value Sensitivity or PMVS. In Part A, two of the measures are based on an instantaneous parallel shift in the entire yield curve, PMVS-L, covering a 50 bp and a 100 bp shock. The tests are carried out for both an upward and a downward shift in interest rates, and the results are provided for whichever direction creates the largest loss in the market value of equity. The third measure in Part A is based on a 25 bp change in the yield curve, either a steepening or a flattening, whichever creates the greatest loss.¹⁰ These data show that Freddie Mac's largest residual interest rate risk in recent years occurred at year-end 1998, when a 100 bp interest rate shock would have caused a 14% or \$1.3 billion loss in the market value of its equity. Test for a shock to yield curve steepness was introduced only recently, and the first readings indicate that it creates a much lower risk exposure than the 100 bp parallel shock.

¹⁰ The yield curve is measured by the spread between the 1-year and 10-year bond rates, and the shock involves changing the 1-year rate by 12.5 bp in one direction and the 10-year rate by 12.5 bp in the opposite direction.

A further aspect of Freddie Mac's interest rate risk is seen by comparing the PMVS-L effects for the 50 bp and 100 bp shocks. For example, as of December 31, 2001, a 50 bp shock caused a 2.2% loss in the market value of equity, whereas a 100 bp shock caused a 8.8% loss in the market value of equity. This indicates that the loss in market value of equity rises much more than proportionately as the size of the rate shock rises—in this case, a doubling in the rate shock leads to a four-fold loss in market value of equity. This is a common feature of mortgage portfolio interest rate risk and is technically referred as a convexity effect. The key implication in the present circumstances is that we cannot extrapolate the results that Freddie Mac provides to larger interest rate shocks, since we do not know the amount of convexity that corresponds to such larger rate shocks.

Part B of Figure 9 shows PMVS results that isolate the effect of interest rate derivatives in reducing Freddie's interest rate risk. The before derivatives results correspond to what I earlier called balance sheet rate risk, and these results confirm the large amount of this risk. The benefit of the derivatives is seen in the 2nd column of Part B, indicating that the derivatives remove from one-third to one-half of the balance sheet risk. Finally, Part C of Figure 9 shows the daily distribution of PMVS-L results for 50 bp shocks over the last four years. These data are available because Freddie Mac uses this PMVS tool for managing and adjusting its interest rate risk on a daily basis.

Fannie Mae Retained Interest Rate Risk

Figure 10 shows the primary information released by Fannie Mae that measures its retained interest rate risk. Part A shows the loss in market value in equity for a 100 bp shock. This is similar in concept to the PMVS measure of Freddie Mac, but differs in two respects:

- 1) Fannie Mae shows the results separately for the 100 bp increase and the 100 bp decrease in interest rates. Freddie Mac, in contrast, only discloses the results for the most severe of the two loss measures.
- 2) The Fannie Mae measure includes the change in the market value of the firm's guarantee fee income as a result of the interest rate change. Guarantee fee income will fall when interest rates fall, since this is when more mortgages are prepaid, and this presumably accounts for the large loss in the market value of equity that Fannie Mae faces when rates fall.

Part B of Figure 10 shows Fannie Mae's Effective Duration Gap in months. These data can be translated into a measure of the sensitivity of Fannie Mae's market value of equity, but only for very small changes in interest rates (perhaps at the level of 5 or 10 bp). This instrument is used by Fannie Mae to monitor its interest rate exposure on a daily basis. Due to the problem of convexity, however, it is not a useful measure of Fannie Mae's interest rate risk for larger rate changes. Finally, Part C of Figure 10 shows a third measure of interest rate risk provided by Fannie Mae, the impact of 100 bp shocks on the amount of net interest income that is lost (or gained), as a cumulative effect for both a one-year and a four-year horizon. This measure is also likely to be valuable to Fannie Mae in monitoring its interest rate exposure on a daily basis. But it has limited value for measuring the aggregate amount of Fannie Mae interest rate risk, because it does not taken into account the valuation change for cash flows beyond the four year date.

Proposals for Modifications in the F&F Interest Rate Disclosures: Summary

The following 6 proposals are offered based on the preceding discussion of the interest rate risk disclosures of Fannie Mae and Freddie Mac:

- 1) Freddie Mac should show its market value results for rate changes in both directions, not just the direction of the greatest loss;
- 2) Fannie Mae should show its market value results with and without the effect of the change in guarantee fee income.
- 3) Fannie Mae should show its market value results with and without the effect of its interest rate derivative positions.
- 4) Both F&F should provide data to measure traditional maturity gaps, as a direct means of measuring the extent of their asset-liability maturity imbalance.
- 5) Both F&F should provide market value results for a much wider range of interest rate shocks. Alternatively, F&F should release detailed convexity information that would convey the same information.
- 6) All data pertaining to interest rate risk should be released at least at a monthly frequency, to allow changes in their interest rate exposure to be tracked over time. This information could be released with a significant time lag relative to the actual date to which it applied to protect F&F confidentiality.¹¹

¹¹ Information on the current risk exposure of F&F could be used by their trading partners to obtain a strategic advantage. This strategic value vanishes, however, if the news is released with a time lag, while it is still valuable for tracking interest rate exposure from a policy perspective. The notion here is similar to the time lag with which the minutes of the Open Market Committee of the Federal Reserve are released.

Proposals for Monitoring F&F Interest Rate Disclosures by OFHEO

Further aspects of F&F interest rate disclosures are best carried out by the Office of Federal House Enterprise Oversight (OFHEO), or by OFHEO working in conjunction with F&F. These proposals are also consistent with recent guidelines developed by the Basel Committee on Bank Supervision and the Federal Reserve's Working Group on Public Disclosure.¹² They are:

- 1) OFHEO should suggest standardized disclosures for F&F, consistent with the 6 proposals just above, to facilitate evaluation of the information and comparisons between the two firms. Since it might be considered improper for the two firms to discuss standardization directly, this would appear to be a useful and appropriate action by OFHEO.
- 2) OFHEO should institute random testing of F&F interest rate sensitivity measures, with respect to both the size of rate shocks and the dates at which the tests are made. Without such random testing, F&F could manage their interest rate derivatives to create window dressing—the appearance of well hedged positions—while the true position was hedged to a much lower degree. Interest rate derivatives lend themselves to window dressing, since low-cost positions can be created that cover only a specific rate shock (say from 99 to 101 bp, but nothing else), or for a specific date (say from December 30 to January 2, but nothing else). Random testing eliminates the potential for window dressing, and is commonly used by banking regulators for this reason.
- 3) OFHEO should institute a systematic program for validating the valuation models used by F&F. Other banking regulators commonly validate the pricing models being used by the institutions they supervise, and OFHEO should adopt a similar technique.

¹² See letter of January 11, 2001 from Walter V. Shipley to Fed Governor Laurence H. Meyer (available at <http://www.federalreserve.gov/boarddocs/press/general/2001/20010111/default.htm> and the Revised Approach of New Basel Capital Accord, available at <http://www.bis.org/publ/bcbsca.htm> .

- 4) OFHEO should create and adopt an explicit strategy for how it would respond were one or the other of the firms to be revealed to hold an unexpectedly large amount of interest rate risk. This would avoid the need to make ad hoc responses in a crisis situation. Ad hoc methods can be very costly, as seen in the response of the S&L regulator during the early 1980s.

4. The Dynamic Interest Rate Hedging Strategy of F&F

We have seen in Figures 9 and 10 that a 100 bp interest rate shock at a recent date could have cost Freddie Mac at least 14% of the market value of its equity, while Fannie Mae has been exposed to losses of more than 25% of the market value of its equity when the runoff of its guarantee fee income is included. Furthermore, due to the likely convexity in their portfolio positions, larger interest rate shocks would have caused substantially larger losses. So how much interest rate risk is actually held by F&F?

To answer this, a first step requires developing a realistic measure of the potential size of future interest rate shocks. One method of calibration is to look at the interest rate changes that have actually occurred in the US over the last 50 years. The data for 1-year and 10-year Treasury security interest rates have already been introduced in Figure 6. The following represent the largest interest rate shocks in the one-year Treasury rate observed in the US over the last 50 years:

- From December 1976 to August 1981 (4.6 years), the one-year rate rose 1,183 bp.
In the same time period, the 1 to 10 year yield curve steepened by 376 bp.
- From June 1980 to August 1981 (14 months), the one-year rate rose 856 bp.
In the same time period, the 1 to 10 year yield curve steepened by 340 bp.

- From August 1981 to October 1986, the one-year rate fell by 1,100 bp.
In the same time period, the 1 to 10 year yield curve flattened by 362 bp.
- From August 1981 to January 1983 (17 months), the one-year rate fell by 810 bp.
In the same time period, the 1 to 10 year yield curve flattened by 349 bp.

The Risks of Dynamic Hedging

F&F employ a technique known as dynamic hedging to protect against the interest rate risk that is otherwise created by such large interest rate shocks. The process involves 3 steps:

- 1) Maintain very complete hedges against near-term, likely, interest rate shocks;
- 2) The further out in time, and the large the possible rate shock, the less complete the hedge.
- 3) As interest rate levels change, and the unlikely becomes more likely, implement additional interest rate hedges. This is why the strategy is called dynamic hedging.

F&F employ dynamic hedging because it substantially reduces the expected costs of its interest rate risk hedging program. In the absence of dynamic hedging, F&F would have to institute a set of interest rate hedges to cover a wide range of extreme interest rate outcomes, each one of which would have a very low probability of occurring. This would entail taking interest rate derivative positions to cover very large rate shocks and for very far away dates. The interest rate derivative markets, however, become less much efficient—bid-ask spreads become much larger—for contracts involving large shocks and far away dates. Dynamic hedging avoids these high transaction costs, because the additional hedges required to offset unlikely rate shocks are implemented only as these events become more likely and the relevant derivative markets become more active and efficient.

There is, however, no free lunch. While dynamic hedging may reduce the hedging costs for a wide range of likely interest rate outcomes, the unlikely may still occur. In particular, a firm following a dynamic hedging strategy can lose most or all of the market value of its equity either because interest rate move by a very large amount over a very short span of time, or because interest rates change steadily and by large amounts over longer periods of time.

Going Short Interest Rate Volatility

Related to the use of dynamic hedging by F&F, both firms appear to be short interest rate volatility in a significant amount. The effects of being short rate volatility can be described as follows:

- If interest rates remain relatively stable, F&F do very well.
- If interest rates become more volatile (either rising or falling), F&F do less well.
- If interest rates become highly volatile, then due to the effects of convexity, F&F may well suffer serious losses.

A short position in rate volatility in effect provides liquidity to the marketplace. F&F are very well positioned to provide such liquidity to the market due to their GSE status. Going short liquidity generates profits on average, since firms in need of liquidity are willing to pay a price to obtain it. This provides a clear motivation for F&F to adopt this strategy. As with dynamic hedging, however, there is no free lunch. The costs of being short volatility arise primarily in the form of the costs of financial distress for F&F created by a liquidity crisis. In the event of a serious and continuing liquidity crisis, the need for F&F to roll over more than \$500 billion of debt annually would become the most visible aspect of this financial distress.

The OFHEO Stress Test

The Federal Housing Enterprises Financial Safety and Soundness Act of 1992 required OFHEO to issue risk-based capital regulations for F&F.¹³ These tests subject F&F to 600 bp rate shocks, both upward and downward, that are maintained over a 10-year period.¹⁴ The tests are even more severe because a major wave of mortgage defaults is assumed to occur at the same time. To pass the test, Fannie or Freddie must hold a sufficient amount of equity capital at the beginning of the test period to cover all the losses that the shock creates over the following ten years. The tests will be officially implemented for the first time later this year. F&F, however, have voluntarily subjected themselves to preliminary versions of the tests, and have reported passing the test each time.

The stress tests provide a highly useful complement to the self-reported interest rate sensitivity measures now being provided by F&F. In particular, many of the concerns raised by the dynamic hedging and short volatility strategies of F&F are answered by the newly created tests. However, I have 4 proposals to improve our confidence that the stress test is achieving its goal:

- 1) OFHEO should carry out rate shock tests of about 1,000 bp, in line with the interest rate changes that were actually observed in the United State little more than 20 years ago.
- 2) OFHEO should require random testing in terms of the size of rate changes and the date at which the test is implemented to avoid concerns of window dressing behavior. This proposal parallels the suggestions made earlier regarding the F&F interest rate disclosures.

¹³ Extensive documentation concerning the stress test is provided on the OFHEO web page, including the 576 page final report, available at <http://www.ofheo.gov/docs/regs/RBCFinal.pdf> .

¹⁴ The actual shocks are more complex, since there are minimum and maximum constraints based on the average interest rate level during the prior nine months, the shocks are phased in during the first year, and there are specific assumptions regarding the shape of the yield curve.

- 3) OFHEO should carry out and report continuing tests to validate its valuation model.
- 4) OFHEO should prepare operational plans for how it will respond were Fannie or Freddie to fail the stress test at some future date.

Mandatory Interest Rate Risk Standards for F&F

The Congressional charters for F&F and related legislation have set explicit standards for the credit risk that F&F could take on in carrying out their mortgage market mandates. For example, F&F can purchase mortgage loans with loan to value ratios up to 80% without additional credit enhancement, while specific enhancements such as private mortgage insurance are required when F&F acquire higher ratio loans. It is intriguing, therefore, that Congress did not set any similar standards for the interest rate risk that F&F could accumulate. My discussion here presumes this was an oversight.

The following factors motivate mandatory interest rate risk standards for F&F:

- It is feasible for F&F to finance their retained mortgage portfolio in a fashion that creates no interest rate risk. The decision by F&F to hold interest rate risk is voluntary and reflects the expected profits that it creates.
- Mortgage borrowers receive no direct benefit when the F&F retained mortgage portfolios contain interest rate risk. The expected profits from such risky positions flow entirely to F&F shareholders.
- Due to the interest rate risk held by F&F, a very large and rapid change in interest rate levels could leave the firms with either a negative value for the market value of their equity or with a serious liquidity crisis. In either case, intervention by the federal government is likely, creating significant costs for US taxpayers.

Implementation of interest rate risk standards can be most flexibly based on value-at-risk methods. The notion here is to delineate a set of future interest paths—perhaps all but the least likely 1%--and to require that F&F hold sufficient capital to cover the losses that would be created by even the most extreme of these outcomes. This can be considered an extension of the stress test model already created by OFHEO.

5. Conclusions

This paper has focused on the exposure of Fannie Mae and Freddie Mac (F&F) to interest rate risk, and has developed public policy proposals for disclosing and controlling this risk..

F&F should be commended for the voluntary interest rate disclosures they now provide. For the most part, the specific proposals I offer concerning rate risk disclosures are extensions and refinements of what F&F already do. However, significant new information will be revealed by our suggestion that the market value sensitivity measures cover much larger interest rate shocks, or equivalently that F&F provide greater disclosure regarding the convexity properties of their retained mortgage portfolio. I also propose a significantly more active role for OFHEO, to provide oversight of the F&F interest rate disclosures. Perhaps our most important proposal for OFHEO is to create methods that would eliminate the possibility of F&F using derivatives to window dress the results for the rate sensitivity of their market value of equity.

Our analysis also raised concerns for the overall level of the interest rate risk held by F&F as the result of F&F using dynamic hedging as a key component of their interest rate risk management strategy. While dynamic hedging is highly cost effective, it provides no direct benefit to mortgage borrowers, and imposes significant costs on US taxpayers in terms of a potential future F&F bailout. As a result, I propose that F&F hold sufficient capital to sustain losses created by all but the most severe of conceivable interest rate environments.

Figure 1: F&F Securitization and Retained Mortgage Portfolio Business Lines

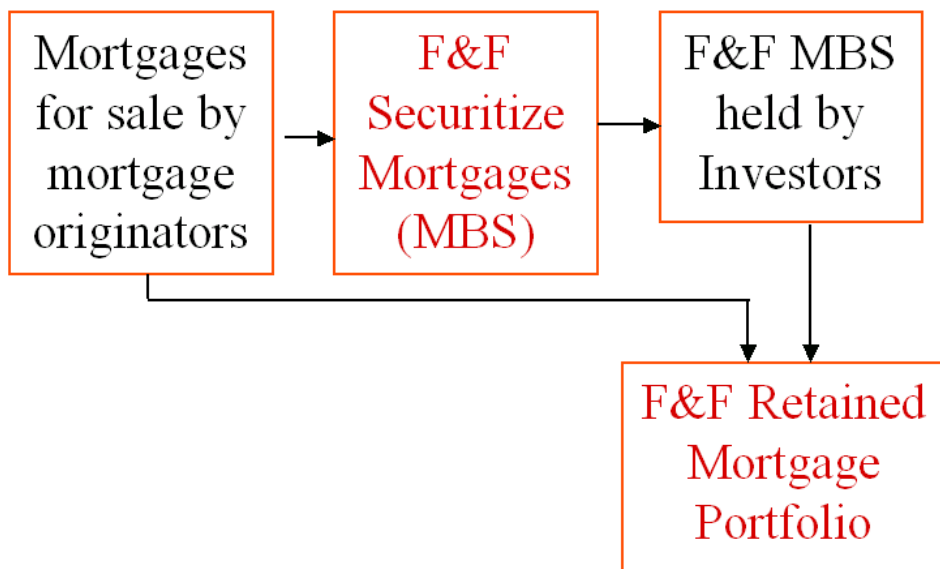


Figure 2: F&F Retained MBS as % of Total MBS Issued

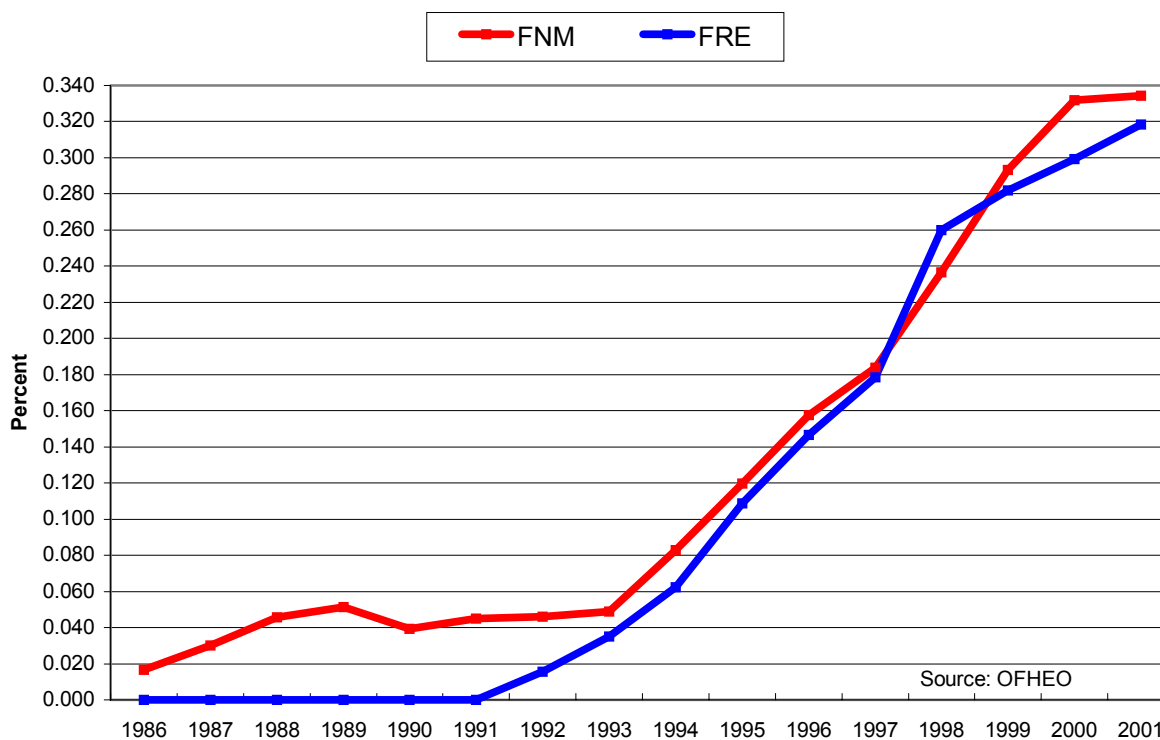


Figure 3: F&F Retained Portfolio relative to Net MBS Issued

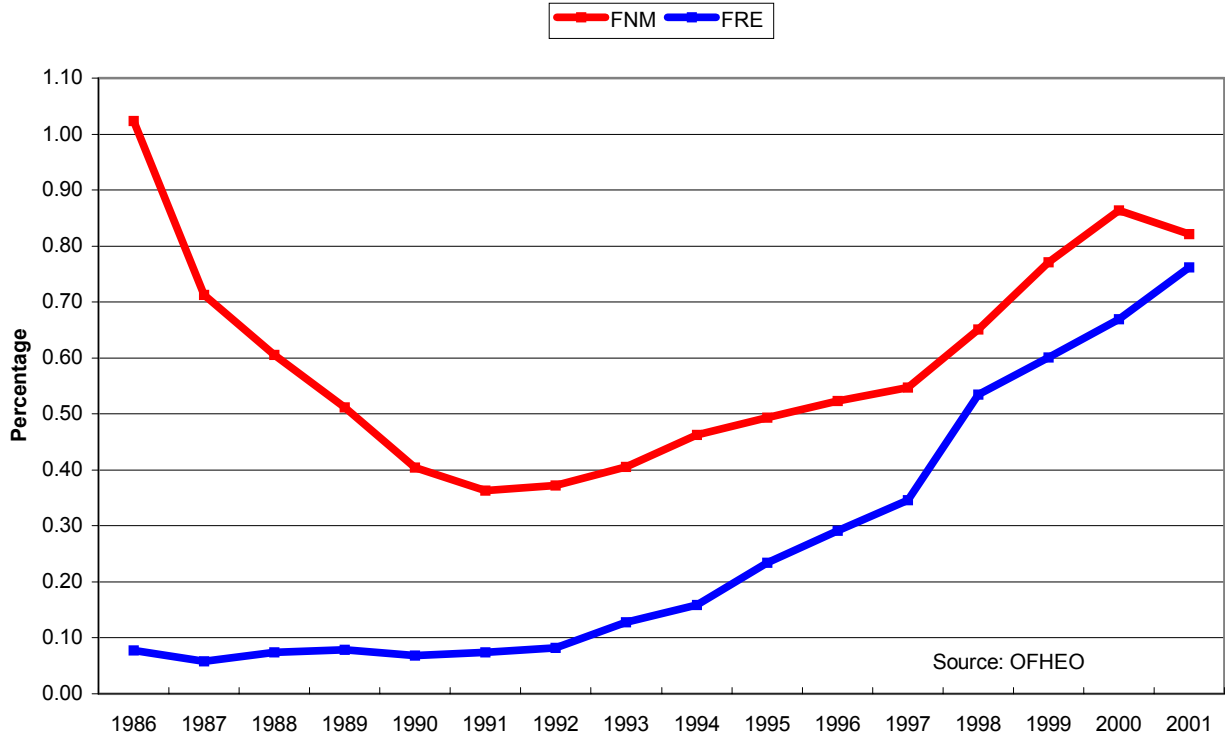


Figure 4: Sources of F&F Profits

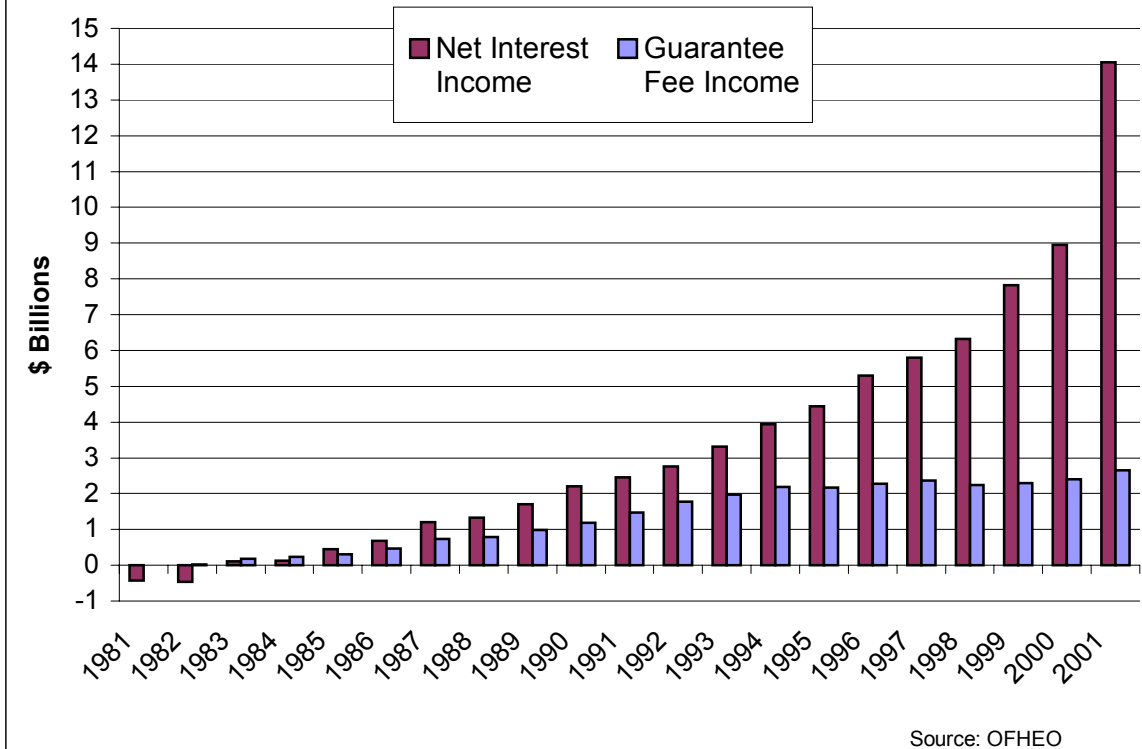
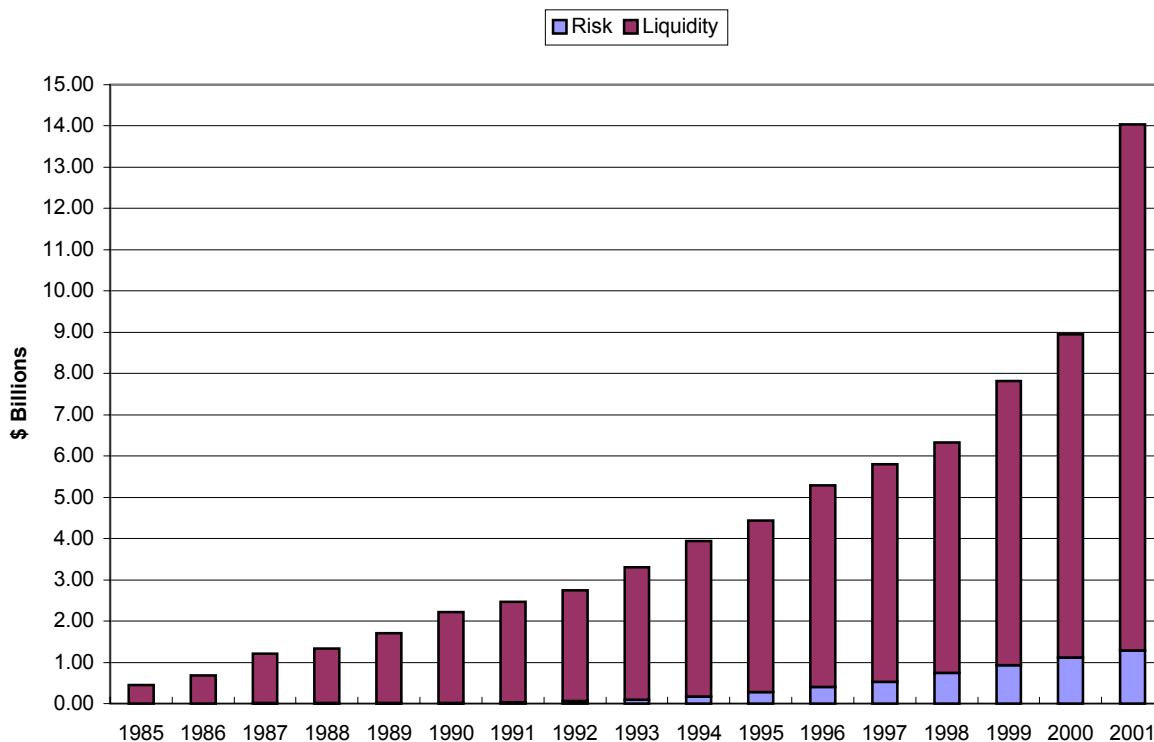


Figure 5: F&F Retained Portfolio Net Income, by Components



Source: OFHEO and author's calculation.

Figure 6: Treasury Constant Maturity Interest Rates

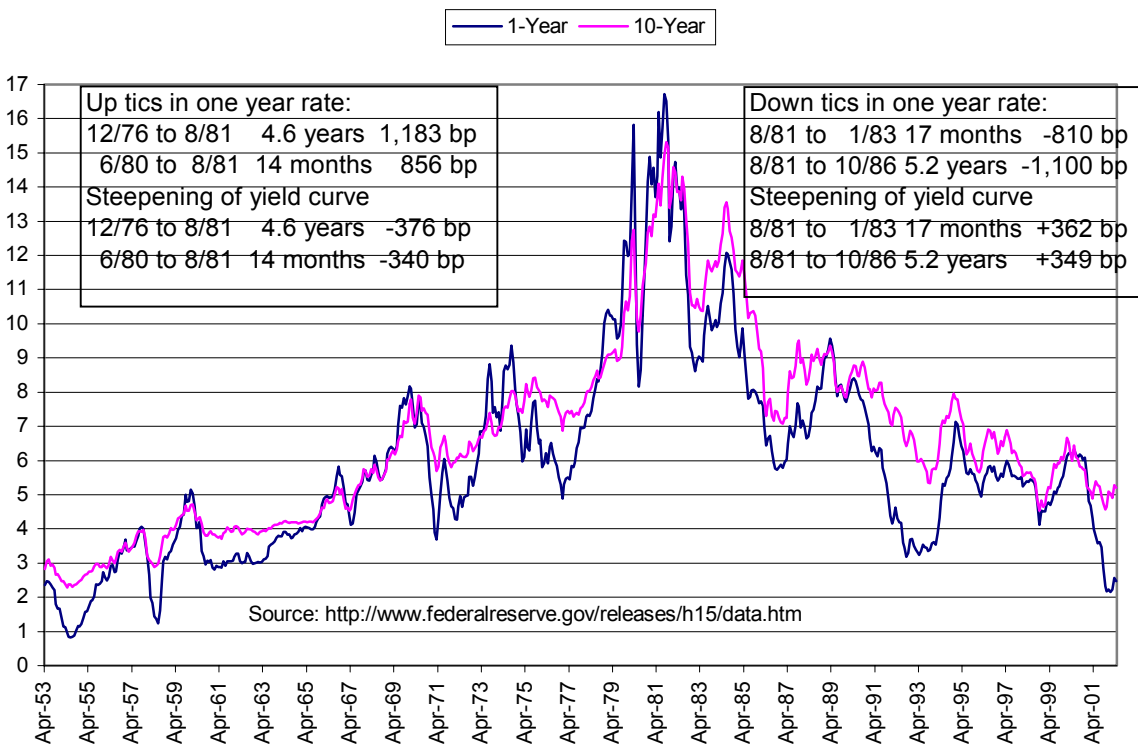


Figure 7

How Total Assets Are Financed Freddie Mac, as of 12/31/2001		
	\$ billions	% of total
Debt, within 1 year	250	40.55%
Debt, after 1 year	312	50.48%
Other liabilities	40	6.48%
Stockholders' equity	15	2.49%
Total	617	100.00%
Memo:		
Callable debt	96	15.63%
Retained	494	80.06%
FRE, Information Statement, 3/29/02		

How Total Assets Are Financed Fannie Mae, as of 12/31/2001		
	\$ billions	% of total
Debt, within 1 year	343	42.95%
Debt, after 1 year	420	52.51%
Other liabilities	18	2.28%
Stockholders' equity	18	2.27%
Total	800	100.00%
Memo:		
Callable debt	140	17.50%
Retained Mortgages	705	88.17%
FNM, Information Statement, 4/1/2002		

Figure 8

Freddie Mac Derivatives, \$ billions as of 12/31/2001		
	Notional Amount	Net Fair Value
Interest-rate swaps	443	-6.0
Option-based	408	5.2
Other	201	0.0
Total	1,052	-0.8

Fannie Mae Derivatives, \$ billions as of 12/31/2001		
	Notional Amount	Net Fair Value
Interest-rate swaps	300	-8.9
Option-based	220	6.3
Other	13	-1.5
Total	533	-4.1

Figure 9: Freddie Mac Retained Interest Rate Risk

Part A (Source: FRE Information Statement, March 2002)

FRA	Loss in Market Value of Equity			Loss in Market Value of Equity		
	Percent			\$ Millions		
	PMVS-L	PMVS-L	PMVS-YC	PMVS-L	PMVS-L	PMVS-YC
As of 12/31	50 bp	100 bp	25 bp	50 bp	100 bp	25 bp
2001	2.2%	8.8%	0.3%	262	1,031	36
2000	2.5%	8.5%	n/a	272	924	n/a
1999	0.8%	2.9%	n/a	102	366	n/a
1998	3.9%	14.0%	n/a	362	1,300	n/a

Part B (Source: FRE Information Statement, May 2002)

PMVS-L	Before	Derivative	After
100 bp	Derivatives	Benefit	Derivatives
31-Mar-02	28.51%	19.54%	8.97%
31 Dec 01	28.90%	18.61%	10.29%
31-Mar-01	23.52%	11.99%	11.53%

Part C (Source: FRE Information Statement, March 2002)

EXHIBIT 2—RISK MANAGEMENT RESULTS

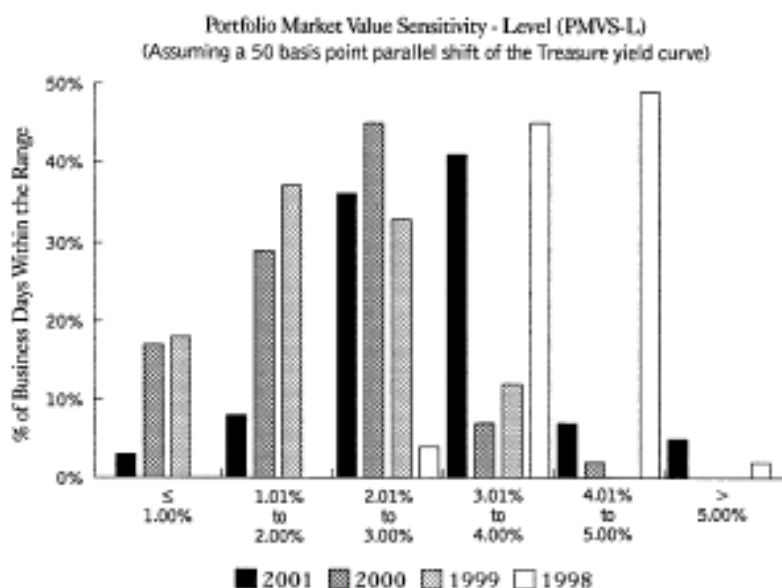


Figure 10: Fannie Mae Retained Interest Rate Risk

Part A (Source: FNM Information Statement, April 2002)

FNM	Loss in Market Value of Equity Percent 100 bp			Loss in Market Value of Equity \$ Million 100 bp	
	As of 12/31	rate rise	rate fall	rate rise	rate fall
	2001	9%	23%	2168	5288
	2000	2%	28%	473	5855

FNM	Net Interest Income Percent Lost During Year 1 100 bp			Net Interest Income Percent Lost During Years 1 to 4 100 bp	
	As of 12/31	rate rise	rate fall	rate rise	rate fall
	2001	10%	-1%	10%	3%
	2000	2%	2%	5%	9%

Part B (Source: FNM Information Statement, April 2002)

FNM	Effective Duration Gap (months)
2001-4	5
2001-3	-1
2001-2	5
2001-1	1
2000-4	-3
2000-3	2
2000-2	4
2000-1	5

Part C (Source: FNM Information Statement, April 2002)

FNM	Net Interest Income Percent Lost During Year 1 100 bp			Net Interest Income Percent Lost During Years 1 to 4 100 bp	
	As of 12/31	rate rise	rate fall	rate rise	rate fall
	2001	10%	-1%	10%	3%
	2000	2%	2%	5%	9%

References

Ambrose, Brent and Arthur Varga [2002], “Measuring Potential GSE Funding Advantages,” Journal of Real Estate Finance and Economics, Volume 25, Issue 2.

Bank for International Settlements [2001], Revised Approach of New Basel Capital Accord, available at <http://www.bis.org/publ/bcbsca.htm> .

Congressional Budget Office [2001a], Federal Subsidies and the Housing GSEs, May.

Congressional Budget Office [2001b], Interest Rate Differentials Between Jumbo and Conforming Mortgages, 1995-2000, May.

Fannie Mae [2002], Information Statement, April 1.

Board of Governors of the Federal Reserve System [2001], Agencies Release Recommendations of Working Group on Public Disclosure, January 11, available at <http://www.federalreserve.gov/boarddocs/press/general/2001/20010111/default.htm> .

Frame, W. Scott and Larry D. Wall, [2002], “Finance Housing through Government-Sponsored Enterprises, Federal Reserve Bank of Atlanta Economic Review, First quarter.

Freddie Mac [2002], Information Statement, March 29..

Hermalin, Benjamin and Dwight Jaffee [1996], “The Privatization of Fannie Mae and Freddie Mac: Implications for Mortgage Industry Structure,” in Studies on Privatizing Fannie Mae and Freddie Mac, US Department of Housing and Urban Development, May 1996.

Office of Federal House Enterprise Oversight [2001], Final Risk-Based Capital Regulation, July 19, available at <http://www.ofheo.gov/docs/regs/RBCFinal.pdf> .

Scholes, Myron S. [2000], “Crisis and Risk Management,” American Economic Review, Vol No, No. 2.