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Controlling the Interest Rate Risk of Fannie Mae and Freddie Mac

Dwight M. Jaffee

Abstract: It is now widely recognized that the interest rate risks embedded in the Fannie Mae and Freddie Mac (F&F) retained mortgage portfolios create a serious threat to the US financial system. This paper evaluates proposals to control the interest rate risk embedded in these portfolios. The analysis focuses on the current proposal to limit the size of the F&F retained portfolios, but also considers alternative means to control this interest rate risk. The analysis takes into account (1) what fund sources would replace F&F as mortgage investors, (2) where will the interest rate risk reside after it is removed from the F&F portfolios, and (3) what is the likely impact of the change on US mortgage interest rates. The conclusion is to endorse several solutions, including size limitations on the F&F retained portfolios, each of which would reduce or eliminate the F&F interest rate risk that currently threatens the US financial system.

About the Author: Dwight M. Jaffee is the Booth Professor of Finance and Real Estate at the Haas School of Business, University of California, Berkeley, where he has taught since 1991. At UC Berkeley, Professor Jaffee previously served as Chairman of the Finance Group and currently serves as Co-Chairman of the Fisher Center for Real Estate and Urban Economics. He received his Ph.D. in economics at the Massachusetts Institute of Technology. Jaffee is the author of 6 monographs and numerous economic journal articles. His research covers such diverse areas as globalization, financial institutions and lending activity, real estate finance, and catastrophe insurance. His most recent work on globalization is the co-authored book *Globalization and a High-Tech Economy: California, the US, and Beyond* (Kluwer, 2003).

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1. Introduction

Fannie Mae and Freddie Mac (F&F) are government sponsored enterprises (GSEs) that operate within the US mortgage market.[1] F&F have two business lines, one to issue mortgage-backed securities (MBS) to investors, the other to purchase and hold mortgages and MBS in their "retained mortgage" portfolios. It is increasingly recognized that the interest rate risk embedded in the F&F retained mortgage portfolios represents a serious threat to the US financial system.[2] This paper evaluates proposals to limit the size of the retained portfolios and other possible methods that would control the interest rate risk embedded in the F&F retained portfolios.

In an earlier paper, Jaffee [2003], I documented that F&F were holding large amounts of unhedged interest rate risk in their retained portfolios, and concluded that government regulation of the firms should be expanded to control this risk. This conclusion has now been reinforced by the recent accounting scandals at the two firms, which provide further evidence that the firms are unable to control their

[1] F&F are "government sponsored" since they were chartered directly by Act of Congress, they retain special connections to the federal government (such as a line of credit at the US Treasury), and their debt and guarantee obligations trade in the financial markets as if they have an implicit Treasury guarantee. At the same time, they are shareholder owned, with equity shares trading on the New York Stock Exchange.

[2] See White and Frame [2005] for a recent survey of a variety of policy issues involving Fannie Mae and Freddie Mac, as well as an extensive list of citations to the growing literature.

interest rate risk. As a result, proposals to limit the size of the GSE retained mortgage portfolios have received significant attention.[3] For example, Fed Chairman Alan Greenspan, CBO Director Douglas Holtz-Eakin, and Treasury Secretary John Snow testified to Congress in favor of placing quantitative limits on the F&F retained mortgage portfolios (Greenspan [2005], Holtz-Eakin [2005], and Snow [2005]). Director Holtz-Eakin set the issue very clearly (Holtz-Eakin [2005], page 1):

> "The large mortgage portfolios held by Fannie Mae and Freddie Mac are not necessary for the secondary mortgage market to operate efficiently; those enterprises' issuance of mortgage-backed securities (MBSs) can accomplish that outcome. In fact, their holdings in portfolios are the source of much of their risks and federal subsidies and most of their accounting difficulties. If the housing GSEs' investment portfolios were reduced through statute, regulation, or the adoption of investment portfolio fees, federal subsidies would lessen, with little change in benefits."

At the same hearings, Fannie Mae CEO Daniel Mudd and Freddie Mac CEO Richard Syron testified against such a proposal (Mudd [2005] and Syron [2005]). CEO Syron made his case equally directly (Syron [2005], p. 16):

> "Artificial caps would not reduce the risks associated with long-term prepayable fixed-rate mortgages. Instead, other institutions, primarily federally insured depositories, would assume the burden of managing the interest risk... In summary, the GSE portfolios serve important policy objectives and are integral to the overall efficiency and stability of the mortgage market. Our portfolio programs represent an important corollary to the securitization process - and therefore cannot be eliminated without the potential of significant harm to the system."

This paper provides a systematic evaluation of proposals to control the interest rate risk embedded in the F&F retained mortgage portfolios. Limiting the

[3] Wallison [2006] provides a highly useful review of how the various proposals before Congress have evolved. In an earlier version of this paper, Jaffee [2005], I focused on a proposal to limit the size of the F&F retained mortgage portfolios. This version of the paper is revised and expanded to evaluate a range of alternative methods that would control the interest rate risk embedded in the F&F retained portfolios.

size of the F&F retained mortgage portfolios is the leading proposal. The paper, however, also considers alternative methods that could achieve the same outcome. These alternatives include higher capital requirements, more rigorous use of the OFHEO stress test, and direct controls on the interest rate risk embedded in the F&F portfolios. If properly implemented, any one of these proposals could control the embedded interest rate risk. The alternatives, however, have differing side effects on F&F and on the mortgage markets they serve. Thus, the choice among them should consider both the ease of implementation and the possible side effects.

We begin by discussing the F&F business model, and the role these firms play within the US mortgage market.

2. Fannie Mae, Freddie Mac, and the US Mortgage Market

Fannie Mae and Freddie Mac (F&F) represent, by a large margin, the two largest participants in the US mortgage market. They have a major impact on most mortgage transactions:

- Mortgage originators anticipate that they must satisfy the F&F "automated mortgage underwriting" criteria if they are to transact with F&F to securitize or sell their mortgages.
- F&F have created as many as two-thirds of all residential mortgage backed securities (MBS).
- F&F have held as much as one-fifth of all US mortgage related securities in their portfolios.

We now consider more precisely how F&F operate and how they affect the US mortgage market.

2.1 The Two Business Lines of Fannie Mae and Freddie Mac

F&F operate two distinct business lines, *mortgage backed securities* (MBS) and

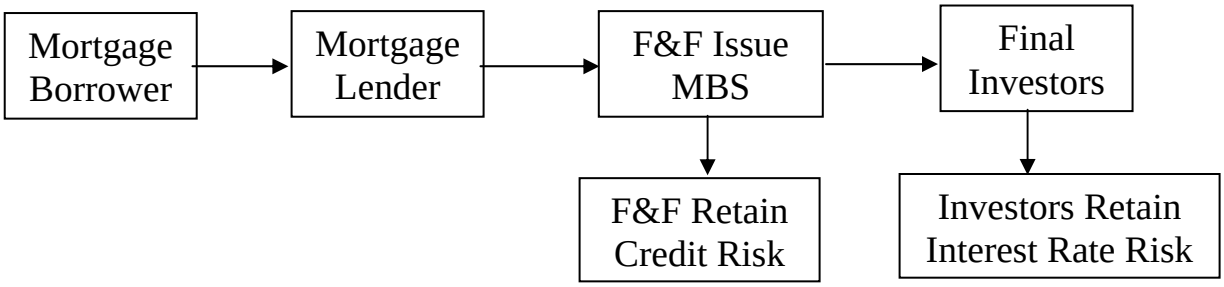
retained mortgage portfolios, both of which are illustrated in Figure 1. The upper panel shows the MBS business line, with the mortgages passing from borrowers to lenders, then to a F&F MBS instrument, which is sold to final investors. The lower panel shows the retained mortgage portfolio business line, in which F&F directly purchase various mortgage-related securities, mainly the repurchase of their own MBS.

For the MBS line, the final investors directly hold the MBS instruments, while for the Retained Portfolio line, these investors hold F&F GSE bonds, which in turn finance the F&F portfolios.[4] This implies that, ultimately, all funding for US mortgages comes from the same final investors. F&F are only intermediaries, who expedite the transfer of funds from the final investors to the consumer borrowers. Thus, from the funding perspective, the impact of F&F on the mortgage market should be essentially the same for both business lines, since they are just alternative means to transfer funds from the final investors to the consumer borrowers.

[4] F&F must also hold capital, equal to 2.5% of their retained mortgage portfolio, and 0.45% of their net outstanding (off-balance sheet) MBS obligations.

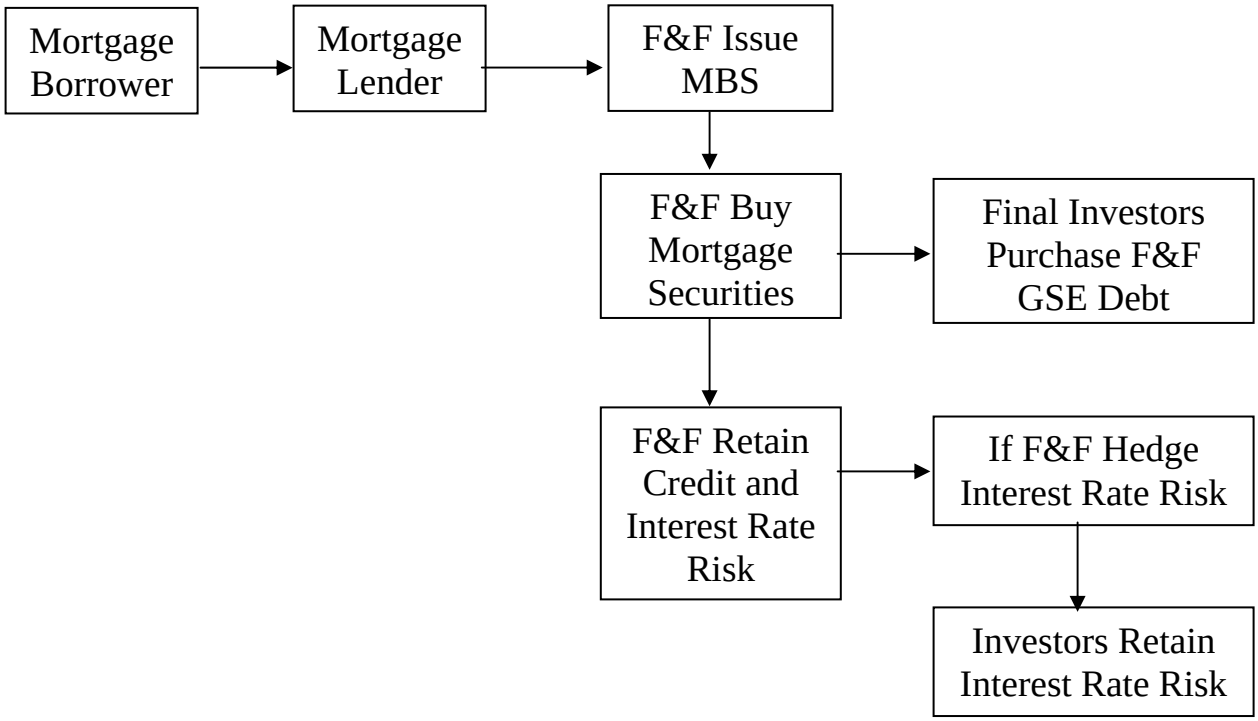
Figure 1: F&F Business Line Interaction with the US Mortgage Market

A. The F&F MBS Channel



MBS Channel: final investors fund the mortgages and retain the interest rate risk;
F&F retain the credit risk.

B. The F&F Retained Mortgage Portfolio Channel



Retained Portfolio Channel: final investors fund the mortgages, F&F retain credit risk, and F&F or final investors retain interest rate risk, depending on F&F rate risk hedging.

The two business lines are also identical in that the embedded credit risk is fully retained by F&F, either through their guarantee of F&F MBS, or through the risk of the mortgages directly held in their retained portfolios. Thus, also from a credit risk perspective, the impact of F&F on the US mortgage market should be the same across the two business lines.

The two business lines are potentially different, however, with regard to who holds the interest rate risk on the underlying mortgages. With the MBS line, all the interest rate risk rests with the final investors. In contrast, for the retained portfolios, where F&F *are* the investors, the interest rate risk rests in the first instance with F&F, although F&F can hedge this risk by transferring it to other final investors, as shown at the very bottom of Figure 1. Indeed, if F&F were to place all their interest rate risk with such capital market investors, then the impact of F&F on the US mortgage market would again be the same across the two business lines. In other words, *a differential impact from the F&F retained mortgage portfolios on the US mortgage market may arise only to the extent that F&F do not hedge all their interest rate risk.*

We next consider quantitative features of the two channels through which F&F have impact on the US mortgage market. We start with the F&F profitability of the two lines.

2.2 The Relative Profitability of MBS Issue and Retained Mortgage Portfolios

The profit potential for the two F&F business lines is substantially different. Revenue from the F&F MBS line derives primarily from the annual fee received for guaranteeing the timely payment of interest and principal. The average guarantee fee

for the most recent year of available data, 2003, was just over 20 basis points (bp) for the two firms.[5] Revenue for the retained mortgage portfolios, in contrast, is based on the spread between the interest rate earned on the mortgage assets and the interest cost of the funding liabilities. For example, in 2003, the average spread was 172 bps for Fannie Mae and 186 bps for Freddie Mac[6]. The relatively large size of this rate spread arises from the low interest cost of F&F debt (due to the implicit Treasury guarantee) and the compensation for accepting the interest rate risk associated with the mortgage securities held in the portfolios. A non-GSE firm could not enjoy these exceptional profits, since its bond investors would require a much higher interest rate to compensate for the interest rate risk embedded in the underlying mortgage portfolio. F&F are able to enjoy such high profit rates only because *their* bond investors assume the US Treasury will bail them out were either firm to face serious financial distress—this is the key benefit of the implicit guarantee.

Figure 2 compares the guarantee fee income F&F received on their net outstanding MBS with the net interest income they earned on their retained mortgage portfolios. F&F's aggregate income is now dominated by the retained portfolio component. Furthermore, as documented in Jaffee [2003], the rate of return on equity (ROE) earned by the retained portfolio line substantially exceeds the ROE on the MBS securitization business line. This has provided F&F a significant incentive to expand their retained portfolios relative to their MBS business, at least until

[5] All aggregate F&F data reported in this paper are from the Office of Federal Housing Enterprise Oversight, OFHEO [2005]. These data include the restated values for Freddie Mac for the years since 2001, but comparable restated values are not yet available for Fannie Mae.

[6] The data are from Table 1 in the Fannie 2003 10K and Table 14 in the Freddie Mac 2003 annual report.

constrained by the recent accounting problems. Furthermore, the overall ROE earned by Fannie Mae and Freddie Mac far exceeds that of all other major US financial firms, representing the combined benefit of the implicit government guarantee on their GSE debt and MBS issues and their relatively low capital requirements.

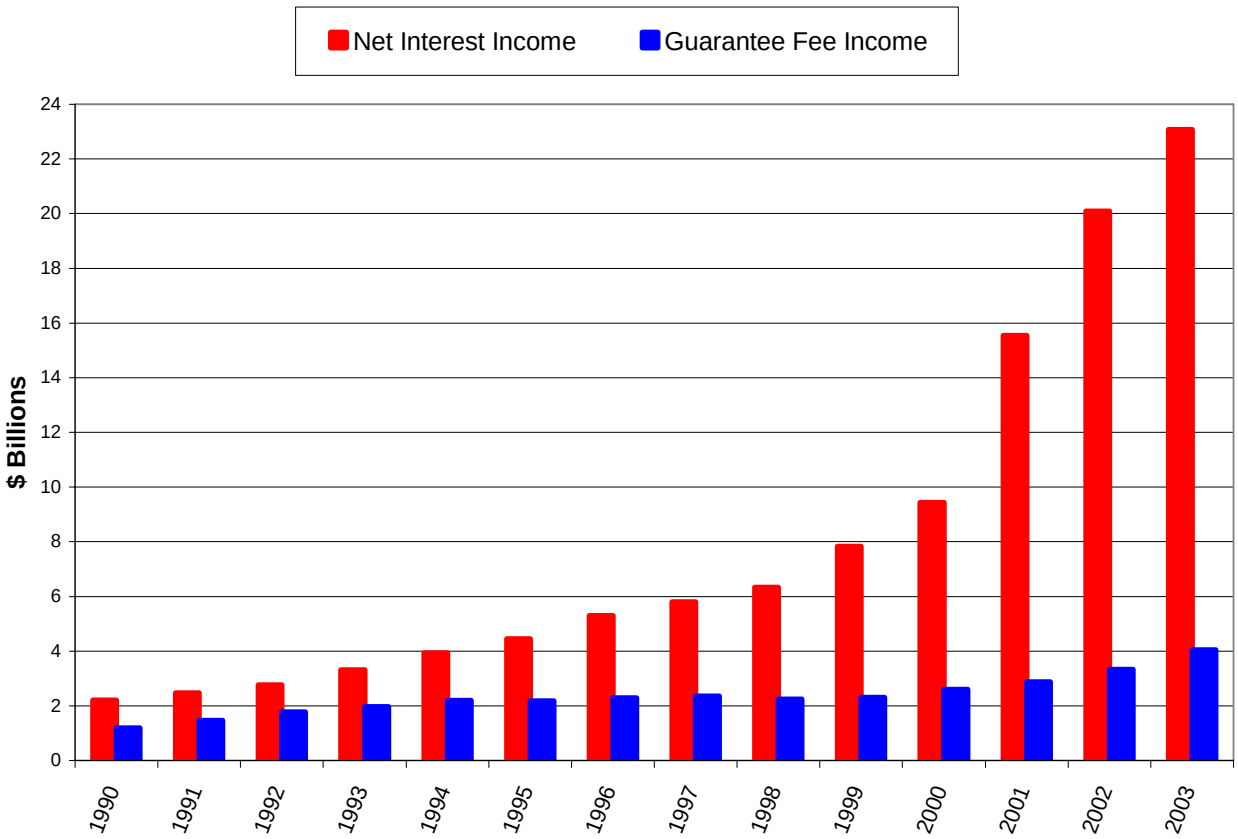


Figure 2. Primary Sources of Fannie Mae and Freddie Mac Revenue. The MBS business-line earns guarantee fees, which have grown slowly over time. The net interest income on the retained portfolios, in contrast, has expanded rapidly in line with the growing size of the portfolios. Source: OFHEO [2005].

2.3 The Relative Size of MBS Issue and Retained Mortgage Portfolios

Figure 3 compares the relative size of the two business lines from 1990 to 2005. In 1990, the Retained Portfolios represented 23% of the Net MBS, but this ratio grew to 80% by 2001 (see solid line and right axis in Figure 3). This dramatic growth in the retained mortgage portfolios reflects the F&F response to the much

higher profitability of this business line. Since 2001, the retained portfolios have declined relatively, as accounting issues have forced the firms to curtail their portfolio purchases. It is expected, however, that once F&F are beyond the current accounting issues, they will again expand the size of the retained mortgage portfolios, unless new regulatory constraints are imposed on the firms.

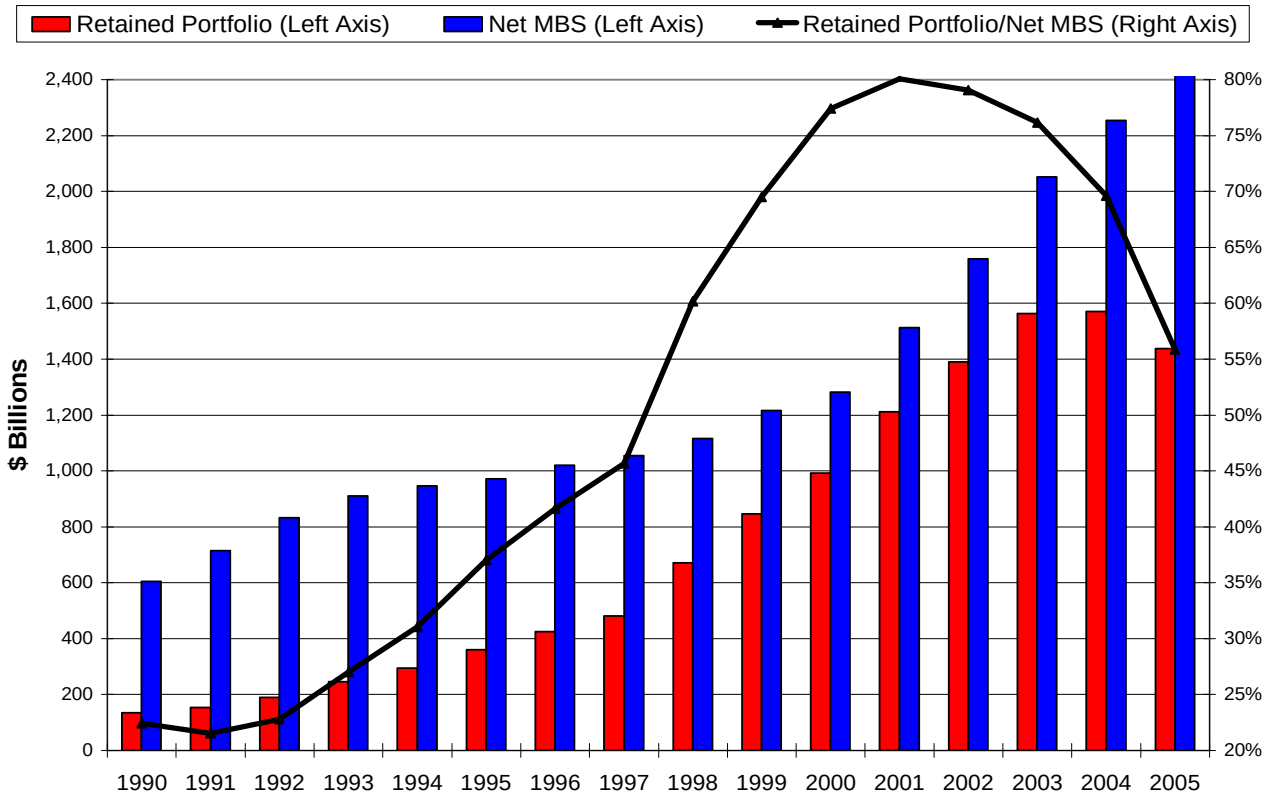


Figure 3: Fannie Mae and Freddie Mac Retained Portfolios Relative to Net MBS. Since 1990, the retained mortgage portfolios of Fannie Mae and Freddie Mac have grown rapidly, reaching 80% of their net MBS outstanding in 2001. Source: OFHEO [2005].

2.4 The Role of the Retained Mortgage Portfolios in the US Home Mortgage Market

US home mortgages or mortgage-backed securities are ultimately held by one of three major investor classes: Banks and Thrifts, F&F retained portfolios, and all others (noted here as Capital Market Investors). The three holder groups represent, in

fact, the three alternative channels through which capital market funds are allocated to holding the outstanding stock of home mortgages. Figure 4 shows the market shares for these three principal and identifiable classes of mortgage holders since 1990. Banks and thrift institutions represent the largest and oldest channel, in which these depository institutions first originate and then hold mortgage securities, based on their deposits and other funds. The F&F retained portfolios are a second holder class, funded through GSE debt, which provides an alternative link to the capital markets. Finally, the Capital Market Investor channel covers all other holders, and primarily represents the channel through which MBS are held by such capital market entities as mutual funds and hedge funds.

Figure 4 shows that from 1990 to 2003, the F&F retained mortgage portfolio share rose from 5% to 22%, before declining to 16% in 2005 (as a result of their accounting crises). From 1990 to 2005, the Bank and Thrift share of total mortgage holdings fell steadily, with a cumulative decline of 10 percentage points (from 56% to 46%). From 1992 to 2002, the Capital Market Investor share fell by 13 percentage points (from 42% to 29%), before recovering to 38% in the last three years. Overall, the figures shows the rapid expansion of the F&F retained mortgage portfolios, curtailed only by the onset of their accounting crises.

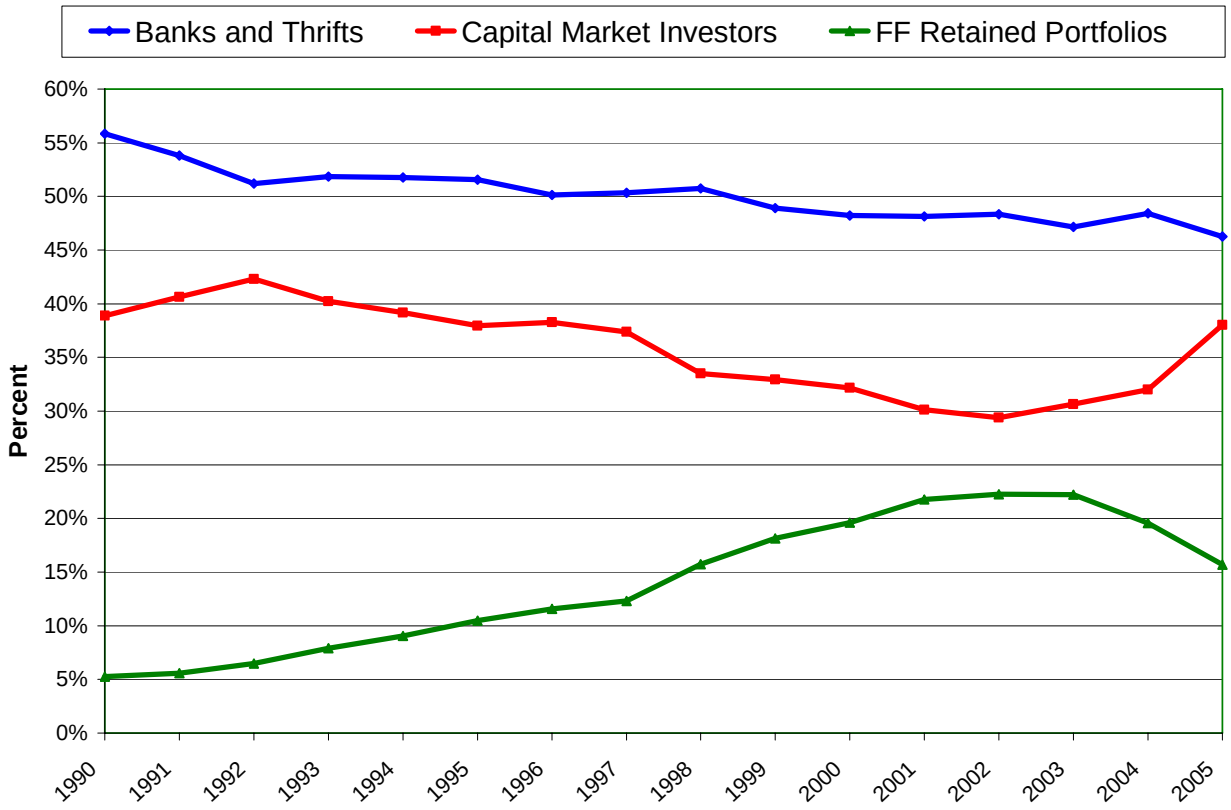


Figure 4. Home Mortgage Securities, by Share of Major Holders. US home mortgages are held by three major groups: Banks and Thrifts, Fannie and Freddie, and Capital Market Investors. Source: Federal Reserve, Inside ABS and MBS, and Fannie Mae and Freddie Mac Monthly Reports.

3. The Interest Rate Risk Embedded in Mortgage Portfolios

We now consider the interest rate risk that is embedded in the F&F retained mortgage portfolios. The interest rate risk arises primarily from the long-term, fixed-rate, and freely prepayable, mortgage that is the mainstay of the US home mortgage market and, correspondingly, underlies the vast majority of the F&F retained mortgage portfolios.

Table 1 provides a useful quantitative gauge of the losses that may be created by a 30 year, fixed-rate, freely-prepayable, mortgage when interest rates change unexpectedly. We start with a hypothetical 6% market rate for the mortgage, and

assume that the mortgage and its funding source both have coupons that put their initial market price at par (100). For Case 1, we now suppose that all market rates *rise* by 2 percentage points, and that the firm is funding its mortgage with short-term debt. As shown in Table 1, the mortgage value falls to 81.8, while the funding source value remains at 100 (because the short-term debt rollover always occurs at par). The upshot is a 18.2% loss, which illustrates the standard result for a "short-funded" portfolio in a rising interest rate environment.

For Case 2, we alternatively assume that all market rates *fall* by 2 percentage points, the firm is maturity matched in its funding, but it has not hedged the mortgage prepayment option. As shown in Table 1, the mortgage value remains at 100, since this is the amount paid by the borrower upon prepayment. The firm, however, is still responsible for the funding source, whose market value is now 125.6. The upshot is a 25.6% loss, which illustrates the loss potential for a maturity-matched firm that fails to hedge the prepayment option on its mortgage assets

Table 1: Potential Mortgage Portfolio Losses	
30-Year, 6% Fixed Rate, Prepayable Mortgage	
Initial mortgage rate	6%
Initial Mortgage Value	100.0
Initial Debt Value	100.0
Case 1: Market Rates Rise by	
2 percentage points (mortgage rate = 8%);	
Firm is short-funded.	
Mortgage Value	81.8
Funding Value	100.0
Net value change	-18.20%
Case 2: Market Rates Fall by	
2 percentage points (mortgage rate = 4%);	
Firm is maturity matched, but mortgage prepays.	
Mortgage Value	100.0
Funding Value	125.6
Net value change	-25.6%

The table thus demonstrates that, whichever way market rates might change, a mortgage portfolio may suffer major losses. To put these potential losses in context, the F&F retained portfolio capital requirement is only 2.5%, so capital would provide no significant protection if the firms were actually to suffer losses to the degree illustrated here. It is also noteworthy, as shown in Figure 5, that changes of 2 percentage points or more within a 12-month period rate have occurred during at least 9 distinct episodes since 1953 for 10-year US Treasury rates, and even more often for shorter-term Treasury securities.

To be sure, F&F hedge a part, and in some cases a significant part, of their interest rate risk. Table 1 thus illustrates only worst case scenarios in the sense that, given the direction of the change in interest rates for each case, we have assumed precisely the worst possibility for how the firms control their interest rate risk. This is appropriate for illustrating the toxic potential that necessarily exists in any

portfolio investing primarily in fixed-rate, long-term, freely-prepayable mortgages. We now consider how F&F actually do hedge their interest rate risk.

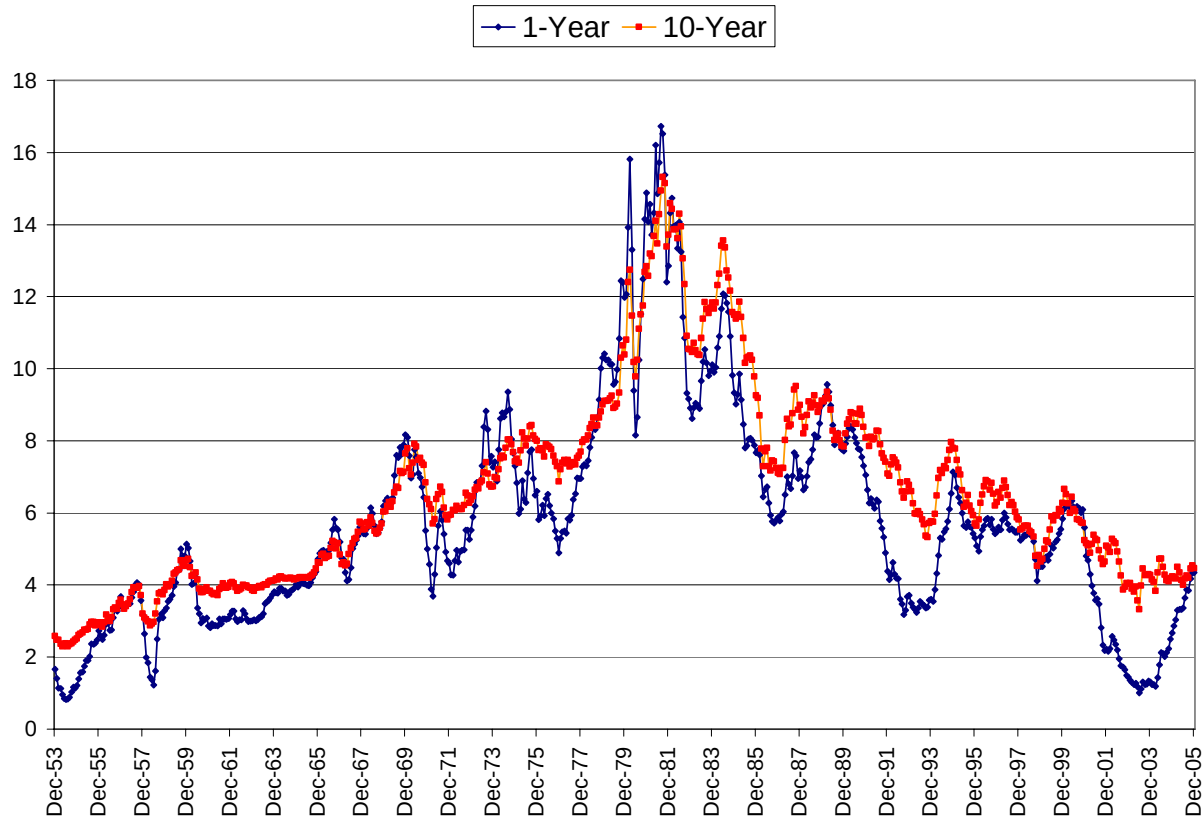


Figure 5. US Treasury Constant Maturity Interest Rates Since 1953. US Treasury 10-year interest rates have changed by more than 2 percentage point within a 12 month period during 9 distinct episodes since 1953 (covering the years from 1980 to 1986 and 1994 to 1995). The one-year Treasury rate, of course, has been even more volatile. Source: US Treasury [2005].

3.1 Interest Rate Risk Hedging by Fannie Mae and Freddie Mac

F&F use interest rate derivatives to avoid the outcomes illustrated in Table 1.The firms have used interest rate swaps to adjust the portfolio duration (to avoid the Case 1 outcome), and they use option-based derivatives (in particular, swaptions) to hedge the mortgage prepayment risk (to avoid the Case 2 outcome). A detailed discussion

of their hedging programs is provided in Jaffee [2003]. The following is a summary of the F&F hedging programs:

1) The firms use very *complete short-run hedging* strategies to hedge against losses from small or moderate, near-term, interest rate changes. This is sensible because, otherwise, the firms would just have to replace any lost capital to continue to meet their capital requirements; furthermore, by hedging, the firms maintain a more stable pattern of earnings.

2) The firms carry out relatively *little long-run or catastrophic hedging* against the risks of potentially very large interest rate changes, especially those that might occur in the more distant future. The firms find it is too expensive to hedge these risks, which in any case are likely to create losses well beyond the level of each firm's capital. The risk is thus borne primarily by the US Treasury as the result of its implicit guarantee of the F&F liabilities.

3) The firms use a *dynamic hedging strategy* in which they progressively adapt their hedged positions as interest rate levels change. This provides a partial offset to the risks in (2), but it is necessarily incomplete since the cost of hedging itself rises as the initially unlikely possibilities become more likely. In addition, the firms do not commit to follow a dynamic hedging strategy. Indeed, recent results for the two firms suggest they have taken distinct bets on the expected direction of interest rates, just the opposite of a dynamic hedging approach.[7]

Overall, the F&F interest rate hedging strategies represent a sophisticated use of interest rate derivatives, implemented to maximize shareholder value. The problem is not the firms' skill in carrying out the strategy, but that this strategy, when

[7] The evidence is provided by the OFHEO stress test results for those quarters in which the losses the firms suffer are asymmetric between the rate increase and rate decrease shocks. This suggests the firms had more fully hedged against rate changes in one direction than the other. This is equivalent to betting that interest rates will move in the unhedged direction. Moreover, it appears from this same evidence there have been periods in which Freddie Mac was betting that rates would fall (which they did), while Fannie Mae was betting that rates would rise. This is a key reason that Freddie Mac's restatement raised its reported profits, while Fannie Mae's restatement is likely to lower its reported profits.

successfully implemented, transfers a significant component of the risk of unexpected, large, and future rate changes onto the US Treasury based on the implicit guarantee. Indeed, it is fair to say that F&F rather fully protect their shareholders equity against the small and foreseeable risks, while imposing on US taxpayers the large and distant risks that would eventually require a US Treasury bailout.

The firms are able to operate in this manner only because GSE debt and MBS investors show little concern for the firms' riskiness, protected as they are by the implicit Treasury guarantee. Thus, the investors have no incentive to provide oversight regarding the inherent riskiness of the F&F portfolios. Private market firms, in contrast, would receive unmistakable market signals, in the form of rising funding costs, whenever investors perceived that their positions were at risk due to imperfect hedging by the issuing firm. In brief, only F&F, based on their implicit government guarantees, can and do operate in this manner.

3.2 Contagion In Risks Between Fannie Mae and Freddie Mac

The discussion has so far focused on the interest rate risks of the firms individually, without considering possible feedback links among the firms and the capital markets. The feedback links arise because a firm's profitability will fall whenever the interest rates on its GSE debt rise (relative to the rates on its mortgage assets). Then, as the firm's profitability falls, the GSE debt rates will rise further, creating a vicious circle. The initial source of the GSE rate rise could reflect market concern that one or the other of the firms has suffered significant losses. Or, it could

as well reflect an event initially unrelated to F&F, but in which "a flight to the safety of Treasuries" raises the spread between agencies and Treasuries.

Whatever the underlying cause, a shock causing the borrowing rates to rise for one of the firms is highly likely to cause the borrowing rates of the other firm also to rise through the shared market for GSE debt. Rising GSE borrowing rates reduce the firms' profitability, further extending the contagion. And given the immense size of the firms, a rise in GSE borrowing rates could also cause a general rise in US interest rates for all risky securities. It is useful to recall in this regard how the Asian financial crisis in the late 1990s caused many US firms and markets to face rising interest rates, even though they had no direct link to the affected Asian countries.

The possible contagion through the GSE debt market is made even worse by the systematic strategy of the firms to issue a substantial amount of their debt with an initial maturity of 1 year or less. At year-end 2003, for example, fully 46% of their debt had an initial maturity of less than one-year, and this does not include that part of their initially long-term debt scheduled to mature in the following year. The firms have adopted this short-funding strategy because the short-term rates in the GSE debt market are especially low.[8] The result is that the two firms must, in effect, go to the GSE debt markets each year to refinance what is approximately one-half of their total outstanding debt, an amount equal to just under $1 trillion at year-end 2003.

[8] In particular, the GSE debt yield curve is typically more steeply sloped than the libor-based swap yield curve. The firms then use the libor-based swap market to transform their short-term GSE debt into synthetic long-term debt. Jaffee [2003] shows that this saves the firms about 23 basis points a year in funding costs relative to issuing long-term GSE debt directly. But the firms are at major risk if GSE interest rates rise unexpectedly relative to Libor rates.

The effect on firm profits can be very large. For example, a 100 basis point jump in GSE debt rates in 2003 would have just about wiped out the combined profits of the two firms in that year. The practical significance of this effect is illustrated in Figure 6, which shows the spread between GSE rates and Treasury rates at the one-year maturity since 1996. Although the average spread is about 15 basis points, the spread has varied from about zero to almost 60 basis points.[9]

To be sure, F&F both actively use derivatives to hedge the interest rate risk created by this short-funding strategy, and in this way they are protected against the normal pattern of interest rate changes. But, as St. Louis Fed President William Poole [2004] has pointed out, the derivatives F&F use are based mainly on Libor interest rates, not GSE rates. Thus, the derivatives would provide no relief against an unexpected rise in GSE interest rates relative to Libor. This outcome would, in fact, be quite likely if the GSE rates rise due to concerns for the credit worthiness of F&F; indeed, Libor rates might actually fall in such circumstances, if there were a flight to quality.

[9] Mark Flannery, in discussing an earlier draft of this paper, pointed out an apparent conflict between treating the GSE debt of F&F as if it has an implicit Treasury guarantee at the same time that we note the large swings in the spreads between GSE and Treasury interest rates. Indeed, it would seem the trust of investors in the implicit guarantee is time varying, conditioned by the firms' status at each moment. Nevertheless, most of the time, the firms can borrow at vary small spreads over Treasuries, suggesting that investors normally ignore the possibility that the firms' strategy might have an adverse impact on their returns.

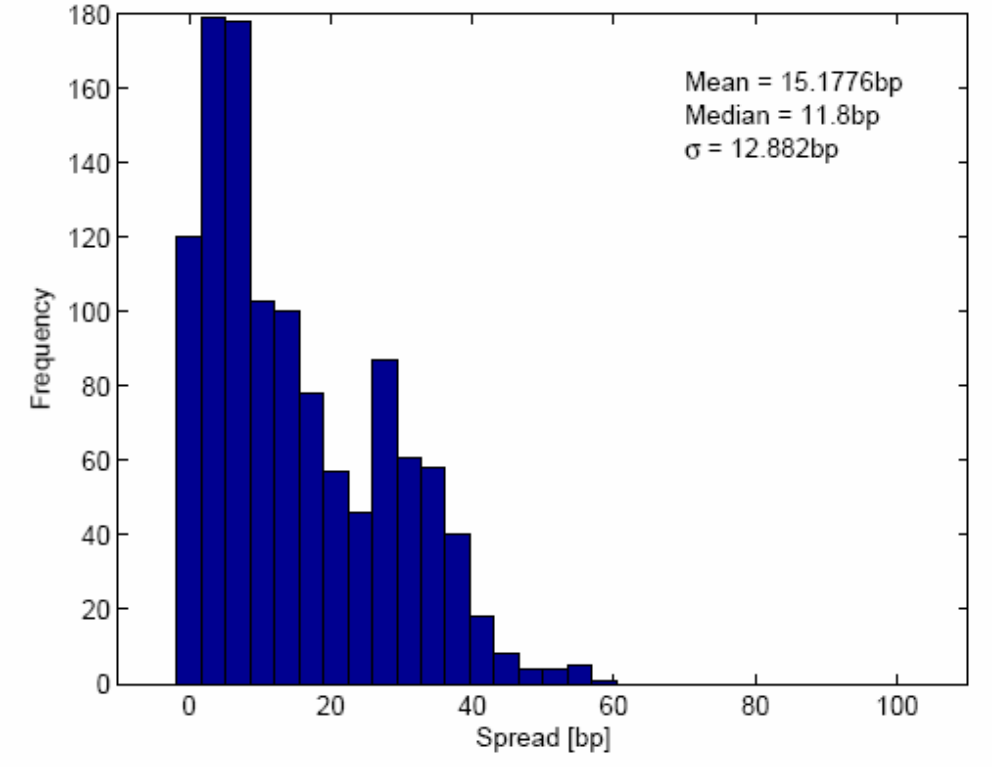


Figure 6. Fannie Mae GSE--US Treasury Rate Spread, 1-Year Maturity. GSE spreads against US Treasury rates have been volatile, from 0 to 60 basis points at the 1-year maturity. Source: Fannie Mae [2005] and US Treasury [2005].

Table 2: Major Components of US Debt Markets, Year End 2005, $ Trillions	
All Treasury debt	4.7
Total FF Guarantees	**4.0**
All corporate bonds	3.0
All commercial loans	2.4
All consumer credit	2.2
All municipal bonds	2.2
FF Guarantees = Retained Portfolios + Net MBS	
Source: Federal Reserve Flow of Funds L.2, Monthly Reports Fannie Mae/Freddie Mac	

3.3 Systematic Risks Created by Fannie Mae and Freddie Mac

The issues of interest rate risk and contagion discussed above would affect F&F directly, and the US Treasury indirectly based on its implicit guarantee. We now consider the possibility that the F&F interest rate risk could disrupt the entire US financial system. This concern reflects a primary reason that Federal Reserve Governors and Bank Presidents have been so outspoken about the danger created by the F&F retained portfolios.

The source of this threat is the immense size of F&F debt and MBS outstanding in comparison with other components of the US debt markets. Table 2 shows that the outstanding F&F guaranteed securities (retained mortgage portfolio plus net MBS outstanding) at year-end 2005 totaled about $4.0 trillion. The remarkable point in the table is that this amount exceeds the total amount of debt outstanding in such other major fixed-income categories as all corporate bonds, all commercial loans, all consumer credit, and all municipal bonds. These categories, of course, represent the debt issued by thousands of firms and municipalities and millions of consumer, yet the F&F obligations far exceed their amounts. And the contagion discussion of the previous section suggests that whatever the initial source of an event—created by just one of the firms, or an event unrelated to either firm--the ramifications in terms of rising GSE debt costs would soon be felt by both firms.

A key implication of the immense size of F&F is that it makes more understandable why investors in F&F debt and MBS are so confident that the implicit guarantee will be honored; the firms are truly too big to be allowed to fail. It

is with the recognition of this serious threat that we now turn to a solution, namely a proposal to limit the size of the retained mortgage portfolios.

4. Limit the Size of the F&F Retained Mortgage Portfolios

Since 2004, Congress has been considering proposals to limit the size of the F&F retained mortgage portfolios; see Wallison [2006]. The proposals are to limit, but not to eliminate, the retained portfolios, since it may be beneficial for F&F to retain certain mortgages that cannot be readily securitized, and there may be cyclical and liquidity benefits to allowing F&F to buy and sell mortgage related securities in special circumstances. The determination of the specific size limit is left for a more detailed and future study, perhaps to be carried out by the F&F regulator (existing or newly appointed as the case might be).

A smooth and orderly transition to a new size limit can be ensured by allowing the existing retained portfolios to liquidate naturally—that is, the liquidation would be based on realized principal payments, not by required security sales—until the desired size is reached.[10] As the portfolio size declines, F&F would accordingly reduce the amount of their GSE debt outstanding, as well as the portfolio of interest rate derivatives they use to hedge the interest rate risk. Since the pattern of liquidation would be predictable, the investors and counterparties involved with all aspects of the retained portfolios and MBS new issues could anticipate the changing

[10] At year-end 2005, the combined retained mortgage portfolios of F&F totaled about $1.4 Trillion. If most of these were liquidated over, say, 5 years, the annual change would be under $300 billion, a manageable amount in the context of the overall size of the US mortgage market. In terms of components, at year-end 2004, the last date of available detailed data, the retained portfolios of F&F consisted of 57% MBS securities issue by Fannie Mae, Freddie Mac or Ginnie Mae, 17% MBS issued by private issuers, and 26% of other securities (including whole mortgages). It is assumed here that the portfolio limit would be based only on the combined amount, although in principle limits could be imposed on the individual components as well.

structure and make the necessary adjustments. It is also possible, following the enactment of a retained portfolio size limit, that F&F might prefer to be privatized, that is to give up their GSE status in exchange for avoiding the size limit and other restrictions imposed on them. The possibility of privatization is discussed further in Section 5.4.

4.1 Mortgage Market Structure with Limited F&F Retained Portfolios

Other investor groups will have to take over the market share of mortgage security holdings released by F&F. At year-end 2005, the F&F retained mortgage portfolios represented 16% of all outstanding mortgage related securities. If, for a numerical example, we assume that F&F were to continue to hold a 5% market share, then new investors must be found for the liquidated 11 percent share. As one possibility, the mortgage market could just return to the structure for holding mortgages and MBS that existed in 1990, as illustrated earlier in Figure 4. This means that most of the 11 percent market share to be liquidated by F&F would be transferred to the depository institutions, with a smaller part transferred to the capital market investors. Of course, this is just one possibility, and it could well be that capital market investors would take up a much larger market share.

It is also noteworthy that in recent years, the F&F market share has declined significantly without any apparent negative impact on the US mortgage market. Specifically, from December 2001 through December 2005, the F&F market share fell by about one-third (from 22 to 16 percent), while: [11]

- US residential mortgages outstanding grew by over 50%;

[11] The growth in mortgages outstanding is from the Federal Reserve's Flow of Funds data, the mortgage rate is the Freddie Mac Primary Mortgage Market Survey, the jumbo-conforming spread is from Inside Mortgage Finance, and the 10 year Treasury rate is the Constant Maturity series.

- the 30-year, conforming, mortgage rate fell from 7.07% to 6.27%;
- the jumbo-conforming mortgage rate spread fell from 37 basis points to 21 basis points.
- The mortgage 10-Year Treasury rate spread fell from 198 basis points to 180 basis points.

Thus, by all four measures, conditions in the US mortgage market improved at the same time that the F&F share of the market fell significantly.

A further question concerns where the depository institutions or capital market investors will obtain the funds to make these additional investments. To answer this, it is important to recall that F&F are only intermediaries: they issue GSE debt on one hand, and use these funds to purchase mortgage securities on the other. Under the proposal, F&F will be liquidating mortgages and redeeming GSE debt in equal amounts. So investors holding GSE debt in the current regime become immediate candidates to replace F&F as holders of mortgage securities.

4.1.1 Issues for Capital Market Investors

The owners of the previously outstanding GSE debt, of course, may not wish to hold the mortgage securities that would otherwise have been in the F&F portfolios. The most important concern for capital market investors is that the mortgage securities will be subject to interest rate risk, the same risk facing the F&F portfolios in the first place. The original GSE debt holders might, instead, prefer to invest in safer securities such as Treasury bonds. Then the question is whether the displaced Treasury bond investors will hold the mortgage securities. There could, in fact, be a chain of such displacements. In the end, however, it is a matter of market

equilibrium that some investors must and will step to the plate and hold the mortgage securities.

Wall Street firms will expedite the transition to this equilibrium by creating structures which facilitate the holding of mortgages by capital market investors. The most obvious solution is to place the mortgage securities into portfolios that allow the interest rate risk to be hedged with the same derivatives used by F&F. These portfolios, which could be marketed as mutual funds or hedge funds, would thus basically replicate the original GSE debt in terms of its risk attributes.[12]

Multiclass MBS, sometimes referred to as Remics or Collateralized Mortgage Obligations (CMOs) represent still another possible solution. Multiclass MBS are created by carving single-class MBS into two primary classes. The senior classes, which may represent a major part of the principal value, can be structured so that the holders face little or no interest rate risk. These classes would be sold to investors with little tolerance for interest rate risk. The junior classes, in contrast, would contain highly concentrated amounts of interest rate risk, and would be sold to investors, such as hedge funds, that were prepared to take on these risks or hedge them directly, in order to earn the higher returns they would be expected to provide.

One final issue arises from the fact that a significant share of the F&F GSE debt is now sold to Asian investors. The question will thus arise concerning the alternative securities to which these investors will transfer their holdings. Presumably, their primary reason for investing in GSE debt is to invest in safe dollar

[12] The cost of hedging MBS should approximately equal the cost faced by F&F, since the same counterparties would presumably be prepared to sell the same hedges to the newly created funds. It is quite possible, however, that the capital market investors may desire more hedging than that used by F&F. The additional hedging provides a distinct public benefit since it would reduce or eliminate the likelihood of a market collapse and/or Treasury bailout due to losses from interest rate risks.

denominated debt, and they would continue to do so. Once they are invested in dollar denominated debt, however, they are really no different than any other group of US capital market investors who were initially holding GSE debt. Thus, the discussion of this section should apply to them as well.

4.1.2 Issues for Depository Institutions

Depository institutions represent the second class of investors who will have to expand their holdings of mortgage related securities as a substitute for the F&F retained portfolios. At year-end 2005, the depository institutions maintained a 46% market share for mortgage securities. The banks should have little problem either accepting or hedging the interest rate risk on additional mortgage securities, given that they are already holding the most concentrated market share. It is also noteworthy that as recently as 1990, the banks were maintaining a 56% market share.

Another possible issue is whether the depository institutions have incentive to purchase additional mortgage securities. One positive factor is that the forthcoming changes in bank capital requirements, generally described as Basel II, are likely to provide depository institutions with significantly expanded incentives to hold mortgage securities (see Calem and Follain [2005]). Another positive factor is that banks have the option to issue subordinated debt as an alternative source to additional deposits. In fact, Ely [2004] has recently proposed a special structure within bank holding companies that would allow banks to create special debt issues that would be collateralized by the mortgage assets.

Overall, it would appear that depository institutions are likely to be willing and able investors to replace the F&F retained portfolios.

4.1.3 Where Does the Interest Risk Go?

The inherent interest rate risk in mortgage securities does not disappear, even if a smooth transition is made from the F&F retained mortgage portfolios to capital market and depository investors. This raises the question, therefore, why is it preferable to transfer the risk from F&F to capital market and depository institution investors? The answer is based on three key factors:

- Portfolio Diversification. Lack of diversification is a key drawback to the F&F retained mortgage portfolios, since they are invested essentially 100 percent in homogenous mortgage securities. The portfolios thus realize no diversification benefit against shocks such as highly volatile interest rates. Capital market and depository institution investors, in contrast, typically hold the mortgage securities within portfolios that contain a wide range of different assets, thus providing the key advantage of diversification.
- Firm Concentration. The F&F retained mortgage portfolios have the disadvantage that they are concentrated in just two firms. Capital market instruments, in contrast, are spread across potentially millions of investors and even depository institution holdings are spread across thousands of banking firms. To be sure, the portfolios of the largest banks are of a magnitude comparable to the F&F retained portfolios, but there is the key difference that these portfolios are widely diversified across different loan classes. The banks also hold substantially more overall capital, all of which is available for mortgage losses.

- Government Guarantees and Market Discipline. GSE debt issued by F&F is unique in that investors believe the US Treasury will bail them out if the issuing firms face serious financial distress. The result is that these investor provide no market oversight and F&F face no market discipline in their investment strategies. Capital market entities, in contrast, have no government guarantees and thus directly face market oversight. Depository institutions fall between these extremes, but rest much closer to the capital market case. Most importantly, deposit insurance today operates as an industry-wide reinsurance plan, without any claims, implicit or explicit, on the US Treasury. Specifically, deposit insurance is funded by the participating institutions using a system based on experience rating, Among its many advantages, this system provides individual institutions with a strong incentive to monitor and if necessary control their brethren, since they will pay the cost of failed institutions.

4.2 The F&F Retained Mortgage Portfolios and US Mortgage Rates

The likely impact of the proposal on US mortgage interest rates is an important question and one difficult to answer with precision. From a conceptual perspective, the proposal amounts to a security for security exchange, with mortgage securities and hedging instructions replacing GSE debt in investor portfolios. If this were an entirely private market transaction, the prima facie case, based on standard finance concepts, would be no interest rate effect at all.[13]

[13] Roll [2003], in contrast, argues that GSE debt and mortgages differ significantly in their risk characteristics, and thus cannot be perfect substitutes. Therefore, he concludes that reducing the retained portfolio will necessarily raise mortgage interest rates. This argument ignores, however, that the hedging instruments currently used by F&F will be equally available to whichever investor group ends up holding the mortgages released from the F&F portfolio. The right question is the degree of substitution between GSE debt on one side and mortgages *plus* the hedging instruments on the other.

For the F&F retained mortgage portfolios, however, the role of government subsidies and guarantees must be considered. Indeed, if the government subsidies are successful in reducing mortgage rates, then it could be expected that removing the subsidies would necessarily raise the interest rates. This conclusion is quite valid when subsidies are provided to an industry of competitive firms, so that the consumers of the good in question benefit from lower prices; if the subsidies are then removed, higher prices for the good in question would be expected.

F&F, however, represent a unique case in which significant subsidies are provided to just two firms within an industry. There is, furthermore, significant evidence that the firms use their market power to maximize profits; see Hermalin and Jaffee [1996] for a general discussion of the issue. In particular, it is hard to imagine that F&F could continue to earn returns on equity well in excess of 30% for a decade or more if other firms could enter their markets and compete. In the present context, this issue takes the specific form of how much of the subsidies are passed through to mortgage borrowers and how much is retained as profits for F&F. This issue has become highly contentious: studies at the Federal Reserve (Passmore [2005] and Passmore, Sherlund and Burgess [2005]) estimate that only a small amount of the subsidy is passed through to mortgage borrowers, less than 10 basis points; while a study sponsored and published by Fannie Mae (Blinder, Flannery and Kamihachi [2004]), estimates the impact of F&F on the conforming mortgage rate to be as high as 30 basis points.

This is an empirical question, and the evidence presented in the text below suggests they are very close substitutes.

It is important to recognize, however, that these studies are basically addressing the question of what might happen to mortgage interest rates if F&F ceased to exist altogether. The question at hand, in contrast, concerns the effect on mortgage interest rates if the F&F retained mortgage portfolios were to be limited, while the firms' MBS business line continued and quite possibly expanded. Fortunately, two recent studies have directly addressed this question. The recent paper by Lehnert, Passmore, and Sherlund [2005], at the Federal Reserve, finds that both portfolio purchases and MBS issues are equally effective in reducing the spread (although neither has a very large absolute impact). The implication is that any tendency for mortgage rates to rise due to smaller retained portfolios can be eliminated by increasing F&F MBS issues. A similar conclusion is implicit in the results of an earlier paper by Naranjo and Toevs [2002], originally sponsored and published by Fannie Mae.[14]

Overall, the conclusion is that an orderly and steady reduction in the size of the retained mortgage portfolios is unlikely to raise US mortgage interest rates by a material amount, everything else being the same. Taking into account that the proposal may avoid a major disruption of the US financial system, future mortgage rates may well be ***lower*** as a result of implementing the proposal. Moreover, even if there was a small initial increase in mortgage rates, this could be readily eliminated by increased volumes of MBS issues. Since F&F will have every incentive to expand their MBS issues under the proposal, it appears that rising mortgage rates are not a

[14] To be precise, Naranjo and Toevs find that conforming mortgage rate spreads fall by 10.5 basis points per $ 1 billion increase in F&F mortgage purchases, while the spreads fall by 8.0 basis points per $1 billion increase in F&F MBS issues. Thus, a sufficiently large volume of MBS issues can offset the effect of any decline in the size of the F&F mortgage purchases.

relevant concern for the proposal to limit the size of the F&F retained mortgage portfolios.

The potential to substitute additional MBS issues for retained portfolio purchases also answers another possible concern, namely that absent the retained portfolios, F&F will be unable to stabilize mortgage markets. This concern vanishes once it is recognized that MBS issues tightly link the mortgage market with the overall capital markets. Thus, idiosyncratic shocks to the mortgage market are readily offset by the large flows of funds available from capital market investors through expanded MBS issues.[15]

5. Alternative Methods to Control the F&F Interest Rate Risk

In concluding, we review several alternative solutions to limit F&F interest rate risk.

5.1 Redesign the Fixed-Rate, Freely Prepayable, Mortgage Instrument

The freely-prepayable aspect of the fixed-rate mortgage instrument is the primary source of the interest risk problem. Without the free prepayment option, the interest rate risk of mortgages becomes substantially easier to hedge and portfolio managers can be more readily monitored to confirm they are carrying out the stated hedging policy. Redesigning the mortgage contract thus has the potential to be a first-best solution.

It is feasible to construct mortgage contracts without free prepayment options. In particular, essentially all commercial mortgages use some version of

[15] Of course, the mortgage market will still have to adapt to whatever fundamental interest rate trends develop in the capital markets. Not even F&F can offset such basic trends, nor would this be desirable even if it were feasible.

"yield maintenance". This means that if a commercial mortgage borrower wishes to redeem a mortgage, the lender has to be compensated for the difference between the market value of the mortgage and the remaining principal value. This difference will be positive when market interest rates have fallen since the mortgage was issued. Yield maintenance tools can provide a flexible mechanism through which borrowers can prepay mortgages, but without imposing a financial cost on the lender.

Most requirements for freely prepayable fixed rate mortgages in the US are state based. Thus, short of a federal override of all such state requirements, there is no quick and feasible method to eliminate the requirements. In addition, in many cases, these requirements were adopted in the belief that they would create a free consumer benefit. While this belief is mistaken--mortgage rates are raised to compensate lenders for providing this benefit—there will surely be fierce and extended battles to change these regulations. Thus, while the removal of requirements for free prepayment options would be a desirable change in the US mortgage markets, it is not a practical means to eliminate the interest rate risk embedded in the F&F retained mortgage portfolios.

5.2 Raise the F&F Capital Requirements

Raising the capital requirements imposed on F&F is an alternative possible solution. The current "minimum" capital requirements—2.5 percent of assets plus 0.45 percent of adjusted off-balance-sheet obligations—were instituted, however, only to provide protection against credit risk. Capital requirement against interest rate risk are difficult to calibrate, since it is difficult to provide precise quantitative measures of the amount of rate risk in a portfolio, and equally difficult to measure

how much of that risk has been successfully hedged. The quantitative Basel I bank capital requirements apply only to credit risk. The new Basel II quantitative requirements for bank capital, soon to be released, will also continue to apply only to credit risk, reflecting the difficulties of creating a practical capital requirement against interest rate risk. In both cases, bank supervisors are also expected to consider interest rate risk, but there are no quantitative measures through which explicit controls may be implemented. Thus, while from a longer-run perspective, capital requirements are likely to be a practical tool for controlling the interest rate risk of financial institutions, they are not yet a feasible tool.

5.3 Expand the OFHEO Stress Test

The OFHEO stress test is currently implemented exactly to confirm that F&F maintain sufficient capital resources to withstand unexpected and extreme movements in interest rates. Indeed, F&F have passed this test at every quarterly test date since it was instituted. There are, however, four fundamental issues that bring to question whether these successes are real.

1) The stress test accepts as given the financial date provided by each firm as of each test date, including the full portfolio of derivative instruments (swaps and swaptions) used to hedge the interest rate risk. Given the accounting errors and misrepresentations now revealed for both firms, the accuracy of these test results is now open to question.

2) A key aspect of the stress test software are equations that characterize mortgage market behavior, such as the speed of borrower prepayment. Borrower behavior

has been rapidly changing, but it is unlikely the stress test software has been sufficiently updated to cover these changes. The result is an understatement in the losses that F&F would likely suffer.

3) The stress methodology should itself be tested, to ensure that a firm with a high degree of interest rate risk would indeed fail the test. OFHEO, however, has not released the results of any such tests. In fact, such tests would be best carried out by independent third party evaluators.
4) As currently administered, the OFHEO stress test is easily "gamed" by F&F, since the precise interest path and the test date are known well in advance. It would thus be a simple matter for F&F to purchase a suitable set of interest rate derivatives to allow the firms to pass the precise test, without conferring any general protection against interest rate risk. The solution here is for OFHEO to administer tests at surprise dates with unexpected interest rate stress paths.

As with the minimum capital requirements just discussed, it is quite plausible that in the long run the OFHEO stress test methodology will become an efficient tool for judging whether a firm is holding sufficient capital to offset its interest rate risk. But it does not yet provide a sufficient level of assurance.

5.4 Require Full Hedging of Interest Rate Risk

Although it is difficult to provide a precise measure of interest rate risk and the extent to which it has been hedged, it is actually quite easy to implement a requirement that *all* interest rate risk be hedged. For the F&F retained mortgage portfolios, the key issue is how to hedge the prepayment risk created by the borrower prepayment option. A simple and complete answer is for F&F to issue callable debt,

with maturities and call option strike prices that perfectly offset the prepayment options embedded in the mortgage assets.

F&F have traditionally use callable debt to hedge some of their interest rate risk. However, their use of callable debt has been limited in part because they felt that swaption interest rate derivatives provided a lower cost hedging tool and in part because they had no incentive to hedge all their interest rate risk. The issues raised by the accounting crises at both firms, however, have highlighted a previously hidden cost of swaptions, namely that under the mark to market requirements of FAS 133, swaption positions can lead to large swings in the reported GAAP earnings. In contrast, callable debt has no mark to market requirements under GAAP, and thus has no unexpected repercussions on reported earnings.

Freddie Mac appears to have now recognized these benefits of callable debt as an interest rate risk hedging device. From 2001 to 2005, callable debt outstanding as a share of fixed-rate assets has more than doubled, from under 30 percent in 2001 to over 60 percent in 2005 (see Freddie Mac [2006], page 41). Of course, there is a cost: the interest cost of a 10-year callable bond for Freddie Mac is about 100 basis points above the cost of a comparable non-callable bond (see Freddie Mac [2006], page 59). This cost is also at least somewhat higher than obtaining a comparable hedge through a swaption, but the callable bond avoids the complications of FAS 133 accounting. It is also likely that the cost of callable bonds would fall if Freddie Mac and Fannie Mae made it a clear policy to fund the greater part of their retained mortgage portfolios with callable debt, since it would then surely induce investment

banking firms to arbitrage any remaining cost differences between callable bonds and swaptions as hedging instruments.

The policy proposal is straightforward: *require F&F to hedge 100 percent of the prepayable mortgages in their retained mortgage portfolio with callable debt of an equivalent duration*.[16]

5.5 User Fees, Leading to Full Privatization

The most complete solution for controlling the interest rate risk of the retained mortgage portfolios is to privatize F&F. This had been given serious consideration earlier by a multi-GSE task force; see Hermalin and Jaffee [1996]. The conclusion at that time was that the legal and administrative impediments were too difficult, as long as F&F did not desire the change. In effect, the implicit guarantee could not be withdrawn as long as the GSE status remained, and the GSE status could not be withdrawn as long as the implicit guarantee remained. The result was a standoff, with no action possible.

Since that time, another GSE, Sallie Mae, was readily privatized once the firm became a proponent of the change. The instrument of change was Congressional action which levied a annual user fee on Sallie Mae for all its GSE debt issues; the user fee was 0.35 percent per dollar of outstanding GSE debt. Soon after the imposition of the user fee, Sallie Mae became a proponent of its own privatization; see (Lea [2005]). In addition to avoiding the user fee, the privatized Sallie Mae was able, for the first time, to originate student loans. Since its privatization, Sallie Mae

[16] It will be trivial for the regulator to verify that 100% of the prepayable mortgages are backed by callable debt. It is less trivial to verify that the callable debt matches the duration of the corresponding mortgages, since this requires Monte Carlo simulations of an empirical prepayment model, but OFHEO could readily obtain third-party services that could carry out this verification as well.

has been extremely successful, and it now dominates the market for student loan originations. F&F are currently also prohibited from originating mortgages, and it is equally plausible that privatization could benefit both of these firms in the same way.

6. Final Comments

1) The interest rate risk embedded within the F&F retained mortgage portfolios is now generally recognized as creating unacceptable risks for the US Treasury, US taxpayers, and the US financial system.
2) Size limitations on the retained portfolios would control the interest rate risks. The limitations could be achieved through an orderly liquidation of the portfolios, based on normal mortgage payments and repayments. The US taxpayers and the US financial system as a whole are major beneficiaries of the proposal. US mortgage borrowers will be largely unaffected by the change. F&F shareholders, however, are likely to be worse off.
3) An alternative strategy would require F&F to fund 100 percent of their fixed-rate, prepayable, mortgages with long-term, callable, debt of a comparable duration. This proposal has the advantage that F&F can maintain their retained mortgage portfolios if they choose to do so. Callable debt has the further advantage that it does not raise the complicated accounting issues of interest-rate derivatives under FAS 133. The US taxpayers and the US financial are again beneficiaries, while there would be some added costs imposed on F&F.
4) Raising the minimum capital requirements and improving the OFHEO stress tests provide an alternative long-term approach to controlling the F&F interest rate risk. However, neither method is sufficiently dependable at this time.

5) F&F privatization also offers a solution, since the interest rate risk would then rest only with the F&F debt and equity holders. The agreement of F&F would greatly increase the feasibility of this approach. The experience of privatizing Sallie Mae, soon after Congress instituted a user fee on its GSE debt issue, offers a practical guide for implementing this approach.

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