Appendix B: Cash Flow Analysis

I. Introduction

The calculation of the economic value of the MMI Fund involves the estimation of the present value of future cash flows generated by the existing portfolio. This requires the projection of the future prepayment and claim incidences as well as attaching proper cash flow items associated with each incidence. This appendix explains the details related to the attribution of cash flows by sources.

The evaluation of the Fund's economic value is done similar to the way an investor would evaluate the market value of a stock. An investor estimates a stock's value as the present value of its current net assets plus the present value of new business expected to be undertaken. Assuming FHA continues to insure loans, its value would be determined by valuing both its current portfolio of loans and its future books of business.

In order to analyze future changes in the Fund's economic value, we developed a model that incorporates projections of the loan performance and information about its existing portfolio composition to project the Fund's individual cash flow sources. This actuarial model uses the forecasts from the econometric models discussed in Appendix A and B. The econometric models forecast conditional claim and prepayment rates for each individual loan depending on its origination timing, age, interest rate, initial LTV ratio, refinancing incentive, probability of negative equity, loan-term, and other characteristics. This loan-level event and cash flow simulation approach is a new development compared to previous Reviews. With the detailed loan level characteristics, we were able to more accurately estimate the prepayment and claim rates and then attach cash flows to each loan.

Based on the termination rates projected by the econometric model, the major components of cash flow are estimated into the future. Future interest income is reflected through the present value discounting process. The relevant cash flow components are listed in Exhibit B-1. These components were projected for each loan and then aggregated according to the product type and origination and policy year for reporting purpose. Below, we discuss the sources of each of these cash flows.

Exhibit B-1

Cash Flow Components		
Cash Flow Components	**Cash Inflow**	**Cash Outflow**
Up-front Premiums	X	
Annual Premiums	X	
Claim Payments		X
Refunded Up-front Premiums		X
Administrative Expenses[a]		X
Distributive Shares[b]		X

[a]The administrative expense was discontinued since the FY 2002 Actuarial Review according to the federal credit reform requirement.
[b]The distributive share has been suspended since 1990. There is no indication that it would be resumed in the foreseeable future.

II. Cash Flow Components

A. Background Information

The following background information helps clarify our discussion of the components of cash flow:

- **Insurance-in-force (IIF):** the nominal value of the unamortized insurance-in-force of the surviving mortgages insured by FHA. This is distinct from the conventional notion of amortized insurance-in-force, which includes only the current outstanding balance on surviving loans.

- **Conditional Claim Rate (ccr):** the number of claim cases during a year divided by the number of surviving loans in force at the beginning of the year.

- **Conditional Prepayment Rate (cpr):** the number of loans prepaid occurring a year divided by the number of surviving loans in force at the beginning of the year.

- **Unpaid Balance (UPB) Factor:** the principal balance outstanding divided by the original mortgage amount. The UPB factor is calculated based on the term and type of the mortgage and mortgage contract rate. For FRMs, the UPB factor for each quarter in the future can be directly computed with the initial contract rate and the amortization term. For ARMs, the UPB factor would decrease at a different rate depending on the interest rate of the particular loan, updated according to the adjustment rule. The contract interest rate of the loan was updated by using the one-year Treasury rate as an approximation for changes in the underlying index, with the annual and life-time caps incorporated. The historical average mortgage contract rates for all loans are summarized in Exhibit B-2. These rates reflect the average contract rate for all originations during each fiscal year.

Exhibit B-2

Average Original Contract Rate of Mortgages (Percentage by Mortgage Types)							
Fiscal Year	**FRM30**	**FRM15**	**ARM**	**SR30**	**SR15**	**SRARM**	**Average**
1975	8.41	8.63					8.41
1976	8.61	8.74					8.62
1977	8.22	8.25		8.50			8.22
1978	8.75	8.64		9.32			8.74
1979	9.60	9.60		9.71			9.60
1980	11.25	11.58		10.83			11.25
1981	13.40	13.84		13.21			13.40
1982	15.19	15.29		15.29			15.19
1983	12.17	11.03		12.08	11.00		12.09
1984	12.76	11.82	12.80	12.65			12.70
1985	12.25	11.66	11.25	12.31	11.77		12.20
1986	10.17	9.95	9.10	9.78	9.45	8.20	10.13
1987	9.30	9.04	7.75	9.41	8.96	7.54	9.27
1988	10.08	9.73	8.87	10.85	10.07	8.99	10.05
1989	10.06	9.87	9.08	11.16	10.23	9.21	10.07
1990	9.69	9.48	8.54	10.70	9.95	8.86	9.71
1991	9.46	9.15	7.56	10.09	9.31	7.74	9.40
1992	8.54	8.35	6.47	8.91	8.37	6.51	8.26
1993	7.76	7.41	5.87	8.16	7.58	6.27	7.64
1994	7.57	7.14	6.06	7.75	7.42	6.08	7.36
1995	8.39	8.25	7.18	8.67	8.69	7.32	8.10
1996	7.84	7.57	6.49	7.98	7.65	6.75	7.53
1997	7.97	7.77	6.53	8.23	7.97	6.77	7.51
1998	7.37	7.22	6.12	7.55	7.16	6.45	7.25
1999	7.24	7.00	6.00	7.16	6.88	6.05	7.16
2000	8.29	8.08	6.95	8.32	8.04	6.30	8.16
2001	7.56	7.16	6.19	7.41	6.85	6.12	7.49
2002	7.00	6.57	5.28	6.95	6.41	5.31	6.84
2003	6.08	5.54	4.37	6.01	5.48	4.44	5.92
2004	6.14	5.58	4.37	6.03	5.51	4.33	5.90

- **Termination Year:** the year in which a mortgage terminates through a claim, a prepayment or other reasons.

- **Policy Year:** the first policy year starts the day the mortgage has originated. Subsequent policy years start on the anniversary of the mortgage origination.

- **Fiscal Policy Year:** a fiscal policy year covers a single fiscal year. The year in which the mortgage is originated is assigned as fiscal policy year one, even though it may not be a complete year. The MMI Fund's fiscal policy year is the same as the federal fiscal year which runs from October 1st of the previous year to September 30th of the specific fiscal year. For example, the time frame from October 1, 2003 to September 30, 2004 is considered as Fiscal Policy Year 2004.

B. Premiums

1. Premium Structure

The primary source of revenue collected by the Fund is the insurance premium. If the Fund's mortgage insurance is priced to be premium-sufficient, the insurance premiums collected and interest earned on them will cover all costs associated with insuring the mortgages. According to the FHA mortgage insurance policy, the insurance premium was structured in three ways:

- Through September 1, 1983 the mortgage premium was collected on a monthly basis at an annualized rate of 0.50 percent of the outstanding principal balance for the period. We assumed for this analysis that the annual premium policy was in effect through September 30, 1983.

- Between September 1, 1983 and June 30, 1991 a mortgage premium based on a percentage of the original mortgage amount was collected at the time of origination. This amount was 3.80 percent for 30-year mortgages and 2.40 percent for 15-year mortgages.

- Effective July 1, 1991, the NAHA specified a new premium structure. This structure specifies that an up-front premium of 3.80 percent for all product types except for 15-year non-streamline refinance loans (which was set at 2.00%) be collected and an annual renewal premium of 0.50 percent would be assessed on the outstanding balance per period. It would cease at different mortgage ages depending on the initial LTV of the loan.

- On October 1, 1992, the upfront premium was reduced from 3.80 percent to 3.00 percent. The annual premium of 15-year mortgages were lowered to 0.25 percent or completely waived, depending on whether the initial LTV ratio is greater than 90 percent.

- As of April 17, 1994, FHA lowered the up-front premium rate on 30-year mortgages from 3.00 percent to 2.25 percent. To align this change with fiscal quarters, we started applying this policy change on April 1, 1994.

- Starting from October 1, 1996, FHA lowered the up-front premium rate on 30-year mortgages for first-time homebuyers who receive homeowner counseling from 2.25 percent to 2.00 percent. This rate was further reduced to 1.75 percent for mortgages executed on or after September 22, 1997. This favorable treatment for borrowers with homeowner counseling was terminated shortly thereafter.

- Effective January 1, 2001, FHA lowered the upfront premium rate of all mortgages to 1.50 percent. The annual premium was reduced to 0.50 percent and the annual premium stopped as soon as the current LTV ratio of the loan becomes below 78 percent according to the home price at the loan origination date. However, the 30-year mortgages are still subject to a minimum of five years that the annual premium must be paid.

These premium rule changes are summarized in Exhibit B-3 below.

Exhibit B-3

Upfront Premium Rates for New FHA Originations		
Fiscal Year	**30yr Loans, Fixed or Adjustable Rate (%)**	**15yr Loans, Fixed or Adjustable Rate (%)**
9/1/83~6/30/91	3.80	2.40
7/1/91~9/30/92	3.80	2.00/3.80[b]
10/1/92~4/16/94	3.00	2.00
4/17/94~9/30/96	2.25	2.00
10/1/96~9/21/97	2.25/2.00[a]	2.00
9/22/97~12/31/00	2.25/2.00/1.75[a]	2.00
1/1/01 & subsequent	1.50	1.50

[a]For first-time homebuyers who received homeowner counseling.
[b]For 15year streamline refinance loans.

The NAHA Annual Premium Schedule for new mortgage originations is shown below in Exhibit B-4:

Exhibit B-4

NAHA Annual Premium Rate for 15- and 30-Year Mortgages		
Fiscal Year	**30yr Loans, Fixed or Adjustable**	**15yr Loans, Fixed or Adjustable**
Prior to 9/1/1983	0.5% for life of loan	0.5% for life of loan
9/1/83~6/30/91	None	None
7/1/91~9/30/92	varies by LTV category[a]	varies by LTV category[a]
10/1/92~12/31/00	varies by LTV category[b]	varies by LTV category[c]
1/1/01 & subsequent	0.5% until LTV reaches 78%, minimum of 5 years	varies by LTV category[d]

LTV Range:	a	b	c	d
below 90%	0.5% for 5 yrs	0.5% for 7 yrs	0%	0%
between 90% & 95%	0.5% for 8 yrs	0.5% for 12 yrs	0.25% for 4 yrs	0.25% until LTV reaches 78%
above 95%	0.5% for 10 yrs	0.5% for 30 yrs	0.25% for 8 yrs	0.25% until LTV reaches 78%

Insurance Premiums for SRs are shown in Exhibit B-5 below:

Exhibit B-5

Premium Rates for Streamline Refinancings				
Period of Origination	**30-Year Mortgages**		**15-Year Mortgages**	
	Up-front Premium	**Annual Premium**	**Up-front Premium**	**Annual Premium**
Prior to 9/1/1983	None	None	None	None
9/1/83~6/30/91	3.80%	None	2.40%	None
7/1/91~9/30/92	3.80%	0.5% for first 7 years	3.80%	0.5% for first 7 years
10/1/92~4/16/94	3.80%	0.5% for first 7 years	2.00%	None
4/17/94~12/31/00	2.25%	0.5% for first 7 years	2.00%	None
1/1/01 & subsequent	1.50%	0.5% until LTV reaches 78%, minimum of 5 years	1.50%	varies by LTV category[d]

LTV Range:	a	b	c	d
below 90%	0.5% for 5 yrs	0.5% for 7 yrs	0%	0%
between 90% & 95%	0.5% for 8 yrs	0.5% for 12 yrs	0.25% for 4 yrs	0.25% until LTV reaches 78%
above 95%	0.5% for 10 yrs	0.5% for 30 yrs	0.25% for 8 yrs	0.25% until LTV reaches 78%

Upfront Premium

The up-front premium is calculated as follows:

*Up-front Premium Payment = Origination Amount before upfront premium *Mortgage Insurance Premium Rate (percentage)*

In practice, the FHA offers a premium finance program to those qualified for mortgage insurance. Borrowers do not have to pay the upfront premium at the beginning of contract. Instead, the

borrower can pay the upfront premium at the same schedule as their mortgage payment. According to FHA, the vast majority of the borrowers do finance the upfront premium.

Annual Premium

The annual premium is calculated as follows:

Annual Premium = Amortized UPB (excluding any up-front premiums) Annual Insurance Premium Rate (percentage)/4*

The annual premium is actually collected on a monthly basis. The above formula assumes that the premium is collected at the beginning of each quarter in our analysis. In addition, it is straightforward that the termination rate will have major impacts on annual premium flows just like an interest-only strip security.

Although FHA is effectively insuring the financed upfront premiums, the annual premium is not assessed on the amount of the financed upfront premium and as a result is not applied against it in the cash flow model.

C. Losses Associated with Claims

The MMI Fund's largest expense comes in the form of losses due to claims. FHA pays the claim to the lender when the lender files a claim. In most cases, FHA takes possession of the foreclosed property and sells the property to recover its loss. This particular type of claim is called a conveyance.

Based on this practice, claim's cash flows can actually be decomposed to two components:

- the cash outflow of the claim payment at the claim date
- the cash inflow of any net proceeds received in selling the conveyed property at the property disposition date

For tractability, we simplify this two-steps cash flow into one lump-sum amount. The single claim loss payment estimated in our model is

$$Claim\ Payment_t = Amortized\ Surviving\ UPB^* Conditional\ Claim\ Rate_t\ ^*Loss\ Rate$$

The amortized surviving UPB is the amount of the unpaid balance of the loan after amortization schedule multiplied by the probability that the loan will survive till time *t*. The conditional claim rate is estimated from the multinomial mortgage termination model stated in Appendix A.

The loss rate is usually referred to as the loss given default (LGD) in the banking industry, which measures the amount of principal not recovered divided by the unpaid balance at the time of default. Based on the historical data of claimed mortgages provided by FHA, the average claim loss rate steadily declined during the last few exposure years. As significant efforts have been invested by FHA to improve the loss rate, we feel future loss rates are likely to be similar to that realized during the last two years instead of the earlier period.

For property dispositions which occurred during FY 2002, FY 2003, and FY 2004, FHA's loss rates averaged 34.5, 33.3, and 34.5 percent of unpaid principal balance, respectively. FHA, however, often expresses its loss rate in terms of a percentage of its acquisition cost, which is the sum of the unpaid principal balance and other allowable costs (such as interest during the foreclosure period and foreclosure expenses) for which FHA reimburses the lender upon the filing of a claim when the property is conveyed to FHA. FHA's loss rates for property dispositions occurring during FY 2002, FY 2003, and FY 2004 were 29.2, 28.3, and 29.5 percent, respectively when expressed as a percent of acquisition cost. For the FY 2004 Actuarial Review, the cash flow model will express the loss rate in terms of the unpaid principal balance, and consistent with the FY 2003 Actuarial Review, will assume a loss rate of 35 percent of unpaid principal balance into the future. For purposes of sensitivity analysis, this report will also model a scenario under which the loss rate is assumed to be 40 percent of unpaid principal balance – a level at which FHA's losses averaged during FY 1999 to FY 2001.

D. Refunded Premiums

The upfront premium was first introduced by FHA in 1983, where FHA began refunding a portion of the premium when borrowers prepay their mortgages. The upfront premiums are considered to be "earned" over the life of the loan. Upon prepayment, an approximation of the unearned upfront premium is returned to the borrower. Therefore, the amount of the refund depends on the time since origination that the mortgage is prepaid.

The refund payments are calculated as follows:

Refund Payments = Original UPB Up-front Premium Rate * Conditional Prepayment Rate * Refund Rate*

In the past, borrowers can receive the upfront premium refund when they prepay their mortgage before the maturity of the mortgage contract. However, the recent policy change in FHA states that borrowers can obtain refunds only if they prepay in the first five years of their mortgage contracts. The current rules as well as past policies related to the upfront premium refund schedule are presented in Exhibit B-6.

Exhibit B-6

Percentage of Upfront Premium Refunded				
Years since Origination	9/1/83~12/31/93		1/1/94~12/31/00*	1/1/01 and later**
	Thirty Year Mortgages	Fifteen Year Mortgages	All Mortgages	All Mortgages
1	0.99	0.99	0.95	0.85
2	0.94	0.93	0.85	0.65
3	0.82	0.81	0.70	0.45
4	0.67	0.66	0.49	0.25
5	0.54	0.51	0.30	0.10
6	0.43	0.39	0.15	0.00
7	0.35	0.29	0.04	
8	0.29	0.21	0.00	
9	0.24	0.15		
10	0.21	0.11		
11	0.18	0.08		
12	0.16	0.06		
13	0.15	0.04		
14	0.13	0.03		
15	0.12	0.02		
16	0.11	0.00		
17	0.10			
18	0.09			
19	0.09			
20	0.08			
21	0.07			
22	0.07			
23	0.06			
24	0.05			
25	0.05			
26	0.04			
27	0.04			
28	0.04			
29	0.04			
30	0.00			

*Based on Mortgagee Letter 94-1, which provides a monthly schedule of refund rate.
**Based on Mortgagee Letter 00-38

III. Economic Value and Capital Ratio

Once all future cash flows are estimated, they can then be discounted to derive their present values. The sum of these present values will then be added to the current capital resources to derive the economic value.

A. Discount Factor

The discount factors we applied in discounting the cash flows are the basket of zero factors that FHA uses in estimating multi-family mortgage performance. The discount factor varies depend on how long in the future a cash flow will occur. The discount factors are shown in Exhibit B-7.

Exhibit B-7

Years that Cash Flow Occur	Discount Factor	Years that Cash Flow Occur	Discount Factor	Years that Cash Flow Occur	Discount Factor
2005	0.987849	2019	0.500429	2033	0.216275
2006	0.956037	2020	0.472746	2034	0.203125
2007	0.919981	2021	0.446340	2035	0.190732
2008	0.882214	2022	0.421185	2036	0.179095
2009	0.843798	2023	0.397247	2037	0.168167
2010	0.805401	2024	0.374491	2038	0.157907
2011	0.767445	2025	0.352879	2039	0.148273
2012	0.730201	2026	0.332371	2040	0.139226
2013	0.693820	2027	0.312926	2041	0.130731
2014	0.658459	2028	0.294503	2042	0.122755
2015	0.624249	2029	0.277061		
2016	0.591324	2030	0.260557		
2017	0.559708	2031	0.244952		
2018	0.529411	2032	0.230204		

C. Calculating the Economic Value and Capital Ratio

At the end of FY 2004, the economic value of the MMI Fund was calculated by first determining the present value of the future cash flows for all existing books of business as of September 30, 2004. This figure was then added to the current capital resources of the MMI Fund. The capital ratio is defined as the economic value divided by the unamortized insurance-in-force of the Fund.

For fiscal years beyond 2004, the economic value of the fund was calculated by the following equation:

Economic Value = Economic Value at the beginning of the year +Investment Interest + Economic Value of the New Book of Business

The investment interest for each of the future years is estimated by using the one-year forward interest rates implied in the discount factors of Exhibit B-8. Specifically, these rates are assumed to be:

Exhibit B-8

Interest Rate Earned by MMI Fund	
Fiscal Year	**Interest Rate (%)**
2004	1.58
2005	3.33
2006	3.92
2007	4.28
2008	4.55
2009	4.77
2010	4.95
2011	5.10