Appendix B

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 and future books of business. This requires the projection of future prepayment and claim incidences as well as attaching appropriate cash flow items associated with each incidence. This appendix explains the details related to the attribution of cash flows by source.

The evaluation of the Fund's economic value is done similarly to corporate valuation. An investor would estimate the value of a firm as the present value of net assets plus the present value of new business expected to be undertaken. Assuming FHA continues to insure loans, the economic value of MMI Fund 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 various cash flow sources. This actuarial model used the projections from the econometric models discussed in Appendix A. The econometric models estimate conditional claim and prepayment probabilities for each individual loan depending on its origination year, age, interest rate, initial LTV ratio, refinancing incentive, probability of negative equity, loan term, burnout, and other characteristics. With the detailed loan-level characteristics, we were able to estimate more accurately the prepayment and claim probabilities and then attach respective cash flows to each loan.

Exhibit B-1

Cash Flow Components		
Cash Flow Components	**Cash Inflow**	**Cash Outflow**
Upfront Premiums	X	
Annual Premiums	X	
Claim Payments		X
Refunded Upfront 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.

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

II. Background Information

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

- **Insurance-in-force (IIF):** the nominal value of the unamortized original mortgage loan amount 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 balances on surviving loans.

- **Conditional Claim Rate (ccr):** the number of loans claimed during a time period divided by the number of surviving loans in force at the beginning of that period.

- **Conditional Prepayment Rate (cpr):** the number of loans being completely prepaid during a time period divided by the number of surviving loans in force at the beginning of that period.

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

- **Fiscal Policy Year:** a fiscal policy year covers a single Federal 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 calendar year to September 30th of the specific calendar year. For example, the time frame from October 1, 2005 to September 30, 2006 is considered as Fiscal Policy Year 2006, or FY 2006.

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

- **Unpaid Principle Balance (UPB) Factor:** the principal balance outstanding divided by the original mortgage amount. The UPB factor is calculated based on the term, the type of mortgage and the 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 decreases at different rates depending on the interest rate of the particular loan, updated according to the contractual rate adjustment rule. In this model, 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 lifetime caps incorporated. The historical average mortgage contract rates for all loans at their origination dates 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 Type)							
Fiscal Year	**FRM30**	**FRM15**	**ARM**	**SR30**	**SR15**	**SRARM**	**Average**
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		15.25			15.19
1983	12.17	11.03		12.08	11.00		12.09
1984	12.76	11.82	12.80	12.50			12.70
1985	12.25	11.66	11.25	12.31	11.77		12.20
1986	10.17	9.95	9.10	9.77	9.45	8.20	10.13
1987	9.31	9.04	7.75	9.38	8.96	7.54	9.27
1988	10.09	9.73	8.87	10.84	10.06	8.99	10.05
1989	10.06	9.87	9.08	11.16	10.22	9.18	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	5.91
2004	6.12	5.59	4.46	5.99	5.52	4.39	5.88
2005	5.92	5.65	4.79	5.85	5.64	4.68	5.79
2006	6.05	5.93	5.19	6.03	5.90	5.05	6.02

III. Cash Flow Components

A. 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 pools of specific mortgage loans. According to current and past FHA mortgage insurance policy, the insurance premium has been structured in different ways over time:

- For loans originated 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. To align this change with fiscal quarters, 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 the mortgage premium was based on a percentage of the original mortgage amount 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 specified an upfront premium of 3.80 percent for all product types except for 15-year non-streamline refinance loans (which was set at 2.00 percent) and an annual renewal premium of 0.50 percent on the outstanding balance per period. The annual premium 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 was lowered to 0.25 percent or completely waived, depending on whether the initial LTV ratio was greater than 90 percent.

- As of April 17, 1994, FHA lowered the upfront 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 upfront 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 homeownership 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 on the UPB and the annual premium would stop as soon as the current LTV ratio of the loan was below 78 percent according to the home price as of the loan origination date. The annual premium must be paid for a minimum of five years for 30-year mortgages.

The upfront and annual premium rates are summarized in Exhibits B-3 and B-4.

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.

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 premium rules for streamline refinance (SR) loans are summarized in Exhibit B-5.

Exhibit B-5

Premium Rates for Streamline Refinance Loans				
Period of Origination	**30-Year Mortgages**		**15-Year Mortgages**	
	Upfront 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	3.00%	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[a]

[a]. 0% if original LTV is below 90 percent; 0.25% until LTV reaches 78% if original LTV is 90 percent and above.

2. Upfront Premium

The upfront premium is calculated as follows:

Upfront Premium Payment =
*Origination Amount before upfront premium * Mortgage Insurance Premium Rate (%)*

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 add it to the balance, in essence paying the upfront premium at the same schedule as their principal balance. According to FHA, the vast majority of borrowers finance their upfront premiums.

3. Annual Premium

The annual premium is calculated as follows:

Annual Premium =
*Amortized UPB (excluding any upfront premiums) * Annual Insurance Premium Rate (%) / 4*

The annual premium is actually collected on a monthly basis. The above formula models the premium as being collected at the beginning of each quarter for purposes of our analysis. In addition, the termination rate will have impacts on annual premium flows similar to the characteristics of an interest-only strip security. That is, all potential future annual premium income would no longer exist when the particular mortgage loan is prepaid or claimed.

Although FHA is effectively insuring the financed upfront premiums, the annual premium is not assessed on the amount of the financed upfront premium.

B. Losses Associated with Claims

The MMI Fund's largest expense component comes in the form of losses due to claims. FHA pays the claim to the lender when a 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 cash flows can actually be decomposed into two components:

- the cash outflow of the claim payment at the claim date and
- 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

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

The $Amortized\ Surviving\ UPB_t$ is the amount of the unpaid balance of the loan after amortization multiplied by the probability that the loan will survive until the beginning of time t. The conditional claim rate is estimated from the multinomial mortgage termination model presented in Appendix A. Note that the claim rate and the prepayment rate are in terms of the number of loans instead of in terms of the UPB. Claim and prepayment rates do vary by loan size. We conducted

the analysis by cohort and aggregated across cohorts. One of the cohorts is loan size, so using the rates in terms of the number of loans produces the same results as using the rates in terms of UPBs.

The loss rate is usually referred to as the loss given default (LGD) or severity 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 declined from 40 percent in 2000 to about 35 percent during the 2001 through 2003 exposure years. However, this rate rose in 2004 and 2005 to about 38 and 40 percent, respectively. Although significant efforts have been invested by FHA to improve the loss rate, with the rising loss severity rate observed toward the end of our historical time series and the forecasted slowdown in house price appreciation rates in the next few years, we believe it is necessary to revise upward the loss severity rate applied in last year's Review.

Exhibit B-6

Average Loss Severity Rates of Claimed Loans by Claim Year								
Termination Year	Non-profit Gift	Mortgage Product Type						
		1	2	3	4	5	6	Average
2000	no	41.41%	57.16%	37.65%	35.13%	51.74%	35.33%	40.06%
	yes	33.97%		53.04%				
2001	no	36.47%	51.30%	33.06%	28.20%	43.16%	28.52%	35.23%
	yes	33.62%		41.58%				
2002	no	34.31%	43.53%	31.03%	26.94%	48.52%	22.33%	33.44%
	yes	34.80%		34.80%				
2003	no	35.29%	44.93%	31.58%	29.60%	37.44%	27.55%	34.61%
	yes	38.00%	39.32%	34.99%				
2004	no	38.57%	46.79%	35.33%	32.70%	45.22%	33.21%	37.88%
	yes	41.66%	36.44%	41.01%				
2005	no	41.25%	47.85%	35.96%	34.20%	46.95%	32.02%	39.97%
	yes	42.46%	47.09%	36.18%				

Exhibit B-6 shows the historical loss severity rate experience by claim year, mortgage product types, and if the loans received a downpayment gift from a non-profit organization. For property dispositions that occurred during FYs 2003, 2004 and 2005, FHA's loss rates averaged 34.61, 37.88, and 39.97 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. Following FHA's definition, the loss rates for property

dispositions occurring during FYs 2003, 2004 and 2005 would be 29.5, 32.3, and 33.9 percent, respectively, when expressed as a percent of acquisition cost.

For the FY 2006 Actuarial Review, the cash flow model expressed the loss severity rate in terms of the unpaid principal balance. The average loss rates for each product type and the utilization of non-profit organization downpayment gifts during the termination years of FYs 2004 and 2005 are used as the expected loss severity rates for all future terminations. These individual loss rates are listed below:

- for FMR30
  - 42.03 percent, if received downpayment gift from a non-profit organization
  - 39.72 percent, otherwise
- for FRM15
  - 41.63 percent, if received downpayment gift from a non-profit organization
  - 47.26 percent, otherwise
- for ARM
  - 38.93 percent, if received downpayment gift from a non-profit organization
  - 35.59 percent, otherwise
- 33.46 percent for FRM30-SR
- 46.04 percent for FRM15-SR
- 32.53 percent for ARM-SR

To provide insights into the impact on the economic value and capital ratios, this year's Review also includes an alternative scenario under which we assumed that the loss rate for each product was five percentage points higher than the above historical average rates.

C. Refunded Premiums

FHA first introduced the upfront premium refund program in 1983, which specified that FHA would refund a portion of the upfront premium when a household prepays its mortgage. The upfront premium is 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 * Upfront Premium Rate * Conditional Prepayment Rate * Refund Rate*

In the past, borrowers could receive the upfront premium refund when they prepaid their mortgages before the maturity of the mortgage contract. The 2000 FHA policy change states that borrowers can obtain refunds only if they prepay within the first five years of their mortgage

contracts. The most recent policy change at the end of 2004 eliminated refunds for early prepayments of newly insured loans except for those occurring within 3 years following the endorsement data if the borrower refinanced with a new FHA loan.

The current and past policies relating to the upfront premium refund schedule are presented in Exhibit B-7.

Exhibit B-7

Percentage of Upfront Premium Refunded					
Years since Origination	9/1/83~12/31/93		1/1/94~ 12/31/00[a]	1/1/01 and later[b]	12/8/2004 and later[c]
	Thirty Year Mortgages	Fifteen Year Mortgages	All Mortgages	All Mortgages	If Refinanced into Another FHA Loan
1	0.99	0.99	0.95	0.85	0.58
2	0.94	0.93	0.85	0.65	0.34
3	0.82	0.81	0.70	0.45	0.10
4	0.67	0.66	0.49	0.25	0.00
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				

[a] Based on Mortgagee Letter 94-1, which provides a monthly schedule of refund rates
[b] Based on Mortgagee Letter 00-38
[c] Based on Mortgagee Letter 05-03, which provides a monthly schedule of refund rates. Applicable only if refinanced into a new FHA loan.

IV. Economic Value and Capital Ratio

Once all the above future cash flow components are determined, the present value can be measured through an appropriate discounting method. Then the economic value will be the sum of the present value of future cash flows plus the current capital resources.

A. Discount Factor

The discount factors applied in discounting the cash flows are the official Federal credit subsidy present value conversion factors. The discount factor varies depending on how long in the future a cash flow will occur. The discount factors are shown in Exhibit B-8.

Exhibit B-8

Years that Cash Flow Occur	Discount Factor	Years that Cash Flow Occur	Discount Factor	Years that Cash Flow Occur	Discount Factor
2007	0.9555	2019	0.5087	2031	0.2610
2008	0.9107	2020	0.4813	2032	0.2469
2009	0.8667	2021	0.4554	2033	0.2334
2010	0.8240	2022	0.4309	2034	0.2207
2011	0.7829	2023	0.4076	2035	0.2087
2012	0.7435	2024	0.3856	2036	0.1973
2013	0.7057	2025	0.3647	2037	0.1866
2014	0.6693	2026	0.3450	2038	0.1764
2015	0.6341	2027	0.3263	2039	0.1668
2016	0.6003	2028	0.3086	2040	0.1577
2017	0.5681	2029	0.2919	2041	0.1491
2018	0.5376	2030	0.2760	2042	0.1410

B. Calculating the Economic Value and Capital Ratio

At the end of FY 2006, the economic value of the MMI Fund was calculated first by determining the present value of the future cash flows for all existing books of business as of September 30, 2006. 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 IIF of the Fund.

For each fiscal year beyond 2006, the economic value of the fund as of the end of the fiscal year is calculated by the following equation:

Year End Economic Value =
Economic Value at the beginning of the year + Total Return on the Beginning Economic Value + Economic Value of the New Book of Business

The return on investment of the beginning economic value for each of the future fiscal years is assumed to equal the forward one-year Treasury rates implied by the discount factors. Specifically, these rates are shown in Exhibit B-9.

Exhibit B-9

Interest Rate Earned by the MMI Fund	
Fiscal Year	**Interest Rate (%)**
2006	4.18
2007	4.65
2008	4.93
2009	5.08
2010	5.17
2011	5.25
2012	5.31
2013	5.35