



Home Equity Conversion Mortgage Insurance Demonstration

Interim Report to Congress

INTERIM REPORT TO CONGRESS
ON THE
HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION

OCTOBER 1990

A report prepared by the Office of Policy Development and Research, U.S. Department of Housing and Urban Development, pursuant to the requirements set forth in Section 255(k) of the National Housing Act, as amended by Section 417 of the Housing and Community Development Act of 1987.

EXECUTIVE SUMMARY

Reverse mortgages are intended to assist elderly homeowners who are "house-rich and cash-poor" to tap the equity in their homes without moving and selling. With a reverse mortgage, an elderly homeowner is able to receive payments from a lender that do not have to be repaid until the homeowner chooses to move or dies. The lender is repaid from proceeds from the sale of the property, with any proceeds in excess of the amount needed to pay off the mortgage going to the borrower or the borrower's estate.

The potential demand for reverse mortgages is substantial. American Housing Survey data for 1987 show that over 20 percent of elderly owners (3.2 million) might be regarded as house-rich and cash-poor--those with incomes below \$15,000 and houses valued at more than \$50,000. Some of these households might be able to live in their homes longer or more comfortably using the proceeds of a reverse mortgage.

Despite the potential demand, prior to 1988, only about 2,500 reverse mortgages were issued by various public and private lenders. To some supporters of reverse mortgages, it seemed that mortgage insurance might provide the needed impetus to further expansion, and they secured Congressional support for a reverse mortgage insurance demonstration.

The Home Equity Conversion Mortgage (HECM) Insurance Demonstration, also known as the Federal Housing Administration (FHA) reverse mortgage program, was created by Section 417 of the Housing and Community Development Act of 1987 which added Section 255 to the National Housing Act (the Act). It authorized the Secretary of Housing and Urban Development (HUD) to insure 2,500 reverse mortgages through September 30, 1991, on the homes of elderly homeowners, enabling them to turn their equity into cash.

This interim report, pursuant to Section 255(k) of the Act, describes the design and implementation of the demonstration. Chapter 1 describes progress to date, summarizing the design process and reporting on current status. Design of the FHA reverse mortgage program involved several offices within HUD, other Federal Agencies, and a number of interest groups in the private sector. A draft proposed rule was published in the Federal Register on October 25, 1988, within the nine-month period mandated by the statute. The final rule was published in the Federal Register on June 9, 1989, and became effective on July 24, 1989. A handbook containing detailed procedures and mortgage documents for the program was completed on August 24, 1989.

Most of the subsequent chapters address design issues: determining borrower, lender, and property eligibility, Chapter 4; calculating payments to borrowers, Chapter 5; calculating loan costs, Chapter 6; insuring lenders, Chapter 7; and providing counseling, Chapter 8. Administrative procedures related to reverse mortgage origination, mortgage insurance premium accounting and collection, servicing, and claims are dealt with in Chapter 9. Legal issues raised by the program are discussed in Chapter 10. The appendix provides a full technical explanation of the payments model used to calculate principal limit factors.

HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION

REPORT TO CONGRESS

INTRODUCTION

Without a reverse mortgage, elderly homeowners who are "house-rich and cash-poor" have few ways of tapping the equity in their home apart from moving and selling. Younger homeowners may be able to take out a home equity line of credit, if they can afford to repay it. Elderly homeowners who need money for home repair, health, or living expenses may not have sufficient income to qualify for a home equity line of credit.

With a reverse mortgage, elderly homeowners are able to receive payments from a lender that do not have to be repaid until the homeowners choose to move and sell, or they die. The lender is repaid from proceeds from the sale of the property, with any proceeds in excess of the amount needed to pay off the mortgage going to the borrowers or the borrowers' estate.

The potential demand for reverse mortgages is substantial. American Housing Survey data for 1987 show that 19.7 million dwelling units were occupied by elderly householders--those 65 years of age or older. Seventy-five percent of these households (14.8 million) owned their own home; almost 40 percent of the elderly owners were 75 years of age or older.

Eighty-three percent of the elderly owners (12.3 million) owned their homes free and clear. Among elderly owners with mortgages, the median outstanding principal amount was only \$15,000. Net equity for all elderly owners totalled \$1.1 trillion.

Over 20 percent of elderly owners (3.2 million) might be regarded as house-rich and cash-poor--those with incomes below \$15,000 and houses valued at more than \$50,000. Some of these households might be able to live in their homes longer or more comfortably using the proceeds of a reverse mortgage.

According to data on over 1000 reverse mortgages gathered by Dr. Maurice Weinrobe of Clark University as of December 1988, the typical reverse mortgage borrower was a 76-year-old woman living alone in a \$160,000 house. Single women constituted over 60 percent of all borrowers; married couples, over 25 percent; and single men, the remainder. Average income was about \$14,000 for couples and about \$9,000 for men and women living alone.

Despite the potential demand, prior to 1988, only about 2,500 reverse mortgages were issued by various public and private lenders. (The development of reverse mortgages is described in more detail in Chapter 3.) To some supporters of reverse mortgages, it seemed that mortgage insurance might provide the needed impetus to further expansion, and they

secured Congressional support for a reverse mortgage insurance demonstration.

HECM Demonstration

The Home Equity Conversion Mortgage (HECM) Insurance Demonstration, also known as the Federal Housing Administration (FHA) reverse mortgage program, was created by Section 417 of the Housing and Community Development Act of 1987 (Pub.L. 100-242) which added Section 255 to the National Housing Act (the Act). It authorizes the Secretary of Housing and Urban Development (HUD) to insure 2,500 reverse mortgages through September 30, 1991, on the homes of elderly homeowners, enabling them to turn their home equity into cash.¹

Under the demonstration, the Secretary is authorized to provide mortgage insurance for reverse mortgages that permit elderly homeowners to convert a portion of their accumulated equity into cash and, thereby, to assist them in meeting health, housing and subsistence costs at a time of reduced income. The demonstration is intended to encourage and increase the involvement of lenders and other participants in mortgage markets in the making and servicing of reverse mortgages for elderly homeowners. Finally, the demonstration is intended to produce data on the extent of the need and demand among elderly homeowners for insured and uninsured reverse mortgages and the types of reverse mortgages which best serve the interests of elderly homeowners, lenders, and the Federal Government. With this

¹Throughout this report, the terms "FHA" and "HUD" are used interchangeably.

data, decisions can be made about the appropriate role of HUD insurance in facilitating the use of reverse mortgages by the elderly.

Report to Congress

Section 255(k) of the Act requires the Secretary to submit an interim report to Congress describing the design and implementation of the demonstration; the number of types of reverse mortgages written to date; the profile of participant homeowner borrowers, including incomes, home equity, and regional distribution; and problems encountered in implementation, including impediments associated with State or Federal laws or regulations governing taxes, insurance, securities, public benefits, banking, and any other problems in implementation that the Secretary encounters.

This report responds to this requirement. Since the program is just getting underway, few data are yet available on the types of mortgages written or the characteristics of the borrowers. Therefore, the report will focus upon the program design issues identified, the options considered, and the choices made. Whenever possible, design variations of interest to potential sponsors of subsidized or conventional reverse mortgage or mortgage insurance programs will be noted. Finally, the report will highlight problems encountered in implementation, separating those that were solved from those requiring further attention.

Organization of Report

Chapter 1 describes progress to date, summarizing the design process and reporting on current status. Plans for ongoing program evaluation are also briefly described. Chapter 2 provides an overview of the Home Equity Conversion Mortgage Insurance Demonstration. These two chapters together are intended as a self-contained summary of the demonstration. Later chapters provide more detail. Chapter 3 discusses the risks to borrowers and lenders of reverse mortgages, analyzes the risk reduction strategies adopted by lenders before the availability of mortgage insurance, and describes risk reduction in the FHA reverse mortgage insurance program.

Most of the subsequent chapters address design issues: determining borrower, lender, and property eligibility, Chapter 4; calculating payments to borrowers, Chapter 5; calculating loan costs, Chapter 6; insuring lenders, Chapter 7; and providing counseling, Chapter 8. Administrative procedures related to reverse mortgage origination, mortgage insurance premium accounting and collection, servicing, and claims are dealt with in Chapter 9. Legal issues raised by the program are discussed in Chapter 10.

CHAPTER ONE

PROGRAM DESIGN AND CURRENT STATUS

PROGRAM DESIGN

Process

Design of the Home Equity Conversion Mortgage Insurance Demonstration involved several offices within HUD, other Federal Agencies, and a number of interest groups in the private sector. Lead responsibility was assigned to the Office of Economic Affairs in the Office of Policy Development and Research (PDR). An interoffice working group was created made up of staff from PDR, the Office of Housing, and the Office of the General Counsel. An initial list of design issues was prepared for review in March, 1988, and work began on a proposed rule in April. Outstanding issues were analyzed and discussed in meetings of the working group.

At the same time, HUD began to consult formally and informally with outside experts, in accordance with Section 416(b) of the Housing and Community Development Act, requiring the Department to consult widely with lenders, insurers, and organizations and individuals with expertise in home equity conversion. Numerous individuals and organizations who are knowledgeable about reverse mortgages were consulted, and meetings were held with key groups. HUD staff met:

- o on February 24, 1988, with an ad hoc group of individuals and groups representing the American Association of Retired Persons, the National Center for Home Equity Conversion, the American Bar Association's Commission on Legal Problems of the Elderly, and others who were responsible for the authorization of the demonstration to hear their initial recommendations;
- o on March 23, 1988, with representatives of State housing finance agencies to discuss State experience with reverse mortgage lending;
- o on April 6, 1988, with representatives of the Administration on Aging in the Department to Health and Human Services to discuss joint efforts between HUD and AoA to fund training for reverse mortgage counselors;
- o on May 3, 1988, with lenders and insurers interested in originating reverse mortgages to discuss mortgage terms and insurance options;
- o on May 10, 1988, with housing counselors, public interest groups representing the elderly, and agencies on aging to discuss counseling about reverse mortgages and their alternatives;

Meanwhile, in February 1989, 50 lenders were selected by lottery and given reservations of insurance authority for 50 reverse mortgages apiece. The first FHA reverse mortgage was closed on October 19, 1989, by the James B. Nutter Company of Kansas City, Missouri. As of July 25, 1990, lenders had taken a total of 572 applications: 110 mortgages were endorsed for insurance; 205 were closed, but not yet endorsed; and an additional 257 were being processed.

Media coverage of the demonstration has been extensive. HUD User, an information dissemination service employed by HUD, received over 28,000 inquiries from borrowers, lenders, and others in the interval prior to the start-up of the program. Inquiries from borrowers continue to flow into HUD and to participating lenders.

Chapter 2 provides an overview of the FHA reverse mortgage program. Unlike a traditional residential mortgage, a reverse mortgage provides for payments to an elderly homeowner over an extended period rather than in one lump sum, and the homeowner repays the loan in one payment rather than through periodic payments. To be eligible for a reverse mortgage, a borrower must be 62 years of age or older, own a home free and clear or be able to pay off existing liens at closing from reverse mortgage proceeds, and occupy the property as a principal residence. A potential borrower must also receive counseling from a third party independent of the lender on reverse mortgages and their alternatives. To offer reverse mortgages, a lender must be a HUD-approved lender and must have a reservation of insurance authority from a HUD Regional Office.

Under the FHA reverse mortgage program, a borrower may choose among three basic payment options: tenure, term, and line of credit. The tenure option provides a borrower with level monthly payments for as long as the borrower occupies the home as a principal residence. The term option provides level monthly payments for a fixed period selected by the borrower. The line of credit option permits the borrower to make draws up to a maximum amount at times and in the amounts of the borrower's choosing. The program permits maximum flexibility. A borrower may receive a lump sum draw at closing to pay off an existing mortgage, to pay off a contractor's lien for repairs, or for other purposes. In addition, a borrower may combine a tenure or term mortgage with a line of credit or restructure payments to accommodate changes in the borrower's circumstances.

Payments to borrowers are based upon the age of the youngest borrower, the mortgage interest rate, and the maximum claim amount. The maximum claim amount is the lesser of the value of the property or the maximum mortgage on a one-unit residence that FHA can insure in a geographical area under the Section 203(b) program. At the present time, this amount ranges between \$67,500 and \$124,875.

Payments are calculated using principal limit factors generated by a payments model which contains assumptions about the longevity of the borrower and the appreciation of the property. Such principal limits are used to evaluate applications under the tenure, term, and line of credit options.

Regardless of the payment plan selected, elderly homeowners cannot be forced to sell their homes to pay off their mortgage, even if the mortgage balance grows to exceed the value of the property. When the borrower does move or die and the property is sold, the borrower's liability will be limited to the value of the home. In addition, a borrower is protected if the lender fails to make the required payments under the mortgage. FHA will make the payments to the borrower, and the defaulting lender will lose all interest on payments made to or on behalf of the borrower.

The borrower will pay an FHA mortgage insurance premium to insure lenders against loss in the event that sales proceeds are not sufficient to pay off the mortgage. It will consist of two parts, both of which may be financed: 1) an up-front premium of two points on the value of the property capped at the maximum claim amount and 2) a periodic premium of 50 basis points on the growing principal balance.

The mortgage insurance premium (MIP) is estimated to cover all losses, whether these losses are borne by FHA or private lenders. At the time that the mortgage is closed, a lender will choose one of two insurance options: the assignment option, or the shared premium option. Under the assignment option, FHA collects all of the MIP. The lender has the option of assigning a mortgage to FHA at the time that the mortgage balance, including accrued interest and MIP, equals the maximum claim amount. Following assignment of the mortgage, the lender files an insurance claim for an amount equal to the mortgage balance and has no further obligations under the mortgage. ~~HUD will continue to make any payments that are owed the borrower and will accept full responsibility in the event of loss.~~

Under the shared premium option, the lender foregoes assignment of a mortgage to FHA and retains a portion of the periodic MIP to compensate for the share of risk borne. FHA will pay the lender the difference between the mortgage balance and the sales proceeds at the time that the mortgage is payable up to the maximum claim amount. The lender is liable for losses that exceed the maximum claim amount, and the lender's share of the periodic MIP has been calculated to equal the expected value of these losses.

Chapter 3 discusses the risks to borrowers and lenders of reverse mortgages, analyzes the risk reduction strategies adopted by lenders before the availability of mortgage insurance, and describes risk reduction in the FHA reverse mortgage program.

- o on June 21, 1988, with representatives of secondary market agencies and private mortgage insurers to discuss payment model assumptions and mortgage insurance premium issues.

A proposed rule was published in the Federal Register on October 25, 1988, within the nine-month period mandated in the statute. At a press briefing on October 27, 1988, PDR and Housing officials announced publication of the rule; the Administration on Aging announced that it was transferring \$250,000 to HUD to help fund training for reverse mortgage counselors; and the Federal National Mortgage Association and Federal Home Loan Mortgage Corporation announced their willingness to purchase FHA-insured reverse mortgages for their own portfolios.

Following publication of the proposed rule, work began on a program handbook. Between October 1988 and March 1989, weekly meetings were held of staff from the Offices of PDR, Housing, Administration, and the General Counsel to develop implementing procedures for all aspects of the program from loan origination to mortgage insurance termination. The final rule for the demonstration was published in the Federal Register on June 9, 1989, and became effective on July 24, 1989. The handbook containing detailed procedures and mortgage documents for the program was completed on August 24, 1989.

Meanwhile, in February 1989, 50 lenders were selected by lottery and given reservations of insurance authority for 50 reverse mortgages apiece

in a manner described in Chapter 4. The first FHA reverse mortgage was closed on October 19, 1989, by the James B. Nutter Company of Kansas City, Missouri.

CURRENT STATUS

The FHA reverse mortgage program is well underway. As of July 25, 1990, lenders had taken a total of 572 FHA reverse mortgage applications: 110 mortgages were endorsed for insurance; 205 were closed, but not yet endorsed; and an additional 257 were being processed. Lenders have had numerous tasks to complete before they could begin accepting applications and have faced various problems arising from the unusual nature of this innovative mortgage instrument. This report describes these issues and the steps taken to address them in subsequent chapters. Legal issues are important; lenders must add relevant State law provisions to the legal documents provided by HUD. In numerous instances, lenders have encountered legal impediments to the issuance of reverse mortgages. Some, but not all, of these could be overcome. All lenders faced the challenge of applying the recently amended truth-in-lending disclosure requirements for home equity lines of credit to reverse mortgages. Efforts to overcome legal barriers and to develop disclosure documents are discussed in more detail in Chapter 10.

Some lenders had difficulty locating a title insurance company knowledgeable about and willing to insure reverse mortgages. This problem

is being overcome as title insurers learn more about the program. Other lenders were located in areas without HUD-approved housing counseling agencies or in areas with counselors who needed additional training to feel comfortable discussing reverse mortgages and their alternatives with borrowers. Efforts are being made to identify counseling agencies and to provide additional training as discussed in Chapter 8.

In the face of these challenges, some lenders withdrew, disappointing some potential borrowers on the waiting list when replacement lenders who did not serve the same lending area were selected. Other lenders withdrew because they concluded the limit of 50 mortgages was too small to justify the start-up costs.

Despite these difficulties, the FHA reverse mortgage program is growing steadily. Applications are being processed in all 10 HUD Regions. Each lender that withdrew from the program has been replaced by another lender from the waiting list, and additional lenders are seeking admittance to the program. Media coverage of the demonstration has been extensive, starting with publication of the proposed rule in October 1988. HUD User, an information dissemination service employed by HUD, received over 28,000 inquiries from borrowers, lenders, and others in the interval prior to the start-up of the program. Inquiries from borrowers continue to flow into HUD and to participating lenders. Lenders who remain in the program have been willing to incur start-up costs because they expect the demand for reverse mortgages to grow.

PROGRAM MONITORING AND EVALUATION

The Department intends to monitor the HECM demonstration program carefully and report on progress to Congress whenever appropriate with particular reference to any impediments to effective implementation.

Preliminary Evaluation

Under Section 255(k)(2) of the Act, the Secretary is directed to submit a preliminary evaluation of the FHA reverse mortgage program to Congress by March 30, 1992. The report is to:

(A) describe the types of mortgages appropriate for inclusion in such program;

(B) describe any changes in the insurance programs under this title, or in other Federal regulatory provisions, determined to be appropriate;

(C) describe any risk created under such mortgages to mortgagors and mortgagees or the insurance programs under this title, and whether the risk is adequately covered by the premiums under the insurance programs;

(D) evaluate whether such program has improved the financial situation or otherwise met the special needs of participating elderly homeowners;

(E) evaluate whether such program has included appropriate safeguards for mortgagors to offset the special risks of such mortgages; and

(F) evaluate whether home equity conversion mortgages have a potential for acceptance in the mortgage markets.

Evaluation reports are to be submitted every two years thereafter and are to include analysis of mortgage repayments.

Program Data

In anticipation of this task, the Department designed creation of a database into the FHA reverse mortgage program. Working with staff in the Offices of Housing and Administration, PDR staff examined mortgage forms and program data systems to determine how data needed for evaluation could be collected in the course of normal administrative processing. Data definitions were clarified and data elements were added to the Computerized Homes Underwriting System (CHUMS).

Once a reverse mortgage is endorsed for insurance, data entered into CHUMS are downloaded into an SPSS-PC database. The records in this

database will subsequently be linked with the records in the automated mortgage insurance premium accounting system, so that, in the future, HUD will be able to study both the characteristics of borrowers and the loans that they initially prefer, and the actual rate at which they consume mortgage proceeds.

The Department will be able to assess the risk of reverse mortgages and the adequacy of the mortgage insurance premium collected by cross-checking data on mortgage repayments with the predicted rate of mortgage terminations from the HECM payments model (discussed in the appendix). Within a few years, it should be possible to ascertain the adequacy of the program's assumptions and whether they need to be adjusted.

From program data, it will, of course, be possible to track the characteristics of lenders in the program and the volume of mortgage originations. The mortgage insurance premium accounting system will record mortgage sales and servicing arrangements. With this information, it should be possible to analyze the potential acceptability of reverse mortgages by the mortgage markets.

CHAPTER TWO

OVERVIEW OF FHA-INSURED REVERSE MORTGAGES

Unlike a traditional residential mortgage, a home equity conversion or "reverse" mortgage provides for payments to an elderly homeowner over an extended period rather than in one lump sum, and the homeowner repays the loan in one payment rather than through periodic payments. The reverse mortgages insured under this demonstration also differ from traditional mortgages and some types of home equity conversion mortgages in that they have neither a fixed maturity date nor a fixed mortgage amount.

Eligibility

To be eligible for a reverse mortgage, a borrower must be 62 years of age or older, own a home free and clear or be able to pay off existing liens at closing from reverse mortgage proceeds, and occupy the property as a principal residence. The property occupied by the borrower must be a one-family dwelling which meets HUD's minimum property standards.

When repairs necessary to meet HUD's property standards do not exceed the borrower's principal limit, they may be made using mortgage proceeds before or after closing in accordance with program rules.

To offer reverse mortgages, a lender must be a HUD-approved lender and must have a reservation of insurance authority from a HUD Regional Office. The initial reservations of insurance authority for the program were

allocated among applicants by lottery at the end of February 1989 following publication of a notice in the Federal Register.

Evolution of Program Design

The statute authorizing the Home Equity Conversion Mortgage Insurance Demonstration does not spell out the types of reverse mortgages that the Department should insure, although it does rule out certain options--for example, fixed-term reverse mortgages--by allowing homeowners to remain in their homes as long as they choose and by making reverse mortgages nonrecourse debt.

After internal consideration and consultation with outside groups, the Department decided to insure several types of reverse mortgages. The proposed rule, published October 25, 1988, authorized insurance for tenure mortgages under which borrowers would receive payments as long as they lived in the property, term mortgages under which borrowers would receive payments for a period of time selected by the borrower and would be able to remain in the property beyond the term, and line of credit mortgages under which borrowers could make withdrawals in the amounts and at the time of their choosing. These mortgages could have fixed or adjustable interest rates. The Department also planned to offer fixed-rate tenure mortgages with shared appreciation. The provisions of this rule offered the borrower only limited flexibility: the borrower could stop and restart monthly payments and could convert a tenure or term mortgage to a line of credit.

Once work began on a program handbook, the value of flexibility combined with simplicity became evident. Anticipating program implementation, staff struggled with "what if" questions such as: "What if the roof goes five years into the mortgage?" or "What if the borrower falls, breaks her hip, and needs funds for temporary home assistance?" It seemed evident that it was in the borrower's, lender's, and HUD's interest for the borrower to be able to tap home equity to make the repair, and so, preserve the security for the mortgage. Likewise, it was consistent with statutory intent to facilitate the borrower's desire to remain in her home as long as she chose. Other questions related to mortgage servicing (e.g., "What if the elderly homeowners fails to pay property taxes?" or "What if the amount withheld by the lender for taxes and insurance is too much or too little?") also suggested the value of such flexibility.

At the same time, work continued on the development of the payments model used to calculate payments to borrowers, and particularly, on a simple method for using the model's results in mortgage lending--ideally, in factor tables similar to the amortization factor tables with which lenders were already familiar. Initially, it seemed that, at a minimum, different tables would be needed for tenure and term mortgages.

A major technical breakthrough occurred when it became evident that, for a borrower of a given age with a known interest rate and house value, all of the types of reverse mortgages had the same present value at closing and differed only in the timing of the borrower's draws. The decision was

then made to use the present value of potential payments, known in the reverse mortgage program as the "principal limit," to calculate all payments to the borrower.

The implications of this technical insight were spelled out in the final rule. Instead of insuring several types of reverse mortgages, the Department would insure one reverse mortgage under which the borrower had several payment options--all generated from one number, the principal limit--and could change a payment plan without violating the actuarial and other assumptions upon which the mortgage was underwritten. Through a series of design decisions to solve specific problems, a line of credit reverse mortgage was created which preserves the present value of the borrower's credit line and permits the borrower to control the timing of payments from the lender. Such a mortgage provides borrowers, lenders, and HUD with the flexibility to adapt the payment stream to the borrower's changing financial circumstances while simplifying the program's design. (These features were also made available to borrowers choosing reverse mortgages with shared appreciation.)

Payment Options

Under the FHA reverse mortgage program, a borrower may choose among three basic payment options: tenure, term, line of credit. The tenure option provides a borrower with level monthly payments for as long as the borrower occupies the home as a principal residence. The term option provides level monthly payments for a fixed period selected by the

borrower. The line of credit option permits the borrower to make draws up to a maximum amount at times and in amounts of the borrower's choosing. The program permits maximum flexibility. A borrower may receive a lump sum draw at closing to pay off an existing mortgage, to pay off a contractor's lien for repairs, or for other purposes.

In addition, a borrower may combine a tenure or term mortgage with a line of credit or restructure payments to accommodate changes in the borrower's circumstances.

Calculation of Payments to Borrowers

Payments to borrowers are based upon the age of the youngest borrower, the mortgage interest rate, and the maximum claim amount. The maximum claim amount is the lesser of the value of the property or the maximum mortgage on a one-unit residence that FHA can insure in a geographical area under the Section 203(b) program. At the present time, this amount ranges between \$67,500 and \$124,875. The maximum claim amount limits the benefits that can be received by a borrower whose property value exceeds this amount.

Payments are calculated using principal limit factors. There is a unique principal limit factor for each combination of the borrower's age and an interest rate. For example, the principal limit factor corresponding to a 75-year-old borrower with a 10 percent interest rate is .416. The principal limit factor may be regarded as a loan-to-value ratio.

It measures the percentage of the maximum claim amount (i.e., 41.6 percent) that is available to the borrower on the first day that a mortgage is in effect.

Principal limit factors are generated by a payments model which contains assumptions about the longevity of the borrower and the appreciation of the property. To calculate a principal limit factor, a payments model is used which fixes the mortgage insurance premium (MIP) structure, assumes the maximum amount will be borrowed at closing, then solves for a principal limit factor subject to a constraint that equates the present discounted value of the mortgage insurance premium (MIP) expected to be collected with the present discounted value of the losses expected to be paid when future loan balances exceed the value of the collateral. The principal limit factor assures HUD that, for a given borrower and interest rate, payments can be calculated such that the losses that the Department can expect to incur will be equal to the premium that it can expect to collect. (See the appendix for a full explanation of the payments model.)

A principal limit factor is multiplied times the maximum claim amount to determine the principal limit. To continue the example used above, if the 75-year-old borrower lives in a \$100,000 house in an area where the Section 203(b) limit equals or exceeds \$100,000, then the borrower's principal limit is \$41,600. In the FHA reverse mortgage program, all payments to borrowers are calculated using a principal limit.

The principal limit is the present value of the mortgage benefits that can be received by a given borrower. In fact, it is the maximum dollar amount that a borrower could withdraw on the first day of a mortgage, after which the borrower would be unable to make another draw, but would be able to remain in the home indefinitely. The nominal value of the principal limit increases each month by the compounding rate (i.e., the mortgage interest rate plus the periodic MIP). As Table 2-1 illustrates, for a 75-year-old-borrower in a \$100,000 with a 10 percent interest rate, the principal limit would grow to \$70,163 at the end of 60 months, \$91,120 at the end of 90 months, and \$118,337 at the end of 120 months. The principal limit operates like a credit limit--once the mortgage balance reaches the limit, a borrower cannot make additional draws.

To calculate a term payment, one projects the principal limit (minus any financed closing costs and MIP) forward to the end of the term and calculates the monthly payment using the compounding rate in a sinking fund formula. As Table 2-2 illustrates, a 75-year-old-borrower in a \$100,000 house with a 10 percent mortgage who finances \$2,000 in up-front MIP and \$1,500 in closing costs may receive 60 monthly payments of \$812, 90 monthly payments of \$608, 120 monthly payments of \$510, or other amounts corresponding to other terms. Younger borrowers would receive less, and older borrowers would receive more.

FHA HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION

TABLE 2-1

Estimated Principal Limits at Origination and at
Selected Time Periods after Origination*

Interest Rate: 10 % (no shared appreciation)
Appraised Value = \$ 100,000

Age	At Origination	- - Months after Origination - -		
		<u>60</u>	<u>90</u>	<u>120</u>
62	\$ 24,700	41,659	54,102	70,262
65	28,000	47,225	61,331	79,650
70	34,200	57,682	74,911	97,286
75	41,600	70,163	91,120	118,337
80	50,000	84,330	109,519	142,231
85	58,900	99,341	129,013	167,549

* Assumes:

Appraised value is within FHA max. mortgage amount for area.

FHA HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION

TABLE 2-2

Estimated Maximum Monthly Payments for Selected Term Mortgages
Compared With Tenure Mortgages *

Interest Rate: 10 % (no shared appreciation) .
Appraised Value = \$ 100,000

<u>Age</u>	- - - Term in Months - - -			<u>Tenure Mortgage</u>
	<u>60</u>	<u>90</u>	<u>120</u>	
62	\$ 452	338	284	187
65	522	391	328	218
70	654	490	411	278
75	812	608	510	357
80	991	742	622	460
85	1180	884	741	607

* Assumes:

Initial payment covers closing costs and fees only.

Appraised value is within FHA max. mortgage amount for area.

Term mortgage payments stop at term expiration, but debt
repayment is deferred if mortgagor remains in occupancy.

A tenure payment is calculated in a similar fashion, using 100 minus the borrower's age times 12 for the number of months in the term. As Table 2-3 illustrates, a 75-year-old borrower in a \$100,000 with a 10 percent interest rate may receive payments of \$357 a month for as long as the borrower lives in the property. Borrowers in less expensive houses receive proportionally less, and borrowers in more expensive houses receive more, as long as the house value does not exceed the maximum claim amount. As Table 2-4 illustrates, borrowers may share appreciation with a lender in exchange for a lower interest rate. For example, if a 75-year-old borrower in a \$100,000 house were offered an 8.5 percent interest rate in exchange for sharing appreciation, the borrower could receive a monthly tenure payment of \$390.

Figure 2-1 illustrates term and tenure payments in relation to the principal limit and also a tenure payment combined with a line of credit showing a one-time draw that exhausts the line of credit, but does not affect the scheduled monthly payments. The principal limit is represented by the heavy black line. It traces the path that the mortgage balance would follow if the borrower withdrew the entire principal limit on the first day that the mortgage is in effect. Since HUD is willing to insure this mortgage, it follows logically that it should be willing to ensure any combination of payments such that the mortgage balance is less than or equal to the principal limit. A borrower may continue to receive payments as long as the mortgage balance does not equal the principal limit.

FHA HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION

Table 2-3

Estimated Maximum Monthly Payments for Tenure Mortgages *

Interest Rate: 10 % (no shared appreciation)

- - - - Initial Appraised Value - - - -

<u>Age</u>	<u>\$50,000</u>	<u>75,000</u>	<u>100,000</u>
62	\$ 92	139	187
65	107	162	218
70	137	208	278
75	176	266	357
80	228	344	460
85	301	454	607

* Assumes:

Initial payment covers closing costs and fees only.

Appraised value is within FHA max. mortgage amount for area.

FHA HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION

Table 2-4

Estimated Maximum Monthly Payments for Tenure Mortgages *

Interest Rate: 8.5 % (plus shared appreciation)

<u>Age</u>	- - - - Initial Appraised Value - - - -		
	<u>\$50,000</u>	<u>75,000</u>	<u>100,000</u>
62	\$114	172	231
65	128	194	260
70	157	237	317
75	193	291	390
80	242	365	488
85	312	471	629

* Assumes:

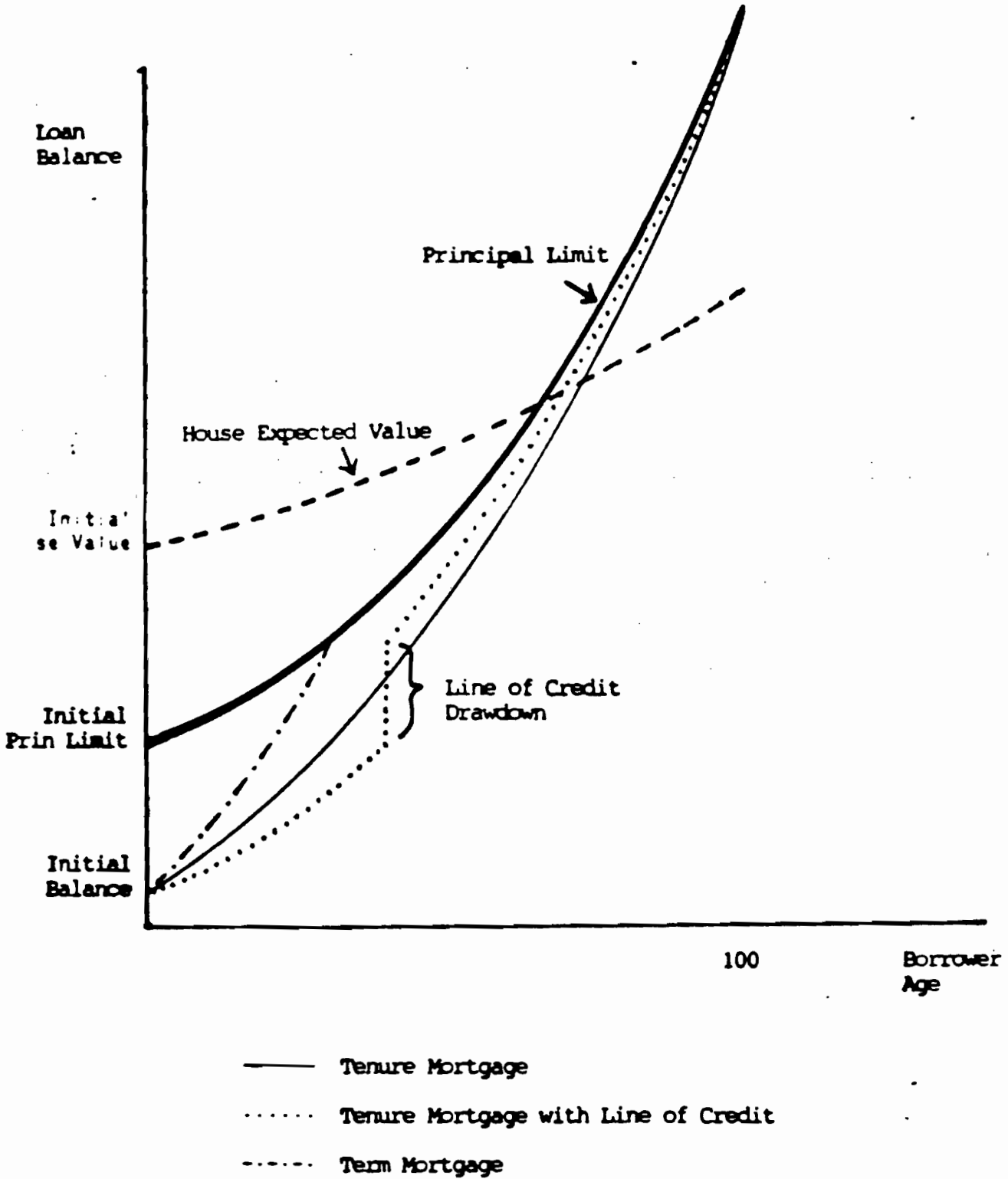
Initial payment covers closing costs and fees only.

Appraised value is within FHA max. mortgage amount for area.

Lender's share of appreciation is 25% with 20% effective interest rate cap.

FIGURE 2-1

Relationship Between Principal Limit, House Expected Value, and Mortgage Balance for Three FHA Reverse Mortgages



The dot-and-dash line illustrates a term payment plan. If a 75-year-old borrower received monthly payments of \$812 for 60 months, at the end of the sixtieth month, the mortgage balance would equal the principal limit of \$70,163, and the borrower would be ineligible to receive any more payments, but could remain in the house as long as the borrower chose. The borrower's balance would continue to grow on the principal limit line.

The lighter solid line illustrates the mortgage balance for a tenure payment plan. The mortgage balance does not equal the principal limit until the year in which the borrower turns 100 years of age. At any prior time, the borrower may elect to withdraw a sum no greater than the difference between the mortgage balance and the principal limit. If the maximum amount is withdrawn, then monthly payments would be stopped, but the borrower could continue to live in the property. If less than the maximum is withdrawn, then the borrower's monthly payments would be reduced.

The dotted line illustrates a tenure payment plan in which a portion of the principal limit (e.g., \$2,000) was set-aside for a line of credit at the time that the mortgage was originated, reducing monthly payments to \$338 for a 75-year-old borrower in a \$100,000 house with a 10 percent interest rate. This set-aside grows at the same rate as the rest of the principal limit. Even if the entire amount of the set-aside were withdrawn at the end of the sixth year when it had grown to \$3,744, the

borrower's payments are unaffected because they were calculated with the amount of principal limit remaining after the set-aside.

Figure 2-1 also shows the relationship between the principal limit, the mortgage balance, and the expected value of the mortgaged property. In the payments model, an assumption is made that houses will appreciate in value at an annual expected rate of four percent (with a standard deviation of 10 percent). The intersection of the house expected value and the principal limit illustrates HUD's actuarially based expectation regarding the termination of the mortgage. Above the intersection of the house expected value and the mortgage balance, the distance between the two lines represents the potential loss to HUD from terminating mortgages. HUD will break even if the mortgage insurance premiums collected on all of the reverse mortgages insured are sufficient to pay these losses.

Protection for Borrowers

Regardless of the type of payment, elderly homeowners cannot be forced to sell their homes to pay off their mortgage, even if the mortgage principal balance grows to exceed the value of the property. When the borrower does move or die and the property is sold, the borrower's liability will be limited to the value of the home. In addition, a borrower is protected if the lender fails to make the required payments under the mortgage. FHA will make the payments to the borrower, and the defaulting lender will lose all interest on payments made to or on behalf of the borrower (for MIP).

Interest Rates

A mortgage may bear interest at either a fixed or an adjustable rate. Adjustable rate mortgages require the use of a fixed interest proxy called the "expected average mortgage interest rate" to determine both the initial principal limit and the compounding rate used to project future values of the principal limit. The expected average rate is fixed at the time of loan origination. It is generally higher than the initial adjustable rate, just as long-term rates are usually higher than short-term rates. The use of this rate results in a lower initial principal limit, and consequently, lower payments, than if the initial adjustable rate were used. This adjustment maintains the actuarial soundness of an adjustable rate mortgage.

Shared Appreciation

FHA will also insure reverse mortgages that provide for shared appreciation between the borrower and the lender. A lender's share of appreciation will be limited to 25 percent of the increase in house values over its value at origination, subject to an effective interest rate cap of 20 percent for the year in which the house is sold. To induce a borrower to share appreciation, a lender will offer a lower interest rate on the note, which makes higher payments available to the borrower and preserves equity.

Mortgage Insurance Premium

The borrower will pay an FHA mortgage insurance premium to insure lenders against loss in the event that sales proceeds are not sufficient to pay off the mortgage. It will consist of two parts, both of which may be financed: 1) an up-front premium of two points on the value of the property capped at the maximum claim amount and 2) a periodic premium of 50 basis points on the growing principal balance.

Lenders' Insurance Options

Since the mortgage insurance premium is estimated to cover all losses, whether these losses are borne by FHA or private lenders, at the time that a mortgage is closed, a lender will choose one of two insurance options: the assignment option, or the shared premium option. Under the assignment option, FHA collects all of the MIP. The lender has the option of assigning a mortgage to FHA at the time that the mortgage balance, including accrued interest and MIP, equals the maximum claim amount. Following assignment of the mortgage, the lender files an insurance claim for an amount equal to the mortgage balance and has no further obligations under the mortgage. HUD will continue to make any payments that are owed the borrower and will accept full responsibility in the event of loss.

Under the shared premium option, the lender foregoes assignment of a mortgage to FHA and retains a portion of the periodic MIP to compensate for the share of risk borne. FHA will pay the lender the difference between the mortgage balance and the sales proceeds at the time that the mortgage

is payable up to the maximum claim amount. The lender is liable for losses that exceed the maximum claim amount, and the lender's share of the periodic MIP has been calculated to equal the expected value of these losses.

CHAPTER THREE

REVERSE MORTGAGES: RISK REDUCTION STRATEGIES¹

Risks of Reverse Mortgages

At the time that the Home Equity Conversion Mortgage Insurance Demonstration was authorized, only about 2,500 reverse mortgages had been written--approximately 1,000 by a single private issuer and the remainder by State agencies or by nonprofit agencies funded by commercial lenders. Legal barriers to reverse mortgages did not explain the low number. Federal savings and loans had been able to write reverse mortgages under Federal Home Loan Bank Board regulations since 1979, and most State barriers to alternative mortgages transactions were removed by Title VIII of the Garn-St Germain Depository Institutions Act of 1982. It is likely that few reverse mortgages were written because neither lenders nor borrowers were happy with existing strategies to reduce the risks associated with reverse mortgages.

Reverse mortgage risks to lenders are substantial. They include term, collateral, and interest rate risk. Term risk is the risk that the lender will have to extend the term of the mortgage if borrower wishes to remain beyond the original term. Faced with a choice between extension and foreclosure, a lender will probably choose extension to avoid the risk of

¹Adapted from Judith V. May and Edward J. Szymanoski, Jr., "Reverse Mortgages: Risk Reduction Strategies," Secondary Mortgage Markets, Volume 6, Number 1, Spring 1989, pp. 16-21.

negative publicity associated with foreclosure. Term extension exposes the lender to additional collateral and interest rate risks.

Collateral risk exists because the mortgage balance is continually increasing as interest accrues even if payments to the borrower have stopped. A lender's recovery of the amount due and payable is normally limited to the value of the collateral--i.e., the mortgaged property. Although property values generally appreciate over time, the mortgage balance generally increases at a faster rate. The longer a reverse mortgage is outstanding, the greater the risk of loss because the mortgage balance has grown to exceed the value of the collateral. In addition, if a lender's portfolio is poorly diversified geographically, it may decline in value due to regional economic reversals.

Interest rate risk under regular, or "forward," and reverse mortgages is similar in some respects and markedly different in others. Both forward and reverse mortgages can be prepaid: forward mortgages, prior to the original term; and reverse mortgages, prior to an actuarially determined expected maturity; so that interest rate risk for both will be based in part upon the volatility of interest rates and the estimated average life of each instrument. With a forward mortgage, the ability to prepay, in effect, gives the borrower an option to call, or refinance, the mortgage when interest rates go down, forcing the lender to reinvest the proceeds in a lower interest rate environment. With a reverse mortgage, however, the borrower has two options. The first is a call option similar to that of

forward mortgages. A reverse mortgage borrower may call, or refinance, when rates come down in order to preserve equity or to raise payments. The second is an option to put, or drawdown, funds in the future in accordance with the terms of the loan agreement. The borrower's put option obligates the lender to loan funds at a contractual rate regardless of the lender's cost of borrowing funds.

Under both forward and reverse mortgages, interest rate risk can be managed by the lender if the note bears an adjustable rate or if a risk premium is added to a fixed rate. However, annual and life-of-loan caps on adjustable rate mortgages prevent the lender from removing all of the interest rate risk, while fixed-rate risk premiums only compensate the lender for the level of risk anticipated at the time of loan origination. Furthermore, discount points, which lenders often charge on forward mortgages to adjust yields and to discourage early prepayments, serve little purpose on reverse mortgages because their initial balances are generally small. Finally, the absence of a secondary market for reverse mortgages reduces their liquidity, with the result that the lender may add a premium to an interest rate.

For each reverse mortgage risk for lenders, there is a corresponding risk for borrowers. These risks are tenure, equity, and interest rate risk. In its clearest form, tenure risk is the risk that a borrower will be forced to move and sell a home because a mortgage has become due and payable. But it takes other forms as well. Even if the lender has

extended the mortgage term, the borrower who has exhausted mortgage benefits may be forced to move because of an inability to maintain the home without continued cash payments. Or a borrower receiving fixed monthly payments may be forced to move by the need for a large lump sum to pay a major expense. (Alternatively, some lenders have incurred high servicing costs for making ad hoc concessions to the borrower's changing needs.)

Equity risk is the borrower's counterpart of collateral risk. Borrowers generally wish to preserve equity in their homes. A reverse mortgage is a form of dissavings--the consumption of equity. Just as the lender does not wish to see the mortgage balance exceed the value of the collateral, the borrower wishes to keep the amount owed below the property value to preserve net equity.

Finally, interest rate risk for the borrower corresponds to the uncertainty of an adjustable rate, or, alternatively, the cost of the risk premium built into a fixed rate. To date, lender's combined risks have caused the nominal coupon rates on conventional reverse mortgages--those not financed with tax-exempt bond surpluses--to be very high. The high cost combined with borrower's risks have held demand low. Together, lender and borrower risks have resulted in a limited market for reverse mortgages.

Strategies for Reducing Reverse Mortgage Risks

In the absence of mortgage insurance, what strategies have been used to reduce the risks to lenders and borrowers? Some of the earliest

reverse mortgages were offered by the San Francisco Development Fund, a nonprofit agency that originated mortgages for a small group of commercial banks. The program offered fixed-term mortgages with an average term of 7 years. Term risk was reduced by closely screening potential borrowers to eliminate those likely to remain in their homes past the end of the term. Collateral risk was reduced by overcollateralization--i.e., calculating payments to borrowers so that, over the mortgage term, mortgage principal plus accrued interest grew to no more than 80 percent of the home's value at origination--and by originating mortgages in areas with high appreciation rates.

State housing finance agencies in Connecticut and Rhode Island accepted greater term risk by developing the "split-term" mortgage. Under a split-term mortgage, a borrower receives monthly payments for a fixed number of years (usually 10 years), but may continue to live in the home after payments stop. While tenure risk for borrowers has not been eliminated, it is reduced. In addition, at the State agency's discretion, mortgage payments may be extended when they expire. Like the San Francisco program, both State agencies have attempted to reduce their collateral risk by using 80 percent loan-to-value ratios and by hoping for a continuation of historically high appreciation rates. Finally, they fund the mortgages from agency reserves which permit them to offer subsidized interest rates to income-eligible borrowers. Recently, the Virginia Housing Finance Agency and the Maryland Community Development Agency have offered line of credit reverse mortgages based on similar principles.

American Homestead Mortgage Corporation, headquartered in Mount Laurel, New Jersey, pioneered the reduction of term and tenure risks by offering monthly payments to borrowers for as long as they lived in their homes--in exchange for a share of property appreciation. A fixed interest rate of 11.5 percent is charged, and payments to borrowers vary with the age of the borrower, the value of the property (assuming a 6 percent appreciation rate), and the lender's share of appreciation, which ranges from 20 to 100 percent. The firm now offers reverse mortgages in 8 States. It claims to control for collateral risk by lending in historically high appreciation areas, and to control for interest rate risk by combining a high fixed interest rate with potentially high contingent interest in the form of shared appreciation. As a consequence, borrowers in rapidly appreciating properties who sell or die in the early years of a mortgage may pay effective interest rates as high as 60 or 70 percent. Recently, the Providential Home Income Plan has begun offering a similar product in California.

In October 1988, Capital Holding Corporation, a large life insurance holding company headquartered in Louisville, Kentucky, began offering a new reverse mortgage product in Louisville, the District of Columbia, and Baltimore. It too makes payments to borrowers for as long as they live in their home. These payments are based on the age of the borrowers; the value of the property, which is assumed to appreciate at the cost of living index plus 1.3 percent (the historical differential between the CPI and

house price inflation); and an adjustable interest rate tied to the 10-year Treasury bond rate. Capital Holding does not share appreciation, but it does charge 3 percent of the home's value at origination for closing costs and a guarantee fee of 7 percent. The guarantee fee functions like a reserve for a deferred-payment annuity to fund payments to borrowers in the event that the mortgage balance grows to exceed the value of the property.

As this brief review of the strategies that lenders have used for dealing with reverse mortgage risks reveals, in the absence of mortgage insurance, reverse mortgages have been viable only within strict parameters. Term risk has been dealt with by careful selection of borrowers and by the introduction of split-term and tenure mortgages. Collateral risk has been dealt with by lending only in areas with historically high rates of house appreciation, by overcollateralization, or by charging risk premiums, either explicitly or as shared appreciation. Interest rate risk has been absorbed by the lender, as in the case of the State agencies, or partially removed through the use of adjustable rates or contingent interest.

From the borrower's perspective, alternatives to fixed term mortgages, such as split-term mortgages or fixed monthly payments for as long as the borrower occupies the property, reduce, but do not eliminate tenure risk. Overcollateralization by lenders preserves borrower equity under some programs, but, in return, borrowers must accept reduced payments. In other programs, the charging of risk premiums in the form of up-front fees,

higher interest rates, or exit fees (e.g., shared appreciation) combine to deplete borrower equity. Interest rates have generally been above rates charged for forward mortgages except where the interest rate has been subsidized. Combine all these borrower risks with the additional risk of lender default, and it is easy to understand why the demand for reverse mortgages has not been overwhelming to date.

FHA-Insured Reverse Mortgages

FHA-insured reverse mortgages have features in common with their predecessors, but differ from them by offering the borrower more security and flexibility, reducing tenure risk, and by offering the lender insurance against term and collateral risks. The lender's term risk is reduced by the tenure payment option, the flexibility available to the borrower, and, most importantly, the assignment option which creates a foreseeable end to the lender's obligations under the mortgage. Collateral risk to the lender is eliminated under the assignment option and is substantially reduced under the shared premium option. Because collateral risk is borne by HUD, the lender need not charge a risk premium above the MIP. Generally, a lender can manage interest rate risk by charging adjustable interest rates.

The borrower's tenure risk is reduced by the assurance that the borrower cannot be forced to move and sell and by the borrower's flexibility in altering payment patterns to fit changing circumstances. Equity risk is lower relative to other private sector reverse mortgages

because the cost of mortgage insurance is low relative to alternative risk premiums. Consequently, the borrower's overall cost-to-benefit ratio is lower. By pooling and transferring to FHA most of all of the lender's term and collateral risks, and so reducing borrowers' costs, FHA mortgage insurance should increase borrower demand, creating a much larger market for reverse mortgages.

There is another difference between the FHA program and its private sector alternatives to date. The loan costs in the form of entrance or exit fees are relatively smaller in the FHA program. Private programs with higher loan costs will appeal only to those borrowers who expect to live a long time. With its lower costs, the FHA program may also attract borrowers whose outlook is less optimistic. Of course, borrowers who expect to live a long time may select an FHA reverse mortgage, too, but at least the program may appeal to a broader base of borrowers.

Risks of Reverse Mortgages to Insurers

Use of mortgage insurance introduces a new actor into the market for reverse mortgages--the insurer--so a brief consideration of the risks for the insurer is in order. As Chester Foster and Thomas Herzog suggest in a November 1981 article in Mortgage Banking, an insurer faces two basic types of risk--diversifiable risks which are independent and, consequently, can be reduced through pooling; and fundamental risks which are interdependent, such as national economic recession, and cannot be reduced through pooling. By pooling a large number of reverse mortgages from many different regions

of the country, an insurer can reduce the risk of loss because an individual house does not maintain its value, or because an individual borrower lives to be 102, or even because a region experiences an economic downturn.

While fundamental risk cannot be diversified away, an insurer can design a program to withstand the stress of a prolonged recession by using appropriate actuarial assumptions. The FHA reverse mortgage program assumes an expected, or mean, nominal appreciation rate for house values of 4 percent annually. It further assumes that actual appreciation rates will be widely distributed around the mean as measured by a variance factor calculated using Annual Housing Survey data. The combination of a 4 percent mean appreciation rate with a large variance--resulting in a standard deviation of 10 percent--allows the FHA program to withstand a relatively prolonged period of low national house value appreciation. It also allows the program to withstand considerable regional variation from the national average. Other actuarial assumptions include a low rate for early loan terminations due to move-outs and refinancings and the use of a risk-adjusted discount rate for purposes of calculating the present value of expected future losses.

Overall, the FHA reverse mortgage program has been designed to break even. It is not intended to be a subsidy program. Data generated by the demonstration will be used to refine program policies and the

assumptions used in the payments model, so that the program continues to pay for itself in the long run.

CHAPTER FOUR

ELIGIBILITY

This chapter discusses issues related to borrower, property, and lender eligibility for participation in the FHA reverse mortgage program.

BORROWER ELIGIBILITY

Borrower eligibility requirements for an FHA reverse mortgage are few. A borrower must be at least 62 year of age, meet minimal credit standards, own the mortgaged property free and clear (or be able to pay off an existing mortgage from reverse mortgage proceeds), and occupy it as a principal residence.

Minimum age

Section 255(b)(1) of the National Housing Act provides that: "The terms 'elderly homeowner' and 'homeowner' mean any homeowner who is, or whose spouse is, at least 62 years of age or such higher age as the Secretary may prescribe." Two design issues are raised by this provision: 1) Must all eligible borrowers be at least 62 years of age, or is a couple eligible if only one spouse is 62 or more? 2) Should the Secretary exercise the discretion afforded by the statute to raise the minimum age?

Few audiences grappling with the notion of reverse mortgages for the first time fail to raise the specter of a 75-year-old man married to a 40-year-old woman. Is this couple eligible? The actuarial risk is obvious, and HUD has responded by requiring both spouses to be at least 62 years of age. A 75-year-old man who takes out a reverse mortgage and subsequently marries a 40-year-old woman would continue to be eligible for reverse mortgage payments, but payments would stop and the mortgage would be due and payable upon his death. If the man married a 65-year-old woman, the same policy would apply. She would not be eligible for payments even though she met the minimum age requirement, unless the mortgage were refinanced so that she became one of the signatories. In this particular case, payments would be lowered because they would be based on her age as the youngest borrower, but the mortgage would not become due and payable until both spouses moved out of the property or the surviving spouse died. If a couple were to divorce, the spouse remaining in the property would retain the rights under the mortgage on the property.

HUD declined to exercise the discretion made available in the statute to raise the minimum age. Given the actuarial basis of reverse mortgage payments, younger borrowers qualify for much lower payments than older borrowers. This serves as a natural limitation. HUD decided to let each borrower decide whether tapping home equity makes financial sense given his or her

circumstances. Lenders participating in the FHA program do not have discretion to set higher minimum age qualifications.

The FHA reverse mortgage program places no limit on the number of borrowers that may be signatories to a reverse mortgage. Three sisters or four friends would be as eligible as a single individual or a couple, assuming that they are all 62 year of age or older and are all owners of the residence, but, in each case, the principal limit--the present value of potential payments--would be based on the age of the youngest borrower.

General credit standing

Credit requirements for a reverse mortgage borrower are minimal. It is understood that many applicants will be applying for a reverse mortgage to pay off other delinquent accounts. Section 206.37 of the regulations requires that a borrower have "a general credit standing satisfactory to the Secretary." As spelled out in HUD Handbook 4235.1, borrowers must show that they are not currently in default with regard to any debt that they owe the Federal Government (or else that a delinquent Federal debt can be paid off at closing). In addition, certain financial information is collected from borrowers using a standard mortgage credit analysis form to facilitate evaluation of the program.

Property liens

An FHA-insured reverse mortgage must be a first mortgage. Therefore, any existing mortgage and certain liens (e.g., a tax lien) on a property must be paid off or subordinated to the reverse mortgage. An existing mortgage or lien may be paid off at closing using reverse mortgage proceeds. The Department initially considered an arbitrary limit on the size of an existing mortgage that could be paid off, but decided that borrowers are in the best position to determine what portion of reverse mortgage proceeds should be used for this purpose. Consequently, the amount of any existing mortgage is limited only by the borrower's principal limit (less any financed costs). Using reverse mortgage proceeds to pay off an existing mortgage can help some elderly homeowners ward off foreclosure and can help others as well if, relieved of their forward mortgage payments, they can afford to remain in their homes.

A lien need not be paid off at closing if a creditor is willing to subordinate the lien to the reverse mortgage. For example, an elderly homeowner could participate in a State's deferred property tax payment program if the State would accept payment from the proceeds remaining after repayment of the reverse mortgage. In other words, a lien which impairs the security of the reverse mortgage must be paid at closing--e.g., a delinquent tax lien, but others may not have to be--e.g., a subordinated lien

securing a special assessment on which the homeowner makes periodic payments.

Principal residence

To be eligible for a reverse mortgage, the borrower must occupy the mortgaged property as a principal residence. "Principal residence" is defined as the dwelling where the borrower resides the majority of the year. Applicants with more than one property must show that the property to be mortgaged meets this criterion. Homeowners with a reverse mortgage are able to spend winters in Florida or summers in Minnesota as long as they retain the mortgaged property as their principal residence. They are also able to rent the property for short periods of time subject to this condition.

A homeowner continues to be eligible for a reverse mortgage, even if one spouse permanently or temporarily resides in an institution, as long as the mortgaged property is the principal residence of the spouse who is not institutionalized.

Reverse mortgages are not assumable since transfer of a mortgage would disrupt the actuarial expectations upon which the mortgage was written. A mortgage becomes due and payable when a residence is no longer the principal residence of at least one borrower or when a borrower has been out of the property for

reasons of health for a minimum of 12 months, and HUD field staff have determined that the borrower is unlikely to return shortly.

Section 206.211 requires lenders to determine on an annual basis whether or not the property is the principal residence of at least one borrower. A borrower will be asked to so certify, and the lender may rely on the certification unless it has information indicating that the certification may be false. Once the mortgage balance exceeds the value of the property, borrowers or their heirs may be tempted fraudently to claim occupancy in order to continue mortgage payments. At some time in the future, once outstanding balances and the size of the program have grown, it may be advisable for the Department to check occupancy claims against other sources of information such as social security or tax records.

PROPERTY ELIGIBILITY

Types of dwellings

Section 255(d) of the statute states that to be eligible for insurance, a mortgage shall "be secured by a dwelling that is designed principally for a 1-family residence." Whether a dwelling is a one-family residence is ultimately determined by an appraiser. In defining the number of units on a property, the appraiser focuses on the viability of each unit as an independent,

self-supporting unit. Characteristics such as separate kitchen and bathroom facilities, private entrances and separate legal addresses are all considered in this determination. If a separate legal description can be written for one half of a duplex, then a reverse mortgage can be written on the half occupied by an eligible homeowner. Some ambiguity arises when a portion of a residence has been converted to a rental unit--a strategy used by some elderly homeowners to increase their incomes. A self-contained rental unit would disqualify a property, while a rented room would not.

Condominiums and Cooperatives

Conceptually, both condominiums and cooperatives qualify as one-family residences potentially eligible for mortgage insurance. In fact, the proposed rule included both condominium and cooperative housing units as types of property eligible for reverse mortgage insurance. In the final rule, condominiums were eligible, but cooperative housing units were not.

The proposed rule had anticipated the use of special procedures and requirements for determining property eligibility applicable to mortgage insurance for cooperative housing units under section 203(n) of the Act. However, the section 203(n) program has rarely been used since it was inaugurated over 10 years ago, and HUD Field Offices have little or no experience in

dealing with mortgages for cooperative housing units. The Department concluded that this lack of experience coupled with the many unusual features of reverse mortgages would probably result in significant delays in processing a reverse mortgage for a cooperative housing unit, and that the limited amount of insurance authority available during the demonstration stage would be better applied to other types of single-family housing more familiar to HUD Field Offices and Headquarters. If the reverse mortgage program were expanded, however, then procedures could be developed for processing reverse mortgages on cooperative units.

For a condominium to be an eligible property, it must be located in a HUD-approved condominium project. To approve a project, HUD field staff review:

- o Legal documents creating the condominium association;
- o The percentage of owner-occupancy (at least 51 percent of the units in a project must be owner-occupied);
- o The condominium budget and a current financial statement; and
- o The management agreement.

If a project has been converted from rental housing, staff also review the conversion process. (HUD approval is also required for new subdivisions and planned unit developments.)

When potential reverse mortgage borrowers own units valued significantly more than the Section 203(b) mortgage limit for their area, their units are not likely to have been previously approved. Securing approval of the project adds to the processing time for their applications and also the cost. Some condominium projects do not meet HUD's standards for approval--e.g., because the project lacks an adequate reserve for repairs, disappointing potential borrowers. Lenders normally bear the cost of securing approval of a project for forward mortgages on condominiums, because they can anticipate originating several mortgages. They are reluctant to do so when only one application is involved; this has created problems for potential borrowers in Florida and California.

Condominiums are also reviewed to determine whether they have protective covenants imposing age-based restrictions that are in compliance with Fair Housing laws and HUD regulations. Consistent with the Fair Housing Amendments of 1988, HUD presently allows age-restrictive covenants only when:

- o The housing is intended for, and solely occupied by, persons 62 years of age or older; or

- o The housing is intended and operated for occupancy by at least one person 55 years of age or older per unit and provides significant facilities and services specifically designed to meet the physical or social needs of older persons; or if it is not practicable to provide such facilities and services, the housing is necessary to provide housing opportunities for older persons.

Failure to meet these requirements have prevented residents in some "retirement" communities from participating in the program.

Leaseholds

The Department will insure a mortgage on a leasehold property if the lease is for a 99 year term and is renewable. Other leasehold properties are eligible, but the lease term must be at least 50 years from the 100th birthday of the youngest borrower. Fifty years is used to eliminate any doubt that the leasehold interest will always have substantial value relative to the least 50 years from the 100th birthday of the youngest borrower.

Fifty years is used to eliminate any doubt that the leasehold interest will always have substantial value relative to the mortgage balance.

Appraisals

Since an elderly homeowner's property constitutes the entire security for a reverse mortgage, concern is sometimes expressed that properties be properly appraised. But accurate appraisals are the key to all sound mortgage underwriting. No special appraisal procedures are mandated by the Department for the reverse mortgage program.

Repair work

To qualify for mortgage insurance, properties must meet minimum property standards. Appraisers will determine what repairs, if any, are needed to bring a property up to these standards. While the Department could have disqualified homeowners whose properties did not meet minimum property standards, this approach would not have been consistent with the statutory aim of meeting "the special needs of elderly homeowners by reducing ... the economic hardship caused by the increasing costs of ... housing ... needs at a time of reduced income." Instead, the Department decided to adapt the provisions of Section 203(k) of the National Housing Act which permit repairs to be financed from mortgage proceeds.

Under the reverse mortgage program, repairs to meet minimum property standards may be made after closing if they are expected to cost less than 15 percent of the maximum claim amount. The lender may charge a fee of the greater of \$50 or one and one-half percent of the amount spent on these repairs as compensation for inspecting these repairs. Repairs expected to cost more than 15 percent of the maximum claim amount may be performed under a contractor's lien which is paid off at closing. This method effectively limits the amount of repairs that can be financed under a reverse mortgage to the borrower's principal limit (minus any financed costs). Whether repairs are made before or after closing, the reverse mortgage program can function as a deferred payment rehabilitation loan program. It will be attractive to elderly homeowners who have sufficient cash to live on, but cannot afford major expenditures for needed repairs.

LENDER ELIGIBILITY

Selection Process

Under the statute, the Department is authorized to insure only 2,500 reverse mortgages. Even if all of these mortgages were made by one lender, they would not constitute a substantial loan portfolio. At the same time, one of the statutory aims of the demonstration was "to encourage and increase the involvement of

mortgagees ... in the making ... of home equity conversion mortgages for elderly homeowners."

In designing the demonstration, the Department could have selected demonstration areas, defined by community or State, or could have selected lenders using competitive criteria. It did neither on the ground that the Department should not prejudge which communities or lenders were suitable program participants. Instead, a system was devised for allocating opportunities to participate in the program evenly over the country and among lenders.

In the proposed rule, published October 25, 1988, HUD announced its intention to issue reservations of insurance authority to lenders who responded to a notice published in the Federal Register prior to the final rule. A reservation of insurance authority conveyed the Secretary's commitment, good for six months, to insure a mortgage consistent with HUD's rules. At the end of six months, reservations for which a conditional commitment had not been issued would be recaptured and reallocated to the next lender on the list.

The Department allocated its 2,500 reservations of insurance authority in lots of 50 among the 10 HUD Regions in proportion to each Region's share of the Nation's elderly homeowners. The

allocation was as follows: Region I, 150; Region II, 200; Region III, 250; Region IV, 500; Region V, 500; Region VI, 300; Region VII, 150; Region VIII, 100; Region IX, 250; and Region X, 100.

In Mortgagee Letter 88-38, dated December 22, 1988, all HUD-approved lenders were informed that they were eligible to apply for 50 reservations of insurance authority in accordance with a notice soon to be published in the Federal Register. The notice, published on January 24, 1989, stated that, to apply, a lender had to send a letter to the Regional Director of Housing requesting the reservations, giving the lender's name, address, 10-digit mortgagee identification number (indicating that the lender was HUD-approved), and the name of a contact person. Thirty days after publication of the notice, random drawings were held in each Region to select participating lenders from among those who had applied. Those not receiving reservations were placed on waiting lists in the order drawn.

Using this method for allocating reservations of insurance authority had a number of advantages:

- o It resulted in the selection of reverse mortgage lenders in proportion to each Region's share of the Nation's elderly homeowners.

- o It gave all HUD-approved lenders the opportunity to participate in the random drawing, assuring that lender interest rather than selection criteria would determine who applied.

- o It imposed minimal application costs upon lenders and protected program administrators from potential claims that the selection process was biased.

- o It permitted the Department to identify lenders early in the development of the program (between the publication of the proposed and final rules), so that it could begin identifying and training counselors in the vicinity of the participating lenders.

- o It permitted the Department to inform potential borrowers about participating lenders.

Within 30 days of the notice, HUD's Regional Offices received applications from 276 lenders. A total of 50 lenders were randomly selected, and the remainder were placed on a waiting list in each Region. Subsequent applicants have been added to the waiting list in the order in which they applied.

While the advantages of selecting lenders in this manner were substantial, there were also some disadvantages:

- o Lenders did not have all of the information that they needed to make a firm decision about whether or not to participate in the program, since neither the final rule nor the handbook had been published; and some withdrew once they had full information about the level of effort required.
- o The withdrawal of some lenders disappointed some potential borrowers. A lender who withdrew was replaced with the next lender on a Region's list. The new lender might not serve the same lending area.
- o Lenders needed more than six months to obtain 50 conditional commitments. Recognizing this problem, HUD used its waiver authority to extend lenders' reservations in all cases where lenders were making an effort to initiate the program.

Characteristics of Participating Lenders

Certain information on lenders who applied for reservations could be culled from HUD's Institution Master File. Of the 276 HUD-approved lenders who applied for FHA reverse mortgage reservations, 41 percent were HUD-supervised mortgage bankers; 21 percent were mortgage banking subsidiaries of supervised lenders; 18 percent were banks or insurance companies; 16 percent were savings and loan institutions; and 4 percent were State housing finance agencies. As a result of the random selection process, similar percentages were subsequently offered reservations: 46 percent, 18 percent, 18 percent, 14 percent, and 4 percent, respectively.

Lenders were classified as "small," "medium," or "large" on the basis of the number of HUD-approved offices. Lenders with one office were classified as small; those with between 2 and 10 offices as medium; and those with more than 10 as large. By this classification, 46 percent of the ~~lenders who applied for~~ reservations were small; 38 percent were medium; and 17 percent were large. Eight lenders applied for reservations in three Regions; and 11 applied in two Regions.

Ten or more applications were received from lenders in the States of California (37), New Jersey (22), New York (14), Arizona (12), Utah (11), and Minnesota (10). Applications were received

from at least one lender in 45 States and Puerto Rico.

(Applications were not received from the States of Alaska, Kansas, New Hampshire, North Dakota, and West Virginia and the District of Columbia.) More lenders applied than could receive reservations in each of the 10 HUD Regions.

As of May 22, 1990, a total of 110 lenders had been offered reservations--50 lenders currently in the program, 58 additional lenders who were offered reservations and had turned them down, and two lenders whose reservations were withdrawn by HUD for nonperformance. Of the 58 lenders who turned down reservations, 27 were selected in the original lottery and 31 were drawn from the waiting list. (Withdrawals by lenders on the original list were more disruptive to the program, because their names were widely circulated, and they accumulated long lists of potential borrowers who could not necessarily be served by the next lender on the list.) Lenders in the program were compared with lenders who withdrew and were found to be substantially similar with regard to type of institution, size, and region, suggesting that the decision to participate in the program depended on factors other than the observable characteristics of the lenders.

Size of Demonstration

Apart from the method used to select lenders for the demonstration, the small size of the demonstration has undoubtedly

shaped the population of lenders interested in participating. Lenders in the program are pioneers: they are excited by the potential market for this new mortgage product. Due to start-up costs, they do not expect to make money from 50 mortgages, but they are motivated to "get in on the ground floor," even at some initial expense to themselves. (At the same time, some lenders have withdrawn, complaining that they could not make money on 50 mortgages.) While the demonstration can show widespread interest among lenders in reverse mortgage given the availability of FHA mortgage insurance, it cannot demonstrate what types of lenders would participate in a mature program without loan production limits.

CHAPTER FIVE

CALCULATING PAYMENTS TO BORROWERS

In this chapter, some of the key concepts that are unique to the FHA reverse mortgage program are defined and discussed, and the method for calculating different payment options is described. The payments model used to generate the program's principal limit factors is explained in full technical detail in an appendix to this report, so that others may use it or adapt it to their own needs.

KEY REVERSE MORTGAGE CONCEPTS

In the FHA reverse mortgage program, payments to borrowers are based on the age of the youngest borrower, the expected average mortgage interest rate, and the maximum claim amount which are used to determine the principal limit and all payment options available to the borrower. Each of these concepts will be discussed in this section.

Age of the Youngest Borrower

Insured reverse mortgage lending requires underwriting rules that vary the size of payments to borrowers with their age. If a borrower may continue to reside in the mortgaged property as long as the borrower chooses, it is evident that younger borrowers must receive smaller payments if risk to the lender and mortgage insurer is to be controlled.

Use of the age of the youngest borrower is a simplifying assumption. Joint mortality tables, which estimate the combined mortality of all borrowers, could have been used, but their use would have negated the use of a single principal limit factor table (a table which is already 9 pages long). Apart from this important practical consideration, joint mortality tables are unlikely to be needed for the bulk of program participants. Based on experience with the 2,500 mortgages made by public and private issuers at the time that the FHA program was authorized, 75 percent of reverse mortgage borrowers have been individuals living alone. In cases of joint borrowers, the wider their difference in age, the more nearly their joint mortality is approximated by the age of the youngest. Joint borrowers with similar ages do have higher joint mortalities, but correcting for this effect at this stage is unlikely substantially to affect the actuarial soundness of the program and would introduce a kind of spurious precision given the lack of program experience to guide the choice of actuarial assumptions.

The same mortality assumptions are used for both men and women. Gender-specific tables cannot be used because the Civil Rights Act of 1968, as amended in 1976, forbids discrimination on the basis of sex in the terms and conditions of a mortgage. Blended mortality tables could have been used, but the decision was made to use of female mortality tables since a large majority of borrowers are expected to be female, and because the use of female rather than blended mortality tables balances other decisions made in the design of the demonstration.

Two technical matters will be briefly noted. 1) The age of the youngest borrower at closing is rounded to the nearest whole year. Consequently, a borrower who is 73 years and four months old is 73, while another who is 73 year and seven months old is 74 for purposes of calculating payments to the borrower. 2) Borrowers over 95 years of age are treated as if they were 95 for the purpose of calculating payments, because the mortality table in the payments model is truncated at age 100, and so underestimates the life expectancy of borrowers over 95 years of age.

Expected average mortgage interest rate

Interest rates affect the present value of payments available to a borrower. While higher interest rates increase the payments owed by a forward mortgage borrower, they decrease the payments that can be received by a reverse mortgage borrower. Higher interest rates cause a reverse mortgage balance to grow at a faster rate; lower payments offset the increased risk to the lender and insurer.

In addition to the age of the youngest borrower, an interest rate is needed to determine the applicable principal limit factor. For a fixed-rate mortgage, this interest rate is simply the interest rate on the mortgage (rounded to the nearest one-eighth of a percentage point). But what rate should be used for adjustable rate mortgages? The payments model can handle only one interest rate at a time, so that a new concept was

needed--called the "expected average mortgage interest rate," also known as the "expected rate"--for use in calculating payments to borrowers. Simply stated, the expected rate is intended to be the market's best estimate of the average mortgage interest rate during the term of the mortgage.

For both forward and reverse mortgages, adjustable interest rates consist of an index plus a margin. The index consists of a series of rates beyond the control of the lender. The margin is set by the lender to cover certain risks, expenses, and profit. It is determined at closing and does not change throughout the life of the mortgage. An interest rate is adjusted by adding the current value of the index to the margin on the change date. All FHA-insured adjustable rate mortgages, including adjustable rate reverse mortgages, use the one-year Treasury rate as the index.

The "expected rate" is defined as the lender's margin plus the 10-year Treasury bond rate. The margin is required to be the same margin used to adjust interest rates annually. The 10-year Treasury rate is used on the ground that it incorporates market expectations of future one-year interest rates. The expected rate is determined at closing and does not change. It is used along with a borrower's age to look up the principal limit factor that is used to calculate payments to the borrower, whether these payments are calculated at closing or at any subsequent date.

The impact of interest rate adjustments on reverse mortgages is very different from the impact of interest rate adjustments on forward mortgages. While payments owed by borrowers with forward mortgages may change on each interest rate adjustment date, payments received by borrowers with reverse mortgages do not. Adjustments to a reverse mortgage interest rate affect only the rate at which the mortgage balance grows, reducing a major potential uncertainty for a reverse mortgage borrower. The lender and insurer take the risk that the expected rate underestimates actual interest rates. A borrower who selects a reverse mortgage promising 120 equal monthly payments will receive those payments even if the mortgage balance grows to exceed the principal limit because actual interest rates exceeded the expected rate. If actual interest rates are lower than expected, the borrower is entitled to make additional draws equal to the difference between the mortgage balance and the principal limit.

Principal limit factor

The age of the youngest borrower and the expected rate determine the applicable principal limit factor. The principal limit factor is calculated using a payments model containing assumptions about the longevity of the borrower and the appreciation of the property. The model solves for a principal limit factor which satisfies the condition that the present value of the mortgage insurance premium expected to be collected will equal the present value of the insurance claims expected to be paid. A matrix of principal limit factors is provided by the Secretary-- corresponding to borrowers' ages between 62 and 95 and interest rates

between 7 and 16 percent by eighths. For example, in Table 5-1, the principal limit factor for a 75-year-old borrower with a 10 percent interest rate is .416.

Principal limit and maximum claim amount

A unique principal limit used to calculate all payment options is calculated for each mortgage by multiplying the principal limit factor provided by the Secretary times the maximum claim amount. The maximum claim amount is a concept necessitated by the limit in section 255(g) of the Act on the amount of an insurance claim that HUD can pay--thence, its name.

Technically, the maximum claim amount is defined as the lesser of the appraised value of the property or the maximum dollar amount that FHA can insure in an area for a one-family residence under section 203(b)(2) of the National Housing Act (as adjusted where applicable under section 214 of the National Housing Act). The appraised value of the property is used if it is less than the Section 203(b) limit to preserve the proportionality of payments to house value up to the statutory limit. Both the appraised value and the maximum insurable amount are to be determined as of the date that the conditional commitment is issued.

This limit on the size of a claim implies a limit on the amount of home equity that HUD should use in calculating payments to borrowers. As initially drafted, section 255(d)(3) of the statute required that a reverse

mortgage be secured by a dwelling "that has a value not to exceed the maximum dollar amount established by the Secretary under section 203(b)(2) for a 1-family residence." Section 203(b) limits are normally applied to the mortgage principal, not the value of the dwelling. This limitation on house value was recognized as a drafting error and was eliminated by Section 1066 of the Stewart B. McKinney Homeless Assistance Amendments Act of 1988, but the limitation on the size of an insurance claim remains. As a consequence, FHA will insure a reverse mortgage on a house of any value, but, for purposes of determining payments to borrowers, will disregard home equity above the maximum claim amount. HUD believes that limiting benefits available to borrowers with home equity above the maximum claim amount will have the salutary effect of encouraging the development of conventional reverse mortgages to complement those insurable under the FHA program.

As a consequence of this limitation, some of the mortgages in the reverse mortgage pool will be secured by houses with values above the maximum claim amount, lowering the risk to both lenders and the insurer. This extra equity is not taken into account in determining payments to borrowers who own it or to borrowers as a whole. Under the FHA program, payments to a borrower are uniquely based upon the age of the youngest borrower, the expected rate, and the maximum claim amount. The program does not make assumptions about the proportion of houses of different values in the pool of insured mortgages. From a practical point of view, it is impossible to know what the composition of house values in the pool will be. In the beginning, the proportion of high-valued properties may be

relatively high, but their proportion should decline as private lenders and insurers develop products that permit owners of these properties to take fuller advantage of their equity.

Some advocates of reverse mortgages, including the American Association of Retired Persons, have recommended that borrowers, including owners of higher valued houses, be permitted to withhold equity from the reverse mortgage transaction. For example, if the maximum claim amount in an area is \$100,000 and a house is valued at \$120,000, the homeowner should be able to withhold \$20,000 in equity, so that regardless of the size to which the mortgage balance grew, the borrower or the estate of the borrowers would retain \$20,000 in equity. Such a proposal in effect gives the borrower a lien prior to the first mortgage lien and create issues about the rules governing the unmortgaged portion of the property and treatment of appreciation or depreciation. Overall, moreover, the proposal would probably increase the attractiveness of FHA reverse mortgages to homeowners whose houses exceed the maximum claim amount and so decrease the incentive to private lenders and insurers to provide conventional reverse mortgages. For these reasons, HUD has not supported this recommendation.

CALCULATION OF PAYMENTS

The initial principal limit may be regarded as the present value of the payments available to a borrower. Under the FHA reverse mortgage program, the borrower is able to control the timing of the payments by selecting among three basic payment options: tenure, term, and line of

TABLE 5-1

Factors for Determining Borrowers Principal Limit

Factor - Shared Premium Points

Age	Interest Rate							
	10.000	10.125	10.250	10.375	10.500	10.625	10.750	10.875
62	.247-50+	.241-50+	.235-50+	.230-50+	.224-50+	.219-50+	.214-50+	.209-50+
63	.258-50+	.252-50+	.246-50+	.240-50+	.234-50+	.229-50+	.224-50+	.219-50+
64	.268-50+	.262-50+	.256-50+	.250-50+	.245-50+	.239-50+	.234-50+	.229-50+
65	.280-50	.273-50+	.267-50+	.261-50+	.256-50+	.250-50+	.245-50+	.239-50+
66	.291-48	.285-50	.279-50+	.273-50+	.267-50+	.261-50+	.256-50+	.250-50+
67	.303-46	.297-48	.291-49	.285-50	.279-50+	.273-50+	.267-50+	.262-50+
68	.316-44	.309-45	.303-47	.297-48	.291-49	.285-50	.279-50+	.274-50+
69	.329-42	.322-43	.316-45	.310-46	.304-47	.298-48	.292-50	.286-50+

70	.342-40	.336-42	.329-43	.323-44	.317-45	.311-46	.305-47	.299-49
71	.356-38	.349-39	.343-41	.337-42	.331-43	.325-44	.319-45	.313-47
72	.370-36	.364-37	.357-38	.351-40	.345-41	.339-42	.333-43	.327-44
73	.385-34	.378-35	.372-36	.366-38	.360-39	.353-40	.348-41	.342-42
74	.400-32	.394-33	.387-34	.381-36	.375-37	.369-38	.363-39	.357-40
75	.416-30	.409-31	.403-33	.397-34	.390-35	.384-36	.378-37	.372-38
76	.432-29	.425-29	.419-31	.413-32	.407-33	.400-34	.394-35	.389-36
77	.448-27	.442-28	.436-29	.429-30	.423-31	.417-32	.411-33	.405-34
78	.465-25	.459-26	.453-27	.446-28	.440-29	.434-30	.428-31	.422-31
79	.482-23	.476-24	.470-25	.464-26	.458-27	.452-28	.446-29	.440-30

80	.500-21	.494-22	.487-23	.481-24	.475-25	.469-25	.463-26	.458-27
81	.517-19	.511-20	.505-21	.499-22	.493-23	.487-23	.481-24	.476-25
82	.535-17	.529-18	.523-19	.517-20	.511-20	.505-21	.500-22	.494-23
83	.553-15	.547-16	.541-17	.535-17	.529-18	.524-19	.518-20	.512-20
84	.571-13	.565-14	.559-15	.553-15	.548-16	.542-17	.537-17	.531-18
85	.589-11	.583-12	.577-12	.572-13	.566-13	.561-14	.555-15	.550-16
86	.607-09	.601-09	.596-10	.590-10	.585-11	.579-12	.574-12	.569-13
87	.624-07	.619-07	.614-08	.608-08	.603-08	.598-09	.593-09	.588-10
88	.642-05-	.637-05	.632-05	.627-05	.622-06	.617-06	.612-07	.607-07
89	.660-05-	.655-05-	.650-05-	.645-05-	.640-05-	.636-05-	.631-05-	.626-05-

90	.678-05-	.674-05-	.669-05-	.664-05-	.659-05-	.655-05-	.650-05-	.646-05-
91	.697-05-	.692-05-	.688-05-	.683-05-	.679-05-	.674-05-	.670-05-	.665-05-
92	.716-05-	.711-05-	.707-05-	.703-05-	.699-05-	.694-05-	.690-05-	.686-05-
93	.735-05-	.731-05-	.727-05-	.723-05-	.719-05-	.715-05-	.711-05-	.707-05-
94	.755-05-	.752-05-	.748-05-	.744-05-	.741-05-	.737-05-	.733-05-	.730-05-
95	.778-05-	.774-05-	.771-05-	.768-05-	.764-05-	.761-05-	.758-05-	.755-05-
96	.778-05-	.774-05-	.771-05-	.768-05-	.764-05-	.761-05-	.758-05-	.755-05-
97	.778-05-	.774-05-	.771-05-	.768-05-	.764-05-	.761-05-	.758-05-	.755-05-
98	.778-05-	.774-05-	.771-05-	.768-05-	.764-05-	.761-05-	.758-05-	.755-05-
99	.778-05-	.774-05-	.771-05-	.768-05-	.764-05-	.761-05-	.758-05-	.755-05-

credit. The borrower may combine a line of credit with a term or tenure option and may alter the payment plan initially selected.

For a 75-year-old borrower with a 10 percent interest rate and a \$100,000 maximum claim amount, the principal limit factor is .416, and the principal limit is $.416 \times \$100,000$, or \$41,600. The principal limit is literally the maximum dollar amount that a borrower can withdraw on the first day that a mortgage is in effect. It increases each month at a compound rate of one-twelfth of the expected rate plus the monthly mortgage insurance premium (MIP). When the mortgage balance equals the principal limit, the borrower cannot receive any more payments (with two exceptions), but is able to remain in the house until the borrower moves, sells, or dies. A borrower who has selected the tenure option and who becomes 100 years old will continue to receive payments even though the mortgage balance equals the principal limit. Likewise, borrowers who have selected the tenure or term options with adjustable interest rates will continue to receive payments for the duration of the selected term, even though the mortgage balance exceeds the principal limit because the actual average mortgage interest rate exceeds the expected rate.

Principal Limit Method

At origination, the principal limit is reduced by any initial payment and any amounts set-aside for a line of credit, for repairs after closing, for a mortgage servicing fee (see Chapter 6-13), and for the first year's payments of taxes, insurance, and other property charges. Then, monthly

payments are calculated by determining the future value of the net principal limit at the end of the applicable number of months using a monthly compounding rate of one-twelfth of the sum of the expected rate and the MIP. This future value and the monthly compounding rate are used in a sinking fund formula for payments made at the beginning of a month to determine the maximum monthly term or tenure payment. Term and tenure monthly payments are both calculated in the same way, except that the number of months for term payments is the number of months selected by the borrower, while for tenure payments it is the age of the youngest borrower subtracted from 100 and multiplied by 12.

As long as the mortgage balance is less than the principal limit, a borrower may request a payment of any amount up to the principal limit or may change from one payment option to another. If the borrower changes payment options or makes a lump sum draw, a lender will recalculate payments to the borrower using a method similar to the one described above. Specifically, the lender will subtract the mortgage balance (and any unused amount set-aside for a line of credit or for other purposes) from the principal limit for the current month, project the net principal limit to the end of the term, and use a sinking fund formula to recalculate monthly payments, if any. A lender may charge a fee, not to exceed twenty dollars, to change a borrower's payment plan.

Using a table of principal limit factors provided by the Secretary and a financial calculator, it is possible to calculate or recalculate any of

the payments plans available under the program. Factors and detailed instructions for making these calculations are contained in HUD Handbook 4235.1. For simplicity of operation, however, the Department hired a contractor to create two software programs: one, to calculate initial payment plans, and another, to calculate changes to an existing payment plan. Each generates print-outs of expected cash flows that can be used by borrowers, lenders, HUD staff, and counselors in assessing payment options.

These software packages generate computation screens for use on an IBM-compatible personal computer and are available free of charge from a computer bulletin board maintained by the Housing Information and Statistics Division in the Office of Housing. The screens (including the principal limit factors) and the payments model itself can be downloaded using the caller's personal computer and communications software by telephoning (202)708-3102, selecting the HECM menu option, and following the instructions on the screen. Technical assistance is available by calling the Housing Information and Statistics Division (202)708-3026. [These are not toll-free numbers.]

Using HECM Software to Calculate Payments

Figure 5-1 at the end of the chapter reproduces the computation screen used to calculate payments at loan origination. To use this screen properly, the current date must appear in the upper right hand corner, because it is used in various calculations. Also in this corner is a code for the version of the software being used (in this case, V4.0C). It also

appears on all print-outs from the model to minimize confusion in the event that the software is changed.

The software is designed to create a payment plan for a particular borrower. In response to screen prompts, certain information is entered in the "Variables" column: the month and year of birth of the youngest borrower, the expected rate, the appraised value of the property, the maximum claim amount, closing costs including the mortgage insurance premium, and the monthly servicing fee, if any. All other entries indicate the payment option selected by the borrower. For example, entries show whether the borrower chooses to receive an initial draw at closing; to set up a line of credit; to receive monthly payments of a given amount; to receive payments as long as he or she lives in the property; or to receive payments for a specified number of months.

When these entries are complete, pressing Function Key "F1" generates the "Calculated" column. The program calculates the age of the borrower to the nearest whole year, looks up the principal limit factor, calculates the principal limit, deducts any financed costs, initial payment, and line of credit set-aside from the principal limit to calculate the net principal limit, and uses this figure to calculate either a monthly payment for a given term or a term given a monthly payment. Pressing "F2" moves these numbers to the "Comparison" column so that another payment plan can be created by making changes to the variables and pressing "F1." Help screens can be made to appear by pressing "F3." Complete or partial principal

limit factor tables can be printed out by pressing "F4." An amortization schedule can be generated by pressing "F5" and selecting the reporting interval, annual or monthly.

Figure 5-1 illustrates two payment options--a ten-year term reverse mortgage with and without a \$5,000 initial draw. Figure 5-2 shows expected annual cash flows given an initial mortgage balance of \$3,500 in financed closing costs and mortgage insurance premium and monthly payments of \$509.64 for 10 years. Notice that the mortgage balance equals the principal limit (\$118,336) at the end of the tenth year (and every year thereafter), signalling that this borrower cannot receive additional payments. Of course, the borrower may remain in the house as long as he or she chooses.

Figure 5-3 shows expected annual cash flows given a \$5,000 initial draw and \$442.76 monthly payments for 10 years. The initial mortgage balance is \$8,500--the \$5,000 initial draw plus \$3,500 in financed closing costs and mortgage insurance premium. Once again, the mortgage balance equals the principal limit (\$118,336) at the end of the tenth year. The initial draw lowers the monthly payments; it does not affect the principal limit itself.

The principal limit is \$41,600 at closing (based on the borrower's 75 years of age, 10 percent interest rate, and \$100,000 maximum claim amount)

and grows at the compounding rate (the 10 percent expected rate plus one-half percent MIP) to \$46,184 by the end of the first year and to \$118,336 at the end of the tenth. If the house appreciates at four percent per year (a simplification of the property appreciation assumptions used in the payments model), then the mortgage balance would not equal the house value until sometime between the thirteenth and fourteenth years, when the borrower is 87 years of age or older. If the borrower lives longer, the lender is protected from loss by mortgage insurance in the manner described in Chapter 7.

Figure 5-4 illustrates additional payment options for the same borrower--a tenure mortgage with and without a line of credit. Figure 5-5 illustrates a tenure mortgage with an initial balance of \$3,500 in closing costs and mortgage insurance premium and monthly payments of \$356.61. The mortgage balance does not equal the principal limit until the year in which the borrower turns 100 years of age.

Figure 5-6 illustrates a tenure mortgage with a \$2,000 line of credit. The \$2,000 set-aside of the principal limit for a line of credit is deducted from the initial principal limit, reducing monthly payments to \$337.89. The \$2,000 set-aside grows at the compounding rate to \$2,220 by the end of the first year, and to \$5,689 by the end of the tenth year. A withdrawal of \$3,000 in the tenth year would be added to the mortgage balance, leaving \$2,689 to grow at the compounding rate pending the next draw. The principal limit plus the set-aside equal the principal limit for

a tenure mortgage without a line of credit. The payment option selected by the borrower should be a matter of indifference to the lender and the insurer because loss estimates are ultimately controlled by the principal limit rather than the pattern of draws.

Initial Payment

The size of any initial payment is limited only by the principal limit, and there are no limitations on the purposes for which it may be used. As noted above, some borrowers may be able to increase their cash flow by paying off existing mortgages. Others may use a reverse mortgage as a deferred payment rehabilitation loan: they may choose to make the repairs before closing to take advantage of any resulting increase in their home's appraised value.

Set-Asides

Use of the principal limit makes it easy to create set-asides of reserve mortgage proceeds for special purposes. They can be used to create a line of credit to accompany monthly payments or to reserve funds for repairs after closing. When repairs must be made after closing to bring a property up to minimum property standards, 150 percent of the estimated repair expenditure is set aside in a line of credit to be drawn upon as needed. Any unused funds can remain in the line of credit, or the payment plan can be recalculated to raise the borrower's monthly payments.

Graduated Payment Plans

One disadvantage of fixed monthly payments is their loss of real value over time. At the request of a borrower, a payment plan could provide for gradually increasing payments--for example, three percent per year. In this case, the borrower would make a one-time request for a line of credit payment plan under which the lender would make monthly payments according to a schedule generated by the lender. The payment schedule would be calculated so that the mortgage balance equaled the principal limit at the end of the desired term.

Figure 5-1

25 May 1989		Federal Housing Administration		12:46:13 Pm	
Home Equity Conversion Mortgage Insurance Demonstration (HECM)		V4.0C			
	Variables	Calculated	Comparison		
Borrowers Birth Mon/Yr:	11/13	Age: 75	Age: 75		
Interest Rate:	10.000%	10.000%	10.000%		
Property Appraised Value:	\$100,000	\$100,000	\$100,000		
Maximum Claim Amount:	\$100,000	\$100,000	\$100,000		
Prin Lim - Shared Prem Fac:		.416-30	.416-30		
Principal Limit:		\$41,600	\$41,600		
Closing Costs:	\$3,500.00	\$3,500	\$3,500		
Initial Draw:	\$5,000.00	\$5,000	\$0		
Monthly Servicing Fee:	\$0.00	\$0	\$0		
Net Principal Limit:		\$33,100	\$38,100		
Line of Credit:	CALCULATE	\$0	\$0		
Monthly Payment:	CALCULATE	\$442.76	\$509.64		
Length of Term:	10 Years	10 Years	10 Years		
Please Enter Borrowers Birth Month and Year					
F1-Calculate F2-Comparison F3-Help F4-Factor Table F5-Print Amort					

Base case term mortgage both with and without an initial draw.

Figure 5-2

Federal Housing Administration
Home Equity Conversion Mortgage (HECM) Program (V4.0C)

Amortization Schedule - Annual Projections

Age of Youngest Borrower:	75	Initial Property Value:	\$100,000
Interest Rate:	10.000%	Expected Appreciation:	4%
Maximum Claim Amount:	\$100,000	Initial Line of Credit:	\$0
Initial Principal Limit:	\$41,600	Monthly Payment:	\$509.64
Beginning Mortgage Balance:	\$3,500	Monthly Servicing Fee:	\$0.00

Yr	Age	-----Annual Totals-----				-----End of Year Projections-----			
		SVC	Fee	Payment	MIP	Interest	Loan Bal	Line of Credit	Prin. Limit
1	75	0	6,116	35	709	10,361	0	46,184	104,000
2	76	0	6,116	71	1,430	17,977	0	51,274	108,160
3	77	0	6,116	111	2,229	26,433	0	56,924	112,486
4	78	0	6,116	156	3,116	35,821	0	63,198	116,985
5	79	0	6,116	205	4,102	46,244	0	70,162	121,665
6	80	0	6,116	260	5,196	57,815	0	77,894	126,531
7	81	0	6,116	321	6,410	70,661	0	86,479	131,593
8	82	0	6,116	388	7,758	84,923	0	96,009	136,856
9	83	0	6,116	463	9,255	100,757	0	106,590	142,331
10	84	0	6,116	546	10,917	118,336	0	118,336	148,024
11	85	0	0	621	12,420	131,377	0	131,377	153,945
12	86	0	0	689	13,789	145,855	0	145,855	160,103
13	87	0	0	765	15,308	161,929	0	161,929	166,507
14	88	0	0	850	16,995	179,774	0	179,775	173,167
15	89	0	0	943	18,868	199,586	0	199,586	180,094
16	90	0	0	1,047	20,948	221,581	0	221,582	187,298
17	91	0	0	1,163	23,256	246,000	0	246,001	194,790
18	92	0	0	1,291	25,819	273,110	0	273,111	202,581
19	93	0	0	1,433	28,664	303,207	0	303,209	210,684
20	94	0	0	1,591	31,823	336,622	0	336,623	219,112
21	95	0	0	1,767	35,330	373,719	0	373,720	227,876
22	96	0	0	1,961	39,224	414,904	0	414,906	236,991
23	97	0	0	2,177	43,547	460,628	0	460,630	246,471
24	98	0	0	2,417	48,346	511,391	0	511,393	256,330
25	99	0	0	2,684	53,673	567,748	0	567,750	266,583

Term mortgage without initial draw.

Figure 5-3

Federal Housing Administration
Home Equity Conversion Mortgage (HECM) Program (V4.0C)

Amortization Schedule - Annual Projections

Age of Youngest Borrower:	75	Initial Property Value:	\$100,000
Interest Rate:	10.000%	Expected Appreciation:	4%
Maximum Claim Amount:	\$100,000	Initial Line of Credit:	\$0
Initial Principal Limit:	\$41,600	Monthly Payment:	\$442.76
Beginning Mortgage Balance:	\$8,500	Monthly Servicing Fee:	\$0.00

Yr	Age	-----Annual Totals-----				-----End of Year Projections-----			
		SVC	Fee	Payment	MIP	Interest	Loan Bal	Line of Credit	Prin. Limit
1	75	0	5,313	59	1,189	15,062	0	46,184	104,000
2	76	0	5,313	94	1,878	22,347	0	51,274	108,160
3	77	0	5,313	132	2,643	30,435	0	56,924	112,486
4	78	0	5,313	175	3,492	39,414	0	63,198	116,985
5	79	0	5,313	222	4,434	49,383	0	70,162	121,665
6	80	0	5,313	274	5,480	60,450	0	77,894	126,531
7	81	0	5,313	332	6,642	72,737	0	86,479	131,593
8	82	0	5,313	397	7,931	86,379	0	96,009	136,856
9	83	0	5,313	468	9,363	101,523	0	106,590	142,331
10	84	0	5,313	548	10,953	118,336	0	118,336	148,024
11	85	0	0	621	12,420	131,378	0	131,377	153,945
12	86	0	0	689	13,789	145,856	0	145,855	160,103
13	87	0	0	765	15,308	161,930	0	161,929	166,507
14	88	0	0	850	16,995	179,775	0	179,775	173,167
15	89	0	0	943	18,868	199,587	0	199,586	180,094
16	90	0	0	1,047	20,948	221,582	0	221,582	187,298
17	91	0	0	1,163	23,256	246,001	0	246,001	194,790
18	92	0	0	1,291	25,819	273,111	0	273,111	202,581
19	93	0	0	1,433	28,665	303,209	0	303,209	210,684
20	94	0	0	1,591	31,823	336,623	0	336,623	219,112
21	95	0	0	1,767	35,331	373,720	0	373,720	227,876
22	96	0	0	1,961	39,224	414,906	0	414,906	236,991
23	97	0	0	2,177	43,547	460,630	0	460,630	246,471
24	98	0	0	2,417	48,346	511,393	0	511,393	256,330
25	99	0	0	2,684	53,674	567,750	0	567,750	266,583

Term mortgage with initial draw.

Figure 5-4

25 May 1989	Federal Housing Administration	09:41:09 Am
Home Equity Conversion Mortgage Insurance Demonstration (HECM)		V4.0C

	Variables	Calculated	Comparison
Borrowers Birth Mon/Yr:	11/13	Age: 75	Age: 75
Interest Rate:	10.000%	10.000%	10.000%
Property Appraised Value:	\$100,000	\$100,000	\$100,000
Maximum Claim Amount:	\$100,000	\$100,000	\$100,000
Prin Lim - Shared Prem Fac:		.416-30	.416-30
Principal Limit:		\$41,600	\$41,600
Closing Costs:	\$3,500.00	\$3,500	\$3,500
Initial Draw:	\$0.00	\$0	\$0
Monthly Servicing Fee:	\$0.00	\$0	\$0
Net Principal Limit:		\$36,100	\$38,100
Line of Credit:	\$2,000	\$2,000	\$0
Monthly Payment:	CALCULATE	\$337.89	\$356.61
Length of Term:	TENURE	TENURE	TENURE

Please Enter Borrowers Birth Month and Year

F1-Calculate	F2-Comparison	F3-Help	F4-Factor Table	F5-Print Amort
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Base case tenure mortgage and modified tenure mortgage with line of credit.

Figure 5-5

Federal Housing Administration
Home Equity Conversion Mortgage (HECM) Program (V4.0C)

Amortization Schedule - Annual Projections

Age of Youngest Borrower:	75	Initial Property Value:	\$100,000
Interest Rate:	10.000%	Expected Appreciation:	4%
Maximum Claim Amount:	\$100,000	Initial Line of Credit:	\$0
Initial Principal Limit:	\$41,600	Monthly Payment:	\$356.61
Beginning Mortgage Balance:	\$3,500	Monthly Servicing Fee:	\$0.00

-----Annual Totals-----						-----End of Year Projections-----				
Yr	Age	SVC	Fee	Payment	MIP	Interest	Loan Bal	Line of Credit	Prin. Limit	Property Value
1	75	0	4,279	30	607	8,416	0	46,184	104,000	
2	76	0	4,279	56	1,123	13,875	0	51,274	108,160	
3	77	0	4,279	85	1,696	19,934	0	56,924	112,486	
4	78	0	4,279	117	2,332	26,662	0	63,198	116,985	
5	79	0	4,279	152	3,038	34,131	0	70,162	121,665	
6	80	0	4,279	191	3,822	42,423	0	77,894	126,531	
7	81	0	4,279	235	4,692	51,629	0	86,479	131,593	
8	82	0	4,279	283	5,658	61,849	0	96,009	136,856	
9	83	0	4,279	337	6,731	73,196	0	106,590	142,331	
10	84	0	4,279	396	7,922	85,793	0	118,336	148,024	
11	85	0	4,279	462	9,244	99,778	0	131,377	153,945	
12	86	0	4,279	536	10,712	115,305	0	145,855	160,103	
13	87	0	4,279	617	12,341	132,542	0	161,929	166,507	
14	88	0	4,279	708	14,150	151,680	0	179,775	173,167	
15	89	0	4,279	808	16,159	172,926	0	199,586	180,094	
16	90	0	4,279	919	18,389	196,514	0	221,582	187,298	
17	91	0	4,279	1,043	20,865	222,701	0	246,001	194,790	
18	92	0	4,279	1,181	23,613	251,774	0	273,111	202,581	
19	93	0	4,279	1,333	26,664	284,051	0	303,209	210,684	
20	94	0	4,279	1,503	30,052	319,885	0	336,623	219,112	
21	95	0	4,279	1,691	33,813	359,668	0	373,720	227,876	
22	96	0	4,279	1,899	37,989	403,835	0	414,906	236,991	
23	97	0	4,279	2,131	42,624	452,870	0	460,630	246,471	
24	98	0	4,279	2,389	47,771	507,309	0	511,393	256,330	
25	99	0	4,279	2,674	53,484	567,746	0	567,750	266,583	

Tenure mortgage.

Figure 5-6

Federal Housing Administration
Home Equity Conversion Mortgage (HECM) Program (V4.0C)

Amortization Schedule - Annual Projections

Age of Youngest Borrower:	75	Initial Property Value:	\$100,000
Interest Rate:	10.000%	Expected Appreciation:	4%
Maximum Claim Amount:	\$100,000	Initial Line of Credit:	\$2,000
Initial Principal Limit:	\$41,600	Monthly Payment:	\$337.89
Beginning Mortgage Balance:	\$3,500	Monthly Servicing Fee:	\$0.00

Yr	Age	-----Annual Totals-----				-----End of Year Projections-----			
		SVC	Fee	Payment	MIP	Interest	Loan Bal	Line of Credit	Prin. Limit
1	75	0	4,055	30	594	8,179	2,220	46,184	104,000
2	76	0	4,055	54	1,085	13,373	2,465	51,274	108,160
3	77	0	4,055	82	1,630	19,139	2,736	56,924	112,486
4	78	0	4,055	112	2,236	25,541	3,038	63,198	116,985
5	79	0	4,055	145	2,908	32,649	3,373	70,162	121,665
6	80	0	4,055	183	3,654	40,540	3,744	77,894	126,531
7	81	0	4,055	224	4,482	49,300	4,157	86,479	131,593
8	82	0	4,055	270	5,401	59,026	4,615	96,009	136,856
9	83	0	4,055	321	6,422	69,824	5,124	106,590	142,331
10	84	0	4,055	378	7,555	81,812	5,689	118,336	148,024
11	85	0	4,055	441	8,813	95,120	6,316	131,377	153,945
12	86	0	4,055	511	10,210	109,896	7,012	145,855	160,103
13	87	0	4,055	588	11,761	126,300	7,785	161,929	166,507
14	88	0	4,055	674	13,483	144,511	8,643	179,775	173,167
15	89	0	4,055	770	15,394	164,730	9,595	199,586	180,094
16	90	0	4,055	876	17,516	187,176	10,652	221,582	187,298
17	91	0	4,055	994	19,872	212,097	11,826	246,001	194,790
18	92	0	4,055	1,124	22,488	239,763	13,130	273,111	202,581
19	93	0	4,055	1,270	25,391	270,479	14,577	303,209	210,684
20	94	0	4,055	1,431	28,615	304,579	16,183	336,623	219,112
21	95	0	4,055	1,610	32,194	342,438	17,967	373,720	227,876
22	96	0	4,055	1,808	36,168	384,469	19,947	414,906	236,991
23	97	0	4,055	2,029	40,579	431,131	22,145	460,630	246,471
24	98	0	4,055	2,274	45,477	482,936	24,586	511,393	256,330
25	99	0	4,055	2,546	50,914	540,451	27,295	567,750	266,583

Modified tenure mortgage.

CHAPTER SIX

LOAN COSTS

Introduction

Reverse mortgage loan costs are discussed in this chapter. Like forward mortgage borrowers, reverse mortgage borrowers pay interest on their outstanding mortgage balances (with the difference that this interest is deferred and compounded), mortgage insurance premiums, origination fees, and fees for appraisals, title insurance, and recordation taxes which vary by jurisdiction. However, they do not pay discount points for reasons explained below. They may pay separate servicing charges and may share house appreciation with lenders. Lower loan costs translate directly into higher payments to borrowers.

Loan costs paid by borrowers cover expenses and provide income to lenders and investors. Since the demonstration is intended to encourage and increase the involvement of lenders and other participants in mortgage markets in the making and servicing of reverse mortgages by providing mortgage insurance, but not subsidies, the Department took the concerns of lenders and investors into account in structuring interest rates and fees. Both FNMA and FHLMC expressed early interest in purchasing FHA reverse mortgages and provided useful advice on both interest rate structures and servicing fees.

INTEREST RATES

Fixed and Adjustable Interest Rates

An FHA reverse mortgage may have a fixed or an adjustable interest rate as agreed upon by the borrower and lender. In practice, it is anticipated that most reverse mortgages will bear adjustable interest rates, unless the interest rate is subsidized, because of the nature of the risk borne by lenders and investors. Under reverse mortgages, lenders are promising to make payments in the future when they cannot know what their borrowing costs will be. To protect themselves from adverse interest rate fluctuations, they are likely to set fixed interest rates higher than would be acceptable to most borrowers. Adjustable interest rates reduce interest rate risk for lenders and, consequently, lower costs to borrowers.

Adjustable Rate Mortgages With and Without Caps

The Department is insuring reverse adjustable rate mortgages (ARMs) with and without interest rate caps. For capped reverse ARMs, the Department has retained the five percentage point life-of-loan limit on interest rate increases and decreases applicable to FHA forward ARMs, but has increased the annual limit on rate increases and decreases from one percentage point to two. The annual limit was changed from one to two percentage points to permit interest rates on reverse ARMs to adjust more rapidly to the market rate and so to reduce the compensation that lenders will seek from borrowers for capped reverse ARMs.

The Department is also insuring a reverse ARM with monthly interest rate adjustments and no caps (except a maximum interest rate chosen by the lender for compliance with Section 1204 of the Competitive Equality Banking Act of 1987) as long as the lender also offers a comparable reverse ARM with annual interest rate adjustments and the above prescribed caps. Section 1204 requires each adjustable rate mortgage loan to include a limitation on the maximum interest rate that may apply during the term of the loan.

The Department decided to offer an uncapped reverse ARM with monthly adjustments for several reasons. In comments on the proposed rule, both secondary mortgage market agencies expressed the view that line of credit payments to borrowers create additional interest rate risk for the lender, necessitating higher interest rates than for fixed payments. Since the final rule transformed all FHA reverse mortgages into line of credit mortgages, the Department took steps to reduce the interest rate risk to lenders and investors, and so, cost to borrowers.

Numerous studies have shown that that a borrower must compensate a lender by paying a higher margin (i.e., the spread between the ARM rate and the index) for a forward ARM with annual and life-of-loan caps than for an ARM without caps. The margin increase depends on the shape of the yield curve and the volatility of interest rates. Generally, lenders charge more for caps when the yield curve slopes upward and interest rate volatility is

high than when the yield curve is flat or downward sloping and interest rate volatility is low.

Lenders will charge more for caps applied to reverse ARMs than to forward ARMs in all yield curve and volatility environments. Unlike forward ARM borrowers, reverse ARM borrowers have the option to withdraw funds (up to the principal limit) at any time. If interest rates rise to a level above the cap, the borrower in effect has the option to borrow funds at a below-market rate. While it is unlikely that all elderly borrowers in this demonstration would exercise this option in such circumstances, lenders will charge a higher margin for capped reverse ARMs than capped forward ARMs because there is a risk that some borrowers would exercise the option.

An uncapped reverse ARM with monthly adjustments is similar to a forward home equity line of credit with monthly adjustments. An uncapped reverse ARM with monthly adjustments will have a lower margin over the index than one with annual adjustments because the borrower's option to withdraw funds at any time increases in value as the period between rate adjustments lengthens. In effect, annual adjustment places a cap on the rate for the year. For example, if rates were to rise rapidly one month after an annual rate adjustment was made, a borrower could receive a below-market rate loan for eleven months by withdrawing an amount up to the borrower's net principal limit. Again, it is unlikely that all elderly borrowers would exercise the option; nevertheless, the lender would price

the effective cap created by the annual adjustment period based on some assumption about how the option may be exercised and would include the price of this cap in the margin. Indications are that the increase in the margin would be less for uncapped than for capped annual adjustments. Monthly adjustments to the interest rate would allow borrowers to be charged the lowest possible margin as interest rate risk is virtually eliminated.

In summary, HUD believes that a lender will typically charge a lower margin for an uncapped reverse ARM with monthly adjustments than for a capped reverse ARM with annual adjustments. By offering a lower margin (and consequently, a lower expected rate) for an uncapped reverse ARM, the lender provides the borrower with the opportunity to receive higher payments.

Difference Between Forward and Reverse ARMs

Under a reverse ARM, payments to the borrower do not change when the interest rate changes. Thus, unlike forward ARM borrowers whose payments to the lender change with the interest rate, reverse ARM borrowers are protected from "payment shock." Adjustments to the reverse ARM rate merely increase or decrease the rate at which the loan balance grows. It should also be recognized that a borrower with an uncapped reverse ARM may experience a lower average interest rate over the long run than a borrower with a capped reverse ARM. During interest rate periods when the caps are not constraining, the capped reverse ARM would have a higher interest rate.

During inflationary periods with sustained high interest rates, when caps would be binding, the higher rate on an uncapped reverse ARM may be offset by increased house value appreciation. Thus, the Department feels that some borrowers may prefer the uncapped reverse ARM. Both are offered under this demonstration.

Legal Basis for Adjustable Rate Options

Section 255(d)(5) of the Act permits a "fixed or variable interest rate ... as agreed upon by the mortgagor and the mortgagee" with no reference at all to interest rate caps or frequency of rate adjustment. The House bill permitted only fixed interest. The Senate bill also permitted variable rates. The Senate report does not discuss caps, but the Conference report does, as follows: "The conferees make clear that they intend that variable interest should be capped at five points above the original rate ..." without any mention of annual caps. Neither of the reports discusses frequency of rate adjustment.

Since the statute does not mention caps or frequency of rate adjustment, the Conference report statement has not been regarded as legally binding on HUD. However, borrowers are protected as desired by the Conferees, since each reverse ARM borrower has the opportunity to choose a reverse ARM with two percentage point annual and five percentage point life-of-loan caps on interest rate increases or decreases. Assessment of acceptable risk to HUD, within statutory restrictions, is a policy question committed to HUD's administrative discretion.

Alternatives to Reverse ARMs

In informal discussions and in comments on the final rule, FNMA and FHLMC proposed other types of interest rate structures. They proposed to offer nonconvertible term and tenure mortgages; to fix the interest rate at the time of each line of credit draw; and to establish a new interest rate at the time of a change in a payment plan. The Department believes that each of these options is potentially more costly to the borrower than capped or uncapped reverse ARMs for the following reasons.

If the Department agreed to insure term and tenure mortgages whose payment plans could not be altered by borrowers, servicing costs--and consequently, interest rates--could be expected to rise, because borrowers would nevertheless experience unanticipated needs for cash (e.g., money to repair the roof) that it would be in the lender's interest to meet. A lender faced with a choice between foreclosing upon a borrower for failure to maintain the property or advancing funds for repairs in most instances would prefer the latter. But the decision to advance funds on a special exception basis could often involve housing counselors, the HUD Field Office, and bank officers, and would likely lead to higher servicing costs than changes made according to standard operating procedures. Of course, a lender could ignore the declining house value in hope that any loss would not exceed the maximum claim amount. By permitting the lender to advance funds for repairs, HUD hopes to discourage this option.

If the Department agreed to insure line of credit mortgages with interest rates fixed for each draw, a lender would have a sort of uncapped reverse ARM, but would be required to treat each draw as a separate loan--again, resulting in higher servicing costs than when the adjusted rate applies to the entire balance. In addition, special accounting rules would be needed to deal with partial prepayments--i.e., first-in, first-out; last-in, first-out; or weighted averaging. None of these are typical of current mortgage servicing practices.

Finally, if the Department agreed to allow the interest rate to change on a tenure or term mortgage at the time of a change in payment plan, the lender would have only partial protection against interest rate risk compared with the alternative of capped or uncapped reverse ARMs which permit the interest rate to be adjusted at periodic intervals over the life of the loan. As a consequence, the lender should be able to offer a capped or uncapped reverse ARMs at a lower cost to the borrower than the proposed option.

MORTGAGE INSURANCE PREMIUM

HUD collects a mortgage insurance premium from all borrowers, so that it can pay claims to lenders under the assignment or shared premium options discussed in Chapter 7. The same mortgage insurance premium, which may be financed, is charged, regardless of the payment option selected by the borrower. The premium consists of an initial payment of two percent of the maximum claim amount (the lesser of the house value or the FHA mortgage

principal limit for an area) and a monthly premium equal to one-half of one percent on an annual basis on the outstanding mortgage balance.

As discussed in Chapter 5, HUD has fixed the mortgage insurance premium so that, for every mortgage, the present value of the MIP expected to be collected equals the present value of the losses expected to be incurred, taking into account the life expectancy of the borrower and the appreciation of the property. By fixing the MIP, HUD has fixed the amount of risk that it is willing to bear by itself or to share with private lenders. Within this constraint, the payments to be received by borrowers are determined.

In choosing a premium structure, the Department had to balance costs and benefits to the borrower with certain equity concerns. Paying the total MIP upfront would result in the lowest cost to the borrower in present value terms, but it would impose the same cost upon a borrower regardless of the duration of the mortgage. Mortgage insurance premiums for the FHA reverse mortgage program are paid into the General Insurance Fund. None of the premium is refundable, even if the borrower were to die shortly after taking out the mortgage. Consequently, charging all of the MIP upfront raises the costs for short-lived borrowers and reduces the costs for long-lived borrowers. In the light of this consideration, it was decided to charge both an upfront premium to lower the present value of the total premium cost to the borrower and a monthly premium so that longer-

lived borrowers who create the most risk to the insurance fund would pay more premium.

HUD also had to balance costs and benefits to the borrower in deciding upon the size of the mortgage insurance premium. Simply stated, increasing premiums raises payments to the borrower, but at a diminishing rate, especially when the premium is financed. Table 6-1 illustrates this point using the base case--a 75-year-old borrower in a \$100,000 house with a 10 percent interest rate and financed closing costs plus a varying amount of MIP.

In Part A of the table, the periodic premium is set at 50 basis points, while the upfront MIP increases in one percentage point intervals from zero percent to 4 percent. As the upfront MIP increases from one percentage point to two, the net principal limit increases by \$2,900, while the present value of the expected MIP increases by \$1,210. In other words, the net principal limit increases by \$2.40 for every \$1.00 increase in MIP. As the upfront MIP increases from two percentage points to three, the net principal limit increases by only \$2,100, while the present value of the MIP increases by \$1,150, or only \$1.83 for every \$1.00 increase in the MIP.

In Part B of the table, the upfront premium is set at two percentage points and the periodic premium increases in 25 basis point intervals from zero to 100 basis points. Increasing the periodic premium from 25 basis

**Table 6-1
Present Value of Expected Premium and Maximum Cash Advances for
Different Fixed Premium Structures**

Borrower Age = 75
 Interest Rate = 10%
 Max Claim Amt = \$100,000
 Closing Costs = \$1500 + Up-Front MIP
 Current MIP = 2% Up-Front +
 50 Basis Points Annually

A. Changes to Up-Front Premium

	0% / 50 bp	1% / 50 bp	(Current) 2% / 50 bp	3% / 50 bp	4% / 50 bp
Prin Limit Factor	0.325	0.377	0.416	0.447	0.475
Pres Value of MIP	\$1,750	\$3,020	\$4,230	\$5,380	6530
Cash Advances:					
Net Prin Limit	\$31,000	\$35,200	\$38,100	\$40,200	42000
Max Tenure Pmt	\$290	\$329	\$357	\$376	393

B. Changes to Periodic Premium

	2% / 0 bp	2% / 25 bp	(Current) 2% / 50 bp	2% / 75 bp	2% / 100 bp
Prin Limit Factor	0.365	0.394	0.416	0.435	0.450
Pres Value of MIP	\$2,000	\$3,050	\$4,230	\$5,570	6990
Cash Advances:					
Net Prin Limit	\$33,000	\$35,900	\$38,100	\$40,000	41500
Max Tenure Pmt	\$297	\$330	\$357	\$381	403

points to 50 increases the net principal limit by \$1.86 for every \$1.00 increase in the present value of the expected MIP, while increasing the periodic premium from 50 basis points to 75 increases the net principal limit by only \$1.42 for every \$1.00 increase of MIP.

Ultimately, choice of an MIP structure is a matter of judgment. After extensive sensitivity analysis, the premium was set at two percent of the maximum claim amount upfront and one-half percent per year on the mortgage balance. Elderly homeowners will determine whether this MIP is worth the amount of principal limit and monthly payments that it supports.

ALLOWABLE FEES AND CHARGES

Origination Fee

An origination fee compensates a lender for the expenses of originating and closing mortgages. In FHA's Section 203 program, the origination fee is limited to one percent of the mortgage amount. Under the FHA reverse mortgage program, the origination fee is not regulated, but the handbook limits the amount of origination fee that can be financed to one percent of the maximum claim amount.

The origination fee was deregulated to encourage lenders to charge fees that cover their actual costs and to reduce their incentive to raise interest rates to make up for shortfalls--common practice when origination fees for forward mortgages do not cover actual expenses. Such adjustments would necessarily be less accurate for reverse mortgages, because lenders

could not anticipate with confidence either the size of reverse mortgage balances or the rate at which they will grow. The Department believes that a borrower will be better off paying the true cost of loan origination in the form of a fee than in the form of additional basis points on an interest rate, since higher interest rates lower payments to borrowers.

A limit of one percent is placed on the amount of the origination fee that can be financed to discourage a lender from tapping a borrower's home equity without restraint. Borrowers must pay any amount not financed in cash at closing. Some lenders have been reluctant to charge more than one percent for this reason even if their origination costs are higher. When an amount over one percent is charged, some borrowers who are cash-poor have effectively circumvented the limitation by requesting a draw after closing to reimburse themselves for the cash payment. It is unlikely that HUD's policy limiting the amount of the origination fee that can be financed will be reexamined until there is competition among reverse mortgage lenders and until more is known about the actual costs of originating reverse mortgages.

Discount Points

Due to the nature of a reverse mortgage, discount points may not be charged. Discount points constitute additional interest charged by the lender to adjust the coupon rate on a lump sum advance taking into account the lender's borrowing costs at the current market interest rate. They are calculated as a percentage of the advance. Under a reverse mortgage, there

is no comparable lump sum payment, and so, no basis for charging an adjusted interest rate. Lenders can accomplish the objective of discount points by setting the mortgage interest rate as close in time to the loan closing as is consistent with the requirements of disclosure.

Servicing Fee

The decisions by Freddie Mac and Fannie Mae to purchase FHA reverse mortgages raised the issue of how loan servicers should be compensated. For forward mortgages, a servicer generally receives a fixed percentage of the outstanding loan balance, which is added into the interest rate. Since forward mortgages have initially high and gradually declining balances, servicers are adequately compensated for all except the most seasoned loans, which are relatively few due to prepayments. With reverse mortgages, however, balances are initially low and gradually growing, so that servicers would be inadequately compensated for all but the relatively few highly seasoned loans if traditional servicing fees were charged.

To deal with this problem, the FHA reverse mortgage program permits (but does not require) an originating lender to charge a flat monthly servicing fee directly to the borrower. If the lender chooses to charge a servicing fee, the amount of the fee must be fixed at loan origination, disclosed to the borrower, and included in the loan agreement, and the principal limit used to calculate payments to borrowers must be reduced by an amount sufficient to fund the fee for the duration of the mortgage. Technically, the principal limit must be reduced by the present value of

the expected future servicing charges, reducing maximum monthly payments to the borrower. The fee is charged to the borrower's mortgage balance only as it is earned by the lender or servicer. Charging such a fee should result in a lower interest rate relative to what it would be without the fee because the fee need not include a servicing risk premium.

A separate servicing fee should benefit all parties to the transaction. Servicers will be compensated for the cost of services performed. Borrowers will pay servicing fees only as services are received. In most circumstances, borrowers paying servicing fees should qualify for higher monthly payments than those who do not. To compare reverse mortgages with and without servicing fees, a borrower need focus only upon the size of the payments that the lender is offering. The higher the payments, the lower the cost to the borrower.

SHARED APPRECIATION

To increase payments available to borrowers, HUD is insuring shared appreciation reverse mortgages under the shared premium option (see Chapter 7). Shared appreciation provides lenders with the opportunity for larger returns while protecting them against losses up to the maximum claim amount. Lenders who offer shared appreciation reverse mortgages must also offer comparable mortgages without shared appreciation, with suitable disclosures so that borrowers are able to compare them.

Monthly payments to a borrower under a shared appreciation reverse mortgage are to be determined in the same manner as under a comparable mortgage without shared appreciation. In other words, they are based on the age of the youngest borrower, the maximum claim amount, and the expected rate. By offering a lower mortgage interest rate (or in the case of an adjustable rate mortgage, a lower margin over the 10-year Treasury rate), the lender can offer the borrower higher payments in return for a share of the net appreciated value of the property, subject to an effective interest rate cap.

The percentage of net appreciated value paid to the lender, known as the appreciation margin, may not exceed 25 percent. If the mortgage balance at the time that the property is sold or transferred is less than the appraised value of the property at origination, the lender's share of net appreciated value is calculated by subtracting the appraised value at origination from the adjusted sales proceeds (i.e., sales proceeds less sales costs and capital improvement costs incurred by the borrower, but excluding liens other than the insured mortgage) and multiplying by the appreciation margin. If the mortgage balance is greater than the appraised value at origination but less than the adjusted sales proceeds, the lender's share of net appreciated value is calculated by subtracting the mortgage balance from the adjusted sales proceeds and multiplying by the appreciation margin. If the mortgage balance is greater than the adjusted sales proceeds, net appreciated value is zero.

The effective interest rate is calculated by dividing the sum of the lender's share of net appreciated value plus interest accrued in the last 12 months by the sum of the mortgage balance at the beginning of the year and the payments made during the year. The effective interest rate cannot exceed 20 percent.

The limits on the appreciation margin and the effective interest rate combine so that a lender can receive a full 25 percent of appreciation for properties that appreciate at the expected average rate of two percent and can receive a higher, but capped dollar amount for properties that appreciate at a faster rate. The lender's risk of loss (beyond the maximum claim amount) declines as the rate of appreciation increases. The cap on the effective interest rate prevents windfall gains to lenders from rapid appreciation.

CHAPTER SEVEN

INSURING LENDERS AND BORROWERS

Under the Home Equity Conversion Mortgage Insurance program, lenders are insured against loss in the event that the mortgage balance grows to exceed the value of the property, and borrowers are insured against loss in the event that lenders default on promised payments. This chapter describes these insurance protections for lenders and borrowers.

INSURING LENDERS

Assignment and Shared Premium Insurance Options

In designing mortgage insurance for a reverse mortgage, HUD had to reconcile the open-ended nature of the mortgage with the statutory limit that Congress had placed on the maximum insurance claim that HUD could pay. Because a borrower may live in a mortgaged property as long as the borrower chooses, a reverse mortgage has neither a maximum mortgage amount nor a maximum term. While the statute does not spell out the form that mortgage insurance for lenders should take, Section 255(i) does provide that, in order to pay an insurance claim to a lender that does not exceed the maximum claim amount, the Secretary may take actions such as "accepting an assignment of the insured mortgage notwithstanding that the mortgagor is not in default under its terms, and calculating the amount and making the payment of the insurance claim on such insured mortgage."

Given this provision in the statute, logically, the Department could limit the size of the claim that it pays without limiting the size of the mortgage balance: 1) by permitting the lender to assign a mortgage to HUD when the mortgage balance equals the maximum claim that HUD can pay, or 2) by paying the lender up to the maximum claim amount when the mortgage is due and payable and the mortgage balance exceeds the value of the property. Under the FHA reverse mortgage program, these two insurance options are called the assignment option and the shared premium option. Since the mortgage insurance premium that HUD collects for a reverse mortgage is estimated to cover all losses, whether these losses are borne by HUD or private lenders, HUD permits a lender to choose either option at the time that a mortgage is closed.

Under the assignment option, HUD collects all of the MIP, and the lender has the option of assigning a mortgage to HUD at the time that the mortgage balance equals the maximum claim amount. Under the shared premium option, the lender foregoes assignment of a mortgage to HUD and retains a portion of the periodic MIP to compensate for the share of risk borne. HUD will pay the lender the difference between the mortgage balance and the sales proceeds at the time that the mortgage is due and payable up to the maximum claim amount. A lender who elected the assignment option but decided not to exercise it could similarly file a claim at the time that a mortgage is due and payable. Lenders who forego assignment and lenders who elect the shared premium option are liable for losses that exceed the maximum claim amount.

Illustrating the Insurance Options

The assignment and shared premium options are illustrated in Table 7-1. This table displays annual cash flows from a tenure payment plan to a 75-year-old borrower in a \$100,000 house, assuming a 10 percent interest rate and financing of \$2,000 of upfront mortgage insurance premium and \$1,500 of closing costs. For simplicity, it is assumed that the house value equals the maximum claim amount; and the property appreciates four percent each year.

Let us first consider a mortgage pay-off that does not involve an insurance claim. If a mortgage becomes due and payable at the end of the seventh year when the borrower is 81 years of age, the mortgage balance is \$51,629, and the property value is \$131,593, \$51,629 would be received by the lender, and nearly \$80,000 would be retained by the borrower or the estate of the borrower. The "survival rate" column indicates that 66 percent of all reverse mortgages made to 75-year-old borrowers are expected to be outstanding at the end of the seventh year.

If the lender elected the assignment option, then the mortgage could be assigned to HUD at the end of the eleventh year when the borrower is 85 years of age and the mortgage balance nearly equals the maximum claim amount of \$100,000. At this time, the lender would receive the mortgage balance (but no more than the maximum claim amount) and would have no further obligation under the mortgage. Approximately 43 percent of these

Figure 7-1

FEDERAL HOUSING ADMINISTRATION
HOME EQUITY CONVERSION MORTGAGE INSURANCE DEMONSTRATION
Potential FHA Claims and Lender Losses

Age of Youngest Borrower:	\$75	Initial Property Value:	\$100,000
Interest Rate:	10.000%	Expected Appreciation:	4%
Maximum Claim Amount:	\$100,000	Initial Line of Credit:	\$0.00
Initial Principal Limit:	\$41,600	Monthly Payments:	\$356.61
Beginning Mortgage Balance:	\$3,500	Monthly Servicing Fee:	\$0.00

Year	Age	Survival Rate	Req Bal	Annual Payment	MIP	Annual Interest	End Bal	Property Value	Loan Loss	FHA Claim	Lender Loss	Present Value of Lender Loss
1	75	96%	\$3,500	\$4,279	\$30	\$607	\$8,416	\$104,000	\$0	\$0	\$0	\$0
2	76	92%	\$8,416	\$4,279	\$56	\$1,123	\$13,875	\$108,160	\$0	\$0	\$0	\$0
3	77	87%	\$13,875	\$4,279	\$85	\$1,696	\$19,934	\$112,486	\$0	\$0	\$0	\$0
4	78	82%	\$19,934	\$4,279	\$117	\$2,332	\$26,662	\$116,985	\$0	\$0	\$0	\$0
5	79	77%	\$26,662	\$4,279	\$152	\$3,038	\$34,131	\$121,665	\$0	\$0	\$0	\$0
6	80	72%	\$34,131	\$4,279	\$191	\$3,822	\$42,423	\$126,531	\$0	\$0	\$0	\$0
7	81	66%	\$42,423	\$4,279	\$235	\$4,692	\$51,629	\$131,593	\$0	\$0	\$0	\$0
8	82	61%	\$51,629	\$4,279	\$283	\$5,658	\$61,849	\$136,856	\$0	\$0	\$0	\$0
9	83	55%	\$61,849	\$4,279	\$337	\$6,731	\$73,196	\$142,331	\$0	\$0	\$0	\$0
10	84	49%	\$73,196	\$4,279	\$396	\$7,922	\$85,793	\$148,024	\$0	\$0	\$0	\$0
11	85	43%	\$85,793	\$4,279	\$462	\$9,244	\$99,778	\$153,945	\$0	\$0	\$0	\$0
12	86	38%	\$99,778	\$4,279	\$536	\$10,712	\$115,305	\$160,103	\$0	\$0	\$0	\$0
13	87	33%	\$115,305	\$4,279	\$617	\$12,341	\$132,542	\$166,507	\$0	\$0	\$0	\$0
14	88	28%	\$132,542	\$4,279	\$708	\$14,150	\$151,680	\$173,167	\$0	\$0	\$0	\$0
15	89	23%	\$151,680	\$4,279	\$808	\$16,159	\$172,926	\$180,094	\$0	\$0	\$0	\$0
16	90	19%	\$172,926	\$4,279	\$919	\$18,389	\$196,514	\$187,298	\$9,216	\$9,216	\$0	\$0
17	91	15%	\$196,514	\$4,279	\$1,043	\$20,865	\$222,701	\$194,790	\$27,911	\$27,911	\$0	\$0
18	92	12%	\$222,701	\$4,279	\$1,181	\$23,613	\$251,774	\$202,581	\$49,193	\$49,193	\$0	\$0
19	93	9%	\$251,774	\$4,279	\$1,333	\$26,664	\$284,050	\$210,684	\$73,366	\$73,366	\$0	\$0
20	94	7%	\$284,050	\$4,279	\$1,503	\$30,052	\$319,885	\$219,112	\$100,773	\$100,000	\$773	\$126
21	95	5%	\$319,885	\$4,279	\$1,691	\$33,813	\$359,668	\$227,876	\$131,792	\$100,000	\$31,792	\$4,853
22	96	4%	\$359,668	\$4,279	\$1,899	\$37,989	\$403,835	\$236,991	\$166,844	\$100,000	\$66,844	\$13,931
23	97	3%	\$403,835	\$4,279	\$2,131	\$42,624	\$452,870	\$246,471	\$206,399	\$100,000	\$106,399	\$27,126
24	98	2%	\$452,870	\$4,279	\$2,389	\$47,771	\$507,309	\$256,330	\$250,979	\$100,000	\$150,979	\$44,225
25	99	1%	\$507,309	\$4,279	\$2,674	\$53,484	\$567,746	\$266,583	\$301,163	\$100,000	\$201,163	\$65,031

mortgages are expected to be outstanding at the end of the eleventh year. HUD would assume responsibility for continuing payments to the borrower under the original mortgage, and it would incur losses beginning in the sixteenth year (when 19 percent of such mortgages are expected to be outstanding) when the mortgage balance begins to exceed the property value.

If the lender elected the shared premium option and the mortgage became due and payable at the end of the sixteenth year when the borrower was 90, the lender would receive the net proceeds from sale of the property (with an expected value of \$187,298) and would file a claim with HUD for the difference between those proceeds and the mortgage balance of \$196,514. If the mortgage terminated in the twenty-first year, when the borrower was 95 (5 percent of such mortgages are expected to be outstanding at that time), then the lender would receive net sales proceeds from a property with an expected value of \$227,876, would file a claim with HUD for \$100,000--the maximum claim amount, and would suffer a minimum loss of \$31,792 (about \$4,853 in present value terms, assuming a discount rate of 9.5 percent). To compensate the lender for the risk of this loss, the lender would have been able to retain 30 basis points, or 60 percent of the periodic MIP charged to the borrower over the life of the mortgage.

Shared Premium Matrix

The payments model is used to determine the portion of the periodic MIP to be retained by the lender. Preparation of the matrix of shared

premiums for borrowers between the ages of 62 and 95 and for all interest rates between 7.0 and 15.875 percent revealed that the lender share of MIP in some cases--those for younger borrowers with high interest rates--exceeds 50 basis points, the size of the periodic premium. In HUD Handbook 4235.1, these premiums have been capped at 50 basis points and starred in the table to warn lenders that these mortgages carry added risk. Premiums below 5 basis points--those for the oldest borrowers with any interest rate, but also for older borrowers with low interest rates--have been raised to 5 basis points (and starred) as an incentive for lenders to choose this option.

Expected Usage of Insurance Options

It is expected that traditional mortgage lenders will prefer the assignment option because it turns an open-ended mortgage into a closed-ended obligation and facilitates sale of the mortgage in the secondary market. In fact, both FNMA and FHLMC are purchasing only FHA reverse mortgages under which lender have elected the assignment option. At some future time, however, nontraditional mortgage lenders who are familiar with actuarially based investing, such as insurance and pension funds, may choose to originate FHA reverse mortgages with the shared premium option for retention in their portfolios. If they believed that the assumptions in the payments model were somewhat conservative, they would do so in order to increase their total return.

Mortgage Insurance Options for Other Insurers

The FHA reverse mortgage program is designed to break even. By virtue of its location in the General Insurance Fund, should claims exceed premiums, Congress is authorized to make up the difference with appropriations. Other insurers without this safeguard may find it advisable to design a reserve into their program. This can be done in several ways. Building upon the notion of overcollateralization discussed in Chapter 3, the insurer could limit the percentage of house value taken into account in calculating payments to borrowers, or could solve for a principal limit factor such that premiums exceed claims by a given ratio-- e.g., 1.2, but otherwise use the payments model, with or without modifying its six assumptions (regarding the mortgage insurance premium, the actuarial figures, the move-out rate, the discount rate, the expected property appreciation rate, and the variance of the appreciation rate).

The FHA program also builds on existing administrative infrastructure. The Department already collects upfront premiums for some mortgages and monthly premiums for others, so that this program merely combines the two administrative methods. Similarly, the program builds on the Department's experience in administering assigned mortgages. For ease of administration, another insurer may prefer to charge all of the mortgage insurance upfront (and provide some refund protection for short-lived borrowers) and to pay claims only when mortgages are due and payable-- paying the entire loss or the loss up to a maximum amount.

To encourage the involvement of other insurers, HUD has made all of its development work available for scrutiny and revision by others and HUD staff have freely offered advice to those seeking assistance in designing their own program. In this manner, the public benefit of the Federal Government's investment in program design may be multiplied.

INSURING BORROWERS

Section 255(i) of the Act provides protection for borrowers in the event of default by "the party responsible for payment." Mortgage insurance normally provides lenders with insurance against borrower default. For the first time, HUD was authorized to insure borrowers against lender default. In a period when many thrifts have closed their doors, this feature of the FHA reverse mortgage program provides an added measure of protection for borrowers. While lender default is expected to be rare, HUD had to prepare for the eventuality; and these preparations spurred administrative innovations which are discussed in more detail in Chapter 9--most notably, the creation of an on-line accounting system which maintains information on each borrower's payment plan and current balance, so that if necessary HUD can step in and make payments to borrowers as quickly as possible.

CHAPTER EIGHT
PROVIDING COUNSELING

Statutory Requirements

Counseling for potential borrowers on reverse mortgages and their alternatives is required by Section 255 of the Act. "Adequate counseling" is to be provided "by a third party (other than the lender)." A lender is required to give borrowers "a written list of the names and addresses of third-party information sources who are approved by the Secretary as responsible and able to provide the information required." Counselors are to discuss the following information with borrowers:

- (1) options other than a home equity conversion mortgage that are available to the homeowner, including other housing, social service, health, and financial options;
- (2) other home equity conversion options that are or may become available to the homeowner, such as sale-leaseback financing, deferred payment loans, and property tax deferral;
- (3) the financial implications of entering into a home equity conversion mortgage;

(4) a disclosure that a home equity conversion mortgage may have tax consequences, affect eligibility for assistance under Federal and State programs, and have an impact on the estate and heirs of the homeowner; and

(5) any other information that the Secretary may require.

Early in the design process, the decision was made to use HUD's existing network of approved housing counseling agencies to provide the counseling services mandated for the FHA reverse mortgage program.

HUD-Approved Housing Counseling Agencies

HUD annually certifies housing counseling agencies to provide comprehensive counseling services. Eligible agencies include local public agencies and nonprofit organizations. Currently, approximately 465 public and nonprofit agencies are approved, down from over 600 agencies in 1980 when Federal funding was curtailed. Since 1980, HUD has received \$3 million annually for housing counseling activities. It has allocated about \$2 million to fund small grants (most between \$5,000 and \$40,000) to about 40 percent of the agencies on a competitive basis.

The agencies provide mortgage default and rent delinquency counseling. While they are authorized to provide reverse mortgage counseling, they have had little demand for this service, and so, the Department faced the challenge of training housing counselors about reverse mortgages, other

forms of home equity conversion, and housing and social service alternatives to home equity conversion.

Housing counseling agencies were not altogether eager to undertake a new responsibility, since, in addition to mandating reverse mortgage counseling, the Housing and Community Development Act of 1987 substantially increased their workload by requiring lenders to notify delinquent homeowners about the availability of homeownership counseling through HUD-approved counseling agencies. While additional funds were authorized for this purpose, they were not appropriated. Consequently, HUD began training staff of HUD-approved housing counseling agencies about reverse mortgages and their alternatives at a time when the staff felt overburdened and resentful about undertaking additional responsibilities without additional compensation.

Housing counseling agencies are barred from charging homeowners for their services, and lenders are prevented from paying for counseling services by the statutory requirement that counseling be provided by a third party independent of the lender. If insurance authority for the Home Equity Conversion Mortgage Insurance program is substantially increased, the unavailability of counseling services could prevent some lenders from participating in the program. Even within the parameters of a 2,500 demonstration, HUD staff have been enlisted to provide reverse mortgage counseling where HUD-approved housing counseling agencies were unavailable or unwilling to assume this new responsibility.

AoA Assistance

Since HUD-approved housing counseling agencies are not available in every community or even in some States, HUD worked with the Administration on Aging under an interagency agreement to identify additional agencies for approval for reverse mortgage counseling. This effort has not been notably successful. First, on December 2, 1988, the Office of Housing sent a memorandum to HUD Regional and Field Offices authorizing them to approve additional counseling agencies that specialize in reverse mortgage counseling as long as they met the other requirements for counseling agencies in HUD Handbook 7610.1 REV. Then, the Administration on Aging (AoA) asked its Regional Offices and its State Agencies on Aging to identify agencies for approval by HUD Field Offices. Less than a dozen agencies sought approval to provide reverse mortgage counseling as a result of these efforts.

Another outgrowth of the interagency agreement was more successful. The AoA and HUD each agreed to contribute \$250,000 to fund the training of existing and new housing counseling agencies about reverse mortgages and their alternatives. Using these funds, HUD entered into a cooperative assistance agreement with the American Association of Retired Persons (AARP) Home Equity Information Center and its subcontractor, the National Center for Home Equity Conversion, to assist HUD in providing training to counselors in the vicinity of the participating lenders selected in random drawings in late February 1989.

Twelve initial training sessions coinciding with the start-up of the demonstration were held in the 10 HUD Regions between June 15 and August 22, 1989. The American Bar Association's Commission on Legal Problems of the Elderly helped by inviting elder law attorneys to each session and identifying State social service and other alternatives to reverse mortgages. Nine additional sessions were subsequently organized as the need arose. As of May 25, 1990, AARP training sessions were attended by a total of 365 housing counselors, 250 representatives of the aging network, 92 representatives of lenders, and 270 HUD staff.

Training Materials

To facilitate the training of housing counselors, PDR's Research Utilization Division supervised the publication of Options for Elderly Homeowners: Reverse Mortgages and Their Alternatives, a guide for reverse mortgage counselors; and the AARP prepared a training manual. The software package developed to calculate reverse mortgage payment options proved to be an invaluable aid to housing counselors in explaining reverse mortgages to elderly homeowners. Use of the software package has been an integral part of each training session. Housing counseling agencies that do not already have a personal computer have been urged to acquire one through purchase or donation.

Requirements for Housing Counseling

Reverse mortgage counseling may take place before or after a potential borrower has contacted a lender. A lender may take the borrower's application before counseling, but may not charge a fee for doing so. If, after counseling, the elderly homeowner decides not to proceed with the transaction. In most instances, a homeowner who contacts a lender will be given a blank set of mortgage documents and a list of one or more housing counseling agencies that provide reverse mortgage counseling.

Homeowners are responsible for making an appointment with a counselor. Counselors are urged to conduct the counseling session in the home of the potential borrower if possible so that the homeowner may be warned if a property is unlikely to meet minimum property standards without repairs. As a general rule, at each stage of the mortgage application process, an effort is made to determine whether an elderly homeowner (or a property) is eligible before the homeowner incurs an expense which cannot be refunded if the transaction is terminated.

Borrowers are urged to invite heirs (or other trusted advisors) to counseling sessions, but heirs may not veto the elderly homeowner's decision to apply for a reverse mortgage. Counselors are advised that they are not responsible for determining the suitability of a reverse mortgage for the borrower: the decision to apply for a reverse mortgage is the borrower's (or the borrower's legal guardian) and the decision regarding the borrower's eligibility belongs to the lender and HUD. The counselor's

responsibility is to discuss certain information with the borrower so that the elderly homeowner is fully aware of the consequences of taking out a reverse mortgage and the alternatives to a reverse mortgage.

At the conclusion of the counseling, which may take more than one session, the borrower and counselor sign a form certifying that certain topics have been discussed. The borrower takes the form to the lender who files it with the lender's application to HUD for a firm commitment of mortgage insurance.

CHAPTER NINE

PROGRAM ADMINISTRATION

The procedures in the handbook for the Home Equity Conversion Mortgage Insurance demonstration were deliberated in weekly meetings between October 1988 and March 1989 attended by HUD staff from the Office of Housing, the Office of Policy Development and Research, the Office of Administration, and the Office of the General Counsel. In these meetings, innumerable "what if" scenarios were entertained, and when problems were identified, solutions were developed that took into account the perspectives of the various participants.

Certain design principles emerged from and guided the discussions. For example, participants shared the assumption that the circumstances of elderly homeowners vary so widely (and unexpectedly over time) that homeowners should retain maximum discretion over the use of mortgage proceeds. They also believed that the reverse mortgage insurance program should be run by existing HUD staff as an integral part of insured single family lending. To reduce the novelty of reverse mortgages to HUD staff and existing FHA lenders, the program should use forward mortgage policies and analogies whenever possible. Finally, servicing issues should be anticipated in the design of the program, and computer technology should be used to make reverse mortgage origination and servicing as simple as

possible. These design principles are illustrated in this chapter which describes reverse mortgage processing.

In general, the steps in processing a reverse mortgage for mortgage insurance parallel those for a forward mortgage. These steps involve approving the property and issuing a conditional commitment, approving the borrower and issuing a firm commitment, and loan closing and endorsement for insurance. In each case, standard HUD forms and procedures are used, modified as necessary to accommodate the unique features of the FHA reverse mortgage program.

When the lender takes the borrower's application, the lender makes a good faith estimate of settlement costs and provides the borrower with various disclosures, including a Truth-in-Lending Act disclosure and adjustable mortgage interest rate and shared appreciation disclosures, if applicable, and provides evidence of having done so to HUD.

Approval of the Property

Generally, a lender will take an elderly homeowner's application for a reverse mortgage after the borrower has received counseling from a HUD-approved housing counseling agency. To initiate processing for mortgage insurance, the lender calls or writes the nearest HUD field office for a case number and appraisal assignment and sends HUD Form 92800, the standard form for requesting an appraisal and conditional commitment of mortgage insurance, and a Uniform Residential Appraisal Report to the assigned

appraiser. All stages of processing are tracked through the Department's automated loan origination system, Computerized Homes Underwriting System (CHUMS), which has been modified for the demonstration. CHUMS will also allow for the collection of information needed to evaluate the program.

The appraiser determines the value of the property and estimates the cost of any repairs needed to bring the property up to minimum property standards. If required repairs amount to less than 15 percent of the maximum claim amount, then, at the borrower's discretion, they may be completed using loan proceeds after closing under a Repair Rider attached to the Loan Agreement. Otherwise, the repairs must be completed before closing. (See the discussion of mortgage documents below.) If the required repairs amount to more than 15 percent, they must be completed before closing, generally under a contractor's lien for repairs which is paid off at closing.

Once the appraisal has been completed, the HUD field office determines the maximum claim amount, depending upon the appraised value of the property, and issues a conditional commitment.

Approval of the Borrower

In the second stage of mortgage insurance processing, the lender completes HUD FORM 92900, the application for a HUD-insured mortgage. Since a borrower's eligibility for a reverse mortgages does not depend upon the quality of the borrower's credit, the information collected for a

reverse mortgage is significantly less than for a forward mortgage. Only a default on a debt owed the Federal Government has an impact on the borrower's eligibility. Delinquent debts to the Federal Government must be repaid before the mortgage can be endorsed for insurance. Therefore, paying delinquent Federal debts at closing may be a condition for the borrower's approval. Borrowers must also meet minimum age requirements and must occupy the mortgaged property as a principal residence. If these conditions are met, the lender will then review the borrower's title to verify what existing liens, if any, are on the title to the property. An existing lien on the property will not disqualify a borrower, if it can be subordinated or paid off from mortgage proceeds at closing.

Closing costs may be financed with two exceptions. First, a borrower may be required to pay cash for services performed by third parties related to the processing of a borrower's application (e.g., appraisal, credit report, title commitment, etc.) at the time that these services are provided. However, the borrower may be reimbursed for these costs out of the loan proceeds at closing. Second, a borrower may finance no more than one percent of the origination fee charged by the lender to cover the costs of originating the loan.

Upon completion of its review of the lender's submissions, the HUD field office issues a firm commitment if the borrower is approved. Upon approval, the field office will also calculate the initial mortgage insurance premium and the borrower's principal limit. The principal limit

may change if interest rates change prior to closing. If the expected rate changes by more than one percentage point, the mortgage credit package must be resubmitted by the lender to the field office, allowing the borrower to reconsider the transaction.

Closing and Endorsement

In order to close the loan, the person who will conduct the closing must prepare a HUD-1 Settlement Statement one business day prior to closing, disclosing all known closing costs and make the statement available to the borrower, upon request, one day prior to closing. The lender must also lock in the mortgage interest rate. In the case of adjustable rate reverse mortgages, the lender must use the one-year and ten-year Treasury indices which apply to the week in which the closing will occur. Reverse mortgages are priced at par because discount points and teaser rates are not allowed. Using the expected rate, the lender prepares a payment plan for the borrower which shows the borrower's principal limit, any deductions from the principal limit for closing costs and servicing fee set-asides, and the borrower's choice of monthly payments, line of credit, or both.

The one-page payment plan is signed by the borrower at closing and any time thereafter that a new payment plan is created.

At closing, the lender and borrower complete the mortgage documents. After closing, the lender records the mortgages, submits a copy of the mortgage documents to HUD along with: an MIP Statement of Account showing that the initial mortgage insurance premium was paid, evidence of a hazard

insurance policy on the property equal to the value of insurable property improvements, evidence of title insurance policy at least equal to the maximum claim amount, and the lender's choice of either the assignment or the shared premium insurance option. FHA reverse mortgages are subject to the three-day right-of-recission provisions of the truth-in-lending act, so that payments to the borrower would not normally begin until this period of time has lapsed.

After verifying the information provided by the lender, the HUD field office will insure the mortgage, issuing form HUD 59100, the Mortgage Insurance Certificate.

Mortgage Documents

Mortgage documents for the FHA reverse mortgage program include: a model first mortgage and note executed in the name of the lender, a model second mortgage and note executed in the name of the Secretary of HUD, and a loan agreement signed by the borrower, lender, and HUD containing the borrower's initial payment plan. Legally, a note contains a borrower's promise to repay loan advances, and a mortgage contains the borrower's pledge of the property as security for the repayment. In the reverse mortgage program, an additional document is needed, called the loan agreement, which contains the lender's promises to make future payments to the borrower. This agreement is binding upon HUD in the event of default by the lender.

First and second mortgages and notes with identical terms are executed to carry out the Department's promise to make payments in the event of default by the lender. A Notice to the Borrower is sent to the borrower by the Department after closing. It contains instructions for the borrower to follow in the event that the lender is frequently late in making payments or fails to make them at all. The borrower is instructed first to contact the lender, and then, if the response is unsatisfactory, to contact a designated staff person in the nearest HUD field office. This staff person will investigate complaints and will authorize emergency payments, if necessary. The lender will then be given the opportunity either to reimburse HUD for the payments plus interest and any unpaid MIP and penalties, maintaining mortgage insurance in force, or else to assign the first mortgage to HUD. If the mortgage is assigned, the lender would then be entitled to file a claim with HUD for any payments made to or on behalf of the borrower, excluding accrued interest. If the lender defaults and cannot assign the first mortgage to HUD, HUD will continue payments under the second mortgage. In this case, the lender may not file a claim for any payments made to or on behalf of the borrower, excluding accrued interest, until the mortgage becomes due and payable.

Model first and second mortgages and notes are published in appendices to the FHA reverse mortgage handbook. Under a new HUD policy which went into effect June 29, 1989 (54 F.R. 27596), each lender is responsible for modifying the mortgage instruments as necessary to conform with State law. In the past, HUD prepared mortgage instruments for each State, but HUD

concluded that private industry was capable of adapting a national model form for particular jurisdictions with minimal risk to HUD and substantial savings in cost and staff resources. Some of the difficulties encountered by lenders in preparing their mortgage instruments are discussed in Chapter 10. The loan agreement, a unique instrument, was designed for use without modification.

Payment of MIP

Under Section 530 of the National Housing Act, HUD is required to collect MIP from a lender immediately after it has been collected from a borrower. For the first time in its history, for the FHA reverse mortgage program, HUD is using an automated MIP and data collection system to collect the initial mortgage insurance premium and monthly MIP.

The initial MIP must be paid before a loan can be endorsed for insurance. It is earned as soon as the loan is endorsed and, therefore, is not refundable after endorsement. Since the monthly MIP accrues daily on the mortgage balance and is added to the borrower's account monthly, it is due to the Secretary on the first day of the month following its accrual. HUD is using an agent to collect the initial MIP, monthly MIP, and all data needed to update its records. Each lender is required to establish a banking account from which HUD can collect payments by means of a Pre-Authorized Debit (PAD) based on data transmitted electronically by the lender to the HUD agent. Each lender must have a personal computer, printer, and modem which are compatible with the agent's equipment. The

HUD agent has provided each lender with program format screens and complete instructions for each of the functions to be performed.

Information on each mortgage is transmitted from CHUMS to the agent's data system after HUD issues a firm commitment. After closing, a lender accesses the automated system and enters information on the characteristics of the mortgage at closing, including the borrower's payment plan. The initial MIP required for endorsement is displayed on the screen after the loan information is entered. The lender must then ensure that funds are in the account within the next nine calendar days. Using the information transmitted by the lender, the agent completes the transaction on the tenth day transferring the funds from the lender's account to HUD's account in an Atlanta bank.

Information on each mortgage may be corrected or updated as needed. If the borrower's payment plan calls for monthly payments, the system will automatically add the amount to the borrower's balance each month. The lender can also enter any unscheduled payments and any payments on behalf of the borrower (e.g., for taxes or insurance). Any payment information may be entered daily, but must be entered by the last day of the month. The monthly MIP will be calculated based on the outstanding balance at the end of the month by the automated system. On the first business day of the following month, the automated system computes the amount of MIP owed for all reverse mortgages serviced by the lender, and the lender is responsible for depositing this amount in the PAD account before the tenth day of the

month. MIP payments are not added to a borrower's mortgage balance until they are actually paid. Late payments are subject to late charges. The automated system will compute the late charge due and automatically assess the late charge. The lender cannot add the amount of any late charge to the borrower's outstanding balance.

Transfers of servicing and termination of insurance contracts can both be accomplished on the automated system. Lenders are able to call up a record of all transactions related to a single mortgage for checking their own records; and HUD staff are able to access the system to confirm the validity of a borrower's complaint or to continue payments in the event of lender default.

Timing of Payments to Borrowers

Monthly payments to borrowers must be mailed to the borrower or transferred to the account of the borrower on the first business day of each month beginning with the first month after closing. Line of credit draws must be mailed or transferred within five business days after the lender has received a written request for payment.

If a monthly payment or requested line of credit payment is not mailed to the borrower or transferred to the borrower's account on time, the lender owes the borrower a late fee. The lender owes a late charge of 10 percent of any late payment as soon as the payment is one day late and an

additional late charge equivalent to the daily mortgage interest rate on the payment until the payment is made, up to a maximum of \$500.

Of course, any late charge owed by the lender must be paid from the lender's funds and may not be added to the mortgage balance of the borrower.

Interest on any payment made during a month accrues daily from the date after the payment is made. This interest, along with the interest that has accrued on the mortgage balance from the previous month, is not added to the mortgage balance until the end of the month.

Payments of Taxes and Insurance

Like a forward mortgage borrower, a reverse mortgage borrower is responsible for the payment of taxes, hazard insurance premiums, and other property charges, if any, but may choose to have the lender pay them with money withheld from the borrower's monthly payments or charged to the borrower's line of credit. These payments are not made from an escrow account, as with forward mortgages. Instead, for a borrower receiving monthly payments, the borrower's monthly payment is reduced by one-twelfth of the amount needed to pay the annual charges, and the payments are added to the mortgage balance at the time that they are made. For a borrower with a line of credit, the lender simply subtracts the payments from the line of credit and adds them to the mortgage balance when they are made. In this manner, the funds remain in the borrower's principal limit, which is growing at the mortgage interest rate plus the MIP, until they are

expended and added to the mortgage balance, at which time the lender rather than the borrower accrues interest on the funds.

A borrower is not required to have the lender pay property charges on the borrower's behalf because such a policy would not be practicable and may be unnecessary. It would not be practicable because some borrowers will withdraw the maximum allowed on the first day or will exhaust their principal limit but continue to live in the property. In these cases, borrowers will be responsible for making these payments from their own funds as long as they reside in the property. Withholding may be unnecessary because many elderly homeowners, having previously paid off their mortgages, will be accustomed to making these payments on their own. If a borrower should fail to make these payments in a timely fashion, the lender can make the payments on behalf of the borrower and request reimbursement from the borrower. If the borrower shows a pattern of missing payments, the lender may withhold the necessary funds from monthly payments or make the payments from a line of credit in order to protect the priority of the lender's lien on the property.

Some States and localities permit elderly homeowners to defer the payment of property taxes until they move and sell their home or die. A lien for the amount of deferred payments plus interest is placed on the property, and the taxes are paid from the property sales proceeds. A borrower may participate in a property tax deferral program sponsored by a State or local government as long as the lien created by the tax deferral

program is subordinated to the reverse mortgage lien. Some State and local governments have been willing to subordinate their liens, while others have not.

Payoffs and Due and Payable Mortgages

A borrower may prepay a mortgage in whole or in part at any time without penalty. A partial prepayment will reduce a borrower's mortgage balance--increasing the borrower's net principal limit. A borrower may request a change in a payment plan to tap these additional resources. When the entire mortgage balance is prepaid, the mortgage is terminated. The borrower (or the estate of the borrower) will never owe more than the value of the property. If the borrower believes that the mortgage balance exceeds the value of the property, the borrower may request an appraisal at the time of sale. The net proceeds from the sale of the property will be applied to the mortgage balance, the mortgage will be released of record, and the lender may file a claim for the difference between the net sales proceeds and the mortgage balance (up to the maximum claim amount).

A mortgage is due and payable without HUD approval when all borrowers have died, or all borrowers have sold or conveyed title to the property. A mortgage is due and payable with HUD approval when the property is no longer the principal residence of at least one borrower for reasons other than death; when the last borrower is out of the property for a period exceeding 12 months because of physical or mental illness; when the property is in serious disrepair and the borrower has refused or is unable

to have it repaired; or when the borrower violates any other covenants of the mortgage (e.g., timely payment of taxes and insurance) and has refused or is unable to comply with the violated conditions of the mortgage.

When HUD approval is needed, a lender will write to the nearest HUD field office requesting permission to declare a mortgage due and payable and providing evidence to support this action. HUD staff will investigate and make every effort to correct the situation causing the default. If the situation cannot be corrected, the lender will be given permission to begin foreclosure proceedings. When a mortgage has been declared due and payable, a borrower may pay off the mortgage for the lesser of the debt or 95 percent of the current appraised value of the property. If the mortgage balance exceeds the value of the property, the borrower may offer the lender a deed in lieu of foreclosure. In such a case, the lender would offer the property for sale for six months. If it were not sold in this period, the property would be reappraised, and the lender could file a claim with HUD for the difference between the appraised value and the mortgage balance (up to the maximum claim amount).

CHAPTER TEN

LEGAL ISSUES

This chapter discusses some of the legal problems encountered by lenders participating in the FHA reverse mortgage program. Some of these problems concern legal authority for reverse mortgage lending under Federal and State law; others concern Federal truth-in-lending disclosures.

LEGAL AUTHORITY FOR REVERSE MORTGAGE LENDING

Section 255(b)(3) of the National Housing Act does not provide independent authority for lenders to make reverse mortgages. Instead, the Act limits the definition of home equity conversion mortgages to those mortgages which a lender is authorized to make under one of three sources of legal authority:

- o Federal law, other than Section 804 of the Garn-St Germain Depository Institutions Act of 1982 (Garn-St Germain);
- o Section 804 of Garn-St Germain, which pre-empts State impediments to alternative mortgage transactions, like reverse mortgages; or
- o State constitution, law, or regulation.

Financial institutions which derive their authority to make loans from Federal rather than State law have clear authority to make reverse mortgages by virtue of the regulations of the Office of the Comptroller which regulates federally-chartered banks, the National Credit Union Administration which regulates federally-chartered credit unions, and the Office of Thrift Supervision (formerly the Federal Home Loan Bank Board), which regulates federally-chartered savings institutions. Financial institutions which derive their authority from State law--i.e., State banks, State savings institutions, and State housing finance agencies--may not have clear authority to make reverse mortgages without recourse to Section 804 of the Garn-St Germain Depository Institutions Act. The problems faced by State-chartered lenders who comprise a majority of the lenders participating in the FHA reverse mortgage program are discussed in the next section.

1. State-Chartered Lenders and Reverse Mortgages.

Typically, State law authorizes lenders to make regular "forward" mortgages in which loan proceeds are disbursed at closing, the loan is amortized in equal monthly payments over a fixed term, and interest is charged at a fixed rate and does not compound. If these features are not present, as they are not in an FHA reverse mortgage, then a lender may not be authorized under State law to make reverse mortgages.

Under Section 255(b)(3) of the National Housing Act, such a lender may still be authorized to originate reverse mortgages by Section 804 in Title VIII of the Garn-St Germain Depository Institutions Act of 1982 (Pub. L. 97-320). It is the purpose of Title VIII to place State-chartered lenders on equal footing with federally-chartered lenders by preempting State impediments to alternative mortgage transactions and permitting State-chartered lenders to enter into alternative mortgage transactions as long as these transactions are in conformance with Federal regulations.

Section 804 states that "[i]n order to prevent discrimination against State-chartered depository institutions, and other nonfederally chartered housing creditors, with respect to making, purchasing, and enforcing alternative mortgage transactions ... ," various classes of State-chartered housing creditors are expressly authorized to "make, purchase and enforce alternative mortgage transactions," in accordance with regulations issued by designated Federal regulatory agencies, "to the extent that such regulations are authorized by rulemaking authority granted" by law to the Federal agencies with regard to federally chartered lenders regulated by them, "notwithstanding any State constitution, law, or regulation."

The term "alternative mortgage transaction" is broadly defined to include loans with variations on the "methods of determining return, term, repayment, or other variation not common to traditional fixed-rate, fixed-term transactions, including without limitation, transactions that involve the sharing of equity or appreciation." By referencing Section 804 of

Garn-St Germain, Congress recognized insured reverse mortgages as "alternative mortgage transactions" within the scope of this law.

The designated Federal regulatory agencies--the Comptroller of the Currency, the National Credit Union Association and the Federal Home Loan Bank Board--were instructed to identify the portions of their regulations that were inapplicable to State-chartered lenders. Each agency acted in response to this instruction. Both the Office of the Comptroller of the Currency and the National Credit Union Association exercised their Title VIII powers in a broad manner so that any insured reverse mortgage loans made by State-chartered commercial banks and credit unions would not be subject to State restrictions on reverse mortgages. The rules are less clear for uninsured reverse mortgages. The Bank Board, the regulatory authority for all classes of lenders except commercial banks and credit unions, identified 12 CFR 545.32(b)(3) and (4), 545.33(c) and (e), and 563.9-9 of its regulations as the only provisions "appropriate and applicable to the exercise of this [Garn-St Germain] authority," stating that all other regulations" are deemed inappropriate and inapplicable."¹

These provisions authorize loans involving adjustable rates and adjustable payments, balances and terms; sharing in appreciation or income from the security property; full, limited or no amortization; lines of credit; and partial deferral and capitalization of interest (or complete

¹ This provision was adopted in its present form by 53 FR 18262, May 23, 1987. Previously, it appeared as an Appendix to 12 CFR 545.

deferral and capitalization for some loans with periodic advances secured by owner-occupied property). This listing includes the main legal impediments to most types of alternative mortgage transactions under typical State laws.²

The Department sought clarification of these regulations from the Bank Board on two specific issues. On September 26, 1988, HUD's Associate General Counsel for Insured Housing and Finance wrote to the General Counsel of the Board seeking clarification on whether the regulations would authorize the complete deferral and capitalization of interest for reverse mortgages structured as lines of credit rather than monthly payment loans. On November 16, 1988, the Associate General Counsel again wrote the General Counsel to inquire whether Texas State constitutional and statutory restrictions on mortgaging homesteads would be preempted for reverse mortgages by Title VIII as implemented by the Board.

On August 4, 1989, the Board's Deputy General Counsel responded that Federal savings and loan associations and Federal savings banks had the authority to make line of credit reverse mortgages with complete deferral and capitalization of interest, and to enforce such mortgages (and, apparently, other reverse mortgages) on Texas homesteads despite contrary State law. However the Deputy General Counsel was unable to say whether State-chartered lenders were authorized to make such mortgages and

² For State law obstacles not pre-empted by the regulations, see Section 2 of this Chapter.

suggested that State-chartered institutions should consult with the "appropriate State regulator" about whether such lenders may make certain loans pursuant to the Garn-St Germain Act.³ At the present time, therefore, there is no clear legal authority for State-chartered lenders to make reverse mortgage loans secured by Texas homesteads.

Title VIII of Garn-St Germain provided a three-year period during which each State could enact laws to prevent application of Title VIII to loans in the State. At least six States did so: Colorado, Maine, Massachusetts, New York, South Carolina, and Wisconsin (certain loans only). Of these States, HUD has become aware of potential legal impediments in New York and Colorado. New York enacted a statute specifically authorizing reverse mortgage loans, but only with fixed interest rates and other restrictions inconsistent with the HUD program. However, there is another New York law which may be interpreted to permit lenders subject to New York law to make any mortgage loan insured by HUD. This has been relied on by a number of title insurers. Colorado law requires finance charges to be included with interest charges and compared to the balance in the first month to determine the interest rate for usury purposes. The law was devised to inform credit card consumers of the cost of borrowing and may work well for that purpose. But, in the case of

³ We would conclude that State-chartered lenders as well as federally-chartered lenders may take advantage of the clarification regarding interest capitalization for line of credit mortgages notwithstanding any State laws prohibiting or limiting capitalized interest, since the provision in question, 12 CFR 545.33(c), has been specifically identified in Board regulations as applicable to State-chartered lenders engaged in alternative mortgage transactions.

reverse mortgages, where the finance charges may run in the thousands of dollars compared to a monthly draw of a few hundred, the interest rate appears to be far above the State usury limit unless certain fees which could be excluded from the finance charge calculation for Federal truth-in-lending purposes can also be excluded when applying Colorado law.

2. State Law Impediments.

A number of other State laws affect reverse mortgage loans which may be outside the intended scope of the Garn-St Germain Title VIII preemption. FHA reverse mortgage lenders will most probably be subject to such laws since the laws either directly regulate reverse mortgages, liens on real property, or alternative mortgage transactions. The laws complicate the substance and documentation of reverse mortgage loans, and may have adverse consequences in the event of noncompliance. There is no feasible way for HUD to research the laws of all jurisdictions and their application to reverse mortgages. Instead, HUD has relied on the lenders participating in the demonstration and other interested parties (such as the AARP) to bring these laws to the Department's attention.

A. State reverse mortgage laws.

Ironically, it is in the States where the legislature enacted legislation with the intent of making reverse mortgages available to elderly homeowners that the FHA reverse mortgage program has encountered the most obstacles. State reverse mortgage laws often set out the terms and conditions of the loans with such specificity that the FHA reverse

mortgage program is prohibited. For example, in Arizona, the legislature attempted to protect the elderly from unscrupulous lenders by including criminal penalties for violation of reverse mortgage statutes. When otherwise minor inconsistencies between the Arizona law and the FHA program were discovered, lenders became unwilling to originate FHA reverse mortgages in Arizona. As a result the State enforcement agency under the statute began petitioning the State legislature for a legislative change. Other examples of conflicts with State reverse mortgage laws exist in New York (discussed above), North Carolina, Illinois, and Florida.

B. State mortgage law obstacles.

Numerous other obstacles have arisen from application of the State mortgage laws. HUD has permitted modifications to the model mortgage documents to accommodate some of the concerns of lenders and title companies regarding compliance with various laws. Some of the more common State statutes which create obstacles are described below:

1. Maximum loan amount.

Many States have laws requiring that the mortgage instrument state the maximum loan amount that may be secured by the mortgage. Some of these laws apply only to mortgages under which money will be advanced in future payments, and some are generally applicable. The concept of a maximum loan amount is not consistent with the reverse mortgage program as authorized by Congress, because the law establishes the borrower's right to remain in the property and so, places no limit on the period over which interest may

accrue. Therefore, the HUD program requires a lender to re-record the mortgage with a higher maximum loan amount, if needed at a later date, provided that any other liens are removed or subordinated, and the borrower signs necessary documents. If these conditions are not met, payments to the borrower may be stopped. The requirement to remove or subordinate other liens may adversely affect the borrower's ability to obtain other long-term loans secured by junior liens or to participate in a tax deferral program for the elderly.

2. Loan-to-value ratios.

Loan-to-value ratios also limit the amount of the loan, but create an absolute limit on the maximum mortgage amount, making accommodations such as re-recording the mortgage with a higher loan amount impossible. Lenders have encountered problems with such laws in New York, New Jersey, and Massachusetts. The FHA program and other reverse mortgages which provide tenure payments cannot operate when the loan amount is capped as a percentage of the property value without other pre-emptions under State or Federal law.

3. Maximum term.

At least a few States have laws with adverse consequences for the lender if the mortgage fails to contain a maturity date. The concept of a fixed maturity date is not consistent with the reverse mortgage program authorized by Congress, but HUD has worked with lenders on ways in which the requirements of State law can be satisfied. For example, Minnesota law

provides that a mortgage without a stated maturity date will not be enforceable for more than 15 years. HUD will permit the instrument to contain a maturity date for longer than the foreseeable lifetime of any borrower, even though any maturity date is theoretically inconsistent with HUD's regulations, so that the lender does not have to demand repayment after 15 years on the ground that its lien is in jeopardy under State law. Similar statutes exist in Florida and North Carolina.

4. Future advance lien priority.

Special legal questions arise for a mortgage loan in which the loan proceeds are advanced over time. Such loans are frequently called future advance mortgages or open-end mortgages. In the absence of a pertinent statute on lien priority, the majority common law rule is that any advances which the lender is obliged to make under the terms of the loan agreement have priority over all liens recorded subsequent to recording of the original mortgage, but advances made at the lender's option have priority only from the date of the advance. However, in some States, the common law rule would not allow the advances to "relate back" to the mortgage recording date for priority purposes, and in some States, it is not clear what common law rule would be followed.

Thus, many States have superseded the common law rules by statute. In some cases, the statutes provide that all loan advances, whether obligatory or optional, have a lien priority from the original recording date. This is compatible with the HUD program which is designed so that all advances

are mandatory. However, these statutes sometimes also provide that the priority only exists for advances made during a specific period of time. For example, in New York, Florida, Illinois, and possibly other States, the statute provides priority only for advances within 20 years of the recording date. HUD has attempted to mitigate the effect of such laws by providing that the lender must record new loan documents to begin a new 20-year period, provided that any other liens are removed or subordinated, and the borrower signs necessary documents.

A Missouri statute provides lien priority only for advances within 10 years of the recording date, and expressly prohibits any agreement to extend the period of advance. Although lenders are not legally required to seek coverage of this statute, it is not clear whether Missouri would otherwise follow the majority common law rule; and HUD has agreed that a prudent lender may reasonably determine that coverage of the statute is needed even though the effect is to remove the tenure payment option from mortgages insured in Missouri. An effort is being made in Missouri to change this law.

5. Registration tax.

Some States base the amount of their registration tax on the loan amount. Since a reverse mortgage balance starts low and grows as payments and accrued interest are added, lenders were originally instructed by HUD to use 150 percent of appraised value when a loan amount is required to be stated in the mortgage. Since the borrower's debt may never reach this

amount, the borrower may be paying an unnecessarily high tax. HUD has recently taken one step to lower the tax by allowing 150 percent of HUD's maximum claim amount to be used if this will result in a lower mortgage amount.

Conclusion

HUD has provided uniform legal provisions for some of the more common State requirements (e.g., the requirement that a maximum mortgage amount be stated). It is up to lenders to seek legal advice and to add any further language needed for valid and enforceable legal instruments under State law. HUD is also requiring that lenders provide evidence of a title insurance commitment with their application for a firm commitment of mortgage insurance. It is hoped that title insurance companies will help to assure that all appropriate language is in the legal document (although, at the present time, many title insurance companies, or branches of these companies, are unfamiliar with reverse mortgages with the result that some lenders have had difficulty securing title insurance). These legal obstacles have added to lenders' start-up costs and slowed their ability to close reverse mortgages.

TRUTH-IN-LENDING DISCLOSURES

Another major hurdle for lenders participating in the FHA reverse mortgage program is the Home Equity Loan Consumer Protection Act (HELCPA, Pub. L. 100-709) which was enacted subsequent to authorization of the FHA reverse mortgage program. It amends the Truth in Lending Act (TILA) to

require extensive lender disclosures when an application is made for open-end consumer credit secured by a principal residence. The amended TILA also restricts the ability of lenders to suspend the provision of such credit or terminate a credit plan entirely. All mortgages originated after November 6, 1989, are subject to the Federal Reserve Board regulations implementing HELCPA (54 FR 24670, June 9, 1989).

The Federal Reserve Board has taken the position that FHA reverse mortgages are a form of open-end consumer credit and are, therefore, covered by the amendments to the TILA. FHA reverse mortgages fall into the category of open-end credit because they can all be partially prepaid by the borrower. Prepaid amounts are included in the funds available to the borrower (i.e., the borrower's net principal limit), and may be re-borrowed.

HUD and many of its approved lenders have no experience in dealing with TILA open-end credit requirements, and no one has experience with TILA as amended by HELCPA. HELCPA was designed to eliminate perceived abuses associated with the types of home equity lines of credit which have become widely available in recent years as an alternative to a traditional second mortgage. It was not designed to deal with perceived abuses of home equity conversion or reverse mortgages. As a consequence, participating lenders have found the rules unresponsive to the characteristics of a reverse mortgage and difficult to apply.

Furthermore, HUD's required disclosures, when combined with HELCPA's numerous disclosures, threaten to overwhelm a borrower. Both HUD and TILA require lenders to give a pre-loan disclosure for adjustable rate mortgages and a post-loan disclosure prior to each rate adjustment. HUD also requires lenders to issue statements of account annually and for each line of credit draw and change in payment plan. (HUD's requirements are in 24 CFR 206.) HELPCA requires lenders to issue a disclosure statement concerning finance charges and billing rights at the time of application (12 CFR 226.5b) and a second disclosure concerning finance charges and billing rights at the time of closing (12 CFR 226.6), periodic statements providing balances and finance charges (12 CFR 226.7), and a subsequent disclosure for change in terms (12 CFR 226.9). Depending on the specific purpose of the disclosure, some of these disclosures may be combined.

FHA lenders have become frustrated because no model disclosures have been provided by the Federal Reserve Board for reverse mortgages. The model disclosures that exist are drafted for home equity lines of credit and make little or no sense for reverse mortgages. Some examples of disclosure difficulties for reverse mortgages are:

- o It is not clear what assumed term to use when calculating the annual percentage rate (APR).
- o The information pamphlet which must be provided to each borrower discusses home equity lines of credit, but not reverse

mortgages. Counselors report that elderly borrowers are frightened by the pamphlet's numerous warnings that the borrower may lose his or her home for failure to make monthly payments. This cannot happen under the FHA reverse mortgage program because the borrower does not repay the loan in installments.

- o One provision requires disclosure of the minimum periodic payment at the maximum possible interest rate on the loan. Since borrowers do not make payments under a reverse mortgage, a lender is required to treat the final debt amount as if it were a periodic payment. If this calculation were made for a monthly adjustable reverse ARM using the arbitrarily high interest rate cap permitted by the Competitive Equality Banking Act (e.g., 25 percent) and a long term, the resulting figure could be truly startling--but meaningless. Due to the nonrecourse nature of the debt, a borrower will never owe more than the value of the property.

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- o Unlike its rule for closed-end credit disclosures for adjustable rate loans, this Federal Reserve Board rule does not permit HUD to substitute its own disclosure rules. Consequently, HUD has not been able to develop integrated disclosure documents for lenders.

One aspect of the Federal Reserve Board's Official Staff Commentary issued to clarify the conditions under which a lender may accelerate a loan clearly conflicts with HUD's program. In the absence of a payment default, fraud, or material misrepresentation by the borrower, HELCPA and its regulation permit acceleration of a loan only if the borrower's action or inaction "adversely affects the creditor's security ... or any right of the creditor in such security," 15 USC 1647(b)(3) and 12 CFR 266.5b(f)(2)(iii). Comment 2 states in part: "If the consumer moves out of the dwelling that secures that [open-end credit] plan, the creditor may not terminate a plan and accelerate the balance unless the consumer's action adversely affects the security."

In contrast, the FHA reverse mortgage program permits a lender to accelerate a mortgage, with HUD approval, when a borrower moves out under conditions which may not adversely affect the lender's security. One condition is that the property ceases to be the principal residence of a borrower for reasons other than death, and the property is not the principal residence of at least one other borrower. Another is that, for a period of longer than 12 consecutive months, a borrower fails to occupy the property because of physical or mental illness, he or she is not likely to return to the property, and the property is not the principal residence of at least one other mortgagor.

Payments to borrowers under the FHA reverse mortgage program are calculated on the assumption that the mortgage will become due and payable

under these conditions without additional showing of security risk. If the mortgage could not be accelerated under these conditions, the risk to the Department as mortgage insurer would increase, or payments to borrowers would have to be decreased. The Board's Staff Commentary conflicts with one of the basic premises of the program--namely, that elderly homeowners receive payments secured by a reverse mortgage only for as long as they occupy the mortgaged property. HUD's Office of General Counsel has concluded that lenders must follow the HUD regulations notwithstanding the conflict with the Commentary, but the conflict provides a potential defense to be raised in foreclosure based on non-occupancy and may expose lenders to enforcement actions by the agencies empowered to enforce the Board's regulations.

APPENDIX

PAYMENTS MODEL

I. Introduction

This appendix provides a technical explanation of the payments model developed for the Home Equity Conversion Mortgage (HECM) Insurance Demonstration. It presents the model in sufficient detail to allow actuaries, economists, and other specialists to replicate and evaluate the payments allowed under the program. It is also written to convey the model's basic concepts to executives and generalists within the finance community whose confidence in the soundness of the model is important to the success of the program.

Reverse mortgages present risks to both lenders and borrowers. The borrowers risk exhausting their home equity, while lenders risk earning less than the market rate of return on their investment. How these risks are managed directly affects the price of a reverse mortgage and its ultimate marketability.

Consider an individual lender operating in a regional market. Without mortgage insurance, this lender is unlikely to generate the volume or geographic dispersion necessary to minimize diversifiable risks in a reverse mortgage portfolio.¹ An uninsured lender who offered a reverse mortgage with all the features of an FHA-insured reverse mortgage would

¹ The lender's risk of earning less than market rate can be separated into two categories: non-diversifiable (or fundamental) risk, and diversifiable risk. An example of non-diversifiable risk is national economic recession which can cause property values to fall in all regional markets, thereby resulting in a larger than anticipated number of loan defaults (in the case of reverse mortgages, loan balances which exceed property values). Such risks cannot be reduced by geographic diversification, which is the process of distributing loans among many regional markets, because the nationwide recession affects all markets. In technical terms, the probabilities of loss due to national recession are interdependent. An example of diversifiable risk is regional economic recession in which one market area experiences falling property values due to declines in the industries which predominate that region's economic base. Geographic diversification reduces the risk in this case because not all regions are affected. That is, the probabilities of loss due to regional recession are independent. Another diversifiable risk is individual borrower longevity (causing the reverse mortgage balance to exceed property value without a recession). Diversification to reduce risk in this case requires a large volume of mortgages rather than geographic diversification. With a large volume, the independent probabilities of borrower longevity make losses quite predictable due to the law of large numbers.

have to add a substantial risk charge, reducing potential demand. If the same lender lowered the charge by offering a modified reverse mortgage which reduced the lender's risks, such as one which placed strict limits on the size of cash advances and which required repayment of the loan at the end of the term, demand would not necessarily increase because the modified mortgage increases the borrower's risk.

The HECM program was designed to manage both borrower and lender risks more efficiently. It allows lenders to offer elderly borrowers a mortgage with substantial borrower protections without a substantial risk charge. Lenders can lower the price of reverse mortgages because they are insured against losses arising from both diversifiable and non-diversifiable risks.

The demonstration is not a subsidy program, so the FHA must collect a premium to offset insurance losses, but FHA can achieve both high volume and geographic diversification, minimizing risks by pooling. The payments model equates the present value of the mortgage insurance premium expected to be collected with the present value of the losses expected to be incurred and solves for a principal limit factor used to calculate payments to borrowers. Section II describes the basic payments model which produced the factor table. Section III details the relationship between the factors and limits on cash advances to borrowers. Section IV deals with the key actuarial assumptions and the sensitivity of the model to changes in these assumptions. The mathematical derivation of the model's key equations appears in an annex to this appendix.

II. The Basic Payments Model

II-A. Introduction

This section presents the underlying assumptions and the mathematical equations of the HECM payments model. At the most basic level, the HECM program provides mortgage insurance to lenders who make cash advances secured by a mortgage and note to qualified elderly borrowers. The loans need not be repaid until the borrower moves, sells the property, or dies (although the borrower may prepay at any time). The debt is non-recourse, which means that when the mortgage is due and payable, the borrower owes no more than the value of the property; the lender may not seek repayment from other assets of the borrower or the borrower's estate.

Without mortgage insurance, a lender would not be repaid in full in the event that a mortgage balance grew to exceed the value of the property. With mortgage insurance, a lender may file a claim (within certain limits which are not relevant to the basic model) for the difference between the property value and the mortgage balance. As the economists would say, the insurance gives the lender a "put" option to sell the mortgage and note to the insurer at a "strike price" equal to the outstanding balance.

Due to the non-recourse nature of the debt, the value of the insurance (put option) is closely related to future levels of the debt and property

value. Assuming a fixed interest rate on the note and a schedule of cash advances to the borrower, future debt levels are predictable.² Future property values are not. Even if the long run annual average property appreciation rate is assumed constant, variations in individual property appreciation rates will result in significant deviations from the average. These deviations will grow wider the further into the future that estimates are to be made. Thus, the key component of the HECM payments model is its specification of the random, or stochastic, nature of future property values.

The remainder of Section II is organized into the following subsections. The first is an explanation of the stochastic process used to predict future property values. The next discusses mortgage insurance claims on both traditional mortgages and reverse mortgages. The next introduces the fundamental relationship of the payments model: the requirement that the value of the insurance (i.e. the investor's put option) to be less than or equal to premium revenue, and achieve equality, or break-even, only at maximum utilization. The next two subsections detail the actuarial basis of the fundamental relationship: one calculates the expected mortgage insurance premium; the other prices the option by computing expected losses. A final subsection defines maximum utilization of the principal limit and explains the accumulation of a premium reserve if utilization is less than the maximum.

II-B. Predicting Future Property Values

The model contains assumptions about future property values. Its most important assumption is that these values can be simulated by a stochastic geometric Brownian motion process. This process, based on probability theory, is often referred to as a log-normal random walk.³ According to

² After the basic model has been developed, the assumptions of fixed interest and specified cash advances will be relaxed.

³ To justify the specification of future property value as a geometric Brownian motion process, consider the mortgaged property as a zero-coupon "real" asset. This assumes the return on owner-occupied housing excludes imputed rent (a reasonable assumption because the mortgage insurer has no interest in imputed rent) and includes only the expected price inflation, μ , plus a stochastic term, σ , to describe deviations from expected inflation. The resulting differential equation ($dH/H = \mu dt + \sigma dz$) describes a geometric Brownian motion process if the inflation parameters, μ and σ , are constant. (Note that dH and dt are differentials of house value and time, respectively, and dz is the differential of a stochastic variable which is normally distributed with mean 0 and standard deviation 1). See Malliaris and Brock (1982), Chapter 4, for a discussion of stochastic inflation processes. Furthermore, see Cunningham and Hendershott (1984), or Epperson, Kau, Keenan, and Muller (1984) for their explicit use of the geometric Brownian motion process to model housing assets.

The geometric Brownian motion process can also be described by the

Ross (1983), geometric Brownian motion is useful in modeling when the percentage changes (and not the absolute changes) are assumed to be independent and identically distributed⁴.

following equation:

$$H(t) = H_0 e^{Y(t)},$$

where

$H(t)$ is the property value at some future time, t ,

H_0 is the initial property value,

$$Y(t) = \mu t + \Phi(t),$$

μt is the expected inflation, or drift term, and

$\Phi(t)$ is a standard Brownian motion, or Weiner process, with $E[\Phi(t)] = 0$ and $\text{var}[\Phi(t)] = \sigma^2 t$.

Note that because a standard Brownian motion $\Phi(t)$ is normally distributed for all $t > 0$, the distribution of $H(t)$ is log-normal for all $t > 0$. For more details of the mathematical properties of stochastic processes see Ross (1983).

⁴ Some would argue that annual percent rates of change in house price are not independent; rather, that they are serially correlated. Serial correlation means that the change in any given year is at least in part determined by the changes which occurred in previous years. Example: do two consecutive years of appreciation above (below) the mean imply that a third year of appreciation above (below) the mean is more likely than not to occur? The random walk model says no, while the serial correlation model says yes. Case and Schiller (1989) examine the efficiency of the real estate market, looking to find evidence of independent price changes (efficient market, random walk model applies), or serially correlated price changes. Although their study finds evidence of correlation in city-wide price indices over short time periods, it nevertheless is inconclusive with regard to accepting or rejecting the random walk model for predicting individual house price changes (the volatility of individual house prices was found to be of far greater magnitude than the serial correlation found in the index).

In a separate study, Case (1986) examined housing prices over time in a single market (Boston), concluding that prices in the mid 1980's clearly grew above levels that market "fundamentals" (i.e. population and employment growth, cost of construction, etc.) could explain. He offers the explanation of a temporary price "bubble", which occurs when expectations of future appreciation drives prices up (or down) without corresponding shifts in market fundamentals (for example, speculation). This results in serial correlation, at least in the short run. Such price bubbles are not believed to be sustainable over time. Gau (1987) also notes the existence of temporary price bubbles in real estate markets, but

Under the random walk assumption, each property's annual appreciation rate is treated as an independent observation of a normally distributed random variable with constant mean, μ , and standard deviation, σ . As will be discussed further in Section IV, the mean, or average, appreciation, μ , is assumed to be 0.04 (i.e., 4 percent annual rate), and the standard deviation of appreciation, σ , is assumed to be 0.10 (i.e. 10 percent annual rate). The geometric Brownian motion (or log-normal random walk) process is also referred to as a "diffusion" process because the cumulative appreciation rates of each property over time are also normally distributed, but with growing mean, μt , and standard deviation, $\sigma\sqrt{t}$ (where t is elapsed time expressed in years).

As Figure 1 illustrates, each property begins at a point value ($H_0 = 1.0$) which is the initial appraised value. Future point values of the property are unknown due to the random appreciation rates; however, the value distribution of a pool of properties is known due to the assumed distribution of the appreciation rates. Specifically, the growing mean and standard deviation of the cumulative appreciation rate causes the future value distribution to widen, or diffuse, as t increases. Figure 1 illustrates the diffusion by showing the locus of points on the house value axis for which cumulative appreciation rates are one standard deviation from the mean. (According to the properties of a normal distribution, 68 percent of the observed values should fall within one standard deviation of the mean.)

11-C. Mortgage Insurance Claims

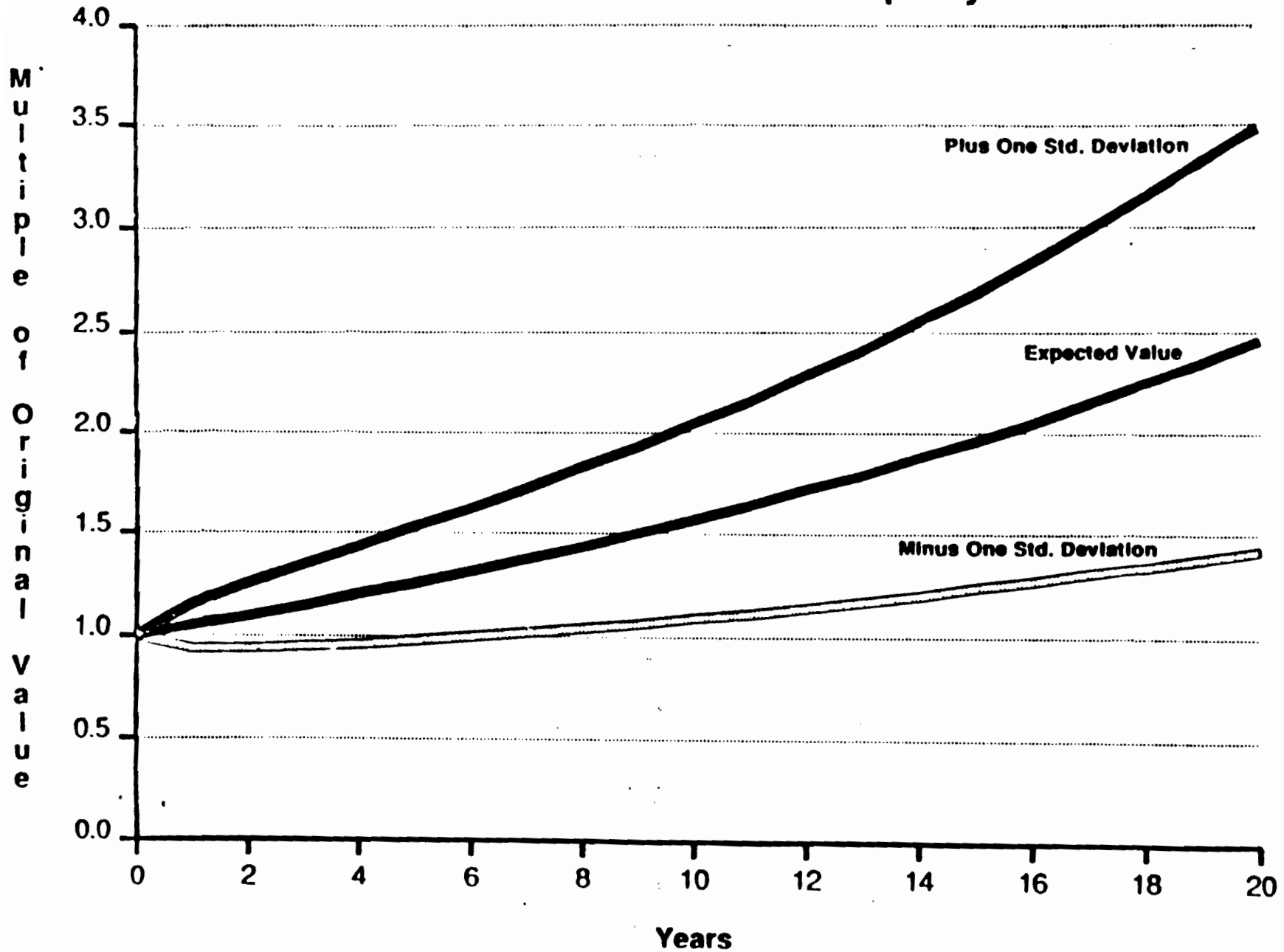
FHA mortgage insurance on traditional, or "forward", mortgages is similar to insurance on reverse mortgages in that both give the investor a put option to sell the loan to the FHA at par. The option may not be exercised while the borrower is in full compliance with the note. That is, as long as the forward mortgage borrower continues to make monthly payments, keeps the property in good repair, and meets all other terms and conditions of his or her mortgage and note, the investor has no valid claim to insurance benefits. The same applies to reverse mortgages: as long as the borrower remains in occupancy, keeps the property in good repair, and meets all terms and conditions of the note, the investor has no claim for mortgage insurance.⁵

goes on to conclude that studies have not been able to reject the hypothesis that real estate markets are efficient. If so, the random walk model may still be appropriate, particularly in the long run. (A long run perspective is appropriate for the HECM program because reverse mortgage insurance losses are "back loaded" in comparison to traditional, or "forward" mortgages, for which losses are "front loaded". HUD is currently undertaking a study of house price changes to fill some of the many gaps which exist in our knowledge of the subject.)

⁵ One exception is when the originating lender chooses the "assignment option" for receiving HECM insurance benefits. Under this option, the investor of record at the time that the loan balance grows to equal the

Figure I. Illustrative of the Log-Normal Diffusion Process for Future Property Values

$\mu = .10$



There is one important difference between forward and reverse mortgages in this regard. While there is a tendency for forward mortgages to default systematically during times when the borrower equity is negative (caused by a drop in property value),⁶ this is not likely to occur with reverse mortgages, because payments to the borrower are unaffected, and a borrower wishing to sell may be able to wait for values to improve. Terminations of reverse mortgages are expected to be actuarially predictable and not sensitive to equity declines.⁷ As a consequence, forward mortgage insurers experience a surge in claim rates during an economic down cycle; reverse mortgage insurers should find claims more evenly distributed between economic ups and downs.⁸

maximum claim amount has a brief window during which he may assign the loan and receive insurance benefits even though the borrower is in full compliance with the note agreement. The existence of the assignment option does not affect the discussion of the basic payments model.

⁶ For a review of the economics literature pertaining to forward mortgage default, see Neal (1989).

⁷ Under the option model of default, a borrower will exercise his option whenever the gains to default are greater than the costs. For traditional mortgages this is when the following inequality holds:

$$MV - H + R > C,$$

where $(MV - H)$ is the recapture of negative equity (MV is the market value of the mortgage, and H is the current value of the property), R is the free rent gained between default and foreclosure, and C represents transaction costs associated with default. See Foster and Van Order (1985). For reverse mortgages, the equation must be modified as follows:

$$(B - A) - H + R > C,$$

where $(B - A)$ is now the market value of the mortgage (B is the outstanding balance and A is the present value of future cash advances). The recapture of negative equity $(B - A - H)$ is never greater than zero due to the non-recourse nature of the FHA reverse mortgage note (unlike forward mortgages where the borrower may owe more than the property is worth). The free rent, R , is zero because the note already allows the borrower to remain in occupancy as long as he chooses. The left hand side of the equation never exceeds the right hand side; hence, there is no financial incentive for borrowers to terminate the mortgage during periods of negative equity.

⁸ There is likely to be some increase in reverse mortgage claims in such circumstances because more borrowers will find themselves in a negative equity position. However, without the systematic defaults brought on by negative equity, reverse mortgage claims should not increase nearly as much as forward mortgage claims.

Another major assumption of the model is that properties with loans remaining in force will keep the log-normal distribution.* The property values of forward mortgages which terminate (both claim and non-claim terminations) are not usually representative of the value distribution of the pool. Instead, properties with below average appreciation are over-represented, and the properties with loans remaining in force no longer have the log-normal value distribution. They have a distribution resembling the log-normal but with a greatly reduced low value tail due to defaults. The property values of reverse mortgages which terminate (both claim and non-claim terminations) will be much more representative of the value distribution of the pool because they will terminate largely for actuarial reasons.

Preservation of the log-normal distribution for loans remaining in force will make the task of pricing reverse mortgage insurance easier as will be shown below. A mathematical value estimate of the reverse mortgage insurance option can be derived from the properties of the log-normal price distribution. Traditional mortgage insurance must be valued by another method. Such methods include extrapolation of past claim experience, or option models which rely on simulation rather than mathematical techniques. The extrapolation method is not possible for reverse mortgages due to the lack of past claim experience, and the simulation method, while possible, would be cumbersome.

II-D. The Fundamental Relationship

The fundamental relationship of the basic payments model requires the present value of the mortgage insurance on a pool of mortgages to be less than or equal to the present value of the premium collected. If, at each future point in time, the expected loss due to payment of insurance claims and the expected premium based on a declining number of mortgages remaining in force can be estimated, then the fundamental relationship can be expressed as follows:

$$\sum_{t=0}^{\infty} \{ E[L(t)] (1+i)^{-t} \} \leq \sum_{t=0}^{\infty} \{ E[MIP(t)] (1+i)^{-t} \}, \quad (1)$$

where

$E[\cdot]$ is the expected value operator,

$L(t)$ is the loss incurred in period t ,

i is the periodic discount rate,

* Some systematic terminations of reverse mortgages may occur among those borrowers whose equity increases due to unusually high appreciation. These borrowers may refinance their reverse mortgages or convert the increased equity to cash by selling the property. To the extent that this occurs, the policies in force may deviate from the log-normal distribution.

$MIP(t)$ is the mortgage insurance premium collected in period t , and,

t is an arbitrary unit of time, which we define as months. Note that the summations from month zero to infinity reflect the fact that HECM mortgages have no stated maturity.

The loss function, $L(t)$, and the premium function, $MIP(t)$, from expression (1) are actually functions of several variables. The borrower's initial age, the initial property value, the interest rate charged on cash advances, and the amounts and timing of cash advances all affect these estimates. They are shown as functions of time only in expression (1), because, in the basic model, initial age, initial property value, interest rate, and pattern of cash advances are assumed before applying the fundamental relationship. Once the specification of the basic model is complete, the effects of changing all these variables will be discussed (Section III).

Note that expression (1) is not an equation, but rather an inequality. Equality between the two summation terms is achieved only when the borrower receives the maximum cash advances to which he or she is entitled. For example, consider a borrower of given age, with a given property value and interest rate. If this borrower wanted to receive a single cash advance from the lender on the first day of the mortgage, forgoing any future cash advances from the lender, what is the maximum amount he or she could receive? The answer is the largest amount for which expression (1) still holds. At the maximum, the expression will be an equation. Therefore, by replacing the inequality sign in (1) with an equal sign, we can solve for the desired maximum cash advance. To accomplish this, we need to develop the equations that will allow us to evaluate both sides of the fundamental relationship.

II-E. Expected Mortgage Insurance Premium

In designing the HECM program, a uniform premium structure was adopted. Risks could have been managed using a risk-adjusted premium structure, but this option was rejected in favor of the fixed premium structure (to avoid confusion among lenders used to fixed premiums under FHA programs). This premium structure is 2 percent of the initial property value paid up-front, plus 1/2 percent (50 basis points) annually (but billed monthly) on the growing loan balance.¹⁰ The up-front portion is paid at the time of loan settlement or closing; hence, it is certain to be collected. The 50 basis point annual premium is to be paid in the future

¹⁰ The HECM program places a limit on the amount of initial property value that can be considered when determining maximum payments to borrowers. This limit is used to determine a quantity defined as the "maximum claim amount", which is the lesser of the initial property value or the program limit for the locality. Therefore, the up-front portion of the premium will actually be 2 percent of the maximum claim amount. For purposes of specifying the basic model, this distinction is not relevant.

and will be collected as scheduled only if the loan remains in force. For a pool of mortgages, varying amounts of premium will be collected depending on how long each mortgage remains in force. The expected mortgage insurance premium, representing an estimate of the average premium collection over all mortgages in the pool, can be calculated using a prepayment function that gives loan survival probabilities over time. Such a function is described below.

Let l_{x-t} be the probability that a HECM loan originated by a borrower with initial age x is still in force t months after origination. If we could specify these probabilities, then the expected premium in month t would be given by equation (2):

$$E[MIP(t)] = l_{x-t} MIP(t), \quad (2)$$

where

$MIP(t)$ is the scheduled MIP in month t , and

l_{x-t} is as defined above with additional properties discussed below.

Note that $l_x = 1$ because all loans are in force at the time of origination ($t = 0$). If T is the month in which the borrower will turn 100 years old, then by assumption we have $l_{x+T} = 0$. The latter assumes that all loans will be terminated by the time the borrower attains age 100, placing an actuarial limit on the summation terms in expression (1). The intermediate values l_{x-t} (for $0 < t < T$) are probabilities between 1 and 0. They resemble an actuarial life table for borrowers between the ages of x and $x+T$. The probabilities are in fact smaller than the borrowers' actuarial survival probabilities to account for loan prepayments and terminations for reasons other than death of the borrower.

The model uses the U.S. Decennial Life Tables for 1979-81 (DHHS Publication No. [PHS] 85-1150-1) to compute the l_{x-t} . These tables are sometimes referred to as the "general population" life tables. The female table is used because female life expectancy is longer than that of males, most HECM applicants are expected to be single females, and the establishment of separate HECM factor tables for males and females (with corresponding differences in maximum cash advances by gender) would violate equal credit opportunity laws. The issues involved in the choice of a life table upon which to base the loan survival probabilities are discussed in Section IV. The remainder of this section will focus upon the numerical techniques involved in transforming the life table into the probabilities in equation (2).

Figures in the life table must be adjusted and interpolated to produce the required monthly probabilities. First, the figures are adjusted for loan terminations for reasons other than death of the borrower by multiplying them by a "move-out factor". The move-out factor is based on data on the general elderly population which show that elderly homeowners have move-out rates that decline with advancing age when expressed as a

percentage of the age-specific death rate (see Jacobs (1988)). Based on data from several sources, Jacobs estimated move-out rates ranging from 519 percent of mortality for the 65-69 year olds down to 47 percent of mortality for those 85 and over. It appears that the younger elderly frequently move into housing suitable for their retirement years, while the older elderly generally move only when they can no longer maintain a home or receive the services that they need. Since the HECM program provides an incentive to remain in the home, move-out factors paralleling the general population rates would be too high. Instead, the HECM payments model uses a constant rate of 30 percent for all ages. This rate is less than that for those 85 and over in the general population, and as such was believed to be sufficiently conservative.

Second, the figures are converted into survival probabilities. The life table used, entitled "number living at beginning of age interval," is defined as follows. For each age in whole years, the table starts with a hypothetical cohort of 100,000 live female births, and shows the number who will survive to each age. For example, the table shows that 67,186 females will survive to age 75, and 64,910 will survive to age 76. For a 75-year-old HECM borrower, the probability of attaining age 75 is 1 (he or she has already attained that age). To compute all future annual survival probabilities for the 75-year-old, the table entries for all subsequent years must be divided by 67,186. Thus, the probability of a 75-year-old surviving to age 76 is 0.9661 ($64,910 \div 67,186$). For a 65-year-old HECM borrower, the probability of surviving to age 76 is only 0.7772 ($64,910 \div 83,520$, where 83,520 represents the number of survivors at age 65).

The model computes annual survival probabilities, $S_{i,j}$, as described above for $i = \{62, 63, \dots, 99\}$, and $j = \{i, i+1, \dots, 100\}$. Note that i is the initial age in years, while j is the attained age in years. Note also that $S_{i,i} \equiv 1$, and $S_{i,101} \equiv 0$ for all i . To convert these annual borrower survival probabilities into monthly loan survival probabilities, $L_{i,j}$, we use the following equation which both interpolates geometrically and adjusts for move-outs:

$$L_{i,j} = (S_{i,j} [S_{i,j+1}/S_{i,j}]^{r/12})^{12m}, \quad (3)$$

where

- i = initial age in years = $\{62, 63, \dots, 99\}$,
- j = attained age in full years = $\{i, i+1, \dots, 100\}$,
- x = initial age in months = $12i$,
- t = attained age minus initial age in months = $12(j-i)+r$,
- r = months between attained ages j and $j+1 = \{0, 1, \dots, 11\}$,
- and
- m = move-out rate expressed as a decimal = 0.3.

Using the earlier example of the 75-year-old borrower, we compute the initial loan survival probability as:

$$l_{x-1} = (1.0 [0.9661 \div 1.0]^{0/12})^{1.3} = 1.0 ,$$

where $i = 75$, $j = 75$, and $r = 0$. The loan survival probabilities estimated for the next two months are:

$$l_{x-1} = (1.0 [0.9661 \div 1.0]^{1/12})^{1.3} = 0.9963 , \text{ and}$$

$$l_{x-2} = (1.0 [0.9661 \div 1.0]^{2/12})^{1.3} = 0.9926 ,$$

where i and j are again 75, but $r = 1$ and 2, respectively.

II-F. Expected Losses

Perhaps the key component of the HECM model is the technique used to evaluate the investors' put option contained in the mortgage insurance contract. The value of this option for a given initial age of the borrower, initial property value, interest rate on cash advances, and pattern of cash advances depends on the loan survival probabilities, l_{x-r} , as described above, and on the mathematical properties of the stochastic process assumed for predicting future house prices. Since investors are likely to exercise their option whenever optimal to do so, its value is the present value of expected insurance claim losses. A loss occurs on those loans which terminate at a time when the outstanding balance exceeds the house value.

Let $B(t)$ represent the outstanding balance on the mortgage at time t . If the mortgage is terminated during time t (either due to death of the borrower or other reason), and if the value of the house is greater than $B(t)$, then there is no loss. But, if the mortgage is terminated at time t , and the house value is less than $B(t)$, there is a loss. The magnitude of the loss, if one occurs, is denoted $L(t)$. It is estimated to be the difference between the amount owed, $B(t)$, and the conditional expected value of the house given that the value is less than $B(t)$.

Since only a small percentage of the loans in a pool will incur a loss during a particular month, we need to compute the expected loss for each month into the future. The expected loss at time t is an average loss for all loans in the pool. It is denoted $E[L(t)]$. It is computed as the amount of loss, $L(t)$, from above times the likelihood of such a loss at time t . The latter is estimated to be the probability of termination multiplied by the probability that the house value is less than the balance, both evaluated at time t . A method of calculating all of these amounts is presented below.

The probability of loan termination at a given time is analogous to the calculation of the probability of death from an actuarial survival table. Let d_t denote the probability of loan termination during month t . Then, from the properties of the loan survival probabilities, l_{x-r} , as previously defined, we have:

$$d_t = L_{t-1} - L_{t-2}. \quad (4)$$

To compute the probability that the house value is less than the balance, $B(t)$, we first define $b(t) = B(t)/H_0$, where H_0 is the original property value. Recall from the discussion of the geometric Brownian motion process that the cumulative appreciation rate (i.e., the natural log of $H(t)/H_0$) is normally distributed with mean μt and standard deviation $\sigma\sqrt{t}$. Utilizing the probability density function of the normal distribution (see equation A-2 in the annex to this appendix), we express the desired probability as:¹¹

$$A(t) = [1/(\sigma\sqrt{t} \sqrt{2\pi})] \int_{-\infty}^{\ln(b(t))} e^{-((y-\mu t)/\sigma\sqrt{t})^2} dy. \quad (5)$$

Equation (5) represents the area under the normal probability density function to the left of the value $\ln[b(t)]$. The model uses numerical approximation methods (Simpson's rule¹² for example) to evaluate the improper integral.

In order to express the conditional expected value of the house given that the value is less than $B(t)$, we first find an expression for the unconditional expected value of the house at time t . The mean, or unconditional expected value, of the house is derived in the Annex and is given by:

$$E[H(t)] = H_0 e^{\mu t + \frac{1}{2}\sigma^2 t}. \quad (6)$$

Intuitively, equation (6) represents the mean of the entire log-normal house price distribution at time t . The conditional expected value is similar in concept, except that it represents the mean of only the left tail of the log-normal distribution, up to the value $B(t)$. Thus, the conditional expected value is always less than the unconditional expected value. In fact, it is calculated by multiplying the unconditional expected value from equation (6) by a factor β . This factor ranges in value from zero to one (i.e., $0 < \beta < 1$), and is calculated by numerical evaluation of a second improper integral:

¹¹ Note that the constants μ and σ were previously defined as annual rates ($\mu = .04$ and $\sigma = .10$), but in expression (1) we defined the unit of time to be months. Hence, the values of μ and σ appearing in equations (5) through (8) must be converted to monthly equivalents: $\mu = .04 \div 12 = .003333$, and $\sigma = .10 \div \sqrt{12} = .02887$.

¹² See Press, Flannery, Teukolsky, and Vetterling (1986), Chapter 4.

$$\beta = [1/A(t)] [1/\sqrt{2\pi}] \int_{-\infty}^{U(t)} e^{-\frac{1}{2}(y-\mu)^2/\sigma^2} dy, \quad (7)$$

where

$$U(t) = \{\ln[b(t)] - \mu t\}/\sigma\sqrt{t}, \text{ and}$$

$A(t)$ is given in equation (5).

Equation (7) is derived in the annex to this appendix. Using this result, we now have an expression for the conditional expected value of the house, $H(t)$, given that the value is less than $B(t)$:

$$E[H(t)|h < B(t)] = E[H(t)] \beta = H_0 e^{i t} e^{-i t} \beta. \quad (8)$$

Using equations (4) through (8) we can express the expected loss at time t succinctly as the product of three terms:

$$E[L(t)] = \{B(t) - E[H(t)|h < B(t)]\} [d_t] [A(t)]. \quad (9)$$

II-G. Principal Limit Factor

Equations (1) through (9) specify the basic HECM payments model. Given the initial age of the borrower, the initial property value, a fixed rate of interest accrual on cash advances, and an assumed pattern of cash advances, an insurer can use the basic model to underwrite the reverse mortgage loan. The insurer chooses the stochastic parameters to use in the model (μ and σ), as well as the survival probabilities ($S_{t,s}$), the move-out factor (m), and the discount rate (i). If analysis of a loan application indicates that the fundamental relationship is valid (i.e. expression (1) holds), then the loan is acceptable for insurance. If not, then the present value of cash advances must be reduced (either by nominal reduction in payment amounts, or by real reduction--i.e. deferral of payments into the future). Insurance risk is managed in the model by limiting the present value of cash advances because borrower age, property value, and interest rate are not generally within the control of the insurer.

Although the basic model may be used to analyze any pattern of cash advances to the borrower, one particular pattern is worthy of detailed analysis. This is the case in which the borrower receives the maximum cash advance in a lump sum on the first day of the mortgage, and receives no further cash from the lender at any time in the future. One advantage of analyzing this pattern of cash advances is that its present value is equal to its nominal value. Management of risk through changes in the present value of cash advances is greatly simplified in this case. Excessive risk can be made acceptable by a simple reduction in the nominal value of an up-front lump sum cash advance. If expression (1) does not hold, then reduce the amount of the advance until it does.

The maximum up-front cash advance is the amount for which strict equality exists in expression (1). For any given borrower age and interest rate, the ratio of this cash advance to the initial property value remains

constant for all property values,¹³ and is called the **principal limit factor**. Multiplying the principal limit factor by the initial property value produces the principal limit--the maximum up-front cash advance for this borrower.

To illustrate, Table I shows that .416 is the principal limit factor for a 75-year-old borrower when the interest rate is 10 percent. Using a house value of \$100,000 as a round number (any value would work), the table shows annual cash flows over 25 years. The principal limit of \$41,600 ($.416 \times 100,000$) consists of the \$2,000 initial mortgage insurance premium paid on behalf of the borrower plus the net amount of \$39,600 cash received by the borrower. (Note that the borrower could have received \$41,600 in cash if the MIP were paid out of pocket. In either case, the initial balance on the loan is limited to \$41,600). The table then lists end of year calculations of equations (3), (5), (6), and (8). Finally, it shows the annual expected MIP and expected losses for a pool of identical mortgages, along with the present values of these amounts (discount rate = 9.5%). Note that the sum of the present values of the expected MIP and the sum of the expected losses both equal approximately \$4230.

If the borrower had opted to receive less than the \$41,600 up-front, then the an excess of premium would be collected. For example, had the borrower taken only \$31,200 (75 percent of the maximum), the present value of expected premium would be \$3674, but the present value of expected losses would be only \$1510, an excess of \$2164. Conversely, had the borrower been given an amount above the \$41,600, there would be a shortfall in the premium collection. The insurer will accept loans for which borrowers receive an amount less than or equal to the maximum and will refuse the others.

Of course, not every borrower is likely to request cash advances up-front in a lump sum. Some may want level monthly payments for a specified time (term mortgage). Others may want level payments for as long as they occupy the home (tenure mortgage). Others may not want monthly payments at all, opting instead for a line of credit. Finally, some may want to combine reduced monthly payments with a small up-front lump sum or line of credit. The basic model could be used to analyze premium and loss expectations for virtually any pattern of cash advances. Unfortunately, there are too many possible cash flow patterns to have a maximum utilization factor (such as the principal limit factor discussed above) for each. The next section shows a way to use the principal limit method to simplify the analysis of different cash advance patterns. The method is an approximation, so there will be minor differences between the limits determined using the principal limit and those using the basic model. But the deviation from the fundamental relationship in expression (1) will be small, and the simplicity and flexibility gained will be significant.

¹³ This is true in the basic model which assumed no limitation on the value of the property for determining payments. In the HECM program, there is a limit on the property value. Therefore, the ratio will be constant for property values less than or equal to the limit.

Table 1

Home Equity Conversion Mortgage Insurance Deduction - Payments Model Illustration
 Verification of Principal Limit Factor

Loan Terms: Borrower Age: 75 Closing Costs: 1500 (Included in Cash Advance)
 Interest Rate: 10.0 Servicing Fee: 0
 House Value: 100000 Principal Limit Factor: 0.416
 Maximum Claim Amount: 100000

year	----- Individual Mortgage Cash Flows -----					----- End of Year Calculations -----				----- Mortgage Pool Averages -----			
	Begin Balance	Cash Advances	Interest Accrued	HIP Paid	End Balance	House Exp Val	Probability	Condit > Val	Exp Val	L(x)	--Expected HIP-- Nominal	--Expected Loss-- Pres Val	Nominal
0	-	30600	-	2000	41600	100000	0.0000	-	1.0000	2000	2000	0	0
1	41600	0	4368	218	48184	104603	0.0000	-	0.9562	214	205	0	0
2	46184	0	4848	242	51274	109417	0.0000	-	0.9104	227	197	0	0
3	51274	0	5382	269	56925	114454	0.0000	54757	0.8625	239	189	0	0
4	56925	0	5974	299	63198	119722	0.0010	59878	0.8122	251	181	0	0
5	63198	0	6633	332	70183	125232	0.0068	65392	0.7595	261	171	1	0
6	70183	0	7364	368	77895	130998	0.0228	71323	0.7045	270	161	4	2
7	77895	0	8175	409	86479	137026	0.0540	77685	0.6476	277	150	18	8
8	86479	0	9076	454	96009	143333	0.1011	84494	0.5885	281	139	43	21
9	96009	0	10077	504	106590	149930	0.1618	91783	0.5310	283	127	97	44
10	106590	0	11187	558	118336	156831	0.2319	99503	0.4730	282	115	187	76
11	118336	0	12420	621	131377	164050	0.3072	107726	0.4160	277	103	318	118
12	131377	0	13790	689	145856	171601	0.3836	116439	0.3606	269	91	496	187
13	145856	0	15308	765	161929	179499	0.4580	125650	0.3080	257	79	712	219
14	161929	0	17040	855	179774	187781	0.5283	135364	0.2592	242	68	953	268
15	179774	0	18969	943	199586	196403	0.5930	145587	0.2148	224	57	1205	308
16	199586	0	20948	1047	221581	205443	0.6514	156321	0.1748	205	47	1459	338
17	221581	0	23258	1163	246000	214699	0.7033	167569	0.1393	183	39	1700	358
18	246000	0	25819	1291	273110	224791	0.7489	179334	0.1085	160	31	1893	363
19	273110	0	28665	1433	303208	235137	0.7885	191620	0.0826	137	24	2012	351
20	303208	0	31823	1591	336622	245980	0.8228	204430	0.0615	115	18	2047	325
21	336622	0	35330	1767	373719	257281	0.8517	217789	0.0448	94	14	2001	289
22	373719	0	39224	1961	414904	269123	0.8764	231644	0.0317	75	10	1878	247
23	414904	0	43547	2177	460628	281511	0.8973	246063	0.0219	58	7	1689	202
24	460628	0	48348	2417	511391	294488	0.9148	261037	0.0149	45	5	1487	160
25	511391	0	53672	2684	567747	308022	0.9288	276578	0.0000	33	3	3908	373

Present Value Expected Total Premium: 4231
 Present Value Expected Total Losses: 4233

III. Determining Cash Advance Payments

Section III deals with the relationship between the basic model and the calculation of cash advances to borrowers using the HECM payments model. The first subsection defines the principal limit, and the second, the expected average mortgage rate and the discount rate. The next subsection gives the equations for calculating term and tenure payments from the principal limit--i.e., "the principal limit method." Next comes a comparison of the cash flow patterns produced by the principal limit method and the basic model, which shows that the method provides a good approximation to the basic model. The final subsection shows how a premium reserve sufficient to cover administrative expenses and a risk charge may result from likely cash flow patterns.

III-A. Principal Limit Defined

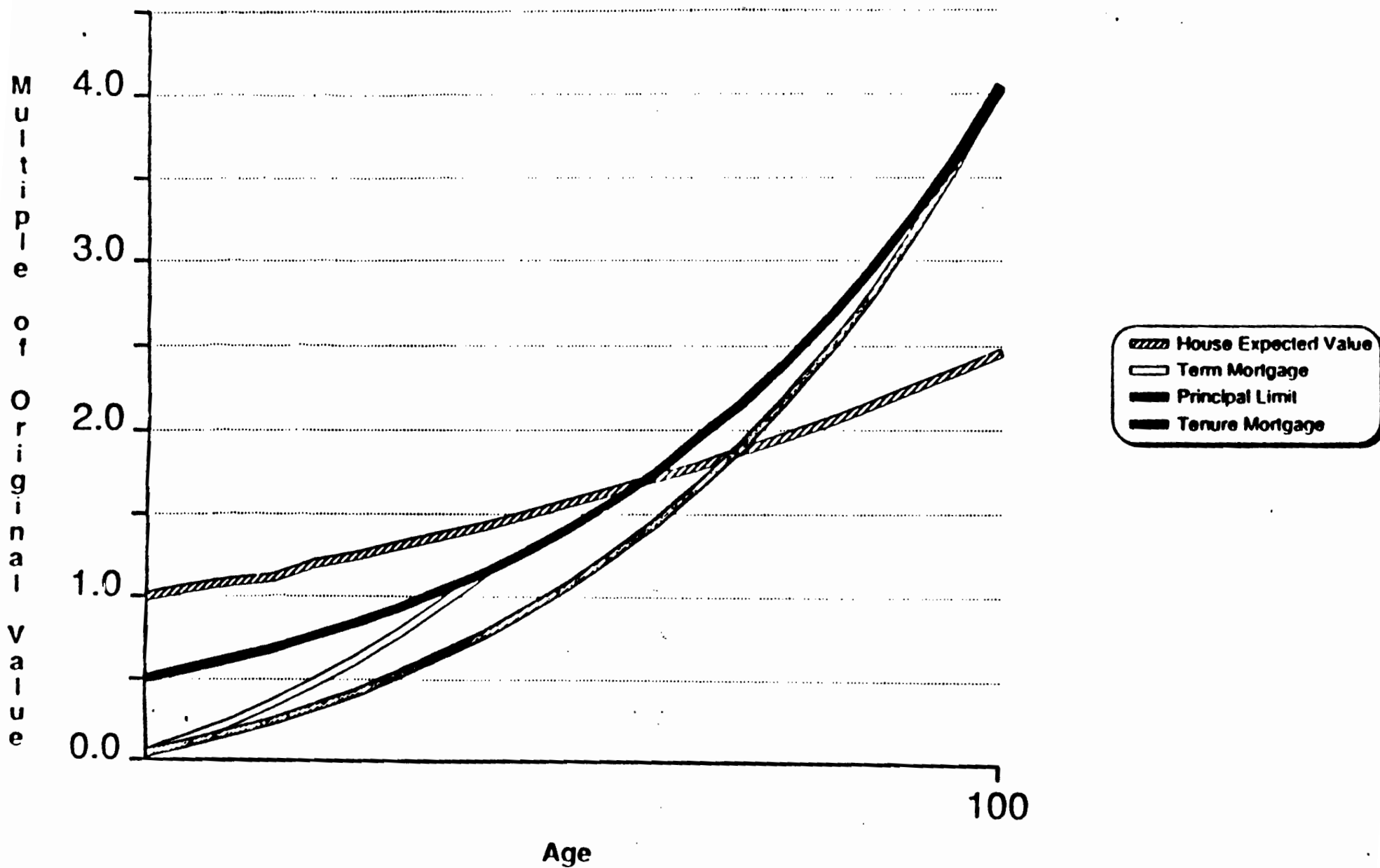
In Section II describing the basic model, the principal limit factor for a given borrower age and interest rate was defined as a loan-to-value ratio--i.e., as the ratio of the maximum up-front cash advance to the initial property value. The HECM payments model uses the same factors as the basic model. The principal limit is calculated by multiplying the principal limit factor by the maximum claim amount, defined as the lesser of the initial property value or the maximum mortgage amount that FHA can insure for a one-family dwelling in the area (i.e., the Section 203(b) mortgage limit).

The principal limit is an increasing function of time. The initial principal limit is the maximum up-front cash advance, given the borrower's age, an interest rate, and the maximum claim amount. The future values of the principal limit represent the outstanding balance on the loan assuming the borrower received the maximum up-front cash advance. As we shall see, the key concept in the "principal limit method" is the definition of the principal limit as the upper bound of the loan balance at any point in time for all patterns of cash advances.

Figure 2 illustrates the relationships between the principal limit, the expected value of the property, and loan balances for term and tenure cash advance patterns. At origination, the principal limit is less than the initial property value. The initial principal limit is the maximum up-front cash advance. If the borrower receives this amount up-front, forgoing any future cash advances from the lender, then the loan balance would follow the principal limit curve over time. The principal limit curve, thus defined, is also the maximum loan balance for term, tenure, or line-of-credit cash advance patterns. If the borrower lives long enough, the principal limit (and the maximum loan balance) eventually grows to exceed the expected property value.

If the borrower elected to receive cash advances in equal monthly installments under a term or tenure payment plan, then the initial loan balance would be much lower than either the initial property value or the

Fig. 2. House Expected Value, Principal Limit, Term and Tenure Mortgage Balances



principal limit. The initial loan balance on term and tenure payment plans equals any financed loan closing costs. Notice how the loan balances for term and tenure mortgages in the early years of the loan grow at a faster rate (i.e., have a greater slope) than the principal limit curve. This is because the principal limit curve is growing only by accrued interest and mortgage insurance premium. The term and tenure balances are growing by accrued interest, mortgage insurance premium, and by the monthly cash advances to the borrower. Note also that the term loan balance grows to equal the principal limit at the end of the term. When this occurs, no further cash advances are available to the borrower, and future balances on the term loan follow the principal limit curve. The tenure loan balance converges with the principal limit only when the borrower's age is 100. Thus the tenure mortgage is similar to a term mortgage in which the term was calculated to expire at age 100.

If the borrower elected a line-of-credit mortgage rather than up-front cash or regularly scheduled monthly cash advances, the borrower may request cash advances in any amount desired and at any time subject to the principal limit. That is, whenever the loan balance, including cash advanced plus accrued interest and MIP charges, reaches the principal limit, the line-of-credit is exhausted. At this point the borrower may not receive any further cash, but may continue to reside in the property. Once the line-of-credit is exhausted, the loan balance follows the principal limit curve. Note that the cash advance pattern in which the borrower receives the maximum up-front amount is actually a special case of the line-of-credit mortgage. In this case the borrower exhausts the line-of-credit on the first day by withdrawing the full amount of the initial principal limit.

III-B. Interest Rates

Up to this point, the definitions of principal limit factor and principal limit have assumed that the interest rate on the loan was fixed. The HECM program allows the loan rate to be adjustable, and it is expected that most loans will have this feature. The reason is that a fixed rate reverse mortgage exposes the lender (investor) to a considerable amount of interest rate risk by requiring funds to be advanced to borrowers in the future at today's rate. The cost of the lender's interest rate risk will be passed along to borrowers, making unsubsidized mortgages prohibitively expensive in most instances. Consequently, most lenders will offer only less costly adjustable rate loans.

Adjustable rate HECM loans will have initial rates equal to a specified interest rate index plus a fixed margin. The index is the one-year Treasury rate¹⁴, while the margin is set by agreement between the

¹⁴ The index actually used is the most recent weekly average yield for U. S. Treasury bonds and notes, adjusted to a constant maturity of one year, as determined by the U. S. Treasury and published by the Board of Governors of the Federal Reserve. References in the text to the ten-year Treasury rate are similarly defined except that the weekly average yields

borrower and the lender at the time of closing. Future adjustments to the loan rates will be determined by the index rate at the time of the adjustment, plus the margin, with interest rate adjustment caps and ceilings as prescribed in the loan agreement.¹⁵

How does the HECM payments model deal with adjustable rate loans when the basic model requires a fixed interest rate to calculate the principal limit factors? To answer this question, we borrow from a model which describes the term structure of interest rates. Richard (1978) shows that under an assumption called the "expectations hypothesis," the equilibrium yield¹⁶ on a long term default-free bond (such as a ten-year Treasury security) equals the average of expected future short-term yields over the same time period. That is, under the expectations hypothesis, the ten-year Treasury yield is an estimate of the average combined yields of the current one-year Treasury plus nine expected future one-year Treasury yields.¹⁷

An alternative to the expectations hypothesis is the "liquidity preference theory." This alternative states that due to the uncertainty of future interest rates and to the generally risk-averse nature of investors, the yield on longer term securities must contain a liquidity, or risk, premium to induce investors to hold them instead of shorter term securities. The two theories are not mutually exclusive. When combined with the expectations hypothesis, the liquidity preference theory implies that the ten-year Treasury yield is greater than the average combined

are adjusted to a constant maturity of ten years.

¹⁵ For HECM's which provide for annual adjustments of the loan rate, the annual adjustment cap is 2 percent, and the life of the loan ceiling is 5 percent. For HECM's which provide for monthly adjustments of the loan rate, there is no monthly adjustment cap, and the life of the loan ceiling is determined by agreement between the borrower and the lender.

¹⁶ Equilibrium in this context refers to standard arguments in which bonds and derived securities are priced to avoid arbitrage opportunities.

¹⁷ To be precise, two points must be clarified regarding the expectations hypothesis. The first is that the equilibrium condition actually applies to default-free discount bonds as opposed to coupon bearing Treasuries due to the distortions caused by taxation. This distortion is minimized by averaging the yields of various coupon Treasury notes and bonds having a specified average maturity. The second is that the equilibrium yield for such bonds (of any maturity) equals the expected average of all future spot rates during the remaining term of the bond. (The current spot rate is the instantaneous risk-free interest rate. Future spot rates are unknown, but investors make assumptions about them which are reflected in their pricing of bonds of various maturity. The latter gives rise to the Treasury yield curve. See Richard (1978)). Thus the ten-year Treasury yield equals the average of current and future one-year Treasury yields, as derived from the yield curve and investor expectations of future spot rates.

yields of the current and future one-year Treasury yields by an amount equal to the liquidity premium.¹⁸

The HECM model makes use of the above theories to define a fixed interest rate proxy called the **expected average mortgage rate**, or **expected rate**, for all loans. For fixed rate loans, the expected rate is simply equal to the fixed rate. For adjustable rate loans, the expected rate is an estimation of the average loan rate over the first ten years of the loan. Since the rate to be averaged is the one-year Treasury rate plus a fixed margin (subject to caps and ceilings as previously indicated), the expected rate is defined as the ten-year Treasury rate at the time of closing plus the same margin. This proxy represents the market's best estimate of the average adjustable loan rate over the specified period.

The expected rate is the fixed interest rate used to calculate the principal limit factor. It is used in the basic model to predict future loan balances, as well as to determine the discount rate (see below). On fixed rate HECM loans, this represents no change. On adjustable rate loans, the expected rate allows the principal limit factor to be estimated without complicating the model with variations in interest rates. The factor determined with the expected rate is generally lower than if the initial adjustable rate were entered into the model as a fixed rate. The reason is that the expected rate is usually higher than the initial loan rate (just as the ten-year Treasury rate usually exceeds the one-year Treasury rate, reflecting market expectations and liquidity preferences). A higher rate in the basic model makes loan balances accrue faster, resulting in higher expected losses, and therefore, a lower principal limit factor.¹⁹

In addition to determining the principal limit factor, the expected rate is also used to compute future values of the principal limit, as illustrated in Fig. 2. Even though loan balances will accrue interest at the variable loan rate, all future values of the principal limit will be determined using the fixed expected rate. This means that on adjustable rate loans, the actual loan balances may eventually exceed the principal limit curve if loan rates exceed the expected rate. Furthermore, the limits on monthly term or tenure payments and cash advances on line-of-credit mortgages will be derived from the principal limit and the expected rate. This will be discussed in detail in the next sub-section.

¹⁸ According to Richard (1978), there are some economists who believe that the liquidity premium can be negative in certain circumstances, particularly when future consumption is valued more highly than present consumption. For purposes of the HECM model, the assumption is that there is more likely to be a positive liquidity premium than a negative one.

¹⁹ Note that the definition of expected rate does not attempt to remove the liquidity premium from the 10-year Treasury rate. The inclusion of the premium, which is generally believed to be a positive amount, raises the expected rate, thereby lowering the principal limit factor. The liquidity premium becomes, in effect, a risk premium which protects the insurer from interest rate fluctuations that differ from expectations.

One final definition must be given before the equations of the "principal limit method" can be introduced. This is the discount rate used in the basic model. **The discount rate, like the expected rate, is a fixed rate that does not change over the life of the loan.** It is defined to be the expected rate minus one half percent (50 basis points). For fixed rate loans, this is equivalent to the loan rate minus one-half percent. Since reverse mortgage fixed rates are likely to be set by lenders at some margin above the ten-year Treasury rate, the discount rate for all HECM's can be considered to equal the 10-year Treasury rate plus a margin minus one-half percent. Depending on the size of the margin, the discount rate will generally be a little greater than the 10-year Treasury rate.

III-C. Equations of the Principal Limit Method

We are now ready to discuss the equations that govern maximum cash advances to borrowers under the HECM payments model. The model incorporates equations (1) through (9) of the basic model, which produced the principal limit factors. However, the HECM payments model includes three additional equations, given below, to derive the maximum cash advances for all types of HECM loans.

We begin with a formal definition of the principal limit. The principal limit at any time t is given by:

$$PL(t) = F(x,R) MCA (1+c)^{-t}, \quad (10)$$

where

$PL(t)$ is the principal limit at time t ,

$F(x,R)$ is the principal limit factor for a borrower of age x and fixed interest rate, R , which equals the expected rate,

MCA is the maximum claim amount, which is lesser of the property value or the FHA maximum insurable mortgage for the area,

c is the periodic compounding rate which equals the expected rate, R , plus the 1/2 percent annual mortgage insurance premium charge converted to a monthly rate, and

t is the number of months after loan origination ($0 \leq t \leq T$), with T being the value of t for which the borrower turns 100 years old.

Note that at origination ($t=0$), the principal limit is equal to the principal limit factor times the maximum claim amount as we would expect. Table 2 illustrates the calculation of principal limit at origination and at selected time periods after origination.

TABLE 2

Estimated Principal Limits at Origination and at Selected Time Periods after Origination*

(Expected) Interest Rate: 10 %
Appraised Value = \$ 100,000

Age	At Origination	- - Months after Origination - -		
		<u>60</u>	<u>90</u>	<u>120</u>
62	\$ 24,700	41,659	54,102	70,262
65	28,000	47,225	61,331	79,650
70	34,200	57,682	74,911	97,286
75	41,600	70,163	91,120	118,337
80	50,000	84,330	109,519	142,231
85	58,900	99,341	129,013	167,549

* Assumes:

Appraised value is within FHA max. mortgage amount for area.
Interest rate on loan may be fixed or adjustable.

TABLE 3

Estimated Maximum Monthly Cash Advance Payments for Selected Term Mortgages Compared With Tenure Mortgages *

(Expected) Interest Rate: 10 %
Appraised Value = \$ 100,000

Age	<u>Term Mortgages (months)</u>			<u>Tenure Mortgage</u>
	<u>60</u>	<u>90</u>	<u>120</u>	
62	\$ 452	338	284	187
65	522	391	328	218
70	654	490	411	278
75	812	608	510	357
80	991	742	622	460
85	1180	884	741	607

* Assumes:

Initial payment to borrower covers closing costs and fees of \$3500, with no additional cash advanced at closing.

Appraised value is within FHA max. mortgage amount for area.

Term mortgage payments stop at term expiration, but debt repayment is deferred if borrower remains in occupancy.

Loan servicing charges are included in the loan interest rate, which may be a fixed or adjustable rate.

Next we define the net principal limit at time t:

$$NPL(t) = \max[0, PL(t) - B(\underline{r}, t)], \quad (11)$$

where

$NPL(t)$ is the net principal limit at time t,

$\max[q_1, q_2]$ is maximum of the quantities, q_1 and q_2 .

$PL(t)$ is the principal limit given by equation (10), and

$B(\underline{r}, t)$ is the actual loan balance at time t, including cash advances, interest accrued (using the actual loan rates given by the vector $\underline{r} = (r_0, r_1, \dots, r_t)$ where r_j is the loan rate in effect during month j), and MIP.

Note that at origination ($t=0$), the net principal limit equals the initial principal limit minus the initial cash advance on the loan²⁰. Note, too, that the maximum function prevents the net principal limit from being negative in cases in which the balance grows to exceed the principal limit due to actual rates, r_j , exceeding the expected rate, R .

For borrowers who wish a line-of-credit, $NPL(t)$ given by equation (11) is the maximum cash advance available at each time t. Once the net principal limit goes to zero, the line-of-credit is exhausted.

For borrowers who wish level monthly cash advances, either for a specified term, or for as long as the borrower remains in occupancy of the property (tenure), one additional equation is required. The maximum monthly advance is given by:

$$p(t, m) = [NPL(t) (1+c)^m] [c / \{(1+c)^{m+1} - (1+c)\}], \quad (12)$$

where

$p(t, m)$ is the monthly cash advance beginning in month t+1 and continuing for a term of m months,

$NPL(t)$ is the net principal limit at time t from equation (11),

c is the monthly compounding rate given by the expected rate, R , plus the 1/2 percent annual MIP charge converted to a monthly rate,

²⁰ The HECM demonstration also accounts for set-asides from the principal limit which further reduce the net principal limit. The right hand side of equation (11) should actually be written as the greater of zero or the quantity given by: $PL(t) - B(\underline{r}, t) - S(t)$, where $S(t)$ is the set-aside amount at time t. Such set-asides are those for repairs, first-year taxes, and those for future loan servicing fees not included in the interest rate. See HUD Handbook 4235.1 for more detail.

$m = (T - t)$ for tenure, where T is the value of t for which the borrower turns age 100, and

$0 < m < (T - t)$ for term, with m chosen by the borrower.

Note that the right hand side of (12) consists of the product of two algebraic expressions contained within brackets. The first is the future value of the net principal limit projected ahead to the end of the term (i.e., for m months). The second is the formula for a standard sinking fund monthly contribution that will grow to \$1 at the end of the term. The rate of interest in both cases is the compounding rate defined above. Their product gives the monthly cash advance which with compound interest will grow to equal the future value of the net principal limit at the end of the term.

Note also that in the special case where $t = 0$, equation (12) gives the maximum monthly cash advance beginning in the first month of the loan. For all other values of t , the same equation allows monthly advances to be modified by the borrower at some future date. Table 3 illustrates tenure and term cash advance payments calculated at origination.

For borrowers who wish to combine reduced monthly cash advances with a line-of-credit, the same three equations may be used. In such a case the borrower is allowed to split the principal limit in equation (10) into two accounts, one designated for the line-of-credit, the other for monthly cash advances. The loan servicer must maintain separate balances for each account, but otherwise, equations (10) through (12) remain valid. If the borrower with separate principal limit accounts wishes to modify the payment plan at some future date, the net principal limit in either account may be switched to the other account. For example, a borrower who originally established a small line-of-credit along with tenure payments, may decide in the 60th month to switch the unused net principal limit from the line-of-credit account into the tenure payment account, and use equation (12) to calculate a higher monthly tenure payment for the remainder of the mortgage.

III-D. Advantages of the Principal Limit Method

There are three advantages to using the principal limit method given by equations (10) through (12) rather than using the basic model to determine maximum cash advances. These are: simplicity of implementation, equity among payment options, and flexibility in restructuring. Simplicity results because a single factor corresponding to each borrower age and interest rate combination can be used to determine maximum cash advances regardless of the pattern desired by the borrower. Equity occurs because borrowers are free to choose the pattern of cash advances which best suits their needs, knowing that any pattern will have the same present value²¹.

²¹ This is true if the borrower uses the compounding rate defined in equation 10 as the discount rate. In practice, borrowers use different

Flexibility is a corollary of the equity argument: a borrower is allowed to restructure future cash advances at any time as long as the revised cash advances have the same present value.

Tables 4 and 5 show term and tenure mortgage cash flows for a 75-year-old borrower in a \$100,000 house with a 10 percent interest rate generated by the principal limit method, while showing expected losses and MIP calculated by the basic model. The sum of the present values of expected losses and premium are no longer equal, as they were in Table 1. The explanation is that maximum payments calculated using the principal limit method are only approximations of the maximum payments that would be generated by the basic model²². The tables show that the principal limit method results in undercollection of premium on term mortgages and overcollection on tenure mortgages. The premium shortfall on the term mortgages is likely to be offset by move-outs which exceed the predicted move-out rate once the monthly cash advances cease. Likewise, the excess premium on the tenure mortgages may be offset by move-outs at a lower rate than predicted.

The above comparison indicates that the principal limit method produces slightly higher monthly cash advances on term mortgages than does the basic model and slightly lower cash advances on tenure mortgages. For the loan terms in these tables, the differences in monthly advances are as follows:

	<u>Prin Limit Method</u>	<u>Basic Model</u>
10-Year Term	\$510	477
Tenure	357	372

The differences were considered for various ages, interest rates, and lengths of term. They were consistently found to be small. Since it is expected that move-out rates will differ by type of payment pattern (i.e., move-outs are expected to rise upon expiration of term payments), the differences seem negligible. When considered in conjunction with the advantages of simplicity, equity, and flexibility, the principal limit method was determined to be superior to the basic model for term and tenure mortgages.

discount rates, depending on whether current or future consumption is more highly valued. Thus, some borrowers will prefer cash advances to be concentrated in the early years, while others will prefer cash advances deferred into the future.

²² More specifically, both the expected MIP and expected loss calculations in the basic model are functions of the loan balance at any point in time. Thus neither is independent of the pattern of cash advances. For example, a tenure mortgage has lower loan balances at every point in time than a mortgage in which the borrower received the maximum lump sum at closing. Thus the tenure mortgage will produce less premium and smaller losses.

Table 4

Home Equity Conversion Mortgage Insurance Demonstration - Payments Model Illustration
 Analysis of Ten Year Term Mortgage

Loan Term: Borrower Age: 75 Closing Costs: 1500 (Included in Cash Advance)
 Interest Rate: 10.0 Servicing Fee: 0
 House Value: 100000
 Maximum Claim Amount: 100000 Principal Limit Factor: 0.418

year	----- Individual Mortgage Cash Flows -----					----- End of Year Calculations -----				----- Mortgage Pool Averages -----			
	Begin Balance	Cash Advances	Interest Accrued	MIP Paid	End Balance	House Exp Val	Probability Bal > Val	Condit Exp Val	L(z)	--Expected MIP-- Nominal	--Expected Loss-- Pres Val	Nominal	Pres Val
0	-	1500	-	2000	3500	100000	0.0000	-	1.0000	2000	2000	0	0
1	3500	6118	710	35	10361	104803	0.0000	-	0.9562	35	33	0	0
2	10361	6118	1429	71	17977	109417	0.0000	-	0.9104	67	58	0	0
3	17977	6118	2229	111	26433	114454	0.0000	-	0.8625	99	78	0	0
4	26433	6118	3118	158	35821	119722	0.0000	-	0.8122	131	94	0	0
5	35821	6118	4102	205	46244	125232	0.0000	44161	0.7595	161	106	0	0
6	46244	6118	5195	260	57815	130998	0.0008	54235	0.7045	190	114	0	0
7	57815	6118	6409	321	70661	137028	0.0089	64881	0.6478	217	118	1	0
8	70661	6118	7758	388	84923	143333	0.0437	76028	0.5895	240	119	9	5
9	84923	6118	9255	463	100757	149930	0.1200	87597	0.5310	260	117	48	21
10	100757	6118	10917	548	118336	156831	0.2319	99503	0.4730	275	112	155	63
11	118336	0	12420	621	131377	164050	0.3072	107725	0.4160	277	103	318	118
12	131377	0	13789	689	145855	171601	0.3838	116438	0.3608	269	91	496	167
13	145858	0	15308	765	161929	179499	0.4580	125649	0.3080	257	79	712	219
14	161929	0	16995	850	179774	187781	0.5283	135364	0.2592	242	68	953	268
15	179774	0	18868	943	199585	196403	0.5930	145586	0.2148	224	57	1205	306
16	199585	0	20948	1047	221580	205443	0.6514	158320	0.1748	205	47	1459	338
17	221580	0	23256	1163	245999	214899	0.7033	167568	0.1393	183	39	1700	358
18	245999	0	25819	1291	273109	224791	0.7489	179334	0.1085	160	31	1893	363
19	273109	0	28664	1433	303206	235137	0.7885	191820	0.0826	137	24	2012	351
20	303208	0	31824	1591	336821	245980	0.8228	204430	0.0615	115	18	2047	325
21	336821	0	35329	1767	373717	257281	0.8517	217769	0.0448	94	14	2001	289
22	373717	0	39224	1961	414902	269123	0.8784	231844	0.0317	75	10	1878	247
23	414902	0	43547	2177	460626	281511	0.8973	248063	0.0219	58	7	1689	202
24	460626	0	48345	2417	511388	294468	0.9149	261038	0.0149	45	5	1487	160
25	511388	0	53673	2684	567745	308022	0.9288	278577	0.0000	33	3	3908	373

Present Value Expected Total Premium: 3545

Present Value Expected Total Losses: 4171 (Losses will be lower if move-outs increase after year 10)

Table 5

Home Equity Conversion Mortgage Insurance Demonstration - Payments Model Illustration
 Analysis of Tenure Mortgage

Loan Term: Borrower Age: 75 Closing Costs: 1500 (Included in Cash Advance)
 Interest Rate: 10.0 Servicing Fee: 0
 House Value: 100000
 Maximum Claim Amount: 100000 Principal Limit Factor: 0.418

year	----- Individual Mortgage Cash Flows -----					----- End of Year Calculations -----				----- Mortgage Pool Averages -----			
	Begin Balance	Cash Advances	Interest Accrued	MIP Paid	End Balance	House Exp Val	Probability Bal > Val	Condit Exp Val	L(u)	--Expected MIP-- Nominal	--Expected Loss-- Pres Val	Nominal	Pres Val
0	-	1500	-	2000	3500	100000	0.0000	-	1.0000	2000	2000	0	0
1	3500	4279	807	30	8416	104603	0.0000	-	0.9562	30	28	0	0
2	8416	4279	1124	56	13875	109417	0.0000	-	0.9104	52	45	0	0
3	13875	4279	1695	85	19934	114454	0.0000	-	0.8625	75	59	0	0
4	19934	4279	2332	117	26662	119722	0.0000	-	0.8122	98	70	0	0
5	26662	4279	3038	152	34131	125232	0.0000	-	0.7595	119	78	0	0
6	34131	4279	3822	191	42423	130996	0.0000	38180	0.7045	140	83	0	0
7	42423	4279	4802	235	51629	137028	0.0002	48438	0.6476	159	88	0	0
8	51629	4279	5856	283	61849	143333	0.0023	57054	0.5895	175	87	0	0
9	61849	4279	6730	337	73195	149930	0.0125	66237	0.5310	189	85	2	1
10	73195	4279	7923	398	85793	156831	0.0401	75975	0.4730	199	81	11	5
11	85793	4279	9244	462	99778	164050	0.0912	86253	0.4160	206	77	41	15
12	99778	4279	10711	536	115304	171801	0.1649	97052	0.3606	208	71	107	36
13	115304	4279	12342	617	132542	179499	0.2544	108348	0.3080	207	64	225	69
14	132542	4279	14150	708	151879	187781	0.3508	120118	0.2582	201	56	399	111
15	151679	4279	16159	808	172925	196403	0.4483	132339	0.2148	192	49	622	158
16	172925	4279	18390	919	196513	205443	0.5354	144987	0.1748	180	42	883	204
17	196513	4279	20865	1043	222700	214899	0.6151	158046	0.1393	164	35	1161	244
18	222700	4279	23613	1181	251773	224791	0.6841	171499	0.1085	147	28	1419	272
19	251773	4279	26665	1333	284050	235137	0.7428	185337	0.0826	128	22	1621	283
20	284050	4279	30052	1503	319884	245960	0.7914	199558	0.0615	109	17	1746	277
21	319884	4279	33813	1691	359667	257281	0.8315	214158	0.0446	90	13	1785	258
22	359667	4279	37989	1899	403834	269123	0.8643	229144	0.0317	73	10	1734	228
23	403834	4279	42624	2131	452868	281511	0.8909	244531	0.0219	57	7	1607	192
24	452868	4279	47770	2389	507308	294488	0.9123	260335	0.0149	44	5	1427	155
25	507308	4279	53485	2674	567744	308022	0.9288	278577	0.0000	33	3	3887	372

Present Value Expected Total Premium: 3201
 Present Value Expected Total Losses: 2880

III-E. Reserve for Administrative Costs and Risk

According to Hogg and Klugman (1984), the premium that an insurer must charge for insurance is the sum of the following three components:

1. Pure premium,
2. Administrative expenses, and
3. Risk charge.

The pure premium is the average amount of loss due to payment of claims. Administrative expenses include items such as salaries, employee benefits, rental of office space and equipment, etc. Finally, the risk charge is the payment that the insurer requires for exposing the surplus in its loss reserve fund (capital investment) to risk fluctuations. All three are expressed as costs per unit of risk exposure. The transition from a basic insurance model to the HECM payments model involves an assessment that the mortgage insurance premium to be collected will cover all three components. Each is addressed below.

The basic model described in the previous section calculates the pure premium. Expression (1) in the basic model assures that the premium to be collected will cover losses under the model's assumptions. If actuarial experience deviates from these assumptions, average losses due to payment of claims could be underestimated. A risk charge is used to maintain a contingency reserve to cover these losses. If the model is properly specified, deviations of actuarial experience from the assumptions will be relatively small, and the appropriate risk charge will also be relatively small. If the model is poorly specified, deviations of actuarial experience from the assumptions will be greater, and so will the risk charge.

Future property value is the least predictable of the actuarial variables needed to evaluate expression (1), as noted in Section II. Note that future property value could have been specified as a non-stochastic function of time. Such a specification would be a poor one, however, because property values must be predicted many years into the future in the model. Instead, the stochastic specification allows future property values to vary considerably about their expected values without violating the model's actuarial assumptions. In this way the model manages the insurance risk more effectively. It computes expected losses more accurately than a non-stochastic model would, and thereby places less reliance on the contingency reserve to cover unexpected losses.

The second component of the premium, administrative expense, was not introduced explicitly into the basic model. Neither is it explicit in the premium structure of the HECM program, because the current premium structure will create a premium reserve which is expected to cover administrative expenses (and the risk charge) as explained below.

Table 6

PRESENT VALUES OF EXPECTED LOSSES/MIP COLLECTED
AT SELECTED UTILIZATION LEVELS

HOUSE VALUE EQUALS SECT. 203(B) LIMIT

Requested Tenure Payment--Percent of Max. Payment	Item	-- Age of Borrower --		
		65	75	85
100 %	Payment	\$218.13	356.61	607.08
	Initial LOC	\$0	0	0
	Expected Loss	\$3860	2880	1859
	Expected MIP	\$3667	3201	2706
	Loss/MIP %	105%	90%	69%
95%	Payment	207.22	338.78	576.73
	Initial LOC	1226	1906	2770
	Expected Loss	3420	2486	1552
	Expected MIP	3599	3151	2675
	Loss/MIP %	95%	79%	58%
90%	Payment	196.32	320.95	546.37
	Initial LOC	2451	3811	5541
	Expected Loss	3005	2121	1277
	Expected MIP	3532	3100	2644
	Loss/MIP %	85%	68%	48%

Assumed Loan Terms:

House Value	=	\$100,000
Sect. 203(b) Lim	=	100,000
Interest Rate	=	10%
Closing Costs	=	1,500
Servicing Fee	=	0
Initial Draw	=	0

Losses calculated assuming Line of Credit (LOC) is never used.

Table 7

**PRESENT VALUE OF EXPECTED LOSSES/MIP COLLECTED
AT SELECTED UTILIZATION LEVELS**

HOUSE VALUE 10 PERCENT OVER SECT. 203(B) LIMIT

Requested Tenure Payment--Percent of Max. Payment	Item	-- Age of Borrower --		
		65	75	85
100 %	Payment	\$218.13	356.61	607.08
	Initial LOC	\$0	0	0
	Expected Loss	\$3263	2333	1420
	Expected MIP	\$3667	3201	2706
	Loss/MIP %	89%	73%	52%
95%	Payment	207.22	338.78	576.73
	Initial LOC	1226	1906	2770
	Expected Loss	2876	1999	1172
	Expected MIP	3599	3151	2675
	Loss/MIP %	80%	63%	44%
90%	Payment	196.32	320.95	546.37
	Initial LOC	2451	3811	5541
	Expected Loss	2514	1693	952
	Expected MIP	3532	3100	2644
	Loss/MIP %	71%	55%	36%

Assumed Loan Terms:

House Value	=	\$110,000
Sect. 203(b) Lim	=	100,000
Interest Rate	=	10%
Closing Costs	=	1,500
Servicing Fee	=	0
Initial Draw	=	0

Losses calculated assuming Line of Credit (LOC) is never used.

If administrative expenses were made explicit, they would amount to about 10 basis points annually on the loan balance. At this level, they would amount to about \$400 (present value) on a reverse mortgage to a 75-year-old borrower with a \$100,000 house and a 10 percent interest rate. If charged explicitly, they would reduce cash advances by about 5 percent. Instead, a policy decision was made to leave cash advances as calculated, with expenses of doing business paid out of the premium reserve.

Finally, the third premium component, the risk charge, compensates the insurer in the event the parameters of the basic model were chosen in error. For example, on a given book of business (say policies endorsed in a given year), the long-run property appreciation rate might average only 2 percent instead of 4 percent. Or the move-out rate might turn out to be significantly lower than 130 percent of the general population mortality rate. In this case, insurance losses would be greater than predicted. Of course, on another book, the errors in parameter estimation could easily work in the other direction. That is, appreciation could average 6 percent, and move-outs could occur at a rate above 130 percent. In this case, insurance losses would be smaller than predicted.

The purpose of the risk charge is to maintain a sufficient level of capitalization to smooth these variations from expectations. If program experience shows that the deviations are consistently in one direction, then the model's assumptions may have to be reassessed, and the insurance repriced. Absent such program experience, the assumptions should be conservatively chosen to compute reasonable expected losses. The basic model is believed to use relatively conservative assumptions. They are discussed in more detail in Section IV. The premium component for risk of model error is not explicit in the HECM demonstration. It is also assumed to be covered by the premium reserve.

The premium reserve will be generated in either of two ways: one, when a borrower combines a monthly payment with a line of credit, and two, when a borrower mortgages a property with a value higher than the maximum FHA loan limit for the area. In the former case, there will be excess premium collected to the extent that the borrower fails to draw down the small line-of-credit account. In the latter situation, the borrower's principal limit is calculated as if the property value were equal to the FHA maximum, ignoring the excess equity. This excess property value will reduce future expected losses regardless of the extent of the borrower's utilization of principal limit.

Tables 6 and 7 illustrate the sensitivity of premiums and losses to changes in utilization of principal limit or excess property value. Essentially, these tables show that the reserve premium collection is relatively large for relatively small amounts of underutilization or excess value. Furthermore, it is reasonable to expect that an insurer's book of business will include a significant number of cases in which some underutilization or excess value exists.

Like Tables 4 and 5, Tables 6 and 7 use the principal limit method for determining cash advances and the basic model for computing expected premiums and losses of these cash advances. Table 6 focuses the level of utilization of principal limit by borrowers. The first column provides a measure of borrower utilization as a percentage of the maximum monthly tenure payment determined by the principal limit method--100, 95, and 90 percent. The rows labelled "payment" list the monthly tenure payments in dollars. The rows marked "initial LOC" maximum line of credit given the indicated tenure payment. For each utilization level, Table 6 then shows the present value of expected MIP and expected losses, and the ratio of losses to MIP computed using the basic model. It is assumed that the line-of-credit accounts are never used by the borrower. Note that the expected losses and premium for a 75-year-old borrower at 100 percent utilization are the same as those given at the bottom of Table 5. The ratio of losses to premium for this borrower and utilization level is 90 percent. If, however, the same borrower utilizes only 95 percent of the maximum tenure payment, the loss-to-premium ratio drops to 79 percent. At 90 percent utilization, the ratio falls even further to 68 percent. Clearly, the reserve premium rises rapidly with small reductions in utilization.

Table 7 is similar in format to Table 6, except that it adds the effect of property value exceeding the FHA Section 203(b) maximum loan limit by 10 percent. Note that the payment amounts, initial line-of-credit amounts, and the present value of expected MIP are all identical to those in Table 6. The reason is that the excess property value assumed in Table 7 does not affect the calculation of the borrower's principal limit, maximum tenure payment, or cash advance pattern. It only affects the calculation of expected losses. Note that the ratio of expected losses to expected MIP for a 75-year-old borrower at 100 percent utilization falls from 90 percent in Table 6 to 73 percent in Table 7 due entirely to the 10 percent excess property value. Thus, a small increase in excess property value also produces a significant amount of reserve premium.

What is the likelihood of the insurer's book including cases which involve underutilization or excess value? It is considerable. With regard to utilization, borrowers will set up lines-of-credit along with monthly payments in order to preserve equity, maintain a line-of-credit for emergencies, and accommodate the treatment of reverse mortgage cash advances by certain entitlement programs for the elderly. Borrowers will seek to preserve equity to reduce the risk that they will exhaust their assets. If they have few other assets, they will be counseled that it would be prudent to create lines of credit for emergencies. Finally, borrowers will need to manage their liquid assets so as to preserve their eligibility for certain entitlement programs (such as Supplemental Security Income (SSI) and Medicaid). They may risk entitlement benefit reduction or even denial if their monthly payment exceed their immediate needs. Apart from maintaining eligibility, borrowers who seek to invest reverse mortgage proceeds will usually be discouraged from doing so by negative arbitrage, creating another incentive for underutilization.

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With regard to excess property value, borrowers with houses values in excess of the FHA limits are likely to seek a reverse mortgage. FHA limits approximate 95 percent of median house price in a market area and currently range between a minimum of \$67,500 and \$124,875 in high cost areas. By design, therefore, properties within the FHA limit constitute the lower end of the local market. As a result, many potential borrowers will have homes valued above the limit. Until such time as there is a competitive market for privately insured or uninsured reverse mortgages to serve these borrowers, the HECM program may be attractive to them, the FHA limit notwithstanding. Therefore, it is reasonable to expect a significant book to be written on properties with excess value. When combined with the underutilization effects described above, there should be sufficient reserve premium to pay for administrative expenses and maintain a risk contingency capital reserve.

IV. Actuarial Assumptions and Parameter Sensitivity

IV-A. Introduction

The actuarial assumptions in the HECM payments model will be separated into two groups for discussion. The first are the assumptions regarding the survival probabilities of borrowers. These are the $S_{1,j}$ from equation (3). The second involve the remaining model parameters which must be estimated by the insurer. The latter consist of the annual average appreciation rate (μ), the standard deviation of annual appreciation rates about the average (σ), the move-out rate (m), and the discount rate (i).

Subsection IV-B deals with the issues involving the survival probabilities of HECM borrowers. Subsection IV-C deals with the estimation of the other model parameters.

IV-B. Survival Probabilities

The issues involved in the treatment of borrower mortality include (1) the effect of possible adverse selection on the choice of mortality table, (2) the trends in future mortality rates due to health care improvements, and (3) the issue of whether to adopt joint mortality tables for co-borrowers. The sensitivity of the model to changes in the underlying mortality assumption is dealt with in IV-C in which changes to the move-out rate are analyzed.

1. Adverse Selection

The issue of adverse selection in reverse mortgage programs is a difficult one to address. Data from private reverse mortgage programs with regard to the mortality rates of borrowers is proprietary information and not generally available. Data from private as well as public sponsored programs (State agencies or non-profit groups), where available, are not very useful in assessing the possible adverse selection in the HECM program. The reasons are differences in program design²³, rapid prepayments in these programs which limits data on mortality²⁴, and lack

²³ None of the public sponsored programs offer a tenure payment option. There is little incentive for borrowers who expect to live a long time to adversely select a program which offers only fixed term mortgages of 10 to 12 years maximum, because any borrower who expects to live longer than the maximum fixed term runs a great risk of outliving his or her assets by entering such a program. Such borrowers may explore other options.

²⁴ A Minnesota lender offered an 8 to 12 year fixed term reverse mortgage. Anecdotal evidence obtained from the lender indicates that rapid prepayment has resulted in an average mortgage term of 3 years. Many borrowers were in poor health and sought reverse mortgages as temporary financial relief. Others used the reverse mortgages to finance housing searches in and subsequent moves to warmer climates. Very little mortality experience was obtained. Another program, offered by the San Francisco Development Authority, was designed as fixed term with 10 year maximum.

of sufficient numbers of borrowers to construct program-specific mortality tables.

Absent data from other reverse mortgage programs to address the adverse selection question, we looked at how the problem is treated in a complementary product, specifically, continuing care retirement communities (CCRC's). According to Winklevoss and Powell (1984), CCRC's are organizations established to provide housing and services, including health care, to people of retirement age. The communities are often campus-like settings that offer both independent living arrangements and congregate living arrangements for those needing a greater level of health care services. CCRC's offer the residents the guarantee of shelter and various health care services for life. Like the HECM program, the minimum age requirement for entering a CCRC is 62. However, the fee structure includes a large one-time entry fee and an additional monthly fee. Winklevoss and Powell found that fee structures varied considerably by quality and level of housing and services provided, and that the average at the time of their study was \$34,689 up-front and \$562 monthly for one person, and \$38,682 plus \$815 monthly for a couple. Clearly, the typical CCRC program will be most attractive to persons who expect to live a long time, and who are seeking a great deal of protection from the possibility of outliving their assets.

How then do managers of CCRC's price their product when the extent of adverse selection is unknown? Each such community is likely to attract residents with unique characteristic profiles depending on how the overall package of housing and services provided by the community compares to alternatives available in the market. Ideally, if the CCRC were large enough, the management would construct a mortality table based upon the age-specific mortality rates observed at the facility over time. Few projects have enough data to accomplish this. An alternative is often used and it is called the "standardized mortality ratio" approach. In this technique, the management selects a "base" mortality table from which to construct a "decrement" table for the community. The decrement table represents the annual expected number of deaths in the community based upon the population age and sex distribution and the mortality rates in the base table. Then, as a sufficient time period elapses (say five years), actual decrements are compared to the expected decrements in the table, and decisions can be made as to the need to adjust the actuarial assumptions due to adverse selection.

For CCRC's using the standardized mortality ratio method, the base table recommended by Winklevoss and Powell is an insurance company annuitant mortality table. Rates in such a table are appropriate because both purchasers of private annuities and continuing care retirement contracts are willing to make substantial up-front financial commitments to protect themselves from outliving their assets. Neither would be likely to

Similar to the Minnesota experience, there were many prepayments in the first two years. No mortality data is available for those who did not prepay.

purchase these contracts if they did not believe they were in good health and likely to live longer than the average life expectancy for their attained age.

The lack of program experience from which to determine borrower mortality rates and to assess the adverse selection question in the HECM program will require the use of an approach similar to the standardized mortality ratio technique described above. The use of an annuitant mortality table as the base, however, seemed inappropriate for several reasons. The first is that the up-front financial commitment to enter the HECM program is much smaller than that of a comparable annuity or CCRC contract²³. The second is that the program has been designed to allow borrowers who are in poor health to receive the full amount of their principal limit in the early years of the loan when needed, rather than require them to enter a tenure plan or term plan which defers payments into the future. Thus, an elderly homeowner in poor health may access the relatively large sums of cash necessary to supplement Medicare/Medicaid coverage for major medical treatment or for in-home nursing care through the HECM program. Of course, the HECM program may also attract those borrowers who believe themselves to be in above average health too, particularly because of the borrower's option to receive cash advances as a tenure payment. Low entrance costs plus the flexibility to receive cash in the present as well as deferred into the future are likely to make the HECM program attractive to both kinds of borrowers: those in good health and those in poor health. If program selection follows this logic, then the mortality rates averaged for all borrowers could approximate those of the general population, which also includes elderly persons in good health and those in poor health²⁴. For these reasons, the general population

²³ While up-front loan costs will vary by state and lender in the HECM program, we expect that they will average about 3 to 5 percent of the maximum claim amount. This amounts to \$3,000 to \$5,000 on a \$100,000 home. The estimate includes the up-front MIP charge, the lender's origination fee, appraisal fee, title insurance, and other miscellaneous loan costs.

²⁴ If we define elderly persons in poor health as those whose age-specific mortality rates are double those of the general population, and elderly persons in good health as those whose age-specific mortality rates are given by an insurance annuity table (source: Society of Actuaries, 1983), then the blended mortality of a population whose members were initially chosen in equal numbers from both groups gives a life expectancy that is comparable to that of the general population. For example, the following are the life expectancies of a 65 year old female:

<u>Population</u>	<u>Life Expectancy (Years)</u>
A. General Population (100% 1979-81 U.S. mortality)	Average 18.4 Median 18.8
B. "Poor Health" Group (200% 1979-81 U.S. mortality)	Average 13.3 Median 13.3

mortality table has been chosen as the base table for HECM. After the passage of some time, mortality experience from the program will become available. Adverse selection will then be analyzed by comparing expected decrements derived from the base table to actual decrements observed.

2. Mortality Trends

Improvements in health care, lifestyle changes, and environmental changes are factors which can affect the life expectancies of the general population. We are particularly interested in the life expectancy trends of current elderly cohorts in the general population, from which HECM borrowers will come. Furthermore, we are interested in knowing whether the life expectancy trends of HECM borrowers will follow the same trends as the general population, or whether the self selection process of the program will systematically bias the life expectancies of borrowers.

The most important factor influencing future life expectancies of the elderly are medical advances such as the development and application of new diagnostic, surgical, and life-sustaining techniques. Such improvements are likely to reduce future age-specific mortality rates in the general population; however, the increased expense of health care may result in less benefit to likely HECM borrowers who are probably the least able to afford these services.

Lifestyle changes that may affect the elderly are the future use of tobacco and drugs (prescription drugs and alcohol, in particular), dietary improvements, and intangible factors which determine the quality of life and how the elderly perceive their value to society. It is not unreasonable to expect the HECM program will improve the quality of life for many borrowers, thereby increasing their life expectancy merely through participation²⁷.

Environmental factors affecting the elderly are air and water quality; as well as the cumulative effects of long-term exposure to harmful substances, which may have gone unrecognized in the past. It is possible that environmental factors will partially offset gains in life expectancy among the elderly attributable to health care and lifestyle improvements.

C. "Good Health" Group (1002 1983 annuitant mortality)	Average	21.8
	Median	22.7
D. Blended (B + C) (Equal weight to both groups)	Average	17.5
	Median	17.6

²⁷ More profound improvements in life expectancy are observed at continuing care retirement centers, which include health care as part of the product. Thus mortality trends in the population being served can differ from those of the general population.

Table 8

TRENDS IN LIFE EXPECTANCY¹ AT AGE 65 THROUGH THE YEAR 2000
 BASED ON OBSERVED AND PROJECTED AGE-SPECIFIC MORTALITY RATES
 (SOURCE: SOCIAL SECURITY ADMINISTRATION)

Calendar Year	--Observed--		-----Projected ² -----					
	Male	Female	Alternative 1		Alternative 2		Alternative 3	
	Male	Female	Male	Female	Male	Female	Male	Female
1980	14.0	18.4 ³	-	-	-	-	-	-
1982	14.5	18.8	-	-	-	-	-	-
1984	14.4	18.7	-	-	-	-	-	-
1986	14.5	18.7	-	-	-	-	-	-
1988	14.9	18.8	-	-	-	-	-	-
1990	-	-	15.0	18.8	15.1	19.0	15.2	19.1
1992	-	-	15.0	18.8	15.2	19.1	15.4	19.4
1994	-	-	15.0	18.9	15.3	19.3	15.7	19.7
1996	-	-	15.0	18.9	15.4	19.4	15.9	19.9
1998	-	-	15.0	18.9	15.6	19.5	16.1	20.2
2000	-	-	15.0	18.9	15.6	19.6	16.2	20.4

¹ Life expectancy is defined as the average remaining years of life to a 65 year old person if he or she were to experience the age-specific mortality rates for the tabulated year throughout the remainder of his or her life.

² The Social Security Administration makes three alternative projections about changes in overall age-specific death rates by analyzing trends in ten specific causes of death. These causes are: heart disease, cancer, vascular disease, violence, respiratory disease, infancy, digestive disease, diabetes mellitus, cirrhosis (liver), and other.

³ This is the life expectancy, in years, for all 65 year old borrowers in the HECM model. It is based on the observed mortality rates in the 1979-1980 U.S. Decennial Tables.

Table 9

CENTRAL DEATH RATES PER 100,000 FEMALES
PROJECTED BY YEAR AND ATTAINED AGE

SOURCE: SOCIAL SECURITY ADMINISTRATION

YEAR/ATTAINED AGE	W/O PROJECTION	- - ALTERNATIVE PROJECTIONS - -		
		OPTIMIS.	LIKELY	PESSIM.
1985 / 70-75	2609	2609	2609	2609
1990 / 75-80	4108	3898	3823	3749
1995 / 80-85	6717	6579	6193	5857
2000 / 85-90	11264	10670	9637	8751
2005 / 90-95	18116	17549	15732	14161

Note: Central death rate is the ratio of the number of deaths during the year to persons at the tabulated age to the midyear population at that age. These rates are then multiplied by 100,000 to give the table entries. Note also that actual deaths projected for a cohort formed in 1985 would apply these rates to a declining number of survivors in the cohort--i.e. the differences in actual deaths for year 2005 would not appear as great as in the above table.

We can determine no reason why HECM borrowers should be affected differently than the general population in this area.

The Social Security Administration has made projections of life expectancy and mortality rates for many years into the future as a part of its actuarial analysis of the Social Security Trust Fund. Tables 8 and 9 illustrate the projected trends in the general population. Table 8 presents three projection scenarios of the life expectancy of a 65 year old (male and female tables) as it would be calculated in each calendar year shown. Note that in 1980 a 65 year old male had a life expectancy of 14.0 years, while a 65 year old female had a life expectancy of 18.4 years. These estimates are consistent with the 1979-81 U.S. Decennial Life Tables. By 1990, however, the agency projects that these life expectancies will have increased to between 15.0 and 15.2 years for a 65 year old male, and 18.8 to 19.1 years for a 65 year old female. By 2000, the life expectancies are projected to be flat under alternative 1, and to increase even more under alternatives 2 and 3. Table 9 presents mortality trends in a different manner than Table 8. The differences are that Table 9 applies only to females, it lists central death rates rather than life expectancies, and the projections follow a cohort of elderly females into the future rather than showing the projections for a single attained age.

The implications for the HECM program are as follows. It is reasonably clear that life expectancies in the general population will rise over time. What is not clear is the extent to which HECM borrowers will reflect the general population shift. The likely appeal of the program to those in poor health as well as others may result in less improvement in life expectancy than the general population. Furthermore, the extent to which HECM will appeal to very low income borrowers may mean that borrowers receive less health care on average than others. If so, they may not benefit from the new health care procedures as much as the general population. On the other hand, the extent to which HECM cash advances are used to pay for additional health care and overall lifestyle improvements may offset the low income effect. In conclusion, we note that, like the issue of adverse selection, mortality trending of HECM borrowers is a phenomenon that will have to be observed. As such, the the base mortality table of the program was not adjusted for trending.

3. Survivorship for Co-borrowers

Given two individuals, such as a husband and wife, two sisters, or two brothers (all are possible co-borrower situations in HECM), many questions may be asked regarding their joint survivorship probabilities. This paper addresses some of these questions. First, what is the probability that at least one co-borrower will survive for a given number of years into the future? How does this compare to the probability that the younger of the two will survive for the same number of years? The joint survivorship is likely to be higher than that of the individual, but by how much? Second, what is the average number of years that we would expect at least one of the two to survive? How does this average compare to the average life expectancy of the younger borrower? The average for

co-borrowers is likely to be greater than that of the individual, but by how much? Finally, what is the likely change in the move-out rate? Is the move-out rate higher for an individual borrower because co-borrowers are less likely to seek nursing home care while one remains well enough to care for the other? Or, is the move out rate higher for a couple because the survivor is more likely to move (for physical reasons such as difficulty in maintaining the house alone or for emotional reasons) soon after a spouse dies or moves to a nursing home?

The answer to the first question depends upon the age difference of the co-borrowers. The probability of at least one borrower surviving for a period of time (say 10 years) is greatest when the older borrower's age is equal or nearly equal to that of the younger. Table 10 illustrates these probabilities for various combinations of borrower age and gender, with the younger borrower assumed to be 75 years old. Note that as the older borrower's age increases, the joint survival probability approaches that of the younger borrower, taken individually. For example, if a husband and wife were both age 75, then there would be a 73.2 percent probability that at least one of them would be alive ten years from now, based on the 1979-81 U.S. Decennial Life Tables²⁰. However, if the husband's age were 85 instead of 75, the probability drops to 61.7 percent. By herself, the 75 year old woman has a 56.2 percent chance of surviving 10 years.

The answer to the second question, as the first, also depends on the age difference of the co-borrowers. The average number of years that at least one borrower will survive is greatest when the older borrower's age is equal or nearly equal to that of the younger. This average for 75-year old co-borrowers is about three to four years longer than the average life expectancy of an individual 75-year old female²⁰. The difference decreases as the age difference between co-borrowers increases.

Unfortunately, there is no good answer to the third question dealing with the change, if any, in the move-out rates when co-borrowers are

²⁰ To derive this number, let ${}_{10}P_{F75}$ be the 10 year survival probability of a 75 year old female, and ${}_{10}P_{M75}$ be the 10 year survival probability for a 75 year old male. Then the 10 year joint survival probability is given by:

$${}_{10}P_{F75.M75} = {}_{10}P_{F75} + (1 - {}_{10}P_{F75}) \times {}_{10}P_{M75}.$$

In the example, ${}_{10}P_{F75} = .562$, and ${}_{10}P_{M75} = .389$ (source: 1979-81 U.S. Decennial Life Tables). Hence the joint probability is:

$${}_{10}P_{F75.M75} = .562 + (1 - .562) \times .389 = .732.$$

²⁰ The life expectancy of a 75 year old female is 11.4 years. For two female co-borrowers, both age 75, the average number of years that at least one will survive is 15.1. If one of the co-borrowers is male, the average is reduced by about one year.

Table 10

Illustration of Joint Mortality

Probability that at least one individual will survive for 10 years.

<u>75 Year Old Female with:</u>	<u>10 Year Survival Probability *</u>
Male age 75	.732
Female age 75	.808
Male age 80	.668
Female age 80	.728
Male age 85	.617
Female age 85	.653
Male age 90	.583 "
Female age 90	.602 "
No co-borrower	.562
<u>75 Year Old Male with:</u>	
Male age 75	.627
Female age 75	.732
Male age 80	.537
Female age 80	.619
Male age 85	.466
Female age 85	.516
Male age 90	.418
Female age 90	.446
No co-borrower	.389

- * Survival probabilities have not been adjusted for move-outs.
- If terminal age of 100 is assumed, then the 10 year joint survival probability becomes .562, same as if there were no co-borrower.
- If terminal age of 100 is assumed, then the 10 year joint survival probability becomes .389, same as if there were no co-borrower.

involved. Such changes will be observed from program experience as part of the demonstration.

The HECM payments model uses the female general population mortality table for all borrowers, including co-borrowers. The reasons are as follows. The majority of borrowers is expected to consist of single females³⁰. Couples should be the next largest group, followed by single males. The potential underestimation of life expectancy for couples will be offset at least partially in two ways. The first is that single male borrowers have life expectancies three or four years less than that of females of the same age (see Table 8), which is approximately equal to the underestimation for a couple. The second is that some couples are likely to move out at an accelerated rate after the death of one spouse, resulting in reductions in loan survival probabilities. The combination of the two effects, along with the expected dominance of single females as borrowers justifies the use of the single mortality table for all borrowers. The benefit of simplicity in not having to develop separate principal limit factors for co-borrowers of various age combinations was also considered in making this decision.

IV-C. Parameter Estimation

The main issues remaining with regard to the model's actuarial assumptions pertain to the estimation of the mean and variance of the stochastic process used to simulate future property values. The choice of the other two parameters, namely the move-out rate and the discount rate, has been discussed previously in the text, and those discussions will not be repeated here. However, the model's sensitivity to changes in all four of these parameters will be addressed below in order to assess the impact of any errors in parameter estimation.

1. Mean Appreciation

Figure 3 shows that there has been an historically close relationship between the average annual house price appreciation as determined by a constant quality housing price index³¹ and the overall inflation rate as determined by the consumer price index. Both housing appreciation and overall inflation averaged slightly over 6 percent per year between 1977 and 1988. For this period, regression analysis confirms that there was an

³⁰ Weinrobe (1988) in his study of existing reverse mortgage programs found the predominance of single females to be consistent in all the programs for which data were available. He reports the average distribution to be: 63 percent single females, 12 percent single males, and 25 percent married couples.

³¹ This index is based upon average sales prices of the kinds of houses sold in 1982. These are estimated using hedonic regression analysis of new construction house price data gathered by the Census Bureau. For an explanation of the methodology used, see Current Construction Reports, Price Index of New One-Family Houses Sold, July 1989, Bureau of the Census.

approximately one-to-one relationship between average annual changes in constant quality house prices, and overall prices. The mean appreciation rate parameter in the model (μ) is a nominal appreciation rate, and not a real rate. Thus, a continuation of the observed one-to-one relationship with the CPI along with the model's assumption of a 4 percent mean housing appreciation rate implies an economic environment in which the CPI is expected to increase by 4 percent annually.²² This is not an unreasonable economic environment for the 1990's. Even if housing inflation lags the CPI for a few years (as has been the case the last 3 years), the actuarial soundness of the program is not jeopardized. HECM insurance claims are expected to be "back loaded". This means that nominal housing inflation below 4 percent in the early years can be offset by nominal inflation above 4 percent in the later years without substantial losses being incurred.

Other researchers have compared constant quality housing price indices with the CPI for individual metropolitan area markets. Case and Schiller (1987) constructed their own housing index for four metropolitan areas using a technique called the weighted repeat sales method²³. The areas were Atlanta, Chicago, Dallas, and San Francisco, and the time period covered by their study was 1970 through 1986. When they compared the results to the CPI, they found that constant quality house appreciation in all four cities was greater than or equal to the CPI change during the same time period²⁴.

One final question arises with regard to the choice of a mean appreciation parameter. It is whether houses occupied by elderly homeowners will appreciate as much as those occupied by homeowners of all ages? Some have argued that the elderly live in older homes located in older neighborhoods, and therefore, house appreciation will lag behind that of the general population. We have not found any study that would confirm this. In fact, we have produced some evidence that would indicate that the difference, if it exists at all, may not be very large. Specifically, we examined the national longitudinal sample of the Annual Housing Surveys from 1974 and 1983. Using the technique described in the next subsection of this paper, we estimated the average annual mean and variance of appreciation based on respondent's self reported value estimates of the same houses in both surveys. In the first case, houses were selected if they had a mortgage and an initial value greater than \$20,000 in 1974²⁵ without regard to the age of the borrowers. The annualized mean and variance of the appreciation rates of these houses was computed to be .083 (8.3 percent) and .017, respectively. In the second case, houses were

²² If one accounts for depreciation of existing homes at a rate of between $\frac{1}{2}$ and 1 percent per year, then average overall inflation of $\frac{1}{2}$ to 5 percent per year is necessary to support the model's 4 percent expected housing appreciation estimate.

²³ This method utilizes large data bases on real estate transactions in a metropolitan area to identify single family homes which sold more than once during the period covered by the data. Then, using only the repeat sales to construct the price index, the authors avoid the quality biases inherent in other housing price indices (such as median sales prices reported by the

selected as before, but with the additional requirement that the homeowner in 1974 be in the 55 or older age category³⁶. The second sample had annualized mean and variance of appreciation of .076 and .016. This finding, while not a full study of the question, did reassure us that houses occupied by the elderly do not have appreciation characteristics that are vastly different from those of all houses.

2. Variance of Appreciation

Most readers know what is a reasonable estimate for a mean appreciation rate based upon their general knowledge of the housing market. The assumed value of 4 percent annual appreciation in the model can be compared to the 1970's and 1980's when the rate averaged around 7 or 8 percent. The 1990's are likely to produce lower appreciation; hence, the 4 percent estimate seems reasonable. However, few readers are likely to know what is a reasonable estimate for the variance or standard deviation of appreciation based upon a general knowledge of the market. Even experts in the housing field have not determined how to measure this parameter³⁷.

The model uses an assumed variance (σ^2) of .01, which is equivalent to a standard deviation (σ) of .10 (10 percent). We have not determined a method of measuring this parameter precisely. Instead, we have used a technique which makes use of the national longitudinal sample of the Annual Housing Surveys between 1974 and 1983 to estimate the order of magnitude of the variance. This technique will be described below, and the results presented in Table 11.

We call the technique the "mid-point" approach. It provides estimates of both the mean (μ) and variance (σ^2) of appreciation averaged over a multi-year period. The problem with using AHS data to estimate μ and σ^2 for short periods of time--i.e., one or two years--is that the survey respondents' estimates of house values are reported by class interval rather than point estimates. If one allocates the house value to be the mid-point of the reported class interval, then substantial errors could be introduced, particularly when estimating the volatility parameter. To minimize errors, we extend the time period. Two multiple year time periods were examined: 1974 to 1983 (9 years) and 1978 to 1983 (5 years). The nine year period is the longest period for which the longitudinal sample could be followed, while the shorter period was chosen to eliminate some of the high housing inflation years of the mid-70's.

National Association of Realtors).

³⁶ Expressed as average annual percentage changes in the indices between 1970 and 1986. Case and Schiller report the following nominal housing appreciation rates: Atlanta 6.91, Chicago 7.02, Dallas 9.12, and San Francisco 11.32. During the same period the CPI averaged 6.72 per year.

³⁷ Choice of houses with a mortgage is a proxy for standard quality, while the \$20,000 minimum value is a way of eliminating "handyman specials" which may have undergone substantial upgrading between the survey dates.

³⁸ One could argue that many elderly homeowners have paid off their mortgages; hence, they would not be included in the second sample. In

Table 11

Appreciation Characteristics by Type of Mortgage

	<u>All Houses in Sample</u>		<u>Houses Sold During Base Year*</u>	
	<u>FHA</u>	<u>Non-FHA</u>	<u>FHA</u>	<u>Non-FHA</u>
<u>1978-83</u>				
Annual Mean				
Appreciation Rate	.071	.065	.064	.060
Variance	.013	.015	.009	.011
Standard Deviation	.113	.123	.093	.103
<u>1974-83</u>				
Annual Mean				
Appreciation Rate	.083	.084	na	na
Variance	.017	.017	na	na
Standard Deviation	.128	.131	na	na

Source: National Longitudinal Sample of Annual Housing Surveys for 1974, 1978, and 1983. The sample included only houses with mortgages and initial values greater than \$20,000 in the base years (1974 and 1978, respectively).

- * Restricting the sample to houses sold during the base year may improve the accuracy of the reported values, which are estimates solicited from the survey respondents. The reason is that respondents are likely to have more accurate knowledge of the value of their house in the year of a sale. Insufficient cases exist in the sample to restrict it to houses sold in both years.

The mid-point technique begins with the assumption that house prices follow a geometric Brownian motion process as defined previously. This means that over a multi-year period of t years the distribution of the cumulative appreciation rates should have a mean of μt , a variance of $\sigma^2 t$, and standard deviation of $\sigma \sqrt{t}$. The sample of houses to be selected included only those with mortgages and initial values greater than \$20,000 in the base year. Let

H_{78} = mid-point value estimate of a selected house in the 1978 survey, and

H_{83} = mid-point value estimate of the same house in the 1983 survey.

Then $\ln(H_{83}/H_{78})$ is one observation of the random variable representing the 5 year cumulative appreciation rate. We compute the mean, variance, and standard deviation of all such observations in the sample and divide by t or the square root of t , as appropriate, to obtain annualized parameter estimates. The results of our calculations are presented in Table 11. Based on these somewhat imprecise measurements, we concluded that the order of magnitude of the variance parameter is about .01. This is the value that we assumed in the HECM model.

3. Sensitivity to Parameter Changes

The final consideration in this section is an analysis of the sensitivity of the model to changes in the parameters. As mentioned previously, the sensitivity to changes in the underlying mortality rates are not explicitly shown here. Instead, the sensitivity to changes in the move-out rate parameter are shown. Together the mortality and move-out rates define the rate of mortgage prepayment, which is the important phenomenon that these parameters are attempting to quantify. Lower mortality can be offset by higher move-outs and vice versa. Hence, the sensitivity to prepayment speed is shown by variations in the assumed move-out rate parameter.

Table 12 is similar in format to Tables 6 and 7. The loan terms are calculated using the principal limit method of the current model. The expected losses and MIP collection are then analyzed by using the assumed parameter values in the basic model.

response to this, we note that HECM borrowers would all occupy homes which meet the quality standards to obtain a mortgage or else they would be required to bring the property up to standard as a condition of the HECM loan agreement.

* Previously cited studies which model housing assets using a similar geometric Brownian motion process do not indicate how the parameter (σ) is to be measured.

Table 12

SENSITIVITY OF PRESENT VALUES OF EXPECTED LOSSES/MIP COLLECTED
TO CHANGES IN THE MODEL PARAMETERS

Assumed Loan Terms:

Borrower Age	=	75	Closing Costs	=	\$1,500
Max Claim Amt	=	\$100,000	Initial Draw	=	0
Interest Rate	=	10%	Tenure Payment	=	\$357
Servicing Fee	=	0	Line of Credit	=	0

<u>Parameter</u>	<u>Lower</u>	<u>Model Assumption</u>	<u>Higher</u>
Mean Appreciation (μ)	3%	4%	5%
Expected Loss	\$4030	2880	1904
Expected MIP	3201	3201	3201
Loss/MIP %	126%	90%	59%
Apprec. Variance ¹ (σ^2)	.005	.010	.015
Expected Loss	2545	2880	3168
Expected MIP	3201	3201	3201
Loss/MIP %	80%	90%	99%
Move-Out Rate (m)	0.0	0.3	0.6
Expected Loss	4424	2880	1938
Expected MIP	3481	3201	3005
Loss/MIP %	127%	90%	64%
Discount Rate (i)	8.5%	9.5%	10.5%
Expected Loss	3486	2880	2384
Expected MIP	3319	3201	3098
Loss/MIP %	105%	90%	77%

¹ Corresponding standard deviations (σ) are 7 percent, 10 percent, and 12½ percent, respectively.

From the table, it is clear that the HECM model is very sensitive to small changes in the mean appreciation rate. An average appreciation rate that varies by one percent in either direction from the assumed 4 percent causes the ratio of loss to MIP to range from 126 percent down to 59 percent. The model appears to be somewhat less sensitive to changes in the variance, although it is difficult to determine whether the range of values shown for the variance represent a small or a large deviation from the assumed value. The model is quite sensitive to the changes in the move-out rate also. As with the variance, it is difficult to determine whether the range shown represents a small or large deviation for this parameter. For both the variance and the move-out rate, the data gathered from the demonstration should provide some indication as to the likely magnitude of fluctuations. Finally, the sensitivity to the discount rate is not great. Large deviations in the discount rate from the assumed value are unlikely because the rate assumed will necessarily be close to the value of the ten year Treasury rate.

ANNEX

DERIVATION OF EXPECTED VALUE AND CONDITIONAL EXPECTED VALUE FOR LOG-NORMALLY DISTRIBUTED HOUSE PRICES

Let

$$\begin{aligned} H(t) &= \text{house price at time } t, \\ H_0 &= \text{initial house price, } t = 0, \\ X(t) &= H(t)/H_0, \\ Y(t) &= \ln(H(t)/H_0), \\ B(t) &= \text{outstanding balance on mortgage at time } t, \text{ and} \\ b(t) &= B(t)/H_0. \end{aligned}$$

Then

$$X(t) = e^{Y(t)},$$

where we assume that $Y(t)$ is a Brownian motion process with drift. Note that this assumption implies that for any given time $t = t^*$, $Y(t^*)$ is a normally distributed random variable with mean μt^* and variance $\sigma^2 t^*$, where μ and σ are constants. Furthermore, $X(t)$ is a geometric Brownian motion and is a lognormally distributed random variable.

Assume:

time is fixed at $t = 1$, making the mean and variance of $Y(t)$ equal μ and σ^2 ,
 x is an observed value of the random variable $X(t)$,
and
 y is an observed value of the random variable $Y(t)$.

For simplicity of notation, we shall use the variables X , Y , and b in place of $X(t)$, $Y(t)$, and $b(t)$, keeping in mind that the variables are actually time dependent. The assumption that $t = 1$ will be relaxed when appropriate. The problem is to find $E[X]$ and $E[X|x < b]$.

A. Derive $E[X]$:

Let

$$g(Y) = e^Y.$$

Then $E[X] = E[e^Y] = E[g(Y)]$. That is, finding the expected value of X is equivalent to finding the expected value of the function $g(Y) = e^Y$. According to Ross (1983) (chapt. 1.3), the expected value of the function of a random variable is given by:

$$E[g(Y)] = \int_{-\infty}^{\infty} g(y) dF(y) = \int_{-\infty}^{\infty} g(y) f(y) dy, \quad (A-1)$$

where

$F(y)$ is the probability distribution function of Y , and $f(y)$ is the probability density function of Y .

(Note that the integrals in (A-1) are non-stochastic because they are expressed in terms of the real-valued variable, y , and not the random variable, Y).

Since Y is assumed to have the normal distribution, we have:

$$f(y) = [1/\sigma\sqrt{2\pi}] e^{-\frac{1}{2}\left(\frac{y-\mu}{\sigma}\right)^2}, \quad (A-2)$$

where equation (A-2) is the density function of a normally distributed random variable with mean μ , and variance σ^2 . Substituting (A-2) into equation (A-1), we get:

$$E[g(Y)] = E[e^{\gamma}] = [1/\sigma\sqrt{2\pi}] \int_{-\infty}^{\infty} e^{\gamma} e^{-\frac{1}{2}\left(\frac{y-\mu}{\sigma}\right)^2} dy. \quad (A-3)$$

Now let

$$y' = (y-\mu)/\sigma,$$

which transforms the y into observed values of a standardized random variable. (Note that $dy' = dy/\sigma$). Rewrite equation (A-3) and simplify:

$$\begin{aligned} E[e^{\gamma}] &= e^{\mu\gamma} [1/\sqrt{2\pi}] \int_{-\infty}^{\infty} e^{\sigma\gamma y'} e^{-\frac{1}{2}y'^2} dy', \\ &= e^{\mu\gamma} [1/\sqrt{2\pi}] \int_{-\infty}^{\infty} e^{-\frac{1}{2}(y'-\sigma\gamma)^2} dy', \\ &= e^{\mu\gamma} \beta. \end{aligned} \quad (A-4)$$

As proved by Parzen (1960) (chapt. 2.24), β is an identity which equals 1. That is,

$$\beta = [1/\sqrt{2\pi}] \int_{-\infty}^{\infty} e^{-\frac{1}{2}(y'-\sigma\gamma)^2} dy' = 1. \quad (A-5)$$

Combine equations (A-4) and (A-5) to get:

$$E[X] = E[e^{\gamma}] = e^{\mu\gamma}. \quad (A-6)$$

Since the variable X , and the constants μ and σ are actually time dependent, we rewrite (A-6):

$$E[X(t)] = e^{\mu t + \frac{1}{2}\sigma^2 t}, \text{ and}$$

$$E[H(t)] = H_0 e^{\mu t + \frac{1}{2}\sigma^2 t}. \quad (\text{A-7})$$

B. Derive $E[X|x < b]$:

Again let

$$g(Y) = e^Y.$$

Then $E[X|x < b] = E[g(Y)|y < \ln(b)]$. That is, the conditional expected value of X given that the observed value, x , is less than b is equivalent to the conditional expected value of the function $g(Y)$ given that y is less than the natural log of b . Rewrite equation (A-1):

$$\begin{aligned} E[g(Y)|y < \ln(b)] &= \int_{-\infty}^{\ln(b)} g(y) dF(y) \\ &= \int_{-\infty}^{\ln(b)} g(y) f(y) dy, \end{aligned} \quad (\text{A-8})$$

where $F(y)$ and $f(y)$ are revised probability distribution and density functions. Specifically, the revised probability density function is given by:

$$f(y) = [1/A] [1/\sigma\sqrt{2\pi}] e^{-\frac{1}{2}((y-\mu)/\sigma)^2}, \quad (\text{A-9})$$

if $-\infty < y \leq \ln(b)$, and

$$f(y) = 0,$$

otherwise. The factor $[1/A]$ is required so that the total area under the probability density function equals 1, as is required of all probability density functions. See graph in this Appendix. That is, in order for

$$\int_{-\infty}^{\infty} f(y) dy = 1,$$

then the constant A must be given by:

$$A = [1/\sigma\sqrt{2\pi}] \int_{-\infty}^{\ln(b)} e^{-\frac{1}{2}((y-\mu)/\sigma)^2} dy. \quad (\text{A-10})$$

Therefore, from equations (A-8), (A-9), and (A-10) we have:

$$\begin{aligned} E[X|x < b] &= E[e^Y|y < \ln(b)] = \\ &= [1/A] [1/\sigma\sqrt{2\pi}] \int_{-\infty}^{\ln(b)} e^y e^{-\frac{1}{2}((y-\mu)/\sigma)^2} dy. \end{aligned} \quad (\text{A-11})$$

Let

$$\begin{aligned} y' &= (y-\mu)/\sigma, \text{ and} \\ U &= [\ln(b)-\mu]/\sigma, \end{aligned}$$

which transforms both y and $\ln(b)$ into standardized form. Rewrite equation (A-11) and simplify:

$$\begin{aligned} E[X|x < b] &= e^{-\mu} [1/A] [1/\sqrt{2\pi}] \int_{-\infty}^U e^{-\sigma y'} e^{-\lambda y'^2} dy' \\ &= e^{-\mu-\lambda\sigma^2} [1/A] [1/\sqrt{2\pi}] \int_{-\infty}^U e^{-\lambda(y'-\sigma)^2} dy' \\ &= e^{-\mu-\lambda\sigma^2} \beta. \end{aligned} \tag{A-12}$$

Note that equation (A-12) is similar to equation (A-4), except that now we have:

$$\beta = [1/A] [1/\sqrt{2\pi}] \int_{-\infty}^U e^{-\lambda(y'-\sigma)^2} dy'. \tag{A-13}$$

Note that now $0 < \beta < 1$, which means that the conditional expected value is always less than or equal to the unconditional expected value. In the case of very large outstanding balance on the mortgage, then $\ln(b)$ and U are also very large, and the values of A and β approach 1. In this case the conditional and unconditional expected values are nearly equal. In the limit, as b goes to ∞ , they are equal.

Since the X , μ , and σ are actually time dependent, we rewrite equations (A-12) and (A-13) as:

$$E[X(t)|x < b(t)] = e^{-\mu-\lambda\sigma^2 t} \beta, \tag{A-14}$$

$$\beta = [1/A] [1/\sqrt{2\pi}] \int_{-\infty}^{U(t)} e^{-\lambda(y'-\sigma t)^2} dy', \tag{A-15}$$

where

$$U(t) = \{\ln[b(t)] - \mu t\}/\sigma t, \tag{A-16}$$

and

$$A = [1/(\sigma t \sqrt{2\pi})] \int_{-\infty}^{\ln[b(t)]} e^{-\lambda(y-\mu t)/\sigma t} dy. \tag{A-17}$$

Equations (A-14) through (A-17) specify the desired conditional expected value. Note that equation (A-14) can also be written as:

$$E[H(t)|h < B(t)] = H_0 e^{-\mu-\lambda\sigma^2 t} \beta. \tag{A-18}$$

...

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