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# Mortgage Company Bids on the GNMA Auction

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In 1968 the Government National Mortgage Association (GNMA) was created as a government agency with two primary functions: 1) To support the residential mortgage market by buying and selling certain Federal Housing Administration (FHA) insured and Veterans Administration (VA) guaranteed loans pursuant to various federally subsidized mortgage programs, and 2) to guarantee the timely payment of principal and interest on mortgage-backed securities, issued against pools of FHA-insured and VA-guaranteed loans.<sup>1</sup> Unlike the Federal National Mortgage Association (FNMA), GNMA is not a permanent mortgage investor and resells all loans within one year after purchase. These loans are sold through an open market auction and are immediately eligible to be pooled to support mortgage-backed securities. To date, mortgage banking companies (MBCs) have been the primary purchasers of GNMA-auctioned loans and the primary issuers of mortgage-backed securities.<sup>2</sup>

A problem for mortgage bankers and others is determining the optimal price to bid for GNMA-auctioned loans. It is the purpose of this paper to provide a solution to that problem. The paper presents a stochastic bidding model that incorporates an empirically derived probability distribution of loan terminations to reflect the uncertainty of premature mortgage payoffs and foreclosures.<sup>3</sup>

The section below is devoted to describing mortgage-backed securities and the functions of MBCs. This discussion is the basis for the bidding model developed in Section II. In Section III cost and revenue estimates, taken from financial data provided by a group of eight mortgage companies are used to illustrate the model and the sensitivity of bids to changes in the values of several parameters. Section IV compares actual bids with those determined by the model. A final section contains a summary and some concluding remarks.

## MBCs and Mortgage-Backed Securities

The purchasers of mortgage-backed securities include savings banks, savings and loan associations, life insurance companies, bank trust departments, and public and private pension funds. These investors receive a coupon interest rate on the securities of one-half of one per cent less than the rate on the pooled loans. The difference is used to pay GNMA's guarantee fee and the issuer's servicing fee. Although the mortgages that support these securities actually are owned by the security issuer, the interest and principal payments (less the insurance and servicing fee) made on the loans are "passed-through" pro rata to the owners of the security.<sup>4</sup>

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<sup>1</sup> The technicalities of issuing mortgage-backed securities are set forth in the *Mortgage-Backed Securities Guide [1973]* and *GNMA Sellers Guide [1973]*.

<sup>2</sup> *Mortgage Banker [1971]* has devoted a special edition to examining the role of MBC's in issuing mortgage-backed securities.

<sup>3</sup> Recent bibliographies of literature examining optimal auction procedures are contained in Bolten [1973] and McDonald and Jacquillat [1974].

<sup>4</sup> The documents evidencing the loans are placed in trust, usually with a commercial bank. Regulations require that interest and principal be paid to the security holder whether or not it is actually collected, thus giving rise to the title "modified pass through" securities. The FHA later reimburses the MBC for principal and interest payments made on loans that are eventually foreclosed.

Because the FHA and VA interest rate ceilings usually are below the market rate these securities generally are issued at a discount from the face amount of the pooled loans.

It is the responsibility of the security issuer to service the pool of loans that supports it. This responsibility includes collecting and transmitting monthly mortgage payments, maintaining accurate payment records, periodically inspecting the mortgaged property, pursuing delinquent payments and initiating foreclosure proceedings when necessary.<sup>5</sup> MBCs have been attracted to the GNMA auction because it allows them to bid on loans that are located only within the geographic area in which they normally maintain servicing facilities.

The procedure usually followed by an MBC that intends to bid on the auction is to obtain a prior commitment from an underwriter to issue a security backed by the newly purchased loans.<sup>6</sup> With a resale price guaranteed by the underwriter, the decision variable for the mortgage banker is the amount by which his bid should deviate from that price. This spread depends on the net after tax cash benefits that the MBC expects to receive for servicing the pool of loans. Identification and estimation of those cash benefits is the basis for the bidding model developed herein.

**Cash Inflows.** MBCs that issue mortgage-backed securities receive a direct cash inflow in the form of a monthly servicing fee. This fee is fixed by GNMA at a level that is equivalent to an annual rate of forty-four hundredths of one per cent of the declining principal balance of the loans being serviced.<sup>7</sup> MBCs receive an indirect cash benefit from the management of funds collected for the payment of FHA mortgage insurance premiums, real estate taxes and fire and hazard insurance premiums. Both FHA and VA require that servicers collect one-twelfth of a mortgagor's annual real estate taxes and insurance premiums with each monthly payment and that these funds be placed in a non-interest bearing escrow account until payments are due. The funds accumulated in escrow are of value because they may be used as compensating balances on commercial bank loans. The implicit rate of return earned on these funds is the opportunity cost of obtaining compensating balances from another source.<sup>8</sup>

As described above, the cash benefits that accrue to a security issuer in each period largely depend on the unpaid principal amounts of the loans being serviced. The unpaid principal amounts of the loans in each period are a function of the original face amounts, interest rates and maturities of the loans. In general, the price (discount) that an MBC should bid for a pool of loans varies directly (inversely) with the maturities, interest rates and face amounts of the loans being auctioned.

**Cash Outflows.** The cash outflows required to service a pool of loans may be separated into two categories: 1) Cash payments required to perform ordinary servicing functions, including collection and disbursement of mortgage payments, record keeping and management of escrow funds, and 2) additional cash outlays required to initiate and pursue foreclosure proceedings when all other efforts fail to cure delinquent loans.

Unlike servicing cash inflows, cash outflows are independent of the sizes, interest rates and maturities of the loans being serviced. But, over time, the cost of servicing does depend on inflation and technological

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<sup>5</sup> The legal responsibilities of mortgage servicers are detailed in Administration of Insured Home Mortgages [1974], and their operating procedures are described in DeHuszar [1972], or Pease and Kerwood [1965], Chapter 21.

<sup>6</sup> By obtaining a prior commitment, the MBC shifts the risk of interest rate changes to the underwriter. The commitment insulates the highly levered MBC from upward movements in interest rates that could substantially erode its equity position. Ganis [1974] contains a discussion of the underwriter's view of issuing mortgage-backed securities.

<sup>7</sup> Mortgage servicers also receive miscellaneous income from late payment penalties. These could easily be included in the model, but will be ignored for convenience of exposition and because they do not alter the primary conclusions.

<sup>8</sup> Since the average debt/total assets ratio for MBCs in 1972 was .90, escrow balances usually are of direct benefit to the servicing company, but excess funds may be rented to other firms. See Financial Statements and Operating Ratios H9721. P. 27.

change. In general, the price that an MBC should bid for a loan varies inversely with the expected rate of increase in the cost of loan servicing.

In addition to the cash outlays required to service a pool of loans, an MBC incurs a "front-end" expense when loans are purchased at the auction. GNMA requires that a successful bidder compensate the original servicer of the loans for the value of income foregone. This fee equals one-half of one per cent of the unpaid principal amount of the loans.

### The Model for Determining Bids

Given the institutional and regulatory environment described above, an MBC should submit a bid for a J-period maturity loan such that

$$(1) \quad \begin{aligned} & [(B_o)(1 - SDP) - (B_o)(1 - BDP)](1 - \tau) \\ & - (.005)(B_o) \\ & + \left[ \frac{(\tau)(.005)(B_o)}{A} \cdot \sum_{j=1}^A \frac{1}{(1+r)^j} \right] \\ & + \sum_{j=1}^J \frac{E(CF_j)(1 - \tau)}{(1+r)^j} \geq 0 \end{aligned}$$

where

- $B_o$  = original face amount of the loan
- $(1 - SDP)$  = price guaranteed by the security underwriter expressed as a fraction of the loan amount (SDP usually is called the discount points on the loan)
- $(1 - BDP)$  = price bid by the MBC expressed as a fraction of the loan amount (BDP represents the discount points bid for the loan)

$\tau$  = tax rate applicable to corporate income

$(.005)(B_o)$  = payment for release of servicing  
 $\left[ \frac{(\tau)(.005)(B_o)}{A} \right]$   
 represents the annual tax saving when this payment is amortized over A periods]

$E(CF_j)$  = net cash flow expected to be received at the end of month j for servicing the loan,  $j = 1, \dots, J$

$r$  = after-tax cost of capital per month

Once a resale price is committed by an underwriter, it is the last term in (1), the discounted value of the net cash flows that are expected to accrue to the security issuer, that determines the price that should be bid for a particular loan. Since the number of periods that a loan will be outstanding is unknown at the time of purchase,

the cash flows expected to be received at the end of each period depend upon the following: 1) The probability that the loan will be paid off at the end of period  $j$ ,  $P(P_j)$ ; 2) the probability that the loan will continue to be outstanding at the end of period  $j$ ,  $P(O_j)$ ; 3) the probability that the loan will be foreclosed at the end of period  $j$ ,  $P(F_j)$ ; and 4) the cash flows associated with each of those events.

Let  $IS_j$  denote the net cash flow received at the end of period  $j$  when a loan is paid off or continues to be outstanding.<sup>9</sup>  $IS_j$  includes servicing fees, servicing costs and the implicit income earned on escrow funds. Let  $FC_j$  denote the net cost per mortgage foreclosure. The cash flow expected at the end of period  $j$  is given by:

$$(2) E(CF_j) = P(O_j) \cdot IS_j + P(P_j) \cdot IS_j - P(F_j) \cdot FC_j$$

which can be written as

$$(3) E(CF_j) = \left[ \prod_{k=1}^{j-1} P(O_k | O_{k-1}) \right] \cdot \left[ P(O_j | O_{j-1}) \cdot IS_j + P(P_j | O_{j-1}) \cdot IS_j - P(F_j | O_{j-1}) \cdot FC_j \right]^{10}$$

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where  $P(O_j | O_{j-1})$ ,  $P(P_j | O_{j-1})$ , and  $P(F_j | O_{j-1})$  represent the conditional probability that a loan will be outstanding, paid off or foreclosed at the end of period  $j$  given that it is outstanding at the end of period  $j - 1$ . Equation (3) can be used to compute the discounted value of expected cash flows, but an expression that is more convenient to work with (for reasons that will become clear) can be derived. By noting that:

$$P(O_j | O_{j-1}) + P(P_j | O_{j-1}) + P(F_j | O_{j-1}) = 1$$

(3) can be written as

$$(4) E(CF_j) = \left[ \prod_{k=1}^{j-1} (1 - P(P_k | O_{k-1}) - P(F_k | O_{k-1})) \right] \cdot \left[ (1 - P(F_j | O_{j-1})) \cdot IS_j - P(F_j | O_{j-1}) \cdot FC_j \right]$$

<sup>9</sup> When a loan is paid off at the end of period  $j$  the MBC receives the servicing fee for that period and no income in subsequent periods.

<sup>10</sup> Equation (3) is derived from (2) by noting that

$$P(P_j) = P(P_j | O_{j-1}) \cdot P(O_{j-1}) + P(P_j | F_{j-1}) \cdot P(F_{j-1}) + P(P_j | P_{j-1}) \cdot P(P_{j-1}) = P(P_j | O_{j-1}) \cdot P(O_{j-1})$$

likewise

$$P(F_j) = P(F_j | O_{j-1}) \cdot P(O_{j-1})$$

And

$$P(O_j) = P(O_j | O_{j-1}) \cdot P(O_{j-1})$$

Then by recursion

$$P(O_{j-1}) = \prod_{k=1}^{j-1} P(O_k | O_{k-1}) \cdot P(O_{k-1})$$

K=1

Equation (4) expresses the cash flows expected at the end of period  $j$  solely in terms of the net cash flows in  $j$  and the conditional probability that a loan will be terminated either through premature payoff or foreclosure in each period prior to  $j$ . This general relationship can be made specific by replacing  $IS_j$  with terms that represent its component parts.

By making the appropriate substitutions, the discounted value of expected after-tax cash flows may be expressed as:

$$(5) \quad (1-\tau) \sum_{j=1}^J \frac{E(CF_j)}{(1+r)^j} = (1-\tau) \sum_{j=1}^J \left[ \prod_{k=1}^{j-1} (1 - P(P_k|O_{k-1}) - P(F_k|O_{k-1})) \right] \cdot \left[ \frac{[1 - P(F_j|O_{j-1})] \cdot [(SF)(B_j)]}{(1+r)^j} - \frac{(SC_0)(1+IF)^j + (EB_j)(i_j)}{(1+r)^j} - \frac{P(F_j|O_{j-1})(FC_0)(1+IF)^j}{(1+r)^j} \right]$$

Where:

- SF = monthly servicing fee expressed as a fraction of the unpaid principal balance of the mortgage loan
- $B_j$  = unpaid principal balance of the mortgage loan at the beginning of month  $j=1, \dots, J$
- $SC_0$  = monthly cost of servicing per loan at the time the mortgage is purchase monthly rate of inflation net of technological change
- $FC_0$  = net cost per foreclosure at the time the mortgage is purchased.
- $EB_j$  = amount of funds held in escrow at the beginning of month  $j - 1, \dots, J$  (including FHA mortgage insurance premiums, RE taxes and F&H insurance premiums)
- $i_j$  = implicit rate of return earned on escrow funds in month <sup>11</sup>

Equation (5) shows that the net cash benefits expected to be received for servicing a loan and, therefore, the appropriate price to bid for the loan, largely depend upon the original face amount of the loan, the maturity of the loan, the periodic probabilities of premature payoff and foreclosure and the rate at which servicing costs are expected to increase.

By substituting the right hand side of (5) for the last term in (1) and solving for  $B$ , (I-BDP) or (I-BDP) it is possible to determine the price or equivalently one-minus-the-discount-points that an MBC should bid for a particular loan.

### Illustrating The Model

In order to illustrate the use of the model, values for the cash flow parameters were estimated from financial data provided by a group of eight MBC's.<sup>12</sup> The parameter values used in the analysis and their sources are summarized in Figure 1.

<sup>11</sup> Although the escrow balances represent an implicit source of revenues they should not be treated as tax-free income. The effect of the escrow balances is to reduce the explicit cost of banking services. Since these costs are tax-deductible, the value of the implicit benefits derived from the escrow balances is only that portion that would not have been deductible for tax purposes.

**Figure 1. Parameter Estimates**

<b>Parameter</b>	<b>Value</b>	<b>Source</b>
(1) Mortgage Interest Rate-percent per annum	8.5%	FHA Regulation
(2) Underwriter Discount Points-percentage of principal	5.0%	Illustrative
(3) Annual Servicing Fee-percentage of principal	.44%	GNMA Regulation
(4) Payment for Released Servicing-percentage of principal	.5%	GNMA Regulation
(5) Amortization Period-in years	8.0 years	MBC Data
(6) Average Variable Servicing Cost-per annum	\$24.59	MBC Data
(7) Average Variable Cost Per Foreclosure	\$379.60	MBC Data
(8) Rate of Cost Increase-per cent per annum	3.0%	Federal Reserve Data
(9) Annual RE Taxes and F&H Insurance Premiums percentage of mortgage amount	2.0%	MBC Data <sup>13</sup>
(10) Number of Times Taxes Paid-per annum	2.0 times	MBC Data <sup>14</sup>
(11) FHA Mortgage Insurance Premium-percentage of principal	.5%	FHA Regulation
(12) Return on Escrow Funds-per dent per annum	8.0%	Treasury Note Yield
(13) Corporate Tax Rate-per cent per annum	49.0%	MBC Data
(14) After-Tax Weighted Average Cost of Capital percent per annum	7.0%	MBC Data

FHA data were used to estimate the conditional probabilities of premature mortgage payoff and foreclosure. Data classified according to policy year and mortgage maturity were used to estimate termination distributions for 25 and 30 year maturity loans. The conditional probabilities of payoff and foreclosure for 35 year maturity loans were estimated from the 25 and 30 year termination distributions.<sup>15</sup>

For computational purposes the annual conditional probability distributions and the annual cash flow parameter values in Figure I were converted to their monthly equivalents.<sup>16</sup>

As discussed earlier, the bid for an individual loan largely depends upon the face amount of the loan, the maturity of the loan, the conditional probabilities of premature termination and the expected rate of increase in the cost of loan servicing. Through sensitivity analysis this section examines the impact of these variables on bids provided by the model. The parameter values presented in Figure 1 and the conditional probabilities of premature payoff and foreclosure were used to determine bids on loans ranging in size from \$12,000 to \$36,000. This range should contain most of the loans auctioned by GNMA.<sup>17</sup>

**Mortgage Maturities.** The prices and bids for 25, 30 and 35 year maturity loans are presented in Figure 2. The table shows that the MBCs included in this study should accept a "loss" on loans purchased at the auction

<sup>12</sup> In terms of their total servicing portfolios, all eight companies were among the 200 largest mortgage servicers in the U.S. Ranking the 200 largest MBCs by size of their servicing portfolios and dividing them into quartiles; shows that four of the eight are in the first quartile, one is in the second quartile, two are in the third quartile and one is in the fourth quartile. The Mortgage Bankers Association reported 750 MBCs in 1972.

<sup>13</sup> In the illustrations escrow balances were computed by using the FHA mortgage insurance formula plus an average balance from other Sources. The average balance from other sources equals one-half of the total annual payment (expressed as a percentage of the face amount of the loan) divided by the number of times payments are due each year.

<sup>14</sup> Ideally this variable would be assigned the appropriate forward rates implied by the current term structure. Using one rate for all periods -implies a flat term structure. Sensitivity analysis with respect to different levels of implicit returns showed that the results were relatively insensitive to changes in this parameter.

<sup>15</sup> I am indebted to the FHA for making the unpublished data available for this Study. The same data were used by Curley and Guttentag [1974] and Von Furstenberg [1969].

<sup>16</sup> A complete discussion of the methodology used to estimate each parameter is available from the author or in McConnell [1976].

<sup>17</sup> The maximum loan eligible for GNMA purchase is \$38,000.

(i.e., the bids exceed the resale price of 95.00 committed by the underwriter). It also shows that the acceptable loss increases with the size and maturity of the loan.

The difference between the bid on a \$12,000 and a \$36,000 loan with a 30 year maturity is 1.60 points. While this may appear to be a relatively small amount, on a \$10 million pool of loans it represents a difference of \$160,000. If the difference between the resale and the purchase price of the loans is considered an investment by the MBC, then the net investment in a \$10 million pool of \$12,000 loans is \$77,000. A difference in bids of 1.60 points is more than double that amount—a seemingly small error in determining bids could represent a substantial part of the MBC's net investment.

Comparing bids on loans of the same size but different maturities shows that the margin between bids on 25 and 35 year maturity loans increases with loan size, growing from .27 on a \$12,000 loan to .62 on a \$36,000 loan. Again this difference may seem negligible, but it represents approximately 28% of the MBC's net investment in a pool of \$36,000, 25 year maturity loans. .

It should be noted that the optimal bid for a \$24,000 loan is not the average of the bids for a \$12,000 and a \$36,000 loan. This implies that the appropriate bid for a pool of loans is not the bid computed for the average size loan in the pool. In general such a procedure will yield excessive bids. To determine the bid for a pool composed of loans of various sizes and maturities a mortgage banker should compute bids for each type (i.e., size and maturity) of loan and calculate a composite bid by weighing the individual bids according to the number of each type in the pool. For example, the composite bid for a pool composed of an equal number of \$12,000 and \$36,000, 30 year maturity loans is  $\frac{1}{2} (95.77 + 97.36) = 96.57$ . This is less than the bid for a \$24,000 loan of the same maturity.

**Figure 2**  
**GNMA Auction Bids For Different Maturity Loans**

Face Amount (dollars)	Mortgage Maturity					
	25 Years		30 Years		35 Years	
	Price (dollars)	Bid (per \$100)	Price (dollars)	Bid (per \$100)	Price (dollars)	Bid (per \$100)
\$12,000	\$11,482	95.68	\$11,493	95.77	\$11,514	95.95
18,000	17,351	96.40	17,383	96.57	17,432	96.84
24,000	23,220	96.75	23,274	96.97	23,349	97.29
30,000	29,089	96.96	29,164	97.21	29,267	97.55
36,000	34,958	97.11	35,054	97.37	35,184	97.73

**Termination Distributions.** To illustrate the impact of different termination distributions the term  $P(P_j/0_j-1)$  in equation (5) was replaced with  $P(P_j/0_j-1) * R$  where R represents the expected probability of premature payoff as a fraction of the historical average payoff rate. In the examples below  $R = .5, 1.5$  and  $2.5$ . The probability that a 30 year maturity loan will be outstanding at any point in time under each of these termination distributions is illustrated in Figure 3. When the periodic probability of premature payoff is 250% of the historical average rate there is a 50% probability that a 30 year maturity loan will be terminated before the

end of the eighth year, but when it is 50% of the historical average rate there is a 50% probability that a loan will last until the 28th year.

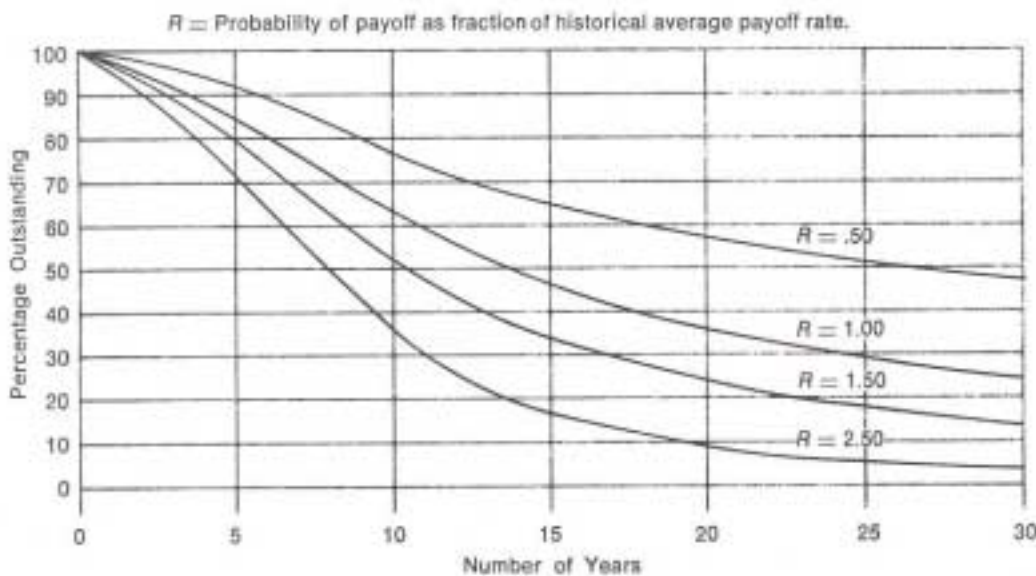
Figure 4 presents bids computed under each termination distribution. As the probability of premature payoff increases, bids decline. Yet even under the highest payoff rate an MBC should accept a loss on all loan sizes shown. The difference between bids when  $R = .5$  and 2.50 is 1.11 points for \$36,000 loans. Since this margin is large relative to their net investment, mortgage bankers should attempt to assess the probability of premature terminations when purchasing GNMA loans.

It is likely that mortgage terminations are a -function of mortgagor characteristics and economic conditions. While it may be difficult to identify those mortgagor characteristics that influence terminations, Curley and Guttentag [1974] have presented evidence indicating that premature payoffs are a function of interest rate changes a decline in rates leading to an increase in the incidence of premature payoffs and an increase in rates having the opposite effect.<sup>18</sup> Although successful prognosticators of interest rate changes are notable for their absence, the available evidence suggests that a mortgage banker anticipating such a change should adjust his bid accordingly.

**Cost Increases.** The periodic rate of cost increases used in the computations presented in Figures 2 and 4 was estimated from the Functional Cost Analysis [1965 and 1972] for the years 1965 to 1972. Over the more recent period 1969 to 1972 the Mortgage Bankers Association's Survey of Single Family Loan Operations [1972] reported an increase of 11.2% per annum. in the variable cost of servicing a mortgage loan.<sup>19</sup> Figure 5

*BIDS ON GNMA AUCTION*

**Figure 3. Probability that a Loan Will be Outstanding Under Different Payoff Distributions**



<sup>18</sup> They note that "... in every mortgage age category for which a comparison is possible, termination rates were higher in years of [mortgage yield] ease than in the immediately prior years of [yield] restraint." Curley and Guttentag, op. cit., p. 124.

<sup>19</sup> Part of this increase was due to an increase in the incidence of delinquent and difficult to collect loans. Survey of Single-Family Loan Operations [1972], p. 16.

presents bids computed under three levels of cost increases. The results show that bids decrease as the expected rate of inflation increases and that the impact is greater for smaller loans. In fact, with a 9% rate of cost increases an MBC should purchase a \$12,000, 30 year maturity loan at a price below the guaranteed resale price. For this size loan the discounted value of the expected cash inflows is less than the discounted value of the expected cash outflows required to service the loan.<sup>20</sup> Since the security issuer is committed to servicing the pool of loans for the duration of their lives, careful consideration should be given to the expected rate of future cost increases when bids are submitted on the GNMA auction. High rates of inflation substantially reduce the optimal bid.<sup>21</sup>

### Comparison With Actual Bids and Prices

The results of the sensitivity analysis showed that it is optimal, over a wide range of parameter values, for MBCs to purchase GNMA-auctioned loans at a price that exceeds their predetermined resale value. That is, the bidding model indicates that the group of companies that supplied data for this study should be willing to accept a loss on mortgage loans purchased to issue a GNMA mortgage-backed security.

**Figure 4. GNMA Auction Bids With Different Payoff Rates**

Face Amount (dollars)	Payoff Rate as Fraction of Historical Average Payoff Rate					
	R = .50		R = 1.50		R = 2.50	
	Price (dollars)	Bid (per \$100)	Price (dollars)	Bid (per \$100)	Price (dollars)	Bid (per \$100)
\$12,000	\$11,498	95.81	\$11,486	95.72	\$11,471	95.59
18,000	17,421	961.78	17,351	96.39	17,300	96.11
24,000	23,344	97.26	23,216	96.73	23,130	96.37
30,000	29,267	97.55	29,081	96.94	28,960	96.53
36,000	35,190	97.75	34,947	97.07	34,789	96.64

**Figure 5. GNMA Auction Bids With Different Rates of Cost Increase**

Face Amount (dollars)	Rate of Cost Increase					
	IF = .00		IF = .06		IF = .09	
	Price (dollars)	Bid (per \$100)	Price (dollars)	Bid (per \$100)	Price (dollars)	Bid (per \$100)
\$12,000	\$11,553	96.28	\$11,403	95.03	\$11,264	93.87
18,000	17,443	96.91	17,293	96.07	17,154	95.30
24,000	23,334	97.22	23,184	96.60	23,044	96.02
30,000	29,224	97.41	29,074	96.91	28,935	96.45
36,000	35,114	97.54	34,964	97.12	34,825	96.74

<sup>20</sup> The cost of servicing could be adjusted for the "quality" of the loan. One of the companies that participated in this study found that the cost of servicing may differ by as much as 35% from poor to good quality loans. See Hillman.

<sup>21</sup> It is probable that interest rates and anticipated inflation are not unrelated. A decline in the anticipated rate of cost increases may lead to a decline in nominal interest rates and an increase in the incidence of premature payoffs. For discussions of this relationship see, for example, Fisher [1930], Sargeant [1972], Hendershott and Van Horne [1973] or Long [1974].

**Figure 6. Actual Bids and Prices on GNMA Auctioned Loans**

<b>Date</b>	<b>Average Bid, (Per \$100)</b>	<b>FNMA Price (Per \$106)</b>	<b>GNVIA Bid FNMA Price (Per \$100)</b>
12/ 6/72	96.08	95.05	1.03
3/ 7/73	88.11	87.20	.89
6/ 6/73	92.58	92.49	.09
9/10/73	86.75	83.60	3.15
12/ 5/73	90.55	87.85	2.70
3/13/74	96.98	95.50	1.48

-Source: Government .National Mortgage Association, Washington, D.C.

In order to judge the reliability of the model the average of the bids submitted on the GNMA auction along with the corresponding FNMA market prices for mortgage loans of the same interest rate are presented in Figure 6. These bids and prices were selected at quarterly intervals starting with the last quarter of 1972. Although the average GNMA bids do not fully reflect the size and maturity composition of the pool of mortgage loans being auctioned the spread between the average bid and the market price on the same date is consistent with the results yielded by the model. In every case (including those not shown) the average bid exceeded the corresponding FNMA market price.

The reason that MBCs have been willing to pay a premium to acquire loans to issue a GNMA mortgage-backed security is that the present value of the explicit and implicit cash benefits expected to be received for servicing these loans exceeds the present value of the associated servicing costs. To the extent that mortgage bankers expect loans to be paid-off prematurely and to the extent that they expect the cost of servicing to increase over the life of the loans this premium should be reduced.

### **Summary and Conclusion**

This paper presented a model with which mortgage bankers can determine optimal bids for GNMA-auctioned loans. The model was illustrated with cost and revenue data supplied by a group of eight mortgage banking companies. Sensitivity analysis was used to show the impact of mortgage amounts, mortgage maturities, mortgage termination distributions and the expected rate of operating cost increases on bids determined with the model.

The sensitivity analysis revealed two interesting phenomena. First, it is optimal for MBCs to purchase GNMA-auctioned loans at a price greater than their guaranteed resale value. Comparing the bids provided by the model with actual auction bids and actual mortgage prices indicates that these results are consistent with the observed behavior of mortgage buyers. Second, the sensitivity analysis showed that small changes in bids could represent a substantial portion of an MBC's net investment in a pool of loans. For that reason, mortgage bankers should give careful consideration to estimating the likely value of each of the variables that affect (explicit and implicit) cash flows when they purchase GNMA loans to issue a mortgage-backed security. The model presented in this paper provides a framework for systematic examination of the impact of each variable.

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