Credit
Research
Center

WORKING PAPER NO. 31

Rates of Return on GNMA Securities: the Cost of Mortgage Funds

1979

Krannert Graduate School of Management – Purdue University

RATES OF RETURN ON GNMA SECURITIES: THE COST OF MORTGAGE FUNDS

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Abstract

This paper examines rates of return earned on GNMA securities over the period January 1971 through June 1978. We find that over this period the mean monthly return on GNMAs was greater than the mean return on long-term government bonds and slightly greater than the mean return on high grade corporate bonds. However, in neither case was the difference statistically significant. Thus, based on this evidence, it is not possible to conclude that the cost of acquiring funds to finance single family housing purchases through the GNMA program exceeded the cost of acquiring funds by the U.S. treasury or financially-strong corporations.

I. Introduction

This paper examines rates of return earned on GNMA mortgage-backed securities over the period January 1, 1971 through June 30, 1978. The concept of rate of return earned on a security generally refers to the investor's perspective, but the concept can also be applied to the party on the other side of the transaction, i.e., the issuer-of the security. In this case, the nominal issuer of the security is a mortgage company, a savings and loan association, or a mutual savings bank, but the true underlying issuers are the mortgagors who issue the loans that "back" the security. Thus, rates of return earned on GNMA securities represent the "cost" of financing house purchases through the GNMA program over the period examined.[1]

This paper is motivated in part by papers and articles that have appeared in the academic and financial press concerning "yields" on GNMA securities. These publications note that the measured yields on GNMAs have persistently exceeded measured yields not only on long-term government bonds, but also on Aaa-rated corporate bonds ([6], [7], [11], [12], [18]). This observation is puzzling because the default risk on GNMA securities is equivalent to that of treasury bonds and marginally less than that of Aaa-rated corporate debt. One implication that is often drawn from these yield comparisons is that the cost of acquiring funds in the capital market for the purchasers of single-family housing substantially exceeds the cost of acquiring funds not only by the Federal government, but also by financially-strong corporations. Thus, it is often concluded that purchasers of single-family housing participate at a disadvantage in the capital market even when they are backed by the "full faith and credit" of the U.S. government. A second implication which is often implicit, but occasionally stated explicitly, is that GNMA securities have been and continue to be improperly priced by the capital market. For example, Curley and Guttentag [6] state:

> It is obvious that the market price of a financial instrument is not its "true value" if the expected yield the buyer associates with that price has not been correctly calculated. This is generally the case with outstanding residential mortgages. It is only by accident that these mortgages are correctly priced, i.e., that the yield expected at the transaction price is the yield correctly implied by that price.

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Financial support for this study was provided by the Credit Research Center, Purdue University and by the Department of Housing and Urban Development under contract #H2893.

[1] Extensive discussions of the institutional characteristics of the GNMA security are available in [17] and [19].

We believe that such conclusions are unjustified and arise because of a misinterpretation of what information is and is not contained in estimated ex ante yields on fixed-income securities.

There is another and, we believe, superior approach to drawing inferences about the relative pricing of alternative securities and, by implication, the relative "cost" of obtaining funds by alternative security issuers. If we specify an ex ante relationship between the returns on alternative securities and if we assume that, on average, expectations by market participants are realized (i.e., if we assume "rational" expectations obtain) we can use ex post data to test ex ante relationships.

Thus, this study has two primary purposes. The first is to clarify some aspects of computed "yields" on fixed income securities with particular emphasis on their application to GNMA securities. The second purpose is to compare the "cost" of obtaining funds through the GNMA program with the cost of obtaining funds by the U.S. government and by financially-strong corporations.

The following section contains a discussion of pitfalls encountered when ex ante yields are used to draw inferences about the pricing of GNMAs and other fixed-rate securities. Section 3 presents a relative pricing model for interest contingent claims. This model motivates the statistical analysis conducted in Sections 4 and 5. The final section contains a summary and some concluding remarks.

II. GNMA "Yields" and the Pricing of GNMA Securities

It is generally recognized that comparisons of "yields" among fixed income securities are likely to provide very little information about the relative prices of those securities. This is because the yield is a derived number. Given the price of a security and a set of future cash payments to be made on the security, it is always possible to compute a yield. It is not possible to go the other direction. That is, it is not possible to use a security's yield to determine what its price should be, except under very limited circumstances.[2]

First, if two securities have identical future cash flows in every period, then their prices should be identical. As a consequence, so should their ex ante yields. Unfortunately, in that situation, computation of the securities, yields is redundant, since their prices can be compared directly. Thus, we may conclude that two GNMAs with the same coupon interest rates, the same maturities, and issued on the same date should have the same yield. But that merely says that they should sell at the same price. We cannot compare the yield on the GNMA with that on a government or corporate bond and draw any conclusion about their relative prices unless the comparison securities also have identical future cash flow distributions (which they do not).

The second situation in which yields can be compared is when: (1) all future spot rates of interest are equal; (2) the future spot rates are known with certainty; and (3) the future cash flows to each security are known with certainty. If these three conditions hold, then the computed ex ante (and ex post) yields on all securities should be equal even though their prices are not.

However, even if the first two conditions are met, it would not be possible to draw any conclusions about GNMA prices based upon their yields because the future cash flows to GNMAs are not known with certainty. Underlying each GNMA security is a pool of mortgage loans. Each of these loans is callable at par immediately after issuance. Thus, a rational mortgagor will call his loan whenever the current market interest rate falls below the coupon rate on the loan. However, one additional peculiarity of GNMA securities is that the issuers of the

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[2] Brealey [3] makes this same point in his discussion of Curley and Guttentag [6].

underlying loans often call (or prepay) their loans when the market interest rate is above the coupon rate on their loans. These "suboptimal" loan prepayments represent an additional stochastic component of the cash flow stream. Thus, (except at maturity) the cash flow at the end of any future time period is uncertain.

To circumvent this problem, GNMA yields are customarily computed on the basis of "average" life rather than term-to-maturity. Because thirty-year maturity mortgage loans on residential property have, on average, been prepaid in twelve years, yields are computed under the assumption that all of, the loans in the pool will be fully prepaid at the end of the twelfth year. This procedure represents at best an ad hoc approach to recognizing the uncertainty associated with future cash flows on GNMAs.

In an attempt to provide greater precision to the computation of GNMA yields, Curley and Guttentag [6] have used historical data to estimate the average fraction of mortgage loans prepaid in each policy year after issuance. These fractions represent point estimates of the probability of loan repayment in each year after issuance. Using these point estimates, they compute a yield to expected maturity. While this procedure is an imaginative extension of the customary procedure used to compute GNMA yields, it too is unlikely to be useful in providing information about GNMA prices or the relative "cost" of mortgage funds.

The problem with the Curley and Guttentag approach is that it imputes a set of expectations to market participants. Because the imputed distribution may differ from the market's estimated distribution, it is not possible to conclude that the market's expected yield is greater or less than the expected yield on some other security, nor is it possible to conclude that the market has "improperly" priced GNMAs relative to other securities. To see this point, consider a standard one-period example. A security is issued at time 0. At time 1, the security will provide some random payoff. Based on some set of expectations about the time I distribution of cash payoffs, capital market participants will determine a time 0 price for the security. We may observe the security's price, but we cannot observe investors' expectations about the time 1 distribution of cash flows.

If we were to impute a time 1 distribution of cash flows, we could then impute an expected return on the security. However, on the basis of this expected return we may not conclude that the market has improperly priced this security relative to any other security. Nor is it possible to conclude that the market's expected return on this security is higher than the expected return on any other security. In essence, either conclusion implies that market participants have improperly assessed the distribution of future cash flows. Unfortunately, it is not possible to distinguish between that possibility and the possibility that the imputed distribution of cash flows is not the "correct" one. Thus, even in a single-period setting (in which the term structure problem is irrelevant) the procedure used by Curley and Guttentag cannot distinguish between these two possibilities.

However, there is an alternative approach that will allow us to draw conclusions about the prices of GNMAs and about the relative "cost" of mortgage funds. If we assume that, conditional upon the set of information relevant to the pricing of these securities, capital market participants form unbiased assessments of the future returns distribution, and if we specify a testable relationship between returns on GNMA securities and the returns on other securities, then we can use ex post data to test ex ante relationships. This is the procedure typically used in tests of the capital asset pricing model with stock market data ([4], [5], [9], [10]) and it is the one that we adopt here.

III. The Model

In order to test hypotheses about the pricing of GNMA securities, it is necessary to have a general model for the pricing of fixed-income or interest contingent securities. Such a model has been developed by Cox, Ingersoll and Ross [8]. With their model, if we assume that: (1) the instantaneous expected returns on GNMA securities, U.S. treasury bonds, and Aaa-rated corporate bonds are dependent only upon the current rate of interest for instantaneous risk-free borrowing and lending;[3] (2) all three securities are default-free; (3) the interest rate elasticity is the same for all three securities; and (4) the stochastic "prepayment" cash flows on GNMAs are uncorrelated with the instantaneous rate of interest and all other fundamental economic factors, it can be shown that the instantaneous expected rate of return on a GNMA security is equal to the instantaneous expected rate of return on a U.S. treasury bond and/or an Aaa-rated corporate bond.

Some discussion of our assumptions is appropriate. Cox, Ingersoll and Ross [8] develop their model under the first assumptions as a special case. The second assumption is an approximation. While U.S. treasury bonds and GNMAs are default-free, the same is not true for Aaa-corporate bonds. Although the probability of default for high-grade bonds is small, it is, nevertheless, positive. The third assumption says that, for a given change in the rate of instantaneous risk-free borrowing and lending, the prices of the three securities will change by equal proportional amounts. The last assumption is equivalent to the assumption that the "risk" associated with the stochastic prepayment cash flows on GNMAs is fully diversifiable or, within the capital asset pricing model framework, it is nonsystematic risk. As a consequence, investors cannot expect to be compensated to bearing this component of total risk.

Undoubtedly these assumptions do not all obtain exactly in practice. However, they do permit us to specify potentially refutable hypotheses about the pricing (i.e., returns) of GNMAs relative to those of the comparison securities. Furthermore, the model on which the hypotheses are based is a rigorously derived equilibrium model for the pricing of interest dependent claims. The question of whether or not the model adequately describes the pricing of fixed-rate securities (and whether or not our assumptions grossly violate the "true" characteristics of these securities) must, of course, be answered by the data.

The hypotheses to be tested can be summarized algebraically as

$$\tilde{R}_{Gt} = \tilde{R}_{Tt} + \tilde{\varepsilon}_{Gt}$$

and

$$\tilde{R}_{Gt} = \tilde{R}_{Ct} + \tilde{\varepsilon}'_{Gt}$$

where tildes represent random variables; R_{Gt}, R_{TV} and R_{Ct} are the instantaneous returns on GNMA securities, treasury bonds, and Aaa-rated corporate bonds, respectively, in time period t; and ε_{Gt} and ε'_{Gt} are random disturbances which represent the unexpected return on the GNMA security in time period t.
Then taking expectations

[3] A more precise statement of this assumption is that the state of the world is completely specified by the level of the current rate of interest for instantaneous risk-free borrowing and lending and, therefore, all relevant uncertainty is completely summarized by the stochastic behavior of the spot interest rate.

$$E(R_{Gt} \mid \phi_{t-1}) = E(R_{Tt} \mid \phi_{t-1}) \tag{3}$$

and

$$E(R_{Gt} \mid \phi_{t-1}) = E(R_{Ct} \mid \phi_{t-1}) \tag{4}$$

where E(.) is the expectations operator and ϕ t-l is the set of information available at time t-l.

In the following two sections we test the relationships expressed in (3) and (4). It should be noted that we are testing the joint hypothesis that: (1) contingent upon the set of information relevant to the pricing of these securities, the market properly anticipates the distribution of future cash flows to them; and (2) the market prices these securities according to equations (3) and (4).

IV. Data

To test our hypotheses, we constructed several alternative monthly rate of return indexes for eight percent GNMA securities over the period January 1, 1971 through June 30, 1978. The return on a GNMA security is composed of four elements: (1) the change in the security's price; (2) the coupon interest payment; (3) the scheduled principal repayment; and (4) the unscheduled or stochastic principal repayment.

IV. A. Principal and Interest Payments

When a GNMA security is issued, the issuer records the total dollar amounts of the outstanding balances of the loans in the pool underlying the security. Each month thereafter, the issuer computes the dollar amount of principal repaid on the underlying loans and sums these amounts over time. Each month this sum is subtracted from the original balance and the difference is divided by the original balance. This fraction is called the paydown factor on the pool. Each month the security issuer is required to report the paydown factor to the Government National Mortgage Association.

Given the paydown factors for the beginning and end of any month (or equivalently, the beginning factors for two consecutive months) we can compute the total principal payments on the loans in the pool during the month as

$$P_{it} = (F^b_{it} - F^e_{it})B_{oi} \tag{5}$$

where P_{it} is the dollar amount of principal repaid on GNMA security i during month t; F^b_{it} is the paydown factor for security i at the beginning of month t; F^e_{it} is the paydown factor for security i at the end of month t (Note: $F^b_{i,t} = F^e_{i,t-1}$); and B_{oi} is the total original principal balance of the mortgage loans "backing" GNMA security i.

Given the monthly paydown factors and the annual coupon interest rate on the security, we can also compute the total dollar amount of interest paid on the security during the month as

$$I_{it} = (F^b_{it} \cdot B_{oi}) \frac{C_i}{12} \tag{6}$$

where I_{it} is the total dollar amount of interest paid on security i in month t and C_i is the annual interest rate on the security.[4]

In computing the rates of return in the GNMA securities we used two sources of paydown factors.

The bulk of the paydown factors were made available to us on a computer tape by Loeb, Rhoades & Co. This tape contains monthly paydown factors for over 25,000 individual pools issued over the period February 1970 through June 1978. Of this total approximately 9,400 were eight percent securities. It was this subset of eight percent pools that we used in our computations.

Although the computer tape included paydown information on securities issued as early as February 1970, the actual paydown factors did not begin until February 1972 because Loeb, Rhoades did not record the information prior to that date.

We supplemented the computer tape with data provided to us by National Homes Acceptance Corporation. National Homes provided us with the monthly balances for twelve 8 percent pools issued between December 1, 1970 and January 30, 1971. From these data we computed monthly paydown factors for the period January 1, 1971 to February 28, 1972 for each of the twelve pools.

By combining these two data sets we constructed a continuous series of monthly paydown factors for the period January 1, 1971 to June 30, 1978. It should be noted that conclusions about rates of return on GNMAs over the period January 1971 to February 1972 are dependent upon the assumption that the twelve pools

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[4] The coupon interest rate on the underlying mortgage loans is one-half percent greater than the coupon rate on the GNMA security. The one-half percent difference represents the "administration" fee received by the loan "servicer" and the insurance premium received by the Government National Mortgage Association. McConnell [15], [16] demonstrates that the cost of a mortgage loan can be divided into the cost of originating and servicing the loan and the cost of acquiring funds in the capital market. Here we are concerned only with the cost of acquiring funds.

obtained from National Homes Acceptance are representative of all outstanding GNMA securities over that period.

IV. B. Market Prices

The second ingredient needed to compute rates of return are monthly market prices for GNMA securities. In this case, three data sources were used.

For the period August 30, 1974 through June 30, 1978 month-end prices for eight percent GNMAs were collected from the Wall Street Journal [20]. Prior to that time the Journal did not report GNMA prices. However, Salomon Brothers' Yield Book [1] does contain "first-of-month" yields on GNMA eight percent securities beginning with December 1, 1971. These yields were computed based on the "consensus" market price at the beginning of each month and with the assumption of a twelve-year average life for GNMAs. By reversing the procedure used by Salomon Brothers to obtain yields, we were able to estimate market prices over the period December 1, 1971 through July 30, 1974.

For the period January 1, 1971 through November 30, 1971 we estimated market prices from a weekly yield series computed by Merrill, Lynch. This series used Friday prices to compute weekly yields. Again we reversed the process used to obtain yields to estimate market prices. We used the week-end price closest to each month-end as an estimate of the month-end price. As with the paydown factor data, the earlier observations in this series may be less reliable than the more recent ones.

By combining these three price series we constructed a continuous price series over the period January 1, 1971 through June 30, 1978.[5]

IV. C. Monthly Rates of Return

With the paydown factor and price data described above we computed monthly rates of return on each individual eight percent GNMA security for which we had paydown factor information as

$$R_{it} = \frac{(M^e_t \cdot F^e_{it}) + (F^b_{it} \cdot \frac{.08}{12}) + (F^b_{it} - F^e_{it}) - (M^b_t \cdot F^b_{it})}{M^b_t \cdot F^b_{it}} \qquad (7)$$

where R_{it} is the rate of return on GNMA security i in month t; M b/t is the market price of eight percent GNMA securities at the beginning of month t expressed as a fraction of the dollar amount of the principal balances of the loans in the pool (for example, a price of .955 means that the buyer of a security would be required to pay $95.50 for each one hundred dollars of unpaid principal); M e/t is the market price of eight percent GNMAs at the end of month t (Note: M b/t = M e/t-1); and other terms are as defined above. In equation (7), the first and last terms on the right-hand-side combined, represent the change in the market price of the security: the second term represents the interest payment: and the third term represents the total principal payment (i.e., both the scheduled and unscheduled principal payment) during month t.

[5] After a lengthy search of possible sources we were unable to discover market prices or yield data prior to December 1970.

A rate of return was computed for each month for each of the approximately 9,4000 eight percent securities if a paydown factor was available for the beginning and end of the relevant month. If an individual monthly factor for a specific pool was missing from the tape, then no rate of return was computed for that specific month for that specific pool.

The rate of return series for the individual securities were combined to construct four different rate of return indexes for eight percent GNMA securities over the period January 1, 1971 through June 30, 1978: (1) an equally-weighted index using all monthly returns for all securities; (2) a value-weighted index using all monthly returns for all securities; (3) a 11new issues" equally-weighted index using only returns computed for the individual securities for the first fourteen months they were outstanding; and (4) a "new issues" value-weighted index using only returns computed for the individual securities for the first fourteen months after the date of issue.

Equally-weighted and value-weighted indexes were constructed because each embodies a different assumption about representative security performance. The "new issue" indexes were computed because the bulk of the total dollar volume of transactions in GNMA securities is composed of relatively new GNMA securities. As a consequence, the observed market prices may be more representative of the value of "new" issues than of the entire GN14A market. If the "true" market values of "old" and "new" securities differ, then using current market prices in conjunction with paydown factors on "old" pools may give a distorted picture of the rate of return experience of GNMA securities.[6]

Monthly rates of return on long-term government bonds and Aaa-rated corporate bonds were made available to us by Roger Ibbotson. The procedure used to construct these monthly return series is described in [13] and [14].[7]

V . Results

V.A. Preliminary Analysis

Table I contains the arithmetic mean, standard deviation, and studentized range for the monthly returns, along with the maximum and minimum monthly return, for each of the four GNMA indexes, the government bond index, and the corporate bond index over the period January 1971 through June 1978 (months 1-90) and the period July 1973 through June 1978 (months 31-90). The 60 month subperiod was considered separately because, as we discussed above, the data for the earlier months may be less reliable than those for the latter months. Table 2 contains correlation coefficients among the six returns series.

As the two tables indicate, the four GNMA series are virtually indistinguishable. The largest difference in mean returns across the four indexes is .0001, while the largest difference in standard deviations is .00003. Furthermore, each of the correlation coefficients among the GNMA indexes is in excess of .99. These results indicate that conclusions obtained with any one of the GNMA indexes will be equivalent to those obtained with any other. In subsequent analysis, vie present results for the equally-weighted index only.[8]

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6 A more complete description of the way in which each index was constructed is available from the authors.

7 The returns series reported in [131 end in 1974. Roger Ibbotsen provided us with updated data through December 1978. We acknowledge his assistance with gratitude.

8 We did carry out the tests with all four GNMA indexes. Because the results were virtually indistinguishable regardless of the index used, we report only those for the equally-weighted index constructed with all data.

Comparison of the results for the GNMAs with those for government and corporate bonds, indicates that, over both the full 90 month interval and the 60 month subperiod, the mean monthly return on the GNMAs did, in fact, exceed the mean return of the two comparison securities. Likewise for the full 90month period the standard deviation of GNMA returns exceeded that of both government and corporate bonds. Over the last 60 months the standard deviation of monthly returns on GNMAs slightly exceeded the standard deviation of monthly returns on government bonds but it was less than the standard deviation of corporate bond returns.

Examination of Table 2 indicates that the correlation coefficients among all the series were significant at the .05 level and that the GNMA returns were slightly more highly correlated with those of corporate bonds than with those of government bonds.

Finally, based on the studentized ranges for the various returns series, it is not possible to reject the hypothesis that the monthly returns on each are distributed normally. This result permits us to conduct additional statistical tests which are based on the assumption that the returns of the various securities are normally distributed.

TABLE 1

SUMMARY STATISTICS FOR MONTHLY RATES OF RETURN ON GNMA SECUTIRIES, GOVERNMENT BONDS, AND Aaa-RATED CORPORATE BONDS

Months[a]	Arithmetic Mean	Standard Deviation	Maximum	Minimum	Studentized Range
GNMA Equally-weighted Index (all data)					
1-90	.00558	.01836	.0634	-.0336	5.446
31-90	.00538	.02097	.0634	-.0336	4.769
GNMA Value-weighted index (all data)					
1-90.	.00557	.01837	.0634	-.0372	5.476
31-90	.00538	.02097	.0634	-.0372	4.797
GNMA New-Issues Equally-weighted Index (14 months only)					
1-90	.00552	.01839	.0633	-.0373	5.470
31-90	.00528	.02100	.0633	-.0373	4.790
GNMA New-Issues Value-weighted Index (14 months only)					
1-90	.00552	.01839	.0633	-.0341	5.470
31-9	.00528	.02100	.0633	-.0341	4.790
Long-Term Government Bonds					
1-90	.00494	.02047	.0526	-.0468	4.856
31-90	.00482	.02024	.0489	.0433	4.555
Long-Term Aaa Corporate Bonds					
1-90	.00546	.02221	.0596	-.0476	4.827
31-90	.00523	.02370	.0596	-.0476	4.523

[a] Months	Time period
1-90	1/1971-6/1978
31-90	7/1973-6/1978

TABLE 2
MONTHLY RATE OF RETURN INDEXES; MONTHS 1-90

CORRELATIONS[a]

SECURITY	EW	VW	NEW	NVW	LTG	LTC
EW	1.00					
VW	.99	1.00				
NEW	.99	.99	1.00			
NVW	.99	.99	.99	1.00		
LTG	.75	.75	.75	.75	1.00	
LTC	.83	.83	.83	.83	.85	1.00

Definitions:
EW = Equally-weighted GNMA Index (all data)
VW= Value-weighted GNMA Index (all data)
NEW = New-issues Equally-weighted GNMA Index
NVW = New-issues Value-weighted GNMA Index
LTG = Long-term Government Bonds
LTC = Long-term Corporate Bonds

[a] All coefficients are significant at the .05 level.

V. B. Tests of Significance

Table 3 contains the results of two statistical tests of equations (3) and (4).

The first is the standard t-test of the difference between two sample means. With either a two-tailed test or one-tailed test, it is not possible to reject the hypothesis that the mean return on GNMA securities was equal to the mean return on government bonds over the two time intervals considered at the .10 level of significance. Examination of the t-values for the corporate bond comparisons yields similar conclusions. For neither the full 90 month interval nor for the 60 month subperiod is it possible to reject the hypothesis that the mean return on GNMAs was equal to the mean return on Aaa-rated corporate bonds at .10 level. This is true regardless of whether a two-tailed or one-tailed test is considered.[9]

The results of the second test are presented in Column 5. Depending upon the time interval considered, we determined the number of months out of 90 or 60 that the GNMA return exceeded the government (corporate) bond return. For government bonds, these numbers were 50/90 and 34/60; for corporates they were 45/90 and, 28/60, respectively, for the two time periods. Then based upon a binomial distribution with a mean of .5, we computed a z-statistic to determine if these numbers were significantly different from 45 or from 30.

At the .10 level of significance, with either a two-tailed or one-tailed test, we cannot reject the hypothesis that, for any month, the probability of the GNMA return exceeding the government (corporate) bond return was equal to the probability of the government (corporate) bond return exceeding the GNHA return. Equivalently stated, we cannot reject the hypothesis that, for any given month, the probability that the return on a G14MA security will be greater (less) than the return on a long-tern, government or Aaa corporate bond is .5.

TABLE 3
COMPARISON OF RETURNS ON GNMA SECURITIES WITH RETURNS ON GOVERNMENT BONDS AND Aaa CORPORATE BONDS

Months	Difference in Mean Monthly Returns (t-statistic)[b]	Maximum Net Monthly Return	Minimum Net Monthly Return	Number of Positive Net Returns (Z-statistic)[c]
Monthly Returns on GNMAs less Returns on Government Bonds [a]				
1-90	.00064	.0345	-.0497	50
	(.438)			(1.054)
31-90	.00056	.027	-.0497	34
	(.306)			(1.0328)
3-B Monthly Returns on GNMAs less Returns on Corporate Bonds				
1-90	.00012	.0444	-.0465	45
	(.321)			(.000)
31-90	.00015	.0174	-.0465	28
	(.088)			(-.516)

[9] These results are qualitatively similar to those reported by Bildersee [2] in his comprehensive study of U.S. agency bonds (which did not include GNMA securities). Using data over the period 1965 through 1973, he reported that, although ex ante yields on long-term agency bonds significantly exceeded yields on long-term-treasury bonds, their mean monthly returns were indistinguishable. In fact, in several instances mean holding period returns on treasury bonds were actually greater that those on the agency bonds.

[a]Computed with GNMA Equally-weighted Index (all data)

[b]Computed as $t = \frac{\bar{R}_g - \bar{R}_k}{\sqrt{S_g^2 + S_k^2 - 2r_{gk}S_gS_k} / n}$

where

$\bar{R}_g(\bar{R}_k)$ = arithmetic mean monthly return on GNMA (comparison) security,

$S_g(S_k)$ = standard deviation of monthly return on GNMA (comparison) security,

r_{gk} = correlation coefficient between monthly return on GNMAs and the comparison security

$n = 90$

[c]Computed as $Z = \frac{d - np}{S_d}$

where

$p = .50$

$n = 90$

d = number of positive net returns

S_d = standard deviation of binomial distribution with $p = .50$ and $n = 90$.

Thus, at traditional levels of confidence, we cannot reject the joint hypothesis that the market properly assessed the distribution of cash flows to GNMA securities and that it priced them according to equations (3) and (4). As a consequence, we cannot conclude that the market improperly priced GNMA securities over the interval January 1971 through June 1978. Nor can we conclude that the cost of acquiring funds to finance single-family housing through the GNMA program exceeded the cost of acquiring funds by the U.S. government or financially-strong corporations.

VI. Conclusion

In this paper we test the joint hypothesis that: (1) contingent upon the set of relevant information, the market properly anticipated the distribution of returns to GNMA securities over the period January 1971 through June 1978 and; (2) that it priced them to earn the same expected returns as long-term treasury bonds and/or Aaa-rated corporate bonds. At traditional levels of significance it is not possible to conclude that the returns on GNMAs were different from the returns on either of the two comparison securities. As a consequence, we cannot conclude that the cost of acquiring funds to finance single-family housing through the GNMA program exceeded the cost of acquiring funds by the U.S. government or by financially-strong corporations.

It is true, however, that the mean return on GNMAs over the period examined not only exceeded the mean return on long-term government bonds, but it also was slightly greater than the mean return on high-grade corporate bonds. The t-statistics indicate that there is a high probability that this result is due entirely to chance. Another possible explanation is that the relative pricing model posited does not adequately describe the relationship among the returns on GNMAs and other securities. For example, it is possible that the stochastic prepayments on GNMAs are correlated with some other (unknown) economic factor not incorporated in the model. Addressing that possibility requires the development of a more complete model for the pricing of GNMA securities. Further refinements in the general model for the pricing of interest contingent claims developed by Cox, Ingersoll and Ross [8] may provide the basis for such a model. In the meantime, it is not possible to conclude that the purchasers of single-family housing participate at a disadvantage in the capital markets relative to the U.S. government or financially-strong corporations. It is our hope that these results will be useful to those individuals responsible for designing and managing federally-sponsored mortgage loan programs.

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