Competitive Pricing of Farmer Mac Mortgage-Backed Securities and its Future Viability: A Contingent Claims Analysis Approach

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(1990) provide some insights into the pricing issues.

We use a continuous-time contingent claims pricing framework based on a recently developed general equilibrium model of the term structure of interest rates to obtain equilibrium prices for Farmer Mac mortgage-backed securities under alternative assumptions on interest rate environment and prepayment behavior. The required yields by investors on these securities are compared with mortgage rates charged by various financial institutions to determine the competitiveness of Farmer Mac loan rates. In the next section we describe the pricing model for Farmer Mac securities. Numerical results on Farmer Mac security prices are then presented along with discussion of their implications for the potential viability of the Farmer Mac program. Finally, we offer some concluding comments along with suggestions for further work.

Farmer Mac Securities Pricing Model

Although the Farmer Mac securities can be structured in a number of different ways, our analysis in this paper focuses on the viability of the Farmer Mac program under its "original structure" in which its securities are designed as pass-through certificates backed by a homogeneous pool of fixed-rate, fully amortizing farm mortgage loans. Each period the issuer of this Farmer Mac security "passes through" to the holder of the security, the scheduled interest and principal payments along with any additional amounts received as loan prepayments from borrowers. There are no penalties for prepayments. Furthermore, since timely payment of principal and interest to the security holder is guaranteed against default by the Farmer Mac, we assume that Farmer Mac securities are perceived by investors to be risk-free in terms of default.

As defined above, a Farmer Mac mortgage-backed pass-through security is an interest rate contingent claim with a call option; in this case a type of default-free callable bond. As a result, two key factors involved in the equilibrium valuation of these securities are: (a) the term structure of

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describes an interest rate process that has a number of desirable properties. The volatility of the interest rate, for instance, is positively related to the level of the interest rate and as a result, negative values of interest rates are precluded. Furthermore, the interest rate tends to revert, with speed k, towards its long-term steady state mean value m. These properties are consistent with the observed behavior of short term interest rates.

In the CIR model, the instantaneous risk-free interest rate r is assumed to completely describe the state of the economy at each point of time and is therefore the primary driving force behind the yield curve as well as other interest rate dependent contingent claims such as bonds and mortgage-backed securities. In particular, if P denotes the current price of a unit discount bond (a zero coupon default-free bond that pays \$1 at maturity), then it will depend only on the current value of the interest rate r and the time to maturity τ, i.e. $P = P(r, \tau)$. Applying Itô's Lemma, the bond price is seen to be described by the diffusion process,

$$(2) \qquad \frac{dP}{P} = \alpha dt + \beta d\hat{z} \text{ , where}$$

$$(2a) \qquad \alpha = [\tfrac{1}{2} \sigma^2 r P_{rr} + k(m-r)P_r - P_\tau]/P$$

$$(2b) \qquad \beta = \sigma \sqrt{r} \, P_r/P$$

Here, the functions α and β denote the drift and standard deviation, respectively, of the bond's instantaneous rate of return; σ, k and m are the parameters of the underlying interest rate process in (1) and the subscripts denote partial derivatives. Following a technique first formulated by Merton (1973), it can be shown that in equilibrium, bond prices will adjust to exclude riskless arbitrage

In (4a), the first three terms on the left-hand side represent the expected return from changes in the price of the discount bond, or expected capital gain, with the first two terms accounting for change in the bond price as the interest rate changes along the yield curve (i.e., the term structure effect) and the third term accounting for change in the price of the bond as it moves towards maturity when its price must equal the face value of $1. The fourth term on the left-hand side represents the bond's risk-free return while the term on the right-hand side is cleary the risk premium in dollar terms. Thus, equation (4a) states that in equilibrium a discount bond is priced such that its excess expected return over and above the risk-free return equals the risk premium that it must command to exclude arbitrage opportunities. The PDE in (4) along with the boundary condition can be solved by the standard separation-of-variables method to give the following closed-form solution,

$$(5) \qquad\qquad P(r,\tau) = A(\tau)e^{-rB(\tau)}$$

where $A(\tau)$ and $B(\tau)$ are constants depending only on the time to maturity τ, parameters k, m and σ^2 of the interest rate process in (1), and the market price of risk q.[4] From (5), the yield-to-maturity of a unit discount bond, $R(r,\tau)$, is given by

$$(6) \qquad\qquad R(r,\tau) = -\frac{1}{\tau}\ln P(r,\tau) = -\frac{1}{\tau}[\ln A(\tau) - r\,B(\tau)]$$

The yield-to-maturity $R(r,\tau,)$ when expressed as a function of the time to maturity τ, describes the term structure of interest rates. According to (6), the entire term structure depends only on the current value of the risk-free interest rate r in a simple linear fashion.[5] The risk-free interest rate here acts as a proxy variable for the fundamental uncertainty in the economy. Despite its relatively

security V so that at every instant of time its expected return

$[\frac{1}{2}\sigma^2 r V_{rr} + k(m-r)V_r - V_\tau + C(\tau)]$ over and above the risk-free return (rV) equals the risk

premium (qrV_r) that it must command in equilibrium to exclude arbitrage opportunities.

Assumptions regarding the prepayment behavior or call policies followed by the borrowers will

determine the form of the security's expected cash flow and the boundary conditions that must be

satisfied by equation (7). Following Dunn and McConnell (1981), we use the following boundary

conditions

(8)
$$V(r,0) - F(0) = 0$$

(9)
$$\lim_{r \to \infty} V(r,\tau) - 0$$

(10a)
$$mkV_r + C(\tau) - V_\tau$$

(10b)
$$V(r,\tau) \leq F(\tau)$$

Here, $F(\tau)$ represents the face value or remaining principal balance of the security at time to maturity

τ. Equation (8) states that the value of the security at maturity $(\tau = 0)$ must equal its face value or

remaining principal balance $F(0)$, which is zero because we are assuming continuous amortization

payments. Equation (9) represents a boundary condition arising from the fact that the value of an

interest dependent security goes to zero as the interest rate approaches infinity. Equation (10a)

corresponds to the natural boundary $r=0$ of the interest rate process and is obtained by setting $r=0$ in

Equation (7a) has the same interpretation as (7) in describing the movement of the security value over time except that the expected return on the security now includes the expected cash flow from suboptimal prepayments in addition to the cash flow $C(\tau)$ from scheduled payments and the capital gain arising from price changes. The equilibrium price of a mortgage-backed Farmer Mac security under various prepayment scenarios can be obtained by solving (7a) subject to the applicable boundary conditions (8), (9), and (10a) or (10b). In general, this equation can not be solved analytically and will require numerical methods to obtain its approximate solution.

Numerical Results

We use the implicit finite difference method as described by Brennan and Schwartz (1977) to numerically solve (7a) and obtain equilibrium prices for a Farmer Mac security under the following alternative assumptions on the prepayment behavior: (1) no prepayments, i.e. a noncallable security; (2) callable security with average prepaid life of 10 years; (3) callable security with an optimal call policy; and (4) callable security with suboptimal prepayments. The interpretation of the last assumption is that the security receives "optimal" prepayments most of the time but is subject to occasional shocks of "suboptimal" prepayments with probability $\lambda(r, \tau)$ per unit time. Unfortunately, no reliable data are easily available on the prepayment characteristics of farm mortgage loans. We therefore follow similar studies on housing mortgage markets (Dunn and McConnell, 1981; Buser and Hendershott, 1984) and use historical Federal Housing Administration (FHA) data to estimate the intensity parameter λ of the Poisson process driving the suboptimal prepayments.

Early attempts[7] to econometrically estimate the parameters of the CIR term structure model encountered the problem of temporal aggregation that arises when a continuous-time model is

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of the noncallable security, reflecting the higher yields required by the investors to compensate for the prepayment risk arising from the borrower's option to call the mortgage. The difference between these two prices represents the value of the call option which, as expected, decreases as the current interest rate increases because at higher interest rates there is less possibility that the option will be exercised.

Column 4 gives prices based on the assumption that all mortgages in the underlying pool backing the security are called or prepaid at the end of 10 years. These prices differ very little from those in column 2 where no prepayments are allowed. The implication is that the assumption of average prepaid life, a widely used method for quoting yields in secondary mortgage markets, may not adequately capture the call option feature of a mortgage-backed security.

The last three columns, 5-7, give the prices of the Farmer Mac security when, in addition to optimal prepayments, borrowers make suboptimal prepayments at increasing rates of 50%, 100%, and 200% of FHA experience. Clearly, suboptimal prepayments benefit the investor because the prepaid mortgage funds can be reinvested at more favorable rates; as a result, the investors will be willing to pay more, i.e. accept a lower yield for securities which might be suboptimally prepaid. Also, the greater the expected rate of suboptimal prepayments, the larger the price investors will be willing to pay. The equilibrium prices of Farmer Mac securities as given in columns 5, 6, and 7 reflect this pattern: prices are higher than corresponding securities with optimal prepayments and they increase as the expected rate of suboptimal prepayments increases from 50% to 200% of FHA experience. As noted earlier, lack of reliable data on the prepayment behavior of farm mortgage loans makes it difficult to price mortgage-backed Farmer Mac securities with the desired degree of accuracy. We have therefore considered alternative assumptions on prepayment behavior to gain insight into the pricing structure. However it should be noted that price under noncallable case in column 2 and the optimal call policy case in column 3 in most instances represent the upper and lower bound,

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Table 3 shows the long-term mortgage rates by quarter for different institutions during the 1987-1991 period. To evaluate the competitiveness of the Farmer Mac loan rates, we present in table 4 the estimated spreads between the mortgage rates offered by the FCS (table 3) and 90% of the required investor yields on Farmer Mac securities (table 2) for the 20 quarterly periods. Adjusting the borrower interest rate, in this case the FCS mortgage rate, by 90% of the required investor yield allows for direct comparison of the resulting "effective spreads" with the estimated transactions cost associated with the Farmer Mac program. Since only 90% of the amount borrowed is funded by the Farmer Mac securities, subtracting 90% of the investor yield on these securities from the borrower's interest rate leaves the amount of return left over to cover the remaining transactions cost of the program.[12] Similar spreads for commercial banks and life insurance companies are presented in tables 5 and 6, respectively. The spreads presented in these tables provide useful insights into the level of transaction costs the Farmer Mac program can support and still be competitive in the farm mortgage loan market.

In Table 7 we present a summary of the effective spreads between mortgage loan rates offered by the three financial institutions and required investor yields on Farmer Mac securities in terms of their ranges and averages calculated from tables 4-6 for the five year period 1987-1991. We note that for the FCS, spreads for the noncallable security range from 2.86% to 4.75% with an average of 3.40% while those for optimal call policy security range from 1.96% to 3.83%, averaging 2.68%. The spreads for securities that also experience suboptimal prepayments (at 100% of FHA) range from 1.96% to 3.91% with an average of 2.76%, and thus lie in between the corresponding values for the noncallable and optimal call securities. Clearly, the average spread values for the noncallable and the optimal call securities represent the approximate upper and the lower limits, respectively, for the Farmer Mac pass-through securities during this period. Accordingly, we can roughly designate the 2.68 - 3.40% range as the "competitive range" with the following interpretation: the Farmer Mac I

agricultural financial economists. Lins and Hofing estimates are based on detailed cost components developed separately for the 90% guaranteed portion and the 10% subordinated portion. As is clear from the total cost figures in row 3 of table 8, there are wide differences among the cost estimates of these studies.

It appears that unlike the Lins/Hofing study, the estimates in Farmer Mac and GAO studies are developed by first assuming that 100% of the loans are financed through Farmer Mac securities and then making an ad hoc adjustment for the potential impact of the subordinated 10% portion which must be financed through equity capital reserves and alternative funding sources. Because this method does not explicitly account for sources of funds underlying the loans, it can only provide rough estimates of the transactions cost. Moreover, the subordinated participation cost estimates in these two studies, especially the Farmer Mac study, appear unrealistically low, presumably because the new risk-based capital requirements have not been properly accounted for. On the other hand, Lins and Hofing have explicitly taken into account the new risk-based capital requirements in assessing the lender's overall cost of funds in supporting Farmer Mac loans. They have first estimated detailed cost components separately for the 90% guaranteed portion and the 10% subordinated portion and then weighted them to arrive at the "effective" transaction costs. In our judgment, the Lins/Hofing estimates of the SPIC as well as the total transaction cost are much more reliable and realistic than the cost estimates of the other two studies. They are also more directly comparable to our estimates of "effective spreads" presented in tables 4, 5, and 6, as explained in footnote 12. Accordingly, we have based our analysis of the Farmer Mac program primarily on these cost estimates.

The Lins/Hofing estimates provide an effective transactions cost range of 2.63 - 3.70% with an average of 3.17%. The major cost component included in the estimated transctions cost is the SPIC. The SPIC costs are high because of two new regulatory requirements. First, the lenders retaining the

restructure its program so that the SPI can be sold to outside investors or find other ways of reducing costs associated with the SPI. In this context, it is not surprising to note that to date almost all of the Farmer Mac mortgage pools have been formed by cash-rich life insurance companies (who are better able to meet the new risk-based capital requirements) who have simply purchased whole loans and not just the unsubordinated 90% portions, thereby taking these loans completely off the lenders' books and thus eliminating the prohibitive SPIC costs. Farmer Mac also needs to explore alternative security structures, placement methods, and perhaps mortgage loans with prepayment penalities with a view to reducing its overall costs of securitization and thus enhancing its competitive position. In this context, the linked-portfolio-strategy (LPS) approach[14] recently adopted by the Farmer Mac appears to be a step in the right direction, although it is not altogether clear if this approach will help reduce the SPIC costs in any significant way.

The Farmer Mac II program has been designed to provide a secondary market for the farm loans guaranteed by the FmHA. Under this program, Farmer Mac buys guaranteed portions (up to 90%) of the FmHA guaranteed loans from lenders at par, assembles them into a pool, and issues securities backed by these pools and a guarantee of timely payment of principal and interest. The Farmer Mac guarantee strengthens the FmHA guarantee which covers only eventual payment of loan principal and accrued interest in the case of default and not timely payment of principal and interest. The original lenders continue to hold the unguaranteed portions (usually 10%) of the loans in accordance with the terms of the FmHA guaranteed loan programs. Unlike the lenders in the Farmer Mac I program who are responsible for the first 10% of pool loan losses, lenders under the Farmer Mac II program are responsible for only 10% of any loss on individual loans and thus face a much lower risk exposure than lenders participating in the Farmer Mac I program. As a result, they are not required to hold a subordinated participation interest, which means that the lenders hold capital only against 10% unguaranteed portion and not against the entire amount of the loan, thus lowering the overall costs

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cost estimates. Lower pooler costs (because Farmer Mac acts as pooler and lenders pay a one-time security issuance fee) and the absence of SPIC reduce the level of effective total costs under the Farmer Mac II program to around 1.71 - 2.01%. Assuming commercial banks charge the same interest rate on the FmHA-guaranteed loans as they charge their average farm borrowers,[15] the competitive range for the FmHA-guaranteed commercial bank real estate loans is 3.30 - 4.02%, as seen from table 7. This suggests commercial banks participating in the Farmer Mac II program will be able to offer competitive rates on FmHA-guaranteed loans if effective total costs do not exceed 3.30%. Clearly, since effective total costs are estimated to be less than 2.01%, the Farmer Mac II program is likely to be strongly competitive.

Table 10 contains the estimated average net yields and management premiums of commercial bank FmHA-guaranteed farm real estate loans for the period 1987-91. As described earlier, management premiums are the lender's net returns (apart from a one-time transaction cost of 0.75% deducted from the first year's management premium) on the 90% guaranteed portion of the loans sold into the Farmer Mac II program. We note from the last column that average management premiums for the 1987-1991 period are positive and of significantly large size. Moreover, the magnitude of the management premiums appears to be fairly sensitive to the term structure of interest rates and prepayment risks. Detailed calculations (not shown here) indicate that on average management premiums are higher during the period when yield curve is relatively flat and tend to decline as the yield curve becomes steeper. Management premiums for securities with prepayment risks range from 1.38 - 1.77%; on the other hand, management premiums for securities with no prepayment risk range from 2.23 - 2.48% and are thus considerably larger. Note, however, that the higher management premiums on no-prepayment securities are somewhat overestimated since we have not taken into account the impact of lower interest rates paid on loans with prepayment penalties. The management premium feature further supports the position that Farmer Mac II program is likely to be strongly

secondary market.[17] Although these factors have slowed the development of the Farmer Mac program by reducing the level of lender participation, they do not per se adversely affect its relative competitive position in any significant way. Moreover, as the economy pulls out of the recession and the interest rates increase and yield curve flattens out, demand for farm loans including long-term fixed-rate loans is likely to increase. However, in our judgment based on the analysis presented in this paper, the high cost and disincentives associated with the SPI are the main factors that erode the Farmer Mac's competitive position and thus threaten the future viability of this fledgling secondary market. A recent GAO study[18] surveyed Farmer Mac stockholders who although eligible have decided not to become its certified poolers. About three-fourths of them, based on their contacts with potential originators, cited disincentives and high cost of the SPI resulting in uncompetitive loan rates as the major reason for their decision. A clear implication of our analysis seems to be that in order to enhance its competitive position and viability, the Farmer Mac needs to restructure its program so that either the SPI can be sold to outside investors or the costs associated with it can be significantly reduced. The findings of our analysis for the Farmer Mac II program are much more encouraging. They suggest that this program should easily be able to offer competitive rates and succeed.

In this study, we have confined our analysis to a single security structure i.e., a fixed-rate-mortgage (FRM)- backed pass-through type security. Strictly speaking, our results are applicable only to this type of security which the Farmer Mac is to offer under its original structure. A future study should examine pricing issues for other types of security structures, e.g., variable-rate-mortgage (VRM)-backed pass-throughs; stripped securities with separate principal-only (POs) and interest-only (IOs) structures; and collateralized mortgage obligations (CMOs). A CMO-type security structure might be especially suitable for Farmer Mac for at least two reasons. First, it tends to reduce prepayments risk for investors by spreading it across different tranches in order of priority. And second, it may be possible to price the 10% Subordinated Participation Interest and sell it to the

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Table 1. Equilibrium prices of fixed-rate Farmer Mac type mortgage-backed securities with face value of $1000, coupon rate of 8% and term-to-maturity of 20 years

(1) Current Risk-free Int. Rate	(2) Farmer Mac Security w/ No Prepayments i.e. Noncallable	(3) Farmer Mac Security w/ Optimal Call Policy	(4) Farmer Mac Security w/ Average Life of 10 yrs	(5) Farmer Mac Security w/ Suboptimal Pre-payments at 50% of FHA Experience	(6) Farmer Mac Security w/ Suboptimal Prepayments at 100% of FHA Experience	(7) Farmer Mac Security w/ Suboptimal Prepayments at 200% of FHA Experience
0.00%	$1260.22	$1000.00	$1253.88	$1000.00	$1000.00	$1000.00
0.50	1241.14	1000.00	1235.37	1000.00	1000.00	1000.00
1.00	1222.62	1000.00	1217.39	1000.00	1000.00	1000.00
1.50	1204.34	1000.00	1199.64	1000.00	1000.00	1000.00
2.00	1186.38	1000.00	1182.19	1000.00	1000.00	1000.00
2.50	1168.73	1000.00	1165.03	1000.00	1000.00	1000.00
3.00	1151.39	1000.00	1148.16	1000.00	1000.00	1000.00
3.50	1134.34	1000.00	1131.57	1000.00	1000.00	1000.00
4.00	1117.58	1000.00	1115.25	1000.00	1000.00	1000.00
4.50	1101.11	1000.00	1099.20	1000.00	1000.00	1000.00
5.00	1084.92	999.81	1083.42	1000.00	1000.00	1000.00
5.50	1069.01	994.99	1067.90	997.26	998.88	1000.00
6.00	1053.36	987.95	1052.63	991.66	994.38	997.35
6.50	1037.99	979.46	1037.62	984.45	988.15	992.59
7.00	1022.87	969.98	1022.85	976.15	980.75	986.57
7.50	1008.02	959.83	1008.33	967.09	972.55	979.69
8.00	993.41	949.22	994.05	957.52	963.79	972.20
8.50	979.06	938.31	980.00	947.59	954.64	964.29
9.00	964.94	927.20	966.18	937.42	945.23	956.09
9.50	951.07	915.96	952.59	927.09	935.63	947.68
10.00	937.43	904.67	939.22	916.66	925.93	939.14
10.50	924.02	893.35	926.08	906.19	916.16	930.52
11.00	910.84	882.06	913.14	895.71	906.36	921.84
11.50	897.88	870.81	900.42	885.26	896.55	913.16
12.00	885.13	859.62	887.91	874.84	886.81	904.48
12.50	872.60	848.51	875.60	864.48	877.09	895.82
13.00	860.29	837.49	863.49	854.19	867.43	887.20
13.50	848.18	826.58	851.58	843.99	857.84	878.63
14.00	836.27	815.78	839.86	833.88	848.33	870.12
14.50	824.56	805.10	828.34	823.87	838.90	861.68
15.00	813.04	794.54	817.00	813.97	829.56	853.3

Table 3. Interest Rates on Long-Term Farm Real Estate Loans

Quarter		3-Month T-Bills	FCS	Commercial Banks	Life Insurance Companies
1987	-I	5.53%	11.40%	10.70%	9.48%
	-II	5.73	10.90	10.73	9.97
	-III	6.03	10.75	11.00	10.50
	-IV	6.11	11.50	11.00	10.88
1988	-I	5.76	9.88	10.80	10.13
	-II	6.23	9.82	10.90	9.90
	-III	6.99	10.06	11.33	10.08
	-IV	7.69	10.56	11.53	10.07
1989	-I	8.53	10.82	11.97	10.71
	-II	8.44	11.01	11.83	10.54
	-III	7.85	10.62	11.63	10.23
	-IV	7.64	10.65	11.47	10.40
1990	-I	7.60	10.62	11.30	9.62
	-II	7.70	10.67	11.40	10.10
	-III	7.49	10.49	11.43	10.30
	-IV	7.02	10.45	11.27	10.97
1991	-I	6.05	10.22	10.90	10.00
	-II	5.59	9.96	10.73	9.74
	-III	5.41	9.89	10.53	9.67
	-IV	4.58	9.46	9.83	9.24
Aver. (1987-91):		6.70%	10.49%	11.11%	10.13%

Notes: The T-Bill, FCS, and life insurance interest rates were taken from the Agricultural Income and Finance, Situation and Outlook Report, USDA, ERS, February 1992.

The FCS interest rates are averages of rates charged by FCS institutions in various districts. While most of these rates were stock-adjusted, some were not and to that extent, FCS rates reported here might be somewhat underestimated, as a measure of effective rates paid by borrowers.

The commercial bank interest rates were computed from data in the Agricultural Finance Databook, Division of Research and Statistics, Board of Governors of the Federal Reserve System. The figures are averages for the agricultural banks in the states in the 7th, 9th and 10th district of the Federal Reserve. [IL, IN, IA, MI, WI, CO, KS, MO, NE, NM, OK, MN, MT, ND, SD]. Nearly 85% of the agricultural banks that have purchased Farmer Mac stock and are thus eligible to participate in its secondary market activities are located in these states. (Koenig and Rossi, 1990).

Table 5. Effective spreads between interest rates on commercial bank fixed rate morgage and estimated investor yields on Farmer Mac mortgage-backed securities

	Quarter	Non-Callable Mortgage	Callable Mortgage w/Optimal Call Policy	Callable Mortgage w/Suboptimal Call Policy
1987	-I	4.05	3.13%	3.19%
	-II	4.01	3.13	3.20
	-III	4.16	3.34	3.43
	-IV	4.13	3.32	3.41
1988	-I	4.07	3.20	3.26
	-II	3.99	3.20	3.30
	-III	4.13	3.44	3.58
	-IV	4.07	3.43	3.62
1989	-I	4.19	4.52	3.85
	-II	4.08	3.51	3.73
	-III	4.11	3.49	3.68
	-IV	4.03	3.39	3.58
1990	-I	3.88	3.23	3.42
	-II	3.93	3.30	3.49
	-III	4.04	3.39	3.57
	-IV	4.06	3.37	3.51
1991	-I	4.06	3.23	3.32
	-II	4.06	3.15	3.21
	-III	3.92	2.98	3.02
	-IV	3.53	2.33	2.33

Note: Effective spreads are calcuated as the borrower interest rate less 90% of the required investor yield (see footnote 12).

Table 7.   Summary of the Effective Spreads between Mortgage Rates and Investor Yields for the Farmer Mac Security for the Period 1987-1991

Prepayment Policy	FCS		Commercial Banks		Life Insurance Co's	
	Range	Average	Range	Average	Range	Average
Non callable	2.86-4.75%	3.40%	3.53-4.19%	4.02%	2.20-4.01%	3.04%
Callable mortgage w/ Optimal call policy	1.96-3.83	2.68	2.33-4.52	3.30	1.55-3.26	2.32
Callable Mortgage w/ sub optimal prepayments	1.96-3.91	2.76	2.33-3.85	3.38	1.74-3.29	2.40

Table 9.   Estimates of Costs for the Farmer Mac II Program[1]

Cost Component	Estimate
1. Fees and Expenses (90% guaranteed portion)	0.75 - 1.00%
a. Farmer Mac Fee and Expenses[2]	0.25 - 0.35
b. Trustee Fee	0.10 - 0.15
c. Loan Servicing Fee	0.40 - 0.50
2. Cost of 10% non-guaranteed portion[3]	10.32 - 11.05
3. Total Costs[4]	1.71 - 2.01

Notes: 1.   These cost estimates are consistent with those provided in "Farmer Mac II: Loan Purchase Plan," Federal Agricultural Mortgage Corporation, December 1990.

2.   This estimate includes a cost component associated with security issuance and administrative costs over and above the usual guarantee fee, since Farmer Mac acts as the pooler in the case of Farmer Mac II program.

3.   Under the Farmer Mac II program, lenders are required to hold capital only against 10% non-guaranteed portion of the loan, unlike the Farmer Mac I program where they have to hold capital against the full amount of the loan. We have therefore used the Lins/Hofing estimates of SPIC assuming 10% of their estimated loan loss provision, an 8% risk-based capital requirement on the 10% non-guaranteed portion of the loans, and loan servicing fees of 0.40 - 0.50%.

4.   The total cost estimates are found by adding 90% of the fees and expenses to 10% of the cost of the non-guaranteed portion.
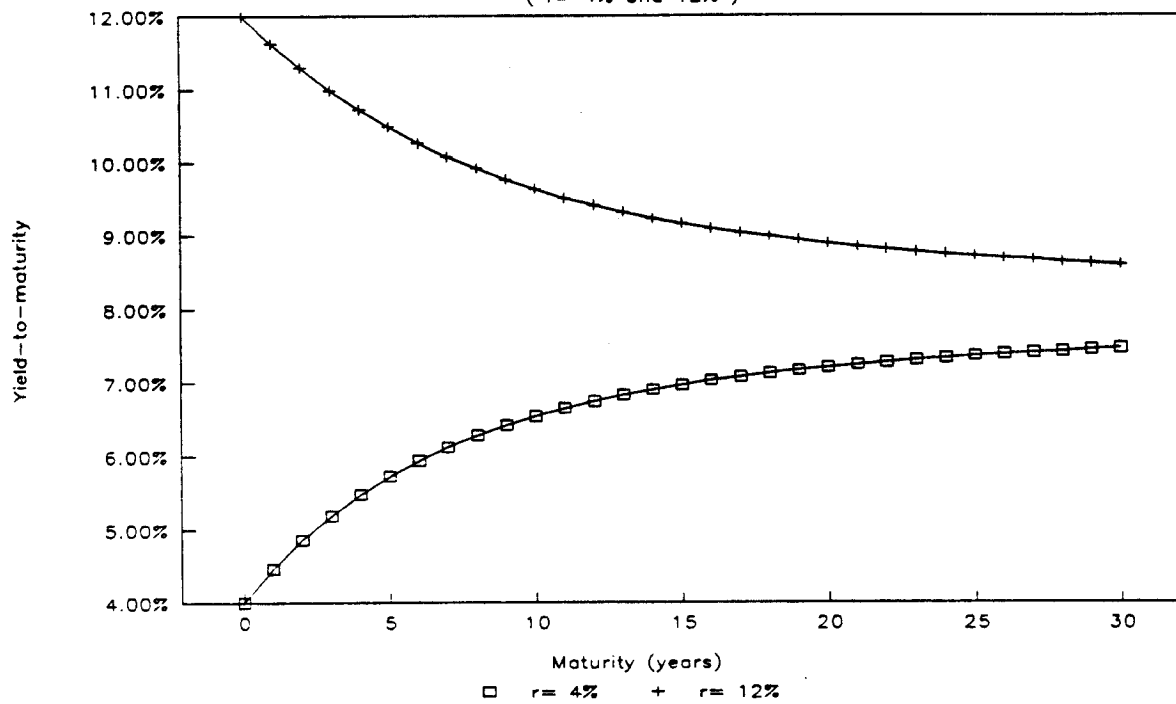
Figure 1a. CIR Term Structure
(r= 4% and 12%)

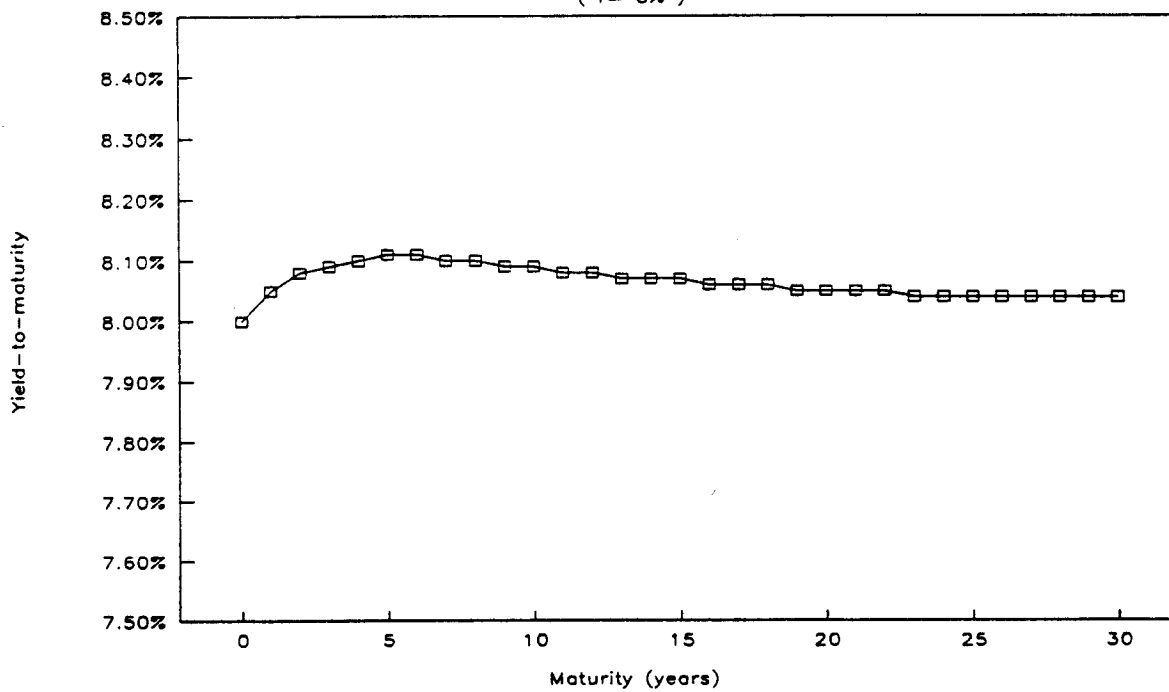Figure 1b. CIR Term Structure
(r= 8%)

Figure 1. Illustration of Term Structures Generated by the CIR Model

12. More formally, the interest rate charged to borrowers can be expressed as $r_B = (.90)(r_I + f) + (.10)(s)$, where r_B is the interest cost to the borrower; r_I is the investor required return on Farmer Mac securities; f is the percentage transactions cost associated with the Farmer Mac security; and s is the overall percentage cost associated with the 10% SPI retained by the lender. Thus the rate charged to the borrower is the weighted average of the cost of funds from the Farmer Mac and subordinated participation sources of funds. Rearranging gives $r_B - (.90)r_I = (.90)f + (.10)s$ where the left hand side represents the "effective spread" shown in table 4 for the FCS institutions (and in tables 5 and 6 for commercial banks and insurance companies, respectively). These effective spreads can now directly be compared to the total transactions costs estimated according to the right hand side of the equation.

13. For a description of the various cost components, see Lins and Hofing (1990).

14. Under the FmHA's existing regulations published in January 1989, a guaranteed loan borrower pays interest at rates no more than the rates the lenders charge their average farm customers. However, there is some empirical evidence that actual rates charged by lenders are slightly above the average mortgage rates charged by the lenders (Koenig and Sullivan, 1991).

15. See, for example, Agricultural Income and Finance: Situation and Outlook Report; USDA, March 1992; p.28.

16. See for example Scott Kilman, "Stuck in Low: As Farm Belt leaves its debt binge behind, its caution lingers on", Wall Street Journal, September 3, 1992; p.1.

17. See GAO/RCED-91-181, September 1991; p.19.