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THE FEDERAL NATIONAL MORTGAGE ASSOCIATION, RESIDENTIAL CONSTRUCTION, AND MORTGAGE LENDING

BY

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The role and impact of the Federal National Mortgage Association (FNMA) in the housing and mortgage markets has in recent years received considerable attention in the academic literature and in public policy debates. In the past several years the policy debate has taken on a more urgent nature with both the Department of Housing and Urban Development (HUD) and Congressional sources vigorously criticizing the activities of FNMA and proposing mechanisms by which closer government control of FNMA can be obtained.

The policy debate revolves around three substantive issues: 1) the counter-cyclical nature of FNMA's activities -- especially the rapid growth of FNMA and the failure of FNMA to sell mortgages during periods in which there is a plentiful supply of private mortgage funds, 2) the provision of funds for low and moderate income housing, and 3) the holding of mortgages on housing in urban areas.

The academic literature focuses on two major questions: 1) the extent to which FNMA activity is exogenous (policy determined) or endogenous to the housing and mortgage markets and 2) the short-run (counter-cyclical) and long-run impact of FNMA on the mortgage supply, mortgage interest rates, and on housing market activity. The work of

Silber (12), Rosen and Kearl (11), Kaufman (10) and Grebler (5), all focus on the former question and estimate various types of policy reaction functions for FNMA. Work by Jaffee (8), and Bosworth and Duesenberry (1), focus on the latter question.

The literature on the reaction function concludes that FNMA activity is in part endogenously determined within the housing and mortgage markets. The studies on FNMA's net impact generally agree that there is some short-run impact of FNMA on housing activity and mortgage supply and rate. The long-run impact is found to be essentially zero by both Jaffee and Bosworth and Duesenberry.

This paper attempts to extend the academic analysis of FNMA in two ways. First, a micro-economic model of the auction process by which FNMA provides commitments to mortgage markets is constructed. This micro-economic model is then combined with a revised policy-reaction function approach. The policy implications of these alternative models are analyzed.

Second, these two models of the commitment process are then combined with a detailed macro-model of the housing and mortgage markets (including a small capital market feedback sector) to test the net short-run and long-run impact of FNMA on these markets. The combination of a detailed micro-model with more specific macro-models of the housing sector provides a better assessment of the way in which FNMA reacts to and impacts the housing-mortgage-capital markets.

The second section of the paper provides a brief introduction concerning the institutional features of FNMA. Section III develops the

micro-economic and policy reaction models. Section IV reports on the empirical tests of these models. Section V shows how FNMA activity is integrated into macro-models and the net impact that FNMA has on the housing-mortgage-capital market sectors of these models. Section VI discusses the policy implication of the theoretical and empirical findings.

II. Institutional Background

The Federal National Mortgage Association was founded in the 1930's, in response to the need for mortgage funds induced by the great depression. At that time, FNMA's purpose was to develop a secondary mortgage market by using funds largely borrowed from the Treasury to finance purchases of existing FHA-insured mortgages.[1]

The Housing Act of 1954 changed FNMA's status from a government corporation to a quasi-government corporation by having FNMA issue non-voting preferred stock to the Treasury and non-voting common stock to the individuals and organizations who sold it mortgages. It also identified a new function to be served by FNMA in addition to its secondary market functions, a special assistance function which involved the financing of certain mortgages that private investors would not finance. The Housing and Urban Development Act of 1968 again changed the status of

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[1] Mortgages guaranteed by the Veterans Administration became eligible for purchase by FNMA in 1948. Conventional mortgages (i.e., mortgages not guaranteed or insured by the Federal Governmant) became eligible for purchase by FNMA in 1970. FNMA's first purchase of a conventional mortgage took place in February, 1972. In March 1978, FNMA began the purchase of FHA insured graduated payment mortgages.

FNMA. Recognizing that the ability of FNMA to perform its secondary market function was hindered by having its mortgage purchases under government budgetary constraints, the Congress directed that FNMA become a privately owned and operated corporation. The changeover was completed and made official in May, 1970.

Despite the transfer of FNMA to the private sector, the Federal Government still has several direct sources of control over FNMA. First, and President of the United States must annually appoint five of FNMA's fifteen directors. Second, the Secretary of Housing and Urban Development exercises general regulatory power over FNMA by setting a debt limit and a debt-equity ratio for FNMA, by approving FNMA's dividend payments, and by requiring that a portion of FNMA's mortgage purchases help further the national goal of providing adequate housing for low and moderate income families, albeit with a reasonable economic return to FNMA. The Secretary of HUD also must approve new activities that FNMA may wish to undertake. Third, the Secretary of the Treasury has the authority to purchase up to $2.25 billion of FNMA obligations (Treasury backstop authority) and must approve all of FNMA's debt and equity issues. Finally, a large portion of FNMA portfolio of mortgages are protected by FHA and VA insurance.

In its present form, FNMA operates as a profit-making mortgage investment corporation. Consistent with its secondary market function though, FNMA does not originate mortgages; rather, its actions involve primarily the purchase of existing mortgages and less frequently, the sale of mortgages. Its income is generated from revenues on the mortgages

in its portfolio net of servicing and borrowing costs, from fees collected for issuing commitments to purchase mortgages, and from profits on the sale of mortgages.

From 1968 to 1979, FNMA's income after Federal taxes increased from $20.4 million to $162 million.[2] During that same period though, FNMA's year-end portfolio of mortgages increased from $7.2 billion to $51 billion, explaining why the major portion of FNMA's working capital is raised externally through the sale of short-term discount notes (30 to 270 days), longer-term debentures (8 to 10 years), and common stock.[3] Because its obligations are classified as Federal Agency Securities, because of the existence of the Treasury backstop authority, and because of the high quality of FNMA's assets, which consist largely of insured or guaranteed mortgages, FNMA's ability to raise capital on relatively favorable terms is generally good.

Prior to 1968, FNMA utilized an over-the counter procedure for purchasing mortgages in which it periodically posted the set of prices it would pay for immediate delivery of various types of mortgages. This procedure functioned poorly because FNMA found it difficult to keep the

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[2]Because of its status as a government corporation from 1938 to 1954, FNMA paid no Federal income taxes during those years. From 1954 to 1968, FNMA made "tax equivalent" payments to the Federal Government in lieu of Federal income taxes. Since 1968, FNMA has paid Federal income taxes. FNMA is exempt from all state and local taxes except the real property tax.

[3]FNMA has also issued subordinated capital debentures and convertible debentures.

posted prices current relative to mortgage market conditions and because it did not assure mortgage lenders of future credit availability.

In 1968, FNMA introduced the Free Market System Commitment Auction (FMS) for purchasing mortgages on 1-4 family houses, replacing its over-the counter procedure.[4] The FMS auction works as follows: every other week, those individuals and organizations wishing to sell mortgages to FNMA specify the dollar volume of the mortgages they wish to sell and the effective yield they are offering on that volume.[5] FNMA then determines the volume and cutoff yield of acceptable bids by considering various mortgage and capital market indicators, the structure of yields on the mortgage bids, and changes in that structure relative to previous auctions. FNMA accepts bids by issuing forward commitments (usually four month commitments) to the successful bidders to purchase their mortgages. Delivery of the mortgages to FNMA is optional. To compensate FNMA for bearing the risk that mortgage interest rates will rise between the time of commitment and delivery, FNMA presently collects a fee from each successful

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[4]The FMS auction is not appropriate for purchasing multifamily housing and project mortgages because they involve more long-term planning and individual preparation than the standard 4 month commitment allows. FNMA offers 24 month negotiated commitments for FHA insured projects and apartment building and is in the process of developing a commitment procedure for conventional multifamily mortgages.

[5]FNMA also accepts noncompetitive bids in its FMS auction. These bids offer to sell a specified volume of mortgages at the weighted average yield of all competitive bid yields that are accepted. This option guarantees the issuance of a commitment.

bidder totaling 5/8 of one percent of the dollar volume of their mortgage commitment.

In October 1972, FNMA instituted a new procedure -- the convertible Standby System (CSS) -- for issuing twelve month commitments to purchase mortgages on proposed or existing 1-4 family houses. Unlike the FMS auction, the CSS does not utilize an auction mechanism to determine purchase volume and yield. Instead, FNMA posts the set of effective yields that it requires for issuing twelve month commitments to purchase various types of mortgages. These yields are established by considering the most recent FMS yields as base yields to which premiums are added to compensate FNMA for the risks that mortgage interest rates and/or borrowing costs will increase during the commitment period. Convertible standby commitments may be converted, after four months, to regular four month commitments at the weighted average yield established in the most recent FMS auction. Fees of one percent of the commitment value are payable when the commitment is issued.

III. Micro Models of the Commitment Process

The mortgage commitment and purchase activity of FNMA is the way in which FNMA influences the supply and price of mortgage credit and the level of housing activity. This section of the paper is concerned with the mechanisms by which FNMA makes mortgage commitments. It will thus model the two mechanisms by which FNMA home mortgages commitments are made, the Free Market Auction System (FMS) and the Convertible Standby System (CSS). Both mechanisms will be modeled in a traditional micro-economic

framework. Two alternative models, a pure profit-making (I) and a combined profit - policy reaction (II) model, will be tested. The essential difference between models I and II concern FNMA's supply of mortgage commitments. Model I has FNMA's activity depending upon a traditional profit variable, the expected return on its mortgage investment. Model II has FNMA's commitments dependent on a public policy objective function such as minimizing the shortage of mortgage funds or a decline in housing starts as well as on a profit-making term.

A. Free Market System Commitment Auction

The FMS auction is the main instrument by which FNMA makes mortgage commitments. The auction occurs every other week and allows approved organizations (primarily mortgage bankers but also savings and loan associations) to offer to FNMA a group of mortgages at a specified effective yield. A portion of the offers to FNMA are made on a non-competitive basis, with the non-competitive bidder guaranteed a mortgage commitment at the weighted average yield of all competitive bids accepted. FNMA then determines the volume of competitive offers it will accept by setting the minimum effective yield it will accept. FNMA's supply of commitments include both competitive acceptances and acceptances of non-competitive offers.

Profit-Making Model

Model I

From the previous description of the FMS auction it is clear that a micro-economic framework would be an appropriate way to model

FNMA's commitment activity. First, looking at the demand for commitments we can postulate the following demand function:

$$(1) \quad D_c = \alpha_1 + \beta_1 Y_{cf} + \gamma_1 MB^e + \Psi_1 Y^e_{cot} + \delta_1 SF^e + \varepsilon_1$$

where D_c = demand for commitments, Y_{cf} = the yield of FNMA commitments,[6] Y^e_{cot} = the expected yield of non-FNMA commitments, MB^e = the mortgage banker's expected volume of total mortgage originations, SF^e = the expected supply of funds (savings flows) to traditional mortgage creating institutions, α_1, β_1, γ_1, Ψ_1, and δ_1 are parameter estimates and ε_1 is an error term.

This demand formulation, which can be viewed as a commitment offer function, states that offers to FNMA are functions of the yield (and so price) on FNMA commitments, the yield of non-FNMA commitments (that is the yield offered by competitive purchasers of mortgage funds), the total mortgage originations made by mortgage bankers (traditional demanders of about 85% of FNMA funds) and the availability of funds to

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[6] Since the commitment process provides for a future mortgage sale (and purchase by FNMA), expected rather than actual values are utilized in the term representing alternative yield offered by potential buyers (other than FNMA) of the mortgage (Y_{cot}). In the competitive bid portion of the auction the seller of the mortgage specifies the price (i.e., yield) he is willing to accept so actual FNMA yield (Y_{cf}) is the appropriate variable to use. In the noncompetitive portion of the auction the seller agrees to accept the average yield, so that the expected yield at the auction Y^e_{cf} would be the appropriate variable for that portion of the auction. Since our specification includes both elements of demand, a weighted average of actual and expected yields might be an appropriate variable for our specification of the demand function.

traditional suppliers of mortgage loans (savings and loan associations) who might be forced to sell to FNMA if they experienced a shortfall of funds.

A priori one would expect that as the yield on FNMA commitments rose (the price paid to the originator falling) the demand for FNMA commitments would fall. Conversely as the yield on non-FNMA commitments rose, the demand for FNMA commitments would rise. It may be appropriate to treat these two yields in relative or spread terms which imposes the constraint that $\beta_1 = \Psi_1$.

Since mortgage bankers are a prime demander of commitments from FNMA, a rise in their mortgage originations would increase the demand for FNMA commitments. In turn the demand for mortgage banker originations would rise as overall housing activity rose and as traditional sources of mortgage funds declined due to a decline in savings flows to savings and loan associations or the adverse impact of usury ceilings on the supply of mortgages by traditional lenders.

Finally, the demand for FNMA commitments by savings and loan associations and others should rise as savings flows fall, as sales to FNMA provide these organizations with a source of liquidity.

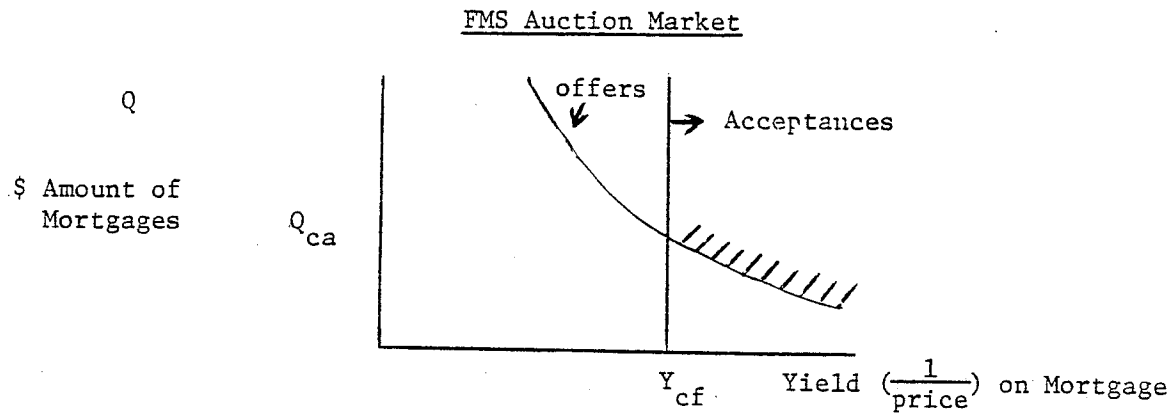
The behavior of FNMA as a commitments supplier is in model I, a function of the expected profitability of these commitments. The supply behavior of FNMA thus is a function of FNMA's spread between yield and borrowing costs -- shown as follows:

$$(2) \quad S_c = \lambda_1 + (\phi_1 Y_{cf} - \theta_1 Y_b^e) + \varepsilon_2$$

where S_c = supply of FNMA commitments, Y_{cf} is the minimum yield on FNMA commitments (including commitment fees), Y_b^e is the expected borrowing costs to FNMA incurred in financing commitments actually taken down (i.e., FNMA purchases), and λ_1, ϕ_1, θ_1 are parameters and ε_2 an error term.

FNMA's supply of mortgage commitments should rise as yield at the FMS auction rises and should fall as expected borrowing costs rise. In essence FNMA examines the yields on all offers and then chooses a cutoff or minimum required yield. Thus, FNMA has a vertical supply curve at that yield for that particular auction.

A graph of the interation of the demand for FNMA commitments and FNMA's supply behavior in the FMS auction follows:



FNMA accepts all mortgages to the right of Y_{cf}.

B. Convertible Standby System (CSS) for Mortgage Commitments (Model IA)

Since late 1972, FNMA instituted an additional mechanism for providing commitments to the mortgage market, the Convertible Standby System. Under the CSS, FNMA issues twelve month commitments at a yield which reflects a premium over a recent FMS auction. The CSS yield, called the posted rate, is generally adjusted to reflect changes in the FMS yield. The commitment then can be utilized at the posted rate or converted to a normal four month commitment at the average FMS yield at the most recent auction. FNMA generally stands ready to accept all mortgages that are offered at the posted yield. The CSS commitment requires a larger 1% commitment fee at the time of issue. The additional commitment fee and premium (which varies depending on yield expectations and lags in FNMA's adjustment to these expectations), over the FMS yield are necessary to compensate FNMA for the extra risks associated with a twelve month fixed interest rate commitment.

In modeling the CSS mechanism we use a framework similar to that used in modeling the FMS system. The major difference concerns the more prominent role that expectations play in the CSS system because of the much longer length of the mortgage commitment. On the demand side, the key variables reflect the expected trend in interest rates (both FMS

auction and other mortgage rates). If the yield at future FMS auctions (4 to 12 months in the future) is expected to rise by more than the difference between the CSS posted rate and the current FMS rate then there should be a large demand for CSS commitments. Conversely, if mortgage rates are expected to fall then demand for CSS commitments would be weak.[7]

The demand and supply equations for CSS commitments can be written as follows:

$$(3) \quad D_c = \alpha_1 + \beta_1 (Y^e_{cf} - Y_{css}) + \gamma_1 MB^e + \Psi_1 Y^e_{co} + \theta_1 SF^e + \varepsilon_3$$

where

Y^e_{cf} = the expected yield on free market system auction, 4-12 months in the future

Y_{css} = the posted rate on convertible standby commitments.

All other variables are the same as Model I, except that the expectation variables are for a 4 to 12 month period rather than a four month period.

The supply side behavior is also similar to Model I. It is depicted in equation (4) which follows:

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[7] If all participants in the market had the expectation that mortgage rates would fall then the demand for CSS commitments might be 0. However, since there is a distribution of expectations over market participants there will likely always be a positive demand for mortgage commitments.

(4) $S_c = \lambda_1 (\phi_1 Y_{css} - \theta_1 Y_b^e) + \varepsilon_4$

Again Y_b^e reflects a 4 to 12 month borrowing cost expectation.

C. Policy Reaction Model

Model II

An alternative model of FNMA's commitment activity might be a policy reaction model as suggested by Silber (11) and Rosen and Kearl (12). In this case the demand for FNMA commitments would be identical to that in Model I, equation (1). The supply of FNMA commitments instead of being determined only by expected profitability, would also be determined by some policy goal function. FNMA might attempt to offset shortfalls and/or an overabundance of private market mortgage funds. Alternatively FNMA might attempt to minimize the fluctuations in housing starts or mortgage interest rates by altering the level and/or timing of its commitment activity.

The usual specification for an optimal policy model is to specify a quadratic "loss" or objective function which the policy maker tries to minimize. In the case of FNMA such a reaction function might look as follows:

(5) $\Omega = \omega_1 (M^*-M)^2 + \omega_2 (Y_{cf} - \alpha Y_b)^2$

where Ω is scaled in units of FNMA utility, and

ω_1 and ω_2 are weighting factors converting squared differences to utility. ω_1 would be positive and ω_2 would be negative.

M = Mortgage Loan Flow (Including FNMA for New Housing)

Y_{cf} = Yield on FNMA Acceptances

Y_b = FNMA borrowing cost

and where * denotes desired level of M.

Implicit in this framework is a model of how FNMA commitments and purchases will effect the key variable, M. Presumably increasing (decreasing) FNMA commitments will increase (decrease) mortgage loan flow.[8]

With an implicit model in mind FNMA would then attempt to minimize some variant of the objective function Ω, minimizing deviation from optimal mortgage flows and maximizing profit (thus ω_2 negative).

The one difficulty with (5), is that the values for M^*, must somehow be derived. Since this is important in determining a reaction function for FNMA it is necessary to make clear our assumption in deriving this term.

Setting the value for M^*, is somewhat complicated as price inflation in the housing market will create an upward trending M^*. In addition, since there is some substitution between mortgage loans made for existing homes and new housing units it is hard to precisely identify M^*. The best proxy for the (M^*-M) term is a measure of need in the mortgage market -- real mortgage originations from all sources. When real mortgage originations fall dramatically $M < M^*$ and FNMA would attempt to offset this shortfall. Likewise, if real mortgage originations rise $M > M^*$ and FNMA would attempt to offset the surplus.

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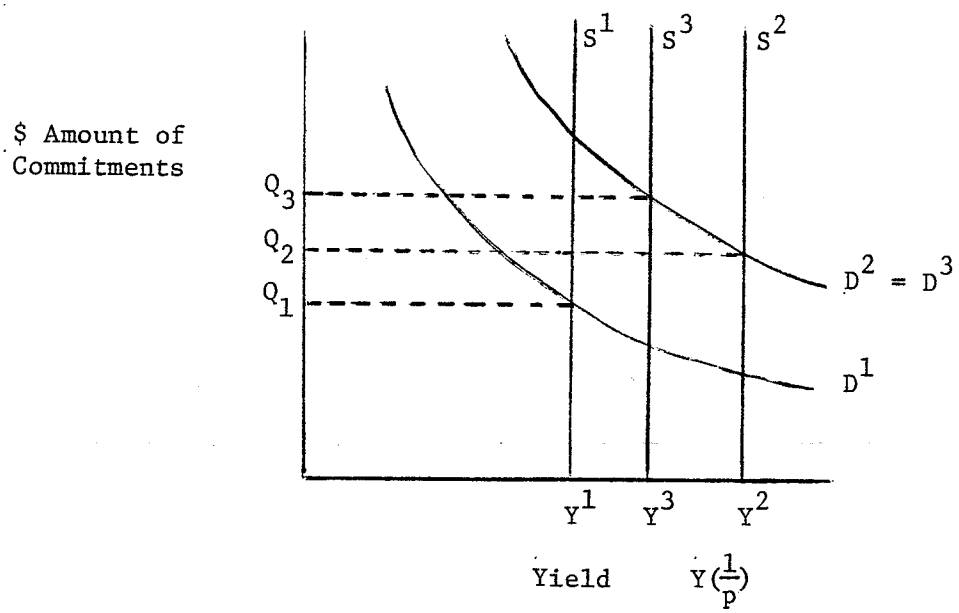
[8] A number of models of the housing and mortgage market provide such a quantification. These will be discussed in Section IV.

D. Comparative Statistics of Models I, IA, II

With the alternative models of FNMA behavior specified, the commitment activity of FNMA during a typical housing cycle can be analyzed. The downturn phase of the cycle is usually marked by rising short- and long-term interest rates, decreased savings flow, and eventually decreased mortgage lending and housing starts. Assuming that β_1, γ_1 are positive, and θ_1 is negative in equations (1) and (3), then a downturn in housing starts would lead to an increase in the demand for FNMA commitments. Thus, in both Models I (and IA) and II, even if there were no shift in the supply curve of FNMA there would be an increase in FNMA commitment activity.

Clearly, however, the same conditions that cause the housing downturn will cause FNMA's expected borrowing costs and so supply curve to shift. In Model I (and IA) one would expect FNMA's supply curve to shift to fully reflect the expected increased borrowing costs. In Model II, however, FNMA in attempt to offset the housing downturn and shortage of mortgage funds would shift its supply curve by less than the amount needed to incorporate the expected increase in borrowing costs. It is the extent to which the supply curve shifts which distinguishes Model I and Model II. In Model II we would basically expect to see FNMA's spread between expected yield and expected borrowing costs to narrow as they attempt to satisfy equation 5. The actual level of FNMA commitments in each case is merely a function of the relative shifts in the demand (the same in Model I and II) and supply curves. The graph below shows these dynamics.



In Model I demand shifts from D^1 to D^2 in periods of tight money and supply shifts from S^1 to S^2. Commitments rise by $Q^2 - Q^1$ and the yield rises from Y^1 to Y^2. In Model II demand shifts from D^1 to D^3 ($= D^2$), but in attempting to offset the cycle supply shifts only to S^3. This leads to a larger increase in commitments $Q_3 - Q_1$, and a smaller increase in yield to Y^3.

A similar set of analyses can be applied to periods of ease in the mortgage and housing markets. One might, however, expect to see some assymetry in the demand coefficients and in the supply response of FNMA, especially in Model II.

E. Purchase Takedowns and Commitment Conversions

Once the mortgage originator has a FNMA commitment it can deliver the mortgage at its option. In the case of the FMS auction, the mortgage

must be delivered in four months at the FMS yield. Under the CSS system, the originator can deliver the mortgage at the CSS posted rate within 12 months, or after four months it can convert the commitment to a four month commitment at the current FMS yield. As a result both the takedown and the conversion of commitments are a function of interest rate changes. These can be modeled as follows:

$$(6) \quad P_{fm} = \lambda_1' + \alpha_1 (Y_{cf(-3)} - Y_{cf})$$

$$(7) \quad P_{cs} = \lambda_2 + \alpha_2 (Y_{css(-12)} - Y_{cf})$$

$$(8) \quad C_{cs} = \lambda_3 + \alpha_3 (Y_{ccs(-12)} - Y_{cf})$$

where P_{fm}, P_{cs} = purchases free market system, purchases convertible standby system respectively

C_{cs} = conversions convertible standby system

Y_{cf} = Free Market System Auction Yield

Y_{css} = Convertible Standby posted yield

(-3, -12) = lags in terms of months

Basically, equations (6) and (7) state that if interest rates have fallen there will be less takedowns of previously made commitments (α_1, $\alpha_2 > 0$). Equation (8) states that if the free market rate (Y_{cf}) is less than the CSS rate on the commitment there will be a conversion ($\alpha_3 = 1$ if $Y_{css(-12)} > Y_{cf}$, else $\alpha_3 = 0$).

Equations (6) and (8) will also be estimated in the empirical section of the paper.

IV. Empirical Results

This section reports the estimation of the equations formulated in Section II. All equations were estimated in log-log form by ordinary least squares. Most equations were also corrected for autocorrelation using the Hildrith-Liu method. The basic theoretical specification of the model implies a simultaneous equation relationship between the required yield equation and the implicit real mortgage originations equation. Thus, because of the possible correlation between the error term and the real mortgage term, a simultaneous equation estimation technique would normally be appropriate. In the empirical specification we have used a four month lagged distribution of real mortgage originations and so the equation is in fact recursive requiring only OLS techniques.

Three sets of equations are reported: 1) Demand equations for FNMA commitments -- shown in Table 3-I, 2) Required yield equations for FNMA commitments -- including both profitability and policy reaction specifications for FNMA behavior -- shown in Table 3-II, and 3) Purchase and Conversion equations -- shown in Table 3-III.

The basic finding of our empirical work is that FNMA activity can indeed be modeled in a micro-economic framework. The demand equations show a strong responsiveness of offers to FNMA to relative interest rates. FNMA yields (lower prices) have a large negative and statistically significant coefficient. The yield expectation variable, the first difference of Y_{cf}, has a positive coefficient

TABLE 3-I

DEMAND EQUATIONS

	Constant	Y_{cf}	ΔY_{cf}	MBankers	$Y_{cot}1$	Real Deposit Flows	$Y_{cot}2$	$\bar{R}^2$	D.W.	ρ
(1) Conventional Offers	-.418 (1.62)	-7.62 (1.86)	1.15 (.268)	1.52 (.199)	4.95 (2.35)	-2.55 (1.27)	-	.639	.96	-
(2) Conventional Offers	-2.60 (2.95)	-8.14 (2.16)	.890 (.222)	1.07 (.313)	8.05 (2.92)	-2.93 (.975)	-	.747	1.97	.6
(3) Conventional Offers	-2.06 (3.57)	-14.86 (3.26)	.729 (.216)	.999 (.343)	6.42 (3.21)	-2.64 (.907)	8.73 (3.13)	.767	2.12	.7
(4) FHA Offers	16.16 (2.60)	-32.66 (7.55)	.472 (.433)	.913 (.298)		-	28.65 (7.99)	.433	1.06	-
(5) FHA Offers	17.98 (4.07)	-27.28 (7.29)	.773 (.412)	.903 (.471)		-	22.28 (7.63)	.55	1.79	.5
(6) FHA Offers	17.46 (4.33)	-27.33 (7.33)	.768 (.414)	.871 (.482)		.80 (2.17)	22.64 (7.74)	.545	1.78	.5

1973:1 to 1980:2 - Monthly Data

Y_{cf} = Average Yield

MBANKERS = Mortgage Banker Originations

$Y_{cot}1$ = Conventional Mortgage Rate

$Y_{cot}2$ = GNMA Passthrough Mortgage Rate

Seasonal factors and a dummy for the number of auctions in a month were also included.

which is significant in most equations. The alternative yield has a strong statistically significant positive coefficient. In the FHA equation, the GNMA passthrough rate is the appropriate alternative and the coefficient is similar but opposite in sign to that on FNMA yield. In the conventional offer equation both the passthrough and the conventional mortgage rate enter with the sum of the coefficients opposite in sign and approximately equal to that on FNMA yield. The mortgage banker origination variable is significant and about equal to 1 in each equation. The real saving and loan deposit flow variable is only significant in the conventional mortgage rate equation confirming the dominant influence of the savings and loans in this market. A separate equation was estimated for overall mortgage banker volume (not just FNMA related originations). This equation showed that mortgage banker's volume is inversely related to deposit flows to savings and loan associations. Thus, the mortgage banker term in the FHA offer equation is picking up part of the real deposit flow effect. As a result, the FHA and Conventional offer equations show a strong counter-cyclical behavior on the part of offerings to FNMA.

On the required yield equations we find that our theoretical model is also confirmed -- though in a somewhat unexpected fashion. The pure profit making fits FNMA quite well. The borrowing costs variables, represented by a 3-5 year and a 10 year bond rate, are correctly signed and statistically significant in most equations. The need for mortgage credit, as represented by real mortgage originations

is positive but not statistically significant in the full sample estimation. This would indicate that FNMA only varys its' required yield in response to open market rates. An alternative explanation is that FNMA has now become so integrated with the overall capital market, and that the set of offering yields it receives are so narrow and close to the market that it really does not have much leeway in setting the required yield. This view is partially confirmed by a second set of equations shown in Table 3-II which are estimated from 1973:1 to 1978:5. In these equations the real mortgage origination term had a statistically significant positive sign, indicating counter-cyclical variation in required yields. However, since the introduction of the money market certificate in June of 1978, it is generally perceived that the mortgage is much more integrated with the capital market -- thus making it difficult for FNMA to move very far from the market as it appeared to do prior to June 1978.

A final explanation of the changing behavior of FNMA could be attributed to the extremely uncertain mortgage market in 1979. In the fall of 1979 and early 1980 monthly mortgage rate changes were dramatic and led many mortgagers to wonder about their financial viability. Thus, it is perhaps not surprising that FNMA emphasized profitability (or minimizing losses) to a greater extent during this period.[9]

Purchases of previous obtained commitments are inversely related to the change in the FMS yield. If the yield falls then

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9 In fact, FNMA experienced the first loss in history in the second quarter of 1980. It could be argued,however, that in 1980(and at the peak in any interest rate cycle), FNMA could maximize counter cyclical activity and profitability by making a larger than normal amount of mortgage commitments. As interest rates declined FNMA would have maximized commitment income and yet few of these high rate mortgages would actually be delivered. Even if they were delivered, borrowing costs would have already declined to pre-peak levels.

Table 3-II

REQUIRED YIELD AND POLICY REACTION EQUATIONS

		Constant	3-5 Year Bond	10-Year Bond	Lagged Dependent	Expected Real Mortgage Originations	$\bar{R}^2$	D.W.	ρ
(1)	CONYLD*1	.143 (.019)	.215 (.044)	.092 (.062)	.661 (.051)	-	.94	1.97	.3
(2)	CONYLD*1	.115 (.080)	.225 (.039)	.076 (.056)	.678 (.046)	.0181 (.008)	.943	1.93	.2
(3)	CONYLD*2	.015 (.062)	.258 (.061)	.172 (.082)	.606 (.054)	-	.98	1.82	.4
(4)	CONYLD*2	.0156 (.064)	.257 (.061)	.172 (.083)	.606 (.055)	.00042 (.0121)	.98	1.82	.4
(5)	FHAYLD*1	.74 (.079)	.265 (.041)	.081 (.058)	.653 (.044)	-	.957	1.99	.3
(6)	FHAYLD*1	.053 (.079)	.274 (.041)	.074 (.057)	.662 (.044)	.0145 (.009)	.958	2.08	.3
(7)	FHAYLD*2	.102 (.070)	.257 (.068)	.269 (.092)	.473 (.051)	-	.985	2.03	.6
(8)	FHAYLD*2	.102 (.070)	.257 (.068)	.269 (.092)	.473 (.051)	.00046 (.014)	.985	2.03	.6

1* = 1973:1 to 1978:5, monthly

2* = 1973:1 to 1980:3, monthly

purchases fall (equations (1), (2), (3), (4) Table 3-III). Conversions are directly related to the difference between the CSS rate and the FMS rate. If CSS rate > FMS rate than a conversion takes place. All the demand equations thus strongly confirm the models developed in Section II.

TABLE 3-III

PURCHASE AND CONVERSION EQUATIONS

		Constant	ΔY_{cf}	Commitments Lagged	$\bar{R}^2$	D.W.	ρ
(1)	PURFHAFMS	141681 (34891)	-127.40*2 (29.84)	180.819*1 (45.16)	.702	1.98	.64
(2)	PURCONFMS	45213 (21215)	-22.40*2 (28.53)	405.08*3 (184.12)	.094	1.94	
(3)	PURFHACSS	5.239 (6.58)	-4.79*4 (2.67)	.165*4 (.033)	.62	1.89	
(4)	PURCONCSS	35.14 (9.89)	-37.73*3 (22.07)	.30138*3 (.08721)	.40	1.83	
(5)	CONFHACSS	16.65 (55.109)	54.7*5 (35.9)	.0274*5 (.081)	.14	1.76	
(6)	CONCONCSS	34.45	40.84*6	.0024	.11	1.68	

1973:1-1977:12

1* = (COMT(-3) + COMT(-4))

2* = (FMSRATE(-3) - FMSRATE)

3* = (COMIT (-3))

4* = (11 month lag on yield change or commitments)

5* = (8 month lag on yield change or commitments)

6* = (6 month lag on yield change or commitments)

PUR = Purchases

FMS = Free Market System

CSS = Convertible Standby System

CON CON = Conversions Conventional

CON FHA = Conversions FHA

V. The Net Impact of FNMA Activity

The previous sections of the paper have been concerned with how FNMA reacts to changes in mortgage, housing, and financial market conditions. In this section of the paper we utilize a model developed by Jaffee and Rosen (9) to assess the short-run net impact of FNMA activity on housing starts, mortgage flows, mortgage interest rates, and general capital market conditions.

There are two basic ways that FNMA influences the housing market. First, FNMA by increasing (decreasing) the supply and price of mortgage credit will directly increase (decrease) housing starts. Second, FNMA through its open market borrowing (redemption) to finance mortgage purchases will increase (decrease) general capital market rates and so reduce (increase) the flow of funds to financial intermediaries and therefore decrease (increase) the mortgage loans of these intermediaries. In additon both of these initial impacts will also change the yield on mortgages relative to other investments and so alter the portfolio choices of intermediaries.

These impacts are further complicated by the possibility that FNMA may have an asymetrical impact depending on the extent of credit rationing in the mortgage market.

Since the Jaffee-Rosen paper attempts to assess this full range of impacts for all the quasi-governmental mortgage agencies (FNMA, FHLMC, GNMA, FHLBB) the FNMA results are only summarized here.

The Jaffee-Rosen model is monthly, and has mortgage, housing, savings, and capital market sectors. FNMA commitments, purchases, and debt issues enter in various portions of the model. The equations in which FNMA activities enter directly are listed as follows:

Housing Market

(4-1) H6SF =

$$\underset{(.2634)}{.5388} * BCOMO(-1) * RAT$$

$$+ \underset{(.0579)}{.09553} * BCOMO(-1) +$$

$$+ \underset{(13.87)}{45.40} * \sum_{n=1}^{5} \Delta\, BCOMO(-n) * RAT$$

$$+ \underset{(.32)}{-2.024} * \sum_{n=1}^{2} RM(-n) + \underset{(.038)}{.344} * RM * RAT$$

$$+ \underset{(1.005)}{1.126} * \sum_{n=2}^{3} FNNC + Z_1$$

$R^{-2} = .957$ D.W. = 2.03
1966:1 to 1976: 12

where BCOMO = real mortgage commitments of S+L's

RM = Mortgage Interest Rate on New Home Purchases

RAT = Credit Rationing variable, when $\Delta RM = +.05$, else 0

FNNC = FNMA New Commitments

Z_1 = Vector of other exogenous variables

Mortgage Market

$$(4\text{-}2)\quad \Delta BCOMO = \underset{(.0628)}{.06491} * (FNNC - \Delta FNMS)$$

$$+ Z_2 \qquad R^{-2} = .924 \text{ D.W.} = 1.79$$
$$1966{:}\ 5 \text{ to } 1976{:}12$$

where

FNMS = FNMA Mortgage Stock

Z_2 = Vector of other variables

$$(4\text{-}3)\quad \Delta BMORT = \underset{(.013)}{.036} * \sum_{0}^{1} (FNNC(-n)) + \underset{(.34)}{.69} * \sum_{0}^{1} (FNNC(-n)) * RAT$$

$$+ Z_3 \qquad R^{-2} = .99 \text{ D.W.} = 1.72$$
$$1966{:}5 \text{ to } 1976{:}12$$

where

$\Delta BMORT$ = Mortgage loans outstanding at S+L's

Z_3 = Vector of other variables

$$(4\text{-}4)\quad RM = \underset{(.365)}{-.71227} * (BMORT(-1) + FNMS(-1))$$

$$\underset{(.0023)}{-.0032} * (FNNC(-2)) + Z_4$$

$$R^{-2} = .997 \text{ D.W.} = 2.07$$
$$1966{:}5 \text{ to } 1976{:}12$$

where

Z_4 = Vector of other variables

Capital Market

$$(4\text{-}5)\ BRTB = \underset{(.031)}{.0637} * \sum_{n=0}^{1} \%\ \Delta\ FNMADEBT\ (-n)$$

$$+ Z_4 \qquad R^{-2} = .917 \quad D.W. = 1.87$$

$$(4\text{-}6)\ FYG35 = \underset{(.020)}{.0293} * \sum_{n=0}^{1} \%\ \Delta\ FNMADEBT\ (-n)$$

$$+ Z_5 \qquad R^{-2} = .862 \quad D.W. = 1.42$$

where BRTB = 91 Day Treasury Bill rate

ΔFNMADEBT = Change in FNMA debt outstanding

FYG35 = 3-5 Year government bond rate

Z_4, Z_5 = Vector of additional exogenous variable

It is clear from even this abbreviated version of the model that FNMA has a number of direct effects on the housing-mortgage-capital markets. In order to quantitatively assess the net impact of FNMA activity it is necessary to perform a set of simulations with the model. Four simulations were performed, two in a period of credit rationing (1974:6 to 1974:11) and two in a noncredit rationing period (1976:1 to 1976:6). These simulations were meant to capture any asymmetries in FNMA's effects on the housing-mortgage-capital markets due to credit rationing. In Simulation I FNMA made three billion dollars of additional commitments (1/2 billion per month) over the period from 1974:6 to 1974:11. In this simulation it is also assumed that

all of these mortgage commitments were purchased by FNMA from 1974:9 to 1975:2, and that these purchases were financed by a FNMA debt issue. In Simulation II, FNMA reduces commitment activity by $3 billion, and reduces purchases and debt issues by $3.0 billion over the same time frame. Simulation III is identical to Simulation I in terms of the volume of activity, but the timing is pushed forward 19 months to the nonrationing period (1976:1 to 1976:6 for commitments and 1976:3 to 1976:9 for purchases and debt issues). In Simulation IV, FNMA reduces its activity as in Simulation II, over the 1976 time period.

The results of the simulations are shown in detail in Table 4-I. The basic findings are as follows.

First, FNMA commitment and purchase activity has a strong positive effect on the housing and mortgage market. During periods of credit rationing in the mortgage market this effect is especially pronounced with a net effectiveness[10] of 24%. During nonrationing periods the net effectiveness is substantially lower, on the order of 17%. Also in the rationing period, the impact of FNMA comes much sooner, with half of the effect coming in the first four months. In the nonrationing period only 10% of the effect comes in the first four months. In terms of FNMA sales and reductions in commitments, roughly similiar results hold.

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[10]The value of housing starts/FNMA commitments

TABLE 4-I

SIMULATION EXPERIMENTS*

WITH JAFFEE-ROSEN MODEL

Changes from Base Run of Model

	FNMA Commitments (Billions $)(Flow)	Mortgage Rate (Percentage Points)	Mortgage Loans Outstanding at S+L's (Billions $)	Savings at S+L's (Billions $)	Housing Starts (000 Units) Σ	Value of Housing Starts (Billions $) Σ	T-Bill Rate (Percentage Points)	3-5 Year Bond Rate (Percentage Points)
Simulation I $3 Billions of Commitments during rationing period								
4 month	2.0	-.027	+.545	-.043	+9.088	+.364	+.054	+.036
7 month	1.0	-.043	+.659	-.268	+14.392	+.585	+.107	+.044
12 month	0	-.017	+.071	-.587	+17.187	+.709	+.044	+.014
Simulation III $3 Billions of Commitments during nonrationing period								
4 month	2.0	-.017	+.182	-.039	+1.295	+.063	+.046	+.027
7 month	1.0	-.024	+.279	-.285	+6.640	+.327	+.112	+.048
12 month	0	-.004	-.164	-.636	+10.647	+.526	+.053	+.015

*Simulation II and IV are not shown as they had nearly identical (but opposite in sign) effects as I and III.

FNMA's impact on the mortgage market follows a comparable pattern. Its activities have substantially greater effect during rationing than during nonrationing periods. The mortgage rate falls (rises) 4 basis points during rationing periods and falls (rises) only 2 basis points during nonrationing periods.

While FNMA's impact on the housing and mortgage market appears to be asymmetrical, its impact on the capital markets does not show this same pattern. FNMA's borrowing (redemption or reduced borrowing) has roughly a similar effect during rationing and nonrationing periods. Treasury bill rates rise by 11 basis points and 3-5 year bond rates rise by 4-5 basis points.

In summary FNMA has a strong positive impact on the mortgage and housing markets precisely when these markets are in need of funds.

VI. Conclusion

Our work has shown that a micro model of FNMA behavior is an excellent tool for analyzing FNMA activity. The supply equations all indicate that FNMA is sensitive to both profitability and counter-cyclical policy considerations. The later took on a somewhat smaller role in the chaotic conditions of late 1979 and early 1980. However, the institutional mechanisms it has set up, the FMS auction and CSS system, continue to be quite responsive to the demand needs of mortgage market participants. As a result FNMA is achieving both profitability and its counter-cyclical public policy objectives.

Our macro-model simulations show, that FNMA, in addition to reacting correctly to market conditions, also has a substantial counter-cyclical impact on the housing and mortgage markets. During periods of credit rationing in these markets, FNMA is especially effective at stimulating housing starts and mortgage loans. Its short-run net effectiveness (24%) is quite respectable given the normal negative feedback of any set of stabilization policies. In summary, FNMA appears to be meeting in public policy objectives with regard to counter-cyclical goals.

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