The Role of Consistent Implementation of Policy:
An Assessment of the Section 502 Low-Income
Homeownership Program

by

George McCarthy, Jr.*
Roberto Quercia**
Gabor Bognar***

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*Assistant Professor of Economics, Bard College
**Postdoctoral Fellow, University of California, Berkeley
***Research Assistant, Bard College

Introduction

Any public policy is only as good as its implementation. Regardless of the quality of its conception, if its delivery is not consistent with its conception, the rhetoric of a program can diverge widely from its reality. Policy evaluation typically takes place *ex ante*. Incentives are evaluated and the outcome of the program is predicted based on assumptions about the logic of the program and the coverage of targeted groups. In contrast, this study presents an *ex post* evaluation of a public housing assistance program: the Farmer's Home Administration Section 502 Low Income Home Ownership program. Specifically, this study examines two aspects of the program: (1) the implementation of the program, and (2) the effect(s) of program implementation on the achievement of program goals.

The Farmer's Home Administration of the USDA administers a number of housing loan and grant programs. One of these is the Section 502 Low-Income Rural Home Ownership Program. The program is designed to assist low-income rural households to obtain loans to purchase, rehabilitate, or relocate modest housing. The program is administered through USDA county offices in more than 1900 sites throughout the country.

The intention of the Section 502 program is to subsidize housing costs in the early years of a mortgage with the hope that borrowers gain self-sufficiency in later years. An interest subsidy is provided to qualifying borrowers on the basis of their

annual household income. The subsidy is adjusted from year to year according to changes in household income. The effective payment on a Section 502 loan is set so that borrowers spend 20 percent of their income on mortgage principal and interest payments, property taxes and home owner's insurance.

While this simple description of the Section 502 program might give the appearance that the program is easy to administer, in fact it is not. Complicated guidelines are followed to recalculate mortgage payments on a yearly basis. To make matters worse, the Section 502 program is administered by Farmer's Home officers at the county level, who are responsible also for a number of other programs and thus may not have an in-depth familiarity with the technical aspects of residential mortgage finance.

Due to its complexity, a comprehensive evaluation of the Section 502 program is problematic. There are a number of broad dimensions across which the program can be evaluated. Does the program live up to its stated goals of promoting low income home ownership and self sufficiency? Does program implementation create unanticipated problems? Is program implementation consistent with the stated goals of the program?

More narrowly, this study examines the effect of program implementation on the promotion of "correct" behavior among Section 502 participants. Specifically, this study examines the quality of program implementation and how it relates to mortgage performance, whether program implementation helps explain loan

performance for those who defaulted or those who succeeded in working their way toward self-sufficiency.

A Note on Previous Research on Program Evaluation

Typically, program evaluations have one of three objectives. First, evaluations can assess the conceptualization and design of interventions. Second, evaluations can be used to monitor program implementation. Finally, evaluations can be used to assess program utility or impact. Although evaluations address all these objectives to some degree, evaluations can be grouped into three types on the basis of the main objective that guides them.

The examination of housing and community development programs ordered by President Nixon in 1973 is an example of the first type of evaluation. The programs evaluated included the low rent public housing, the Section 502 interest credit and noninterest credit rural homeownership, the Section 504 rural home repair assistance, the Section 235 homeownership, the Section 236 rental assistance, and the rent supplement programs[1].

Many of these programs began during the 1960s as part of the Great Society initiatives of President Johnson. President Nixon used this evaluation to reconceptualize the nature of government intervention in housing and community development issues. As a

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[1] USHUD (1974).

result, President Nixon replaced many of the categorical programs evaluated with a block grant program, the Community Development Block Grant (CDBG) program.

Another example of an evaluation that assessed the conceptualization and design of programs was done by Stegman, Quercia, McCarthy and Rohe (1991). A simulation model was constructed using the Panel Study of Income Dynamics (PSID). The model was used to evaluate the affordability characteristics of a variety of low income homeownership programs and mortgage instruments. The simulation "placed" low income renters in the various programs and used the longitudinal data to evaluate how they would have performed if they had participated.[2]

The Public Housing Home Ownership Demonstration study (PHHD) is an example of the evaluation of program implementation. The PHHD was evaluated during its demonstration phase. As part of the PHHD, a number of public housing and Indian authorities were authorized to transfer to income-eligible tenants the units they were occupying. USHUD left it up to the public housing authorities to select the public housing units that were most appropriate for sale to tenants and to set the prices and terms of unit sale. The goal of the evaluation was to assess the

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[2] The model was used to evaluate the Section 235 program, the National Housing Trust (NHT) and the Homeownership and Opportunity for People Everywhere (HOPE) initiatives contained in the National Affordable Housing Act (NAHA) of 1990, and four mortgage instruments: the standard fixed rate mortgage, the adjustable rate mortgage (ARM), the price level adjusted-mortgage (PLAM), and the dual indexed mortgage (DIM).

effectiveness, efficiency and unexpected impacts of a variety of
limited scale, operating programs. This was done to determine
the essential characteristics of successful low income
homeownership programs utilizing the existing public housing
stock.[3] Many of the study findings were later incorporated in
the design of the Homeownership and Opportunity for People
Everywhere program (HOPE).

Finally, the study of the FHA Section 203(b) single family
mortgage insurance program, done by USHUD in 1984, represents an
example of the third type of evaluation, which assesses program
utility and impacts. The goal of this study was to assess
whether those served by the FHA Section 203(b) program were
distinct from those served by the private mortgage insurance
industry. This was an important goal given that the FHA Section
203(b) was established in 1934 when private mortgage insurance
was not available and thus the impact and utility of the FHA
program needed to be reassessed.

Of particular importance to the present study is the
evaluation of the Section 502 program done by the Housing
Assistance Council (HAC 1988), which is another example of the
third type of evaluation. HAC examined the impact of the program
on the targeted population to determine whether housing
assistance for the poor through subsidized homeownership was cost
effective relative to rental subsidy. HAC evaluated the program

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[3] Stegman and Rohe (1990)

descriptively, using mean and median measures and personal
interviews to capture a portrait of the program.

In contrast to HAC's evaluation of the Section 502 program,
the present study exhibits two distinct characteristics. First,
because HAC's study is based on descriptive analyses, it is not
possible to assess the real impact of program characteristics on
program participants, unless they are evaluated within a fully
specified multivariate model. A multivariate analysis is used in
this study.

Second, in contrast to HAC's evaluation, this study only
examines one aspect within the overall implementation of the FmHA
Section 502 Home Ownership program: its delivery system. The
Section 502 program offers an interest credit subsidy to make the
purchase of homes more affordable to low and moderate income
rural households. The study assess the effect of improper
interest credit and mortgage underwriting calculations on the
short-run mortgage repayment behavior of Section 502
participants.[4] Specifically, the study examines whether
mortgage default or "graduation"[5] from the program are related
to program delivery.

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[4] Program regulations state that any interest credit or
other subsidy assistance granted improperly either as a result of
false information or through error will be repaid by the
borrower. Thus, the short run examination presented in this
study should not be taken as a critique of the government
officials responsible for implementing the FmHA Section 502
program who, in accordance with the legislative mandate, are
expected to review and correct errors in the long run.

[5] HAC (1988)

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The conceptual foundations used to examine mortgage payment performance among Section 502 participants is based on postulates derived from the mortgage default literature. The following section reviews the theory of mortgage default used to develop the multivariate models tested.

Mortgage Default

Most contemporary studies of mortgage default are couched in option theory.[6] This theory states that at the beginning of each payment period, borrowers have the option of making the payment due, of selling their house and paying off the mortgage balance (prepayment), or of exercising the option to give the house to the lender in exchange for extinguishing the first mortgage lien and canceling the associated debt (default). In assessing whether or not to exercise the default option, a so called put option, borrowers consider the market value of the mortgage and the equity they have in the home, which is a crude measure of the extent to which the put option is "in the money"[7] From this perspective, default is seen as a purely financial matter, in which borrower characteristics such as income and

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[6]For a review of the literature on residential mortgage default see Quercia and Stegman (1992). This section is based on pp. 17-20 of Quercia and Stegman's review.

[7] Quigley and Van Order (1991)

employment status do not matter.[8]

Ideally, borrowers will exercise the default option whenever the value of the house plus any costs of exercising the option falls below the mortgage value.[9] However, because the default option has intrinsic value and the current value of the mortgage is affected by the option to default in the future, some borrowers with negative equity may not default because they would forfeit the option of defaulting later.[10] This factor makes it difficult to compute the value of the option.

A second issue that makes this computation complex is the problem of estimating the costs of exercising the default option. Borrowers are assumed to consider costs such as transaction costs, moving costs, and the value of the borrower's reputation and credit rating, which are also affected by default.[11] Moreover, a number of other borrower related factors have been found to have a significant effect on default (Vandell and Thibodeau 1985). The importance of these factors, however, is not consistent with the purely financial view of the default option,

The role of transaction costs and borrower related-factors in the default decision remains open to debate. Kau, Keenan, and

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[8] For a discussion of options in the financial literature see Simons (1990) pp. 82-86.

[9] Foster and Van Order (1984)

[10] Epperson, et al. (1985)

[11] Quigley and Van Order (1991).

Kim (1991) have solved numerically an option-based theoretical model of default that indicates that transaction costs play little or no role in the exercise of the option; therefore, they conclude that the option is exercised ruthlessly. Quigley and Van Order (1992), however, have identified a number of inconsistencies between the theoretical premises of the ruthless model and observed default behavior. Quigley and Van Order suggest that reputation costs (one form of transaction cost), along with a random term of the mortgage, can explain observed default behavior (for instance, among borrowers with nonassumable mortgages who want or have to move). Quigley and Van Order did not test this premise empirically.

A major reason for this ongoing debate has been a lack of adequate panel data containing relevant borrower-related information. Typically, borrower information at the time of default has been estimated from borrower information that was collected at the time of loan origination through the use of proxy measures and multivariate statistical techniques. Unfortunately, these estimated measures may not reflect the specific circumstances of individual borrowers who default, thus resulting in conflicting or insignificant findings. Panel data is required to analyze the role of contemporaneous borrower-related factors, as well as property and loan characteristics, on default.

Although the debate continues due to lack of panel data on a sample of unsubsidized borrowers, a recent study by Quercia,

McCarthy, and Stegman (1993) examined the default behavior of a sample of Section 502 participants using panel data. The authors found that contemporaneous measures of equity, including monetary transaction costs, had little influence on the probability of default. Financial stress and demographic factors, however, showed strong statistical effects on the probability of default. Thus, they found no support for the purely financial view of the default option. Obviously, the generalizability of these findings may be limited because of the subsidized nature of the sample. As other panel data become available, the significance of transaction costs and borrower related factors on the default decision of unsubsidized borrowers may be clarified.

The panel data used by Quercia, McCarthy and Stegman (1993) was collected by the Housing Assistance Council for their evaluation of the Section 502 program. The same panel data is used in the present study.

The Section 502 Low Income Home Ownership Program

The Farmer's Home Administration (FmHA) Section 502 Home Ownership program provides direct loans to qualified households for the purchase of new or existing single family homes.[12] FmHA Section 502 loans can also be used to build, rehabilitate, improve or relocate a dwelling or provide related facilities. The terms of the loan are for 33 years, or 38 years for borrowers

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[12] The information presented in this section draws from HAC (1987) and Quercia, McCarthy, and Stegman (1993).

with incomes at or below 60 percent of area median income (AMI) and who need the extra term to show payment ability, or 30 years for loans made for the purchase of manufactured homes.

The loans have an interest rate (note rate) approximately equal to the federal costs of long-term borrowing. Although the loans have a fixed note rate, the actual rates paid by borrowers depend upon their annual income. The difference between the note rate and the interest rate actually paid by borrowers is called the interest credit. This is the subsidy provided by the program.

The effective rate on a Section 502 loan is set so that borrowers spend 20 percent of their adjusted income on mortgage principal and interest payments, property taxes, and homeowner's insurance. Adjusted income is estimated by subtracting a number of authorized deductions from a borrower's annual income. These adjustments include deductions for each family member under 18 years of age, elderly, disabled or full time student residing in the household (other than applicant, spouse or co-applicant). Some medical expenses, and a number of other family related deductions are also authorized. It is the borrower's adjusted income that is used in the computation of the interest credit.

The maximum interest credit can reduce the effective interest rate paid by borrowers to 1 percent. Borrowers who initially qualify for this maximum interest credit subsidy must absorb out-of-pocket all future increases in property taxes and home owners' insurance. Higher income borrowers who qualify for

a smaller interest credit at the time of loan origination, can have their subsidy increase with increases in taxes and insurance over time, until they, too, qualify for the maximum.

The interest credit is calculated as the lesser of either (1) the difference between (a) the total annual payment of mortgage principal and interest at note rate, insurance, and property taxes and (b) 20 percent of annual adjusted income; or (2) the difference between (a) the annual payment for principal and interest at note rate, and (b) the payment of principal and interest at a 1 percent interest rate. Every year, the interest credit is revised based on changes in household income.

Borrowers must have incomes at or below 80 percent of area median income (AMI) to receive an interest credit at the time of loan origination. Borrowers continue to receive an interest credit as long as they have low incomes. As income rises, the interest credit is reduced. The phasing out is gradual, up to the point where household income reaches a certain threshold, set by FmHA, on average, at $5,500 above 80 percent of AMI. At this point, the borrower loses the interest credit and must thereafter pay the full rate at which the mortgage was originally written. Once the interest credit is lost, only those borrowers whose incomes fall below 80 percent of AMI again become eligible to receive the interest credit.

Moderate income borrowers, those with incomes above 80 percent of AMI at origination, can also qualify for Section 502 loans, but they do not receive any interest credits. For these

borrowers, the interest rate remains fixed for the life of the mortgage. The interest rate subsidy, or interest credit, is a key component of the FmHA Section 502 program. It acts as a buffer when borrowers experience unexpected declines in income, thus minimizing risk of loan termination due to mortgage non-payment.

In broad terms, termination of a Section 502 loan can occur in three ways: (1) when the mortgage is refinanced; (2) when the unit is sold by the borrower and the loan is prepaid; and, (3) when, in the eventuality of mortgage non-payment, title to the property is transferred to the lender in exchange for extinguishing the mortgage debt. The transfer of title to the lender can occur in three ways: (a) through foreclosure; (b) through transfer of the deed in lieu of foreclosure; and (c) through voluntary conveyance. In all three cases, borrowers forego their claim to any equity in the property in exchange for cancellation of the outstanding debt.

The FmHA Section 502 program has a built-in recapture provision. When dwellings are sold or loans transferred, any unpaid principal and interest due at note rate are disbursed to FmHA. At this time, borrowers also receive an amount equal to their original equity. The remaining balance, if any, is called value appreciation. A share of this value appreciation is received by FmHA as repayment for the subsidy granted. FmHA's share varies by length of residence and the average effective interest rate paid by borrowers over the holding period. The

recapture estimation is structured so that borrowers receive the largest share of any value appreciation.

There is an important variation to the basic Section 502 program. Groups of families that are unable to build or acquire adequate homes due to their low incomes can participate in mutual self help housing projects, which are sponsored usually by nonprofit organizations. Typically, 6 to 12 eligible families help each other build their homes under qualified supervision. The resulting reduction in labor costs allows otherwise ineligible families to own their homes. Loans are made available to each participating family. If families cannot meet their mortgage obligations during the construction period, unmet payments can be added to the principal outstanding balance of the loan.

FmHA Section 502 housing loans are available only to rural households. Loans are available to households living in (1) open country, and (2) small towns, even if adjacent to densely settled areas. Small towns are considered eligible if they have less than 10.000 people and are rural in character. If mortgage credit is unavailable, towns with populations between 10.000 and 20,000, that are not contained in a metropolitan area, are also eligible.

Research Methodology

The research methodology used to analyze the mortgage payment performance of a sample of low income, Section 502

borrowers is presented in this section. Three issues are discussed in some detail: (1) a description of the Section 502 panel data, (2) a description of the measures included in the analysis, and (3) a description of the proportional hazard estimation used in the multivariate analysis.

1. The panel data

The Section 502 panel data used in the analysis was collected by the Housing Assistance Council (HAC), a well-known non-profit, rural advocacy, technical assistance, and development organization, based in Washington, D.C. The panel data is for a cross section of 894 Section 502 borrowers who received loans in 1981-84. HAC followed the progress of these borrowers from the time of loan origination to 1986, collecting a wide range of contemporaneous data on families, loans, and properties throughout the period. The sample was selected in three steps: (1) counties were selected to be representative of counties nationwide based on a matrix of census region, and the metropolitan status, racial composition and incidence of poverty in each county; (2) FmHA Offices with a maximum of 1981 loan activity in counties in each of the matrix groupings were selected for sampling; and, (3) all the usable loan records in each of these offices were included in the sample.

The clustering used in the survey weighted the sample in favor of areas where FmHA was both active in home loans, i.e., had the largest caseloads, and serving very low-income households. The exclusion of loans from offices with small loads

does not limit the overall representativeness of the sample because offices with the largest caseloads represented the bulk of Section 502 activity. Evidence of this representativeness can be derived from comparing the sample's average income and subsidy trends with those of all FmHA borrowers. The average adjusted income of sample borrowers was $9,333 compared with FmHA's 1981 nationwide average of $9,485. Similarly, subsidy trends among sample borrowers reflected those of all FmHA borrowers.[13]

2. Variables and measures

The data set contained or allowed for the generation of all the variables necessary in the analysis. A summary of the variables and measures included in the analysis is presented in Appendix 1. Estimation was done using two different durations as dependent variables. First, the hazard of mortgage default was estimated using the duration of the mortgage until default occurred as the dependent variable. A dichotomous variable was designed to capture the occurrence of default, i.e., the transfer of the property title to the lender in exchange for the cancellation of the outstanding debt. Households defaulted on their loans if one of the following occurred: foreclosure, transfer of deed, or voluntary conveyance. Second, a model was estimated using the duration until the zero-subsidy state was reached as the dependent variable.

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[13] HAC (1988) p. 32.

A number of independent variables, suggested by theory and prior work, were included in the analysis. First, consistent with the bulk of the default literature, a measure of annual loan balance to house value ratio (LVRATIO) was constructed to capture the equity position of borrowers during each year of the study period. The data set contained annual loan balance information. In contrast, the data set only contained purchase price information at time of origination. House value information for each year of the study period was estimated by adjusting the appraised value of the home at the time of origination to reflect changes in the regional consumer price index for each year.[14]

Second, a measure of a borrower's ability to pay was included in the analysis. This measure was constructed as the ratio of housing costs to adjusted household income (PTIRATIO). The housing costs included in the construction of this ratio were mortgage principal and interest payments, and annual property taxes and home owners insurance payments (PITI). Adjusted income (ADJINC) was determined by FmHA based on family composition.

Third, information on the subsidy received over the course of the mortgage was also included in the analysis. The amount of subsidy received was included in the multivariate model as a continuous variable (SUBSIDY). This allowed for an assessment of the effect of the magnitude of the subsidy received on default

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[14]   The Loan-to-Value measure included in the analysis was adjusted to reflect the recapture provision in the Section 502 program and transaction costs associated with foreclosure and resale.

and graduation.

In order to determine whether the program was implemented correctly, two variables were created. The first measured the difference between the unsubsidized mortgage note payment and the one charged in the program (NOTEPAYDIF). For this, the current federal fund rate and the size of the loan were used to generate a standard monthly payment. The generated quantity was subtracted from the actual quantity charged to the participant to create NOTEPAYDIF.

The difference between an individual's actual monthly payment and what the payment should have been had the program been correctly implemented (PAYDIF) was also generated. For this variable, the most current information on adjusted income was used (the same information available to Farmer's Home) and the rules as stated in the Homeownership Assistance Program were applied. From this variable, another variable was created which accumulated the difference in payment over the life of the mortgage (ACCPAYDIF).

Finally, a number of control variables suggested by prior work were also included in the analysis. Borrower related factors included in the analysis were the gender, race, and changes in household composition, change in the number of dependents, and the ratio of transfer income (AFDC, SSI, disability, pension, and child support) to total adjusted household income.

3. Proportional hazard model

The questions addressed here relate to discrete transitions made by participants. One transition is default on the mortgage. In particular, we are interested in determining which factors exert strong effects on the likelihood of default. For the purposes of this study, how program implementation relates to the likelihood of default is the major focus.

The second transition is from the subsidized to the unsubsidized state. While we are interested in determining which factors contribute to the probability of "graduation", our focus is on the relation between program implementation and the likelihood of achieving independence.

To assess the effect of contemporaneous program implementation, property, loan, and borrower related factors on default, a multivariate analysis is required. It is assumed that graduation from the program is related to mortgage performance. For this reason, it is assumed that same factors which determine default probability will influence the probability of graduation. Consistent with most recent default studies, a proportional hazard methodology was used in the analysis.[15]

Two factors dictate both the choice of proportional hazards specification and the particular specification chosen. First, a process is being modeled rather than an event that has run its

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[15] Green and Shoven (1986), Quigley (1987), Van Order (1990), Quigley and Van Order (1991). See Quercia and Stegman (1992) for a discussion of proportional hazard models in the study of mortgage default.

course. The data gives information for individuals at different points of time during the life of a mortgage. For most of the observations the mortgage is "alive" during the entire period of study. The proportional hazards specification is an effective way to fully utilize information for all participants. Second, the data is longitudinal. This allows us to juxtapose contemporaneous information with the states of participants. For this purpose, a model with time-varying covariates is estimated.[16]

The sample can be divided into two groups according to the type of information that is yielded. The first group is defined as those for whom default (or subsidy termination) has occurred. The information yielded by this group is months duration of the mortgage and all exogenous factors which describe the individual before and at the time of default (subsidy termination).

The second group is composed of censored observations. Censoring can occur in two ways, either by reaching the end of the study period with the mortgage (subsidy) "alive" or by terminating the mortgage (subsidy) through sale or refinance. For both those who sell or refinance and those who leave the

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[16] This should be distinguished from the standard proportional hazards model which estimates the hazard rate based on the value of a covariate which is assumed to remain constant over time. It should also be distinguished from models with time-dependent covariates. In these models, covariates are assumed to vary over the relevant period as a function of time. The time-varying covariate model allows for discrete changes in the value of covariates which are assumed to remain constant within specific periods of time within the larger duration studied.

study "alive", the information yielded is the number of months survived and the vector of covariates which supported that duration of survival (subsidization). We cannot assume that censoring indicates that default will never occur, we only know that up to the point of exit from the sample, it had not yet occurred.

While we are interested in whether an individual defaults (graduates), the "time to default" or the "time to 'graduation'" is the focus of analysis. Although a probit or logit model estimating the probability of default might seem to be the more appropriate and intuitive model, such a model would be a misspecification. There is, however, a direct correspondence between the time to default and whether one defaults. The proportional hazards model employed estimates how particular covariates affect the probability of defaulting within a given period of time (here, measured in months) relative to the probability of defaulting at some unknown time in the future. An important thing to consider is that an individual leaving the sample without defaulting or reaching independence is not necessarily a non-defaulter or permanently dependent on the program, respectively.[17]

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[17] To accurately assess the probability of default using a multinomial probit or logit specification it would be necessary to follow all mortgages to their completion. One could model the different exit states, i.e. amortization of mortgage, resale, default, and assign a probability to each. Since we are looking at something in process rather than after completion, we can only make inference about the probability of default.
It would be a misspecification to use probit for the task

The Cox proportional hazards model used is based on the hazard rate function. This function depicts the risk of an event occurring at any instant. In the models estimated, the event is either mortgage default or graduation from the program.

$$h(t) = \frac{Prob(mortgage\text{-}failure\text{-}during\text{-}interval\text{-}(t, t+\Delta t))}{(\Delta t)\,Prob(mortgage\text{-}failure\text{-}after\text{-}time\text{-}t)}$$

$$h(t) = h_0(t)\, e^{\beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k}$$

The function $h_0(t)$ is called the baseline hazard function. This can have any shape. The proportional hazards specification compares the probability of default within an interval to the probability of default outside the interval. Since both probabilities depend on the baseline rate, it cancels out in the numerator and denominator.

While this specification a implies a continuous-time hazard rate, the particular functional form estimated is in discrete-time. For this, the it is assumed that the hazard rate is constant within discrete time intervals. The hazard rate can vary in discrete jumps from interval to interval given changes in

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because we are looking at default within a window of six years. Treating those who didn't default within the window as non-defaulters is clearly wrong. Further, not all mortgages originate at the same point within the interval. More weight is given to those who are in the sample for a shorter time if duration isn't taken into account.

the values of covariates. The unit of time measurement is months
with discrete jumps taken at yearly intervals as the payment
schedule is recalculated.

The coefficients (betas) are estimated in the regression.
The relative risk or hazard ratio of a change in a covariate is:

$$\frac{e^{\beta_1 x_1 + \ldots \beta_j (x_j + \Delta x_j) + \ldots \beta_k x_k}}{e^{\beta_1 x_1 + \ldots \beta_j x_j + \ldots \beta_k x_k}} = e^{\beta_j \Delta x_j}$$

Typically, hazard ratios are reported for a one unit change in
the covariate. This can be interpreted as meaning: a one unit
increase in the covariate for a specific interval will increase
the relative risk of an event by this ratio:

$$e^{\beta_j}$$

The results of the analysis are reported in Tables A–E in
Appendix 2. For the covariates in each model the hazard ratio
is reported. A hazard ratio greater than (less than) one
indicates an increased (decreased) probability of default given
an increase in the covariate. The t-ratio is interpreted in the
standard fashion using the prob-val included. The sign of the t-
ratio also indicates the direction of the effect.

Results of Empirical Analysis

Descriptive statistics are reported in Tables 1 and 2 in

Appendix 1. Of 874 observations included in the sample, 81
defaulted by the definition above. The means reported in Table
1a reveal that the average borrower was almost 32 years of age
with just over 10 years of education. Thirty-three percent of
the households were headed by single females. Fifty-nine percent
of the households were two-parent "family units." Twelve percent
of the families were characterized as African American, ten
percent Hispanic. Thirty-five percent of the borrowers had new
houses built for them or participated in the self-help
partnership program. The average mortgage survived 63.69 months
in the sample.[18] The average loan was $37,305. The average
total subsidy paid by Farmer's Home was $7,942. Downpayments
averaged $596.

Comparing defaulters to non-defaulters across the non-time-
varying means, a few observations can be made. First, there
appears to be a marked difference in the average age of
defaulters compared to non-defaulters, 27.42 years compared with
32.30, respectively. Education level does not differ very much
across default groups. Fewer than average family units, African-
American and Hispanic households defaulted. A greater proportion
of female-headed households seem to default. Those that built
new homes had a smaller proportion of defaulters than others.
The loan size of defaulters was slightly lower than average,

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[18] Of course, a large number of the mortgages are considered
censored. Given that the observation window is six years in
duration, this mean indicates that most mortgages left the sample
still "alive."

while the subsidy size was much smaller. Down payment was higher for defaulters than for non-defaulters.

The discrepancy measures reported in Table 2 show that from the beginning payments were calculated incorrectly. From year to year, the average miscalculation varies from 57.81 dollars per year in 1982 to 375.74 dollars per year for 1986. The accumulated difference in payments reveals increasing discrepancy. While the mean discrepancies from year to year are positive for both defaulters and non-defaulters (indicating a general habit of overcharging the borrower), the means are higher for every year for defaulters.

In general, errors in monthly payments were the result of the payment not being recalculated given a change in income. The general rise in the value of the discrepancy indicates that as the duration of mortgages increased, recalculations were less likely to be made. This would have to be considered an error of omission. The data included identifiers for region, state, and office. There was no pattern for inaccuracy exhibited across any of these strata.

Since the mortgages are fixed-rate, the value of the note payment remains the same through the mortgage. The mean note payment discrepancy is small and negative for non-defaulters and positive for defaulters. As indicated, about one percent of the sample had the terms of their mortgage calculated incorrectly. This would have to be considered an error of commission.

How the delivery of mortgage services affected mortgage

performance is evaluated in the models presented in Tables A-E.[19] Baseline models of mortgage default are presented which employ variables suggested by the literature on mortgage default. The program delivery variables are then separately added to the specification. For all the models, the duration of the mortgage until default is the dependent variable.

The simplest specification has mortgage default depending on four variables: payment-to-income ratio (PTIRATIO), loan-to-value-ratio (LVRATIO), the total subsidy paid by Farmer's Home (SUBSIDY), and the proportion of adjusted income accounted for by transfer payments (TRANSFER). In this model, the relation between the probability of default and PTIRATIO is positive and statistically significant. Default probability has a negative and statistically significant relationship with SUBSIDY and TRANSFER. LVRATIO does not show a statistically significant effect on the probability of default.[20]

Each of the program implementation variables shows a statistically significant and positive effect on the probability of default. Models 1b-1d show that the quality of program delivery not only impacts the probability of default, but it tends to diminish the effect of other variables. In particular,

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[19] These models build on models presented in Stegman, Quercia and McCarthy (1993)

[20] This is consistent with the claim made by Stegman, Quercia, and McCarthy (1993) that the default option is not exercised ruthlessly by borrowers in the program.

when PAYDIF or ACCPAYDIF are added to the model the significance

of PTIRATIO and TRANSFER fall below the .05 significance

threshold. Including NOTEPAYDIF drives the significance level of

TRANSFER below the cutoff level.

A second specification, building on Model 1, is shown in

Table B. It includes the size of loan at origination (LOAN), a

dummy variable denoting those who built new homes (BUILD) either

through participation in the self-help program or through

contracted construction, a dummy variable identifying those who

went through a marital disruption in the previous year

(MAR_CHANGE)[21], and a dummy variable identifying those for whom

the number of children in the household decreased (LESSKID).

In the baseline model, LOAN and LESSKID show a positive and

statistically significant effect on the probability of

default.[22] Those who built a new home had a statistically

significant, lower probability of default. The other variables

show results similar to Model 1, except that PTIRATIO is no

longer statistically significant.

When added to this model, the yearly payment variables bear

a statistically significant, positive effect on the probability

of default. NOTEPAYDIF is no longer statistically significant.

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[21] A marital disruption is defined as: divorce, separation,
or the death of a spouse.

[22] The measured effect of loan size is consistent with the
HAC (1988, p.1) finding that "poverty-level households were less
likely than others to be delinquent, and more likely to be ahead
in payments," given that loan size is contingent on ability to
pay (income).

Incorporating PAYDIF in the specification had large effects on the other variables in the model. In particular, the effects of TRANSFER and LOAN disappeared while MAR_CHANGE became statistically significant.

Table C presents the results of a "demographic" model. This includes the standard variables from Model 1 with variables depicting demographic characteristics of the borrowers. These are: a dummy variable indicating an African-American borrower (AF_AMER); a dummy variable designating female-headed households; a dummy variable designating two-parent households (FAMUNIT). The model shows that African-American households and "family units" have a statistically significant lower probability of default. Female-headed households show a negative but not statistically significant effect.

All of the variables depicting quality of implementation show a statistically significant, positive effect when added to this model. PAYDIF diminishes the measured effect of PTIRATIO, TRANSFER, and AF_AMER. ACCPAYDIF and NOTEPAYDIF exert less influence on the coefficients of other variables.

The duration until graduation from the program is presented in Tables D and E. Again, simple specifications are presented and the program delivery variables are then included. In Model 4, PTIRATIO has a positive and statistically significant effect on the probability of graduating from the program. TRANSFER and SUBSIDY exert a negative and statistically significant effect on the probability of graduation. In Model 5, LOAN and LESSKID have

a positive and statistically significant effect while BUILD,

TRANSFER, and SUBSIDY show statistically significant negative

effects.   LVRATIO and MAR_CHANGE do not show significance in

either model.

As in the default models, PAYDIF and NOTEPAYDIF show a

statistically significant, positive effect on the probability of

graduation from the program.   NOTEPAYDIF does not, however, show

significance in either model.

Discussion and Implications

The empirical evidence indicates that the quality of program

delivery has a large impact on mortgage performance for

participants in the section 502 program.   As monthly payments

rise above those mandated by the program, both the probability of

default and the probability of "graduation" from the program

increases.   In terms of the evaluation of program performance,

errors in payment calculation will increase the number of those

who default.   Oddly, these errors will also work to give the

appearance that the program is performing better in terms of

moving borrowers to the unsubsidized state.   HAC notes that

"recent emphasis on increasing 'graduations' out of the program

have produced some stress and anxiety among borrowers."[23]   There

is clearly incentive incompatibility built into the program if

graduation is stressed as a goal.

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[23] HAC (1988) p. 23

If part of the financial strain of maintaining a mortgage is exerted through program implementation, why wouldn't relief have been sought through payment recalculation at the request of the borrower? One key might be the complicated written regulations of the program. Those who participated in the program had to wade through numerous forms and an one-hundred-plus page document full of complicated calculations and legalese.[24] The implication here is that the borrowers were not familiar with the terms of the program.

Further, the program was administered at multiple levels. Personal intervention took place at the initiative of the local Farmer's Home offices while bookkeeping was done at the regional level and at the central Finance Office in St. Louis. HAC notes that "there were many examples of statements from the Finance Office which had been corrected by the County Office. However, in the absence of such assistance, the borrower bears the burden of proof."[25]

Faulty underwriting plays a statistically significant role in mortgage default while it does not have much impact on graduation. It is unlikely that many of the participants had enough knowledge of mortgage underwriting to be able to check whether calculations had been performed correctly. It is also

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[24]   Merely creating the computer algorithm to calculate repayment in the event of default or resale was a vexing problem that required three days.

[25]   ibid p. 23

possible that those in Farmer's Home Offices responsible for delivering the program were not entirely familiar with mortgage underwriting. A one-percent error rate is not exceptionally high.[26] For program evaluation, faulty underwriting will increase the number of defaults without much effect on the graduation aspect of the program.

Form FmHA 1944-6 titled "Interest Credit Agreement" is one of many pieces of paperwork required to gain financing under Section 502. It details the methods by which subsidies and payments are calculated. In the stipulations of the contract listed on the back of the form it states: "The Government may amend or cancel the agreement and collect any amount of reduction granted which resulted from incomplete or inaccurate information, *an error in computation*, or any other reason which resulted in interest credit that the borrower was not entitled to receive."[27] This implies that some form of oversight might have been planned. Since the extent of the data used for this study is limited to a six year window, it is entirely possible that some oversight took place outside the sample period. Regardless of whether it did, this study argues for some form of oversight.

Section 502 of the Farmer's Home Administration is a well-

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[26] I remember a study done a few years back checking how mortgage lenders adjusted payments on ARMs. The results were striking...a huge number of mortgages were miscalculated and the errors were not typically in the banks' favor. I will, of course, track down the citation for this study.

[27] HAC (1987) Appendix 5, p. 43 (italics added for emphasis)

conceived program. Even with the delivery problems analyzed here, the default rate was less than ten percent. Given that the participants are the poor and very poor, this is an impressive rate. Housing assistance for the rural poor is an important component of a national housing policy. That program implementation exerted negative effects on the performance of the program is troubling. The real question is whether FmHA is the best agency to provide delivery for the program. A comprehensive national housing policy might best be implemented by a single agency devoted to housing alone.

When Section 502 is a minor portion of the activity of a FmHA office, it is unlikely that individual agents will have the time or desire to gain a full understanding of the program. This study certainly argues for simpler-to-implement policy. Understanding the subtleties of Section 502 was a daunting task for our analysis. It is understandable that errors were made in its delivery by FmHA. Further, the size of the transactions are small enough and the administrative costs high enough to push the program down the priority list in favor of larger agricultural programs. HAC notes that limited manpower in County Offices made intervention with "high risk" borrowers difficult and argues for increasing staff in the local offices: "The typical office visited serviced a caseload of hundreds of mortgagors (both home and farm) with a total staff of four people."[28]

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[28] HAC (1988) p. 22, 30

The major policy recommendation coming from this study is for better program delivery. This could be accomplished in a number of ways. First, a simpler process minimizing administrative and individual confusion should be adopted. Second, better staffing of local offices would increase the ability of offices to adequately address their caseloads. Third, oversight should be done on a regular basis to protect the interests of both the government and program participants. A final option might be to move the responsibility of rural homeownership assistance under the aegis of a single national housing authority.

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APPENDIX 1.

Table 1a (Means, non-time-varying variables)

Variable	Mean (all) n=874	Mean (non-default) n=793	Mean (default) n=81
Age	31.93	32.39	27.42
Education	10.29	10.31	10.10
Female HH	0.332	0.330	0.346
Family Unit	0.592	0.599	0.519
Black HH	0.121	0.127	0.062
Hispanic HH	0.104	0.106	0.086
Build	0.349	0.363	0.209
Months	63.69	65.39	47.05
Loan	37305	37327	37099
Tot. Subsidy	7942	10817	4470
Down Payment	596	530	1245

Table 1b (Means, time-varying variables)

Variable	Yr	Mean (all) n=874	Mean (non-default) n=793	Mean (default) n=81
ADJINC	81	9302	9373	8614
	82	9752	9812	9165
	83	11060	11086	10810
	84	12139	12163	11912
	85	13141	13181	12744
	86	13927	13985	13367
PTIRATIO	81	.243	.242	.255
	82	.241	.239	.263
	83	.267	.262	.322
	84	.294	.286	.378
	85	.311	.295	.466
	86	.340	.320	.539
TRANSFER	81	.132	.139	.069
	82	.127	.134	.056
	83	.149	.156	.074
	84	.152	.158	.092
	85	.127	.135	.054
	86	.120	.131	.013
LTVRATIO	81	.963	.964	.954
	82	1.068	1.069	1.058
	83	1.154	1.142	1.284
	84	1.302	1.305	1.263
	85	1.357	1.359	1.329
	86	1.300	1.309	1.021

Table 2 (Discrepancy Measures)

Variable	n	Mean	Std. Dev.	Min	Max
NOTEPAYDIF	874	0.0977	27.10	−331	486
PAYDIF81	758	145.20	580.52	−761	4654
PAYDIF82	869	57.81	381.73	−2223	4365
PAYDIF83	869	69.71	419.25	−1426	4007
PAYDIF84	864	134.65	570.28	−2435	4447
PAYDIF85	840	214.07	728.70	−4440	4750
PAYDIF86	781	375.74	1101.92	−3864	4840
ACCPAYDIF81	758	145.20	580.52	−761	4645
ACCPAYDIF82	869	184.47	738.52	−2223	7062
ACCPAYDIF83	869	244.26	927.49	−2508	10083
ACCPAYDIF84	864	369.97	1181.95	−2503	10299
ACCPAYDIF85	840	547.88	1542.21	−4610	11715
ACCPAYDIF86	781	808.83	1935.42	−4610	14048

Table 2b (Discrepancy Measures − defaulters)

Variable	n	Mean	Std. Dev.	Min	Max
NOTEPAYDIF	81	6.12	62.31	−188	486
PAYDIF81	68	219.28	651.23	−308	3672
PAYDIF82	81	211.75	753.81	−1222	4365
PAYDIF83	78	220.61	713.68	−443	4007
PAYDIF84	73	430.74	987.56	−2396	3456
PAYDIF85	55	874.99	1286.70	−1264	4750
PAYDIF86	24	1459.2	1521.30	−1233	4254
ACCPAYDIF81	68	219.28	651.23	−308	3672
ACCPAYDIF82	81	395.83	1039.78	−1242	4807
ACCPAYDIF83	78	521.15	1347.89	−1094	7355
ACCPAYDIF84	73	865.49	1690.33	−2071	9854
ACCPAYDIF85	55	1479.1	2039.98	−1270	6862
ACCPAYDIF86	24	1968.7	2146.46	−2503	6225

Table 2c (Discrepancy Measures − non-defaulters)

Variable	n	Mean	Std. Dev.	Min	Max
NOTEPAYDIF	793	−0.52	20.32	−331	235
PAYDIF81	690	137.90	573.08	−761	4645
PAYDIF82	788	41.99	316.65	−2222	3546
PAYDIF83	791	54.83	375.51	−1426	3738
PAYDIF84	791	107.32	507.47	−2435	4447
PAYDIF85	785	167.76	649.17	−4440	4447
PAYDIF86	757	341.40	973.47	−3864	4840
ACCPAYDIF81	690	137.90	573.08	−761	4645
ACCPAYDIF82	788	162.75	697.55	−2222	7062
ACCPAYDIF83	791	216.96	871.66	−2508	10083
ACCPAYDIF84	791	324.24	1113.97	−2503	10299
ACCPAYDIF85	785	482.64	1481.06	−4610	11714
ACCPAYDIF86	757	772.06	1918.47	−4610	14047

APPENDIX 2

Table A   (Model 1)
Dependent Variable: Duration of mortgage

Covariate	Model 1	Model 1b	Model 1c	Model 1d
PTIRATIO	1.1934	1.1579	1.1769	1.1952
	(2.27)**	(1.25)	(1.88)	(2.30)**
LVRATIO	1.0046	1.0052	1.0074	1.0052
	(0.24)	(0.25)	(0.45)	(0.31)
TRANSFER	0.0765	0.1280	0.0859	0.0788
	(-1.99)**	(-1.68)	(-1.94)	(-1.98)**
SUBSIDY	0.9998	0.9999	0.9999	0.9998
	(-3.18)**	(-3.13)**	(-2.06)**	(-2.18)**
PAYDIF		1.0007		
		(8.34)**		
ACCPAYDIF			1.0002	
			(4.97)**	
NOTEPAYDIF				1.0068
				(2.88)**

** denotes statistical significance at the .05 level
t-ratios appear below reported hazard ratios

Table B   (Model 2)
Dependent Variable: Duration of mortgage

Covariate	Model 2	Model 2b	Model 2c	Model 2d
PTIRATIO	1.1609 (1.84)	1.1398 (1.12)	1.1578 (1.63)	1.1647 (1.88)
LVRATIO	1.0100 (0.59)	1.1026 (0.66)	1.0127 (0.76)	1.0099 (0.59)
TRANSFER	0.0804 (−1.98)**	0.1264 (−1.69)	0.0844 (−1.97)**	0.0809 (−1.98)**
SUBSIDY	0.9998 (−5.58)**	0.9998 (−3.57)**	0.9998 (−2.55)**	0.9998 (−5.21)**
LOAN	1.0000 (2.91)**	1.0000 (0.983)	1.0000 (1.06)	1.0000 (2.55)**
BUILD	0.2428 (−3.65)**	0.2575 (−3.48)**	0.2462 (−3.61)**	0.2574 (−3.47)**
MAR_CHANGE	2.6194 (1.59)	3.6699 (2.16)**	2.8850 (1.76)	2.6518 (1.61)
LESSKID	3.6088 (3.89)**	2.0908 (2.08)**	3.3813 (3.67)**	3.6095 (3.90)**
PAYDIF		1.0007 (6.59)**		
ACCPAYDIF			1.0002 (3.86)**	
NOTEPAYDIF				1.0037 (1.254)

** denotes statistical significance at the .05 level
t-ratios appear below reported hazard ratios

Table C   (Model 3)
Dependent Variable: Duration of mortgage

Covariate	Model 3	Model 3b	Model 3c	Model 3d
PTIRATIO	1.1712 (1.95)	1.1319 (1.02)	1.1703 (1.70)	1.1729 (1.98)**
LVRATIO	1.0047 (0.29)	1.0062 (0.30)	1.0077 (0.48)	1.0049 (0.31)
TRANSFER	0.0522 (-2.16)**	0.0952 (-1.81)	0.0665 (-2.07)**	0.0534 (-2.14)**
MAR_CHANGE	2.8272 (1.73)	3.7217 (2.18)**	3.6193 (2.08)**	2.8784 (1.76)
LESSKID	3.5402 (3.88)**	1.7255 (1.53)	3.0117 (3.39)**	3.4377 (3.78)**
AF_AMER	0.2089 (-2.17)**	0.3245 (-1.55)	0.2288 (-2.04)**	0.2158 (-2.12)**
FEMALE	0.4645 (-1.86)	0.5214 (-1.59)	0.6393 (-1.06)	0.5121 (-1.58)
FAMUNIT	0.3546 (-2.70)**	0.4353 (-2.16)**	0.4653 (-1.94)	0.3913 (-2.36)**
PAYDIF		1.0007 (7.516)*		
ACCPAYDIF			1.0027 (6.49)**	
NOTEPAYDIF				1.0046 (2.17)**

** denotes statistical significance at the .05 level
t-ratios appear below reported hazard ratios

Table D (Model 4)
Dependent Variable: Duration until "graduation"

Covariate	Model 4	Model 4b	Model 4c	Model 4d
PTIRATIO	1.2245 (4.35)**	0.7517 (-0.57)	1.2050 (3.64)**	1.2246 (4.35)**
LVRATIO	1.0115 (1.65)	1.0156 (1.84)	1.0136 (1.97)**	1.0116 (1.66)
TRANSFER	0.1917 (-3.83)**	0.5199 (-1.60)	0.2171 (-3.57)**	0.1928 (-3.81)**
SUBSIDY	0.9998 (-10.6)**	0.9998 (-11.7)**	0.9999 (-5.73)**	0.9998 (-10.5)**
PAYDIF		1.0011 (16.2)**		
ACCPAYDIF			1.0002 (9.24)**	
NOTEPAYDIF				1.0018 (0.79)

** denotes statistical significance at the .05 level
t-ratios appear below reported hazard ratios

Table E   (Model 5)
Dependent Variable: Duration until "graduation"

Covariate	Model 5	Model 5b	Model 5c	Model 5d
PTIRATIO	1.1905 (3.47)**	0.9255 (0.20)	1.1835 (2.99)**	1.1882 (3.42)**
LVRATIO	1.0097 (1.40)	1.0173 (2.12)**	1.0117 (1.66)	1.0098 (1.41)
TRANSFER	0.2859 (−2.99)**	0.5744 (−1.37)	0.2986 (−2.91)**	0.2872 (−2.98)**
SUBSIDY	0.9997 (−13.3)**	0.9998 (−10.6)**	0.9998 (−7.71)**	.9997 (−13.3)**
LOAN	1.0001 (6.88)**	1.0000 (1.72)	1.0000 (3.90)**	1.0000 (6.88)**
BUILD	0.5133 (−3.96)**	0.6312 (−2.71)**	0.5093 (−4.07)**	0.4965 (−4.10)**
MAR_CHANGE	0.3882 (−1.59)	1.0683 (0.11)	0.4878 (−1.22)	0.3788 (1.62)
LESSKID	5.2599 (11.0)**	1.6182 (2.63)**	5.1787 (10.8)**	5.2087 (10.9)**
PAYDIF		1.0010 (14.0)**		
ACCPAYDIF			1.0002 (6.25)**	
NOTEPAYDIF				0.9972 (1.126)

** denotes statistical significance at the .05 level
t-ratios appear below reported hazard ratios