Mortgage Default Among Rural,
Low Income Borrowers

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ABSTRACT

In this paper, we examine the effect of contemporaneous borrower, property, and loan characteristics on the default decision of a sample of lower income, subsidized rural borrowers participating in the Farmers Home Administration Section 502 program. To our knowledge, this is the first time that borrower related panel information has been used in a default study. Contrary to prior work, contemporaneous net equity, captured by the variable loan to value ratio, was found to have no effect on default. In contrast, mortgage payment to income ratio and a number of borrower related factors were found to significantly affect the default decision. Overall, the study findings suggest that the main aspect of the FmHA Section 502 program, the interest rate subsidy, minimizes default risk for the average program participant.

Introduction

A better understanding of the mortgage risks posed by borrower and loan characteristics is key to extending home ownership opportunities to low income households. When mortgage risks are not well understood, households may be forced to pay mortgage interest rates that are higher than necessary, or mortgage insurance premiums to compensate for the higher risks that lenders perceive them to represent. In extreme situations, borrowers may be denied loans altogether because they have certain characteristics, or are residents of areas considered risky, regardless of their individual credit worthiness.

Given that lenders minimize default risks by lending to borrowers they consider more credit worthy, it is not surprising that most empirical studies of default end up analyzing the mortgage payment decisions of middle- and high-income households who represent the vast majority of residential mortgage borrowers. Although much insight has been gained about the default decision from these studies, they have not shed much light on the default behavior of lower-income mortgagors, subsidized or otherwise. This paper addresses this issue by examining the effects of borrower, property, and loan characteristics on the default decisions of a sample of lower income, subsidized borrowers in a cross-section of rural housing markets in the United States.

Previous Research

Most contemporary studies of mortgage default are couched in option theory.[1] This theory states that at the beginning of each payment period, borrowers have the option of making the payment due, of paying off the mortgage balance through sale of the home or refinance (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" (Quigley and Van Order 1991).[2] From this perspective, default is seen as a purely financial matter, in which borrower characteristics such as income and employment status do not matter.

Theoretically, borrowers will exercise the default option whenever the value of the house plus any costs of exercising the option falls below the mortgage value (Foster and Van Order 1984). 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

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[1] See Quercia and Stegman (1992) for a comprehensive review of the residential mortgage default literature.

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

later (Epperson et al. 1985). 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 (Quigley and Van Order 1991). Once these issues are taken into account, the option can be computed in a purely financial way.

However, in addition to these issues that make the computation of the option difficult, crisis events and other borrower related factors can be said to affect the exercise of the default option too (Vandell and Thibodeau 1985). This is because crisis events, such as a change in marital status or number of dependents, may trigger, delay, or eliminate the need to exercise the default option over time.[3]

The importance of borrower related-factors and transaction costs in the default decision, however, remains open to debate. This debate, is exemplified by the works of Kau, Keenan, and Kim (1991) and Quigley and Van Order (1992). Kau, Keenan, and Kim (1991) have solved numerically an option-based theoretical model of default that indicates that transaction costs play little or

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[3]In fact, Vandell and Thibodeau (1985) founds that borrower-related variables, such as self-employment and source of income from commissions, have a larger effect on default than traditional financial variables, such as contemporaneous net equity and the difference between the market and par value of the mortgage.

no role in the exercise of the option; therefore, they conclude that the option is exercised ruthlessly. From this perspective, non-financial considerations play no role in the decision to exercise the default option. 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 are required to analyze the role of contemporaneous borrower-related factors, as well as property and loan characteristics, on default.

In contrast to prior work, the present study is based on panel information on 874 participants in the Section 502 Home

Ownership program administered by the Farmer's Home Administration (FmHA), which is part of the U.S. Department of Agriculture. The Section 502 program is available to residents of rural housing markets.

Rural housing markets

The housing programs administered by FmHA are available in rural housing markets.[4] Kravitz and Collings (1986) contend that rural housing markets are characterized by two issues. First, they are characterized by a typical lack of a mortgage lending system. This is due to the fact that, unlike urban counterparts, rural areas lack large population bases that make the existence of mortgage lending viable.

Second, rural housing markets are characterized by a disproportionate number of households living in poverty and households having housing problems. For instance, while less than 1/4 of the U.S. population lives in rural areas, more than 1/3 of all substandard units in the U.S. are located in these areas, and 38 percent of these units are occupied by households living in poverty (Kravitz and Collings 1986).

Compared with their urban counterparts, rural households living in poverty present three distinct characteristics. First, poor rural households are more likely to work and to be headed by an older person than in urban areas. For instance, while three

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[4] The information presented in this section is from Kravitz and Collings (1986).

of every five poor rural households work, only two of every five poor urban households do. Similarly, while one in every five poor rural households is headed by a person age 65 and older, only one in every ten poor urban households is headed by such a person (Kravitz and Collings 1986).

Second, rural households also exhibit distinct housing characteristics. While in urban areas, for every two poverty level renters, there is one poor home owner, the exact opposite is the case in rural areas: for every 2 poverty level home owners there is one poor renter (Kravitz and Collings 1986). Thus, unlike their urban counterparts, most of the poor rural households are home owners. Not surprisingly, rural home owners present many of the undesirable housing characteristics commonly associated with poor urban renters. Rural home owners are likely to live in substandard units, with deficiencies such as a lack of complete plumbing, inadequate heating, and dilapidation.

Finally, compared with their urban counterparts, poor rural households are also less likely to receive public assistance. While more than one in every three poor urban households receive public assistance, less than one in every four poor rural households do so. Similarly, while more than two in every eight poor urban renters live in public housing or receives government assistance in renting a privately owned unit, only a little over

one in every eight poor rural renters receives such assistance
(Kravitz and Collings 1986).[5]

To meet the particular housing needs of rural households,
FmHA provides assistance in rural housing markets. Broadly
defined, assistance is provided to households living in (1) open
country, or (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.

The FmHA Section 502 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.[6] 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
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.

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[5]More precisely, only 18 percent of all rural renters living
at or below the poverty level live in public housing or receive
government assistance in renting a privately owned unit.

[6]The presentation in this section follows Housing Assistance
Council (HAC 1987).

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 credit. For these borrowers, the interest rate remains fixed for the life of the mortgage.

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.

Previous research on the FmHA Section 502 program

The most comprehensive examination of the Section 502 program was undertaken by the Housing Assistance Council (HAC 1988). HAC found the program to be a cost effective means of extending home ownership opportunities to low income households. In spite of an overall favorable evaluation of the program, HAC identified certain problematic aspects that are relevant to the present study.

First, HAC concluded that the subsidy phase out mechanisms in the Section 502 program posed problems to borrowers. The phasing out is gradual until income rises above a certain threshold, which is generally fixed at some amount above 80 percent of area median income.[7] This ceiling is low enough that once it is reached, 20% of borrower's income is still insufficient to cover shelter expenses. Nevertheless, once the

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[7]For the period under study, 1981-1986, this threshold was set at an average of $5,500 above 80 percent of area median income.

ceiling is reached, slight increases in income produce a sharp
payment increase. In addition, once the subsidy is phased out, a
borrower's income has to fall below 80 percent of area median
income to receive subsidy again.

Second, HAC found that poverty level borrowers had better
repayment performance than other borrowers (HAC 1988). HAC
suggested that this may be due to the fact that poverty level
borrowers are more dependent upon transfer payments which are
steady sources of income. In contrast, HAC noted that low
income, but non-poor, borrowers are more dependent upon earnings,
which, in FmHa sample. tended to be irregular and volatile.

Finally, HAC identified the loss of borrower income as the
major factor affecting poor repayment performance. For instance,
HAC found that in 19 of 31 delinquency cases, the borrower's
earnings declined or disappeared altogether. In 4 cases, the
household lost a wage earner through divorce and, in another
case, a widow lost pension payments when her minor son turned 18.
All these demographic changes appear to have a large impact on
the level of resources available to borrowers.

Because HAC's contentions were based on descriptive
analyses, it is not possible to assess the real impact of these
issues on default unless they are evaluated within a fully
specified multivariate model. The methodology used to test HAC's
empirical contentions as well as the theoretical premises
discussed earlier are presented in the next section.

Research Methodology

The research methodology used to analyze the default decision 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.

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 874 Section 502 borrowers who received loans in 1981.[8] HAC followed the progress of these borrowers from the time of loan origination (1981) to 1987, 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, metropolitan status, racial composition and incidence of poverty in each county; (2) FmHA Offices with the most 1981 loan activity in counties in each of the matrix groupings were selected for

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[8] Some borrowers actually received their loans in 1982. The original data set contained information on 894 borrowers. Twenty cases were dropped from the study due to missing information.

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 (HAC 1988, p. 32).[9]

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 Table 1. A dichotomous variable, the dependent variable was

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[9] This nationwide representativeness compares favorably with many prior studies on mortgage risk. For instance, Vandell and Thibodeau (1985) used 450 conventional loans provided by a single Dallas Federal Savings and Loan Association. Other researchers that have used only sub-national data sets (state, county, and city-wide) include von Furstenberg (1969, 1970); von Furstenberg and Green (1974); Williams et al. (1974); Sandor and Sosin (1975); and Morton (1975).

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.

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 contemporaneous net equity was constructed, the annual loan balance to house value ratio (LTV). The data set contained loan balance information for each year in the study period but only appraised house value information at time of loan origination. House value information for all other years was estimated by adjusting the appraised value to reflect annual changes in the regional consumer price index. The annual LTV measure included in the multivariate estimation was adjusted to reflect the value of the Section 502 recapture provision.[10]

Second, a measure of a borrower's ability to pay was also included in the analysis. This measure was constructed as the ratio of housing costs to adjusted household income (PTY). The housing costs included in the construction of this ratio were

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[10]Refer to Appendix A for a detailed discussion of the estimation of the Section 502 recapture provision.

mortgage principal and interest payments, and annual property

taxes and home owners insurance payments (PITI).[11]

Third, information on the annual subsidy received was also

included in the analysis.[12] The effect of the interest credit

on mortgage default was controlled in three ways. First, 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. Second, a dummy variabl⌐ identifying borrowers who

received the maximum subsidy (MAXIMUM) was also included in the

model. This dummy variable was included to assess whether these

borrowers have a pattern of default different from other

borrowers. Third, a dummy variable identifying borrowers who

received interest credit at origination and later graduated from

the subsidy (ZEROSUB) was also included. This dummy variable was

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[11]A note needs to be made about this measure of housing
costs. Although in theory the initial PITI costs in the section
502 program is set at 20 percent of household income, in reality
the housing expenditure to income ratio appears to be more
variable. Among our sample of FmHA section 502 participants, the
average 1981 PTY ratio was 24.3 percent with a standard deviation
of 6.3 percent. In addition to the variation in the PTY ratio
at the time of loan origination, the panel nature of our data set
allowed for a more detailed analysis of variation than in prior
cross-sectional default studies.

[12] Although the interest credit subsidy could be considered,
in part, a limitation to the generalizability of the study to
non-program participants, some implications can be drawn beyond
those pertaining to the section 502 program. This is because
borrowers who received the maximum subsidy initially had no
buffer against unexpected declines in income and thus may have
reacted to income changes as borrowers do when they hold
mortgages from private lenders (about 28 percent of the sample,
250 borrowers, received the maximum subsidy at the time of loan
origination).

included to assess whether these borrowers exhibited a higher risk of default than borrowers who continued to receive subsidy.

In addition to these interest credit variables, two other program variables were included in the analysis. These variables are size of loan at origination (LOAN) and a dummy variable denoting those who built new homes (BUILT) either through participation in the self-help program or through contracted construction.

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

Proportional hazard model

Hazard methodology is ideally suited to analyze default. The questions addressed here relate to discrete transitions made by borrowers. The 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 purpose of this study, how program characteristics relate to the likelihood of default is also a major focus.[13]

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[13]See Quercia and Stegman (1992) for a discussion of proportional hazard models in the study of mortgage default.

The Cox proportional hazard model used in the analysis 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 mortgage default.

$$h(t) = \frac{\text{Probability of default between times t and t+}\Delta\text{t}}{(\Delta\text{ t})(\text{Probability of default after time t})}$$

$$= h_o(t)\ e^{\beta_1 X_1 + \ldots + \beta_k X_k}$$

The function $h_o(t)$ is called the baseline hazard function. This can have any shape. The proportional hazard 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 implies a continuous-time hazard rate, the particular functional form estimated is in discrete time. For this, it is assumed that the hazard rate is constant within discrete time intervals. The hazard ratio can vary in discrete jumps from interval to interval given changes in the values of the covariates.[14] The unit of time measurement is

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[14]The model with time-varying covariates used in the analysis 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 covariates model allows for discrete changes in the value of covariates which are assumed to remain constant within specific

months with discrete jumps taken at yearly intervals as the payment schedule is calculated.

The results of the multivariate estimation of the Cox proportional hazard model are reported in the next section.

Results of empirical analysis

<u>Description of the Sample</u>

Table 2 describes the sample of 874 households used in the analysis. Over the 1981-1986 period, 9 percent of the sample defaulted on their loans. A more detailed breakdown of defaulted loans, also presented in Table 2, indicates that of these 81 loans, 13 loans were terminated by foreclosure, in 22 cases a transfer of deed in lieu of foreclosure occurred, and 46 borrowers voluntarily conveyed the title of the property back to FmHA in exchange for the extinction of the outstanding mortgage debt.

The distribution of key variables is presented in Table 3. First, the average loan-to-value ratio (LTV) at time of loan origination was 96.3 percent. As expected, the mean LTV declined by about 22.9 percent over the study period. This decline, however, does not reflect the subsidy recapture provision in the program, which affects the ratio over time. When this provision is taken into account, the mean 1986 LTV was 130 percent, a 35 percent increase over 1981.

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periods of time within the larger duration studied.

A second key variable presented in Table 3 is the payment to adjusted household income ratio (PTY). The mean PTY at time of loan origination was 24.3 percent. That is, the average borrower spent about a quarter of his/her adjusted household income to pay for mortgage principal and interest payments, property taxes, and insurance. Over the study period, the mean PTY increased to 34 percent, a 40 percent increase. This increase shows how rapidly increasing property taxes and insurance premiums may pose particularly difficult burdens for many low income borrowers.

Three variables were included to capture different aspects of the subsidy received. First, the average interest credit at time of loan origination was $2,042.[15] The 1986 average subsidy was $2,422, a 18.6 percent increase in real terms over the study period. This increase suggests that the income of many borrowers did not increase as fast as the increase experienced in housing expenditures. Second, the dummy variable MAXIMUM indicates that 29.2 percent of the sample received the maximum subsidy at the time of loan origination.[16] Over the study period, the average annual number of borrowers receiving the maximum subsidy went down by more than 41 percent, to 17.2 percent of the sample. Third, the variable ZEROSUB indicates that 17.7 percent of the borrowers who received an interest credit at loan origination had

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[15]All dollar figures in this section are in 1990 dollars.

[16] The maximum subsidy was an interest credit that reduced the effective interest rate paid by borrowers to 1 percent.

their subsidy phased out due to increases in adjusted household income over the study period.

Table 3 also presents the distribution of other economic variables included in the model. Among these variables, it is interesting to note that the average borrowers experienced an increase in annual adjusted income of almost 25 percent in real terms, from $13,367 to $16,596 in 1986 (INCOME). During the same period, the proportion of income represented by transfer payments declined by more than 9 percent (TRNINC).

In spite of a low 1981 income, the average borrower was able to purchase a home appraised at $56,126 (APPRAISED) and to obtain a $53,583 loan (LOAN).[17] This was possible due to the deep subsidy provided by the program. The average borrower paid an effective interest rate (RATE) of 2.5 percent in 1981 (compared to market rates of about 13 percent). Over the 1981-86 period, the average effective rate paid by borrowers increased by 154 percent, from about 2.5 to 6.3 percent, reflecting the fact that, on average, as borrowers improved their financial situation their subsidy declined.

Finally, the demographic characteristics of the borrowers are also presented in Table 3. Most of the borrowers were married couples (FAMILY), 59.2 percent, or single female heads of households (FEMALE), 33.2 percent. Most of the borrowers were nonminorities, only one in every eight was an African American

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[17]It is interesting to note than more than one in every three borrowers built their own home, either through a contractor or self help (BUILD).

borrower (MINORITY). Although changes in household composition among borrowers occurred during the 1981-86 period, the incidence of such changes was not widespread: (1) 13.3 percent of borrowers who were married at loan origination either divorced, separated or were widowed over the study period (MARITAL), and (2) 18.2 percent of borrowers who had children, age 18 or younger, at time of loan origination lost a dependent over the study period (LESSKIDS).

Multivariate Analysis

The results of two multivariate proportional hazard estimations are presented in Tables 4 and 5.[18] The first model, Table 4 includes the variables suggested by prior work, the variables capturing the main characteristics of the Section 502 program, and three key demographic variables. The second model, Table 5, includes a number of key demographic variables.[19]

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[18]The coefficients (betas) were estimated in the regression. The relative risk or hazard ratio of a change in a covariate is:
$$e^{\beta 1 X1 + .. + \beta j(Xj\Delta j) + .. \beta kXk} / e^{\beta 1 X1 + .. + \beta jXj + .. \beta kXk} = e^{\beta j \Delta Xj}$$

Typically, hazards 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 the ratio $e^{\beta i}$. A hazard ratio greater than one indicates an increased probability of default given an increase in the covariate. In contrast, a hazard ratio less than one indicates a decreased probability of default. The t-ratio is interpreted in the standard fashion. The sign of the t-ratio also indicates the direction of the effect.

[19]Given that the number of borrowers who defaulted is 81 and the 10 observations per variable rule of thumb, no more than eight or nine variables could be included in the estimation at any given time.

Model 1 - the fully specified model

Contrary to prior work, loan to value ratio (LTV) was found to have no significant effect on default. This lack of significance was consistent in a number of alternative specifications of the model. In contrast, the payment to income ratio (PTY) exhibited a consistent significant positive effect on default. Households that experienced a 1 percent increase in this ratio were found to be 1.2 times more likely to default than other households.[20]

The effect of the Section 502 program subsidy on default is also presented in Table 4. Consistent with the goals of the program, the interest credit (SUBSIDY) was found to have a significant negative effect on default. Borrowers who received the maximum subsidy at the time of loan origination (MAXIMUM) were not more likely to default in later years than other borrowers. Borrowers who received an interest credit at loan origination and later had their subsidy phased out due to increases in adjusted household income (ZEROSUB) were more likely to default than other borrowers. On average, these borrowers were 2.3 times more likely to default than other borrowers.

The effects of other program variables on the default decision are also presented in Table 4. First, consistent with prior work, the magnitude of the loan (LOAN) was found to be

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[20]Several alternative specifications of Model 1 were estimated to assess the effect that changes in property taxes and insurance payments had on default. Findings were consistent in indicating that increases in these expenditures are not associated with a higher likelihood of default over time.

positively correlated with default risk. Second, of particular importance, is the fact that borrowers who build their own homes, either through a contractor or self help (BUILD), were found to be less likely to default than other households. This may indicate that borrowers who invest something personal in their homes are less likely to walk away when confronted with difficulties.

Finally, the effects of three demographic variables on default are also presented in Table 4. Borrowers who experienced a change in marital status (MARITAL), i.e, divorce, separation or widowhood, were found to be more likely to default than other borrowers. On average, experiencing changes in marital status increases the risk of default about 4.5 times. Similarly, borrowers who had children, age 18 or younger, at time of loan origination and had children move out over the study period (LESSKIDS) were found to exhibit a higher risk of default than other borrowers. On average, these borrowers were found to be almost twice as likely to default as other borrowers. In contrast, the proportion of household income that came from transfer payments (TRNINC) was found to have no effect on default decisions.

Before discussing the implications of this and other findings, it is important to consider the impact of demographic variables.

Model 2 - The Demographic Model

In addition to the two variables suggested by prior work, LTV and PTY, a number of demographic characteristics traditionally considered risky were included in the model in Table 5. Contrary to stereotypes, African American borrowers (MINORITY) were found to exhibit a lower risk of default than non-minority borrowers. Also, borrowers who were female heads of households and married couples at origination were found to exhibit a lower risk of default than those who were single male heads of households.

Consistent with the findings in Table 4, borrowers who experienced changes in marital status (MARITAL) or a reduction in the number of dependents living at home (LESSKIDS) were found to have a higher risk of default than other borrowers. Also consistent with prior findings, the effects of these variables on default risks is greater than those of variables capturing equity (LTV) or ability to pay (PTY) considerations.

Unlike the findings in Table 4, however, larger ratios of transfer income to total adjusted household income (TRNINC) were found to be associated with lower default risks.

Discussion and implications of the findings

The discussion of the study findings is divided into two sections, the implications of the findings for the default literature and for the FmHA Section 502 program.

<u>Implications of the findings for the default literature</u>

In this paper, we have examined the effect of contemporaneous borrower, property, and loan characteristics on the default decision of a sample of lower income, subsidized rural borrowers. Contrary to prior work, contemporaneous home equity, captured by the variable loan to value ratio, was found to have no effect on default. This lack of effect may be due to the fact that this measure of equity was estimated using regional indexes that may not reflect the characteristics of local housing markets. An alternative explanation for this lack of effect is the fact that sample borrowers faced high transaction costs if default occurred due to the extra benefits derived from participating in the FmHA Section 502 program.

The central empirical finding of this study is the significant effect of mortgage payment to income ratio on the default decision. This is contrary to the findings of prior work. The use of panel data in the analysis may have allowed a better estimation of the role of borrower-related factors, especially changes in household income and the occurrence of crisis events, on the default decision. This is the first time that such borrower related panel information has been used in a default study.

A second, key finding is that borrower characteristics traditionally considered risky were found to exhibit no significant effect on default. Of particular importance is the finding that being a minority or a female headed household is not

associated with higher default risk. Denying loans to these potential borrowers, or charging them interest premiums to compensate for the 'excessive risk commonly believed such demographic characteristics represent, is not appropriate based on the findings.

Obviously, these implications may be highly conditioned by the characteristics of the **FmHA** Section 502 program. As other panel data become available, the significance of the mortgage payment to income ratio and the importance of borrower related factors, such as demographic characteristics traditionally considered risky, need to be examined among unsubsidized borrowers.

Implications of the findings for the **FmHA** Section 502 **program**

Overall, the study findings suggest that the **FmHA** Section 502 program is working as it should. Specifically, the program's main aspect, the interest credit, seems to minimize default risk for the average program participant. Even for those borrowers who received the maximum subsidy at origination, and who had to **pay** out of pocket any increases in housing expenditures over time, the program seemed to minimize default risks.

In contrast, the findings indicate that the subsidy phase out mechanism in the program needs to be reconsidered. Borrowers who received a subsidy at loan origination and later had their subsidy phased out due to increases in household income were found to exhibit a higher risk of default than other borrowers.

The way the subsidy is phased out put people at risk because, at the threshold, a small increase in household income produces sharp increases in housing expenditures (HAC 1988). Conversely, there has to be a substantial decline in household income for the borrower to receive a subsidy again. These findings are consistent with HAC's contention that borrowers had problems with this aspect of the program (HAC 1988).

Also consistent with HAC's contentions, study findings show that poverty level borrowers have good repayment performance. HAC attributed this good performance to the reliance of poverty level borrowers on transfer income, which tends to be less variable than other sources of income. Although the percentage of household income that comes from transfer payments exhibits a significant negative effect on default in the demographic model presented in Table 5, it does not exhibit a significant effect in the more fully specified model in Table 4. This difference may be due to the fact that the model in Table 4 includes several variables that captured the flexibility of the program subsidy, which is dependent on variations in household income.

Finally, although the program seems to be effective in minimizing default risk resulting from financial factors, the program does not address default risks that result from non-financial considerations. The occurrence of crisis events, such as marital dissolution, appear to have strong consistent effects on default, even when financial considerations are taken into account. This suggests the need to build into the program some

type of early detection/referral service that would make counseling available to borrowers at risk.

Overall, the study findings are consistent with HAC's conclusion that the Section 502 program is a well designed low income home ownership initiative. However, given the positive effect of the subsidy phase out mechanism on default, a more in depth examination of this and other program characteristics is needed.

APPENDIX A.   FmHA SECTION 502 RECAPTURE PROVISION

The unpaid balance of loans being liquidated by sale or transfer is equal to the sum of unpaid principal and interest, and a share of the subsidy. An example of the estimation of the unpaid loan balance of a loan being terminated, including the subsidy recapture calculation, is presented in Table A.1.

The amount of the subsidy to be repaid by the borrower is determined on the basis of the following considerations:

a.   The market value of the property is the selling price. Appraised value is used if FmHa County Supervisor believes that the reported selling price is substantially below the real property value. For instance, if the appraised value is 5 percent or more above the reported selling price, the estimation of the subsidy recapture is based on the appraised value rather than on the reported selling price.

b.   The subsidy is recaptured from the real estate mortgaged and not from any personal assets.

c.   As long as the borrower owns and occupies the property, he/she can pay off the mortgage and defer the payment of any subsidy recapture until the property is conveyed or no longer occupied.

d.   The subsidy recapture is net of transaction costs including sales commissions, advertising costs, appraisal fees, legal and related costs such as deed preparation and transfer taxes.

e.   The original equity is considered to be a percent of the market value of the property. The percent is determined by dividing the original equity by the market value of the property when the loan was closed.

f.   The borrower receives the original equity, the amount of principal paid, and any value appreciation, less any subsidy to be repaid or recaptured.

g.   The subsidy to be repaid is based on the number of months the mortgage loan was outstanding.

h.   The subsidy to be repaid is based on the amount of subsidy granted, i.e. the effective interest rate paid by the borrower over time.

The actual subsidy to be repaid by the borrower varies with the last two factors: the length of residence (g) and the average effective interest rate paid (h). Table A.2 presents the percentage of subsidy received to be repaid based on the these two factors.

EXAMPLE OF THE ESTIMATION OF UNPAID LOAN BALANCE
AND SUBSIDY RECAPTURE

ASSUMPTIONS

Appraised	$33,000
Loan	$31,400
Down	$1,600
Note Rate	12.00%
Term	33

ESTIMATION OF DEBT SERVICE

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
POB	$31,400	$31,325	$31,242	$31,148	$31,043	$30,925
Note rate	12%	12%	12%	12%	12%	12%
Pay due	$3,843	$3,843	$3,843	$3,843	$3,843	$3,843
Int. pay	$3,768	$3,759	$3,749	$3,738	$3,725	$3,711
Princ. pay	$75	$84	$94	$105	$118	$132

ESTIMATION OF SUBSIDY

	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5	YEAR 6
Pay due note rate	$3,843	$3,843	$3,843	$3,843	$3,843	$3,843
Value, 1% aprec. year	$33,000	$33,300	$33,663	$34,000	$34,340	$34,683
+TaxIns	$660	$667	$673	$680	$687	$694
Adjinc.	$8,614	$9,164	$10,810	$11,912	$12,743	$13,367
-20% inc.	$1,723	$1,833	$2,162	$2,382	$2,549	$2,673
SUBSIDY 1	$2,780	$2,677	$2,354	$2,140	$1,981	$1,863

TABLE A.1

EXAMPLE OF ESTIMATION OF UNPAID LOAN BALANCE
AND SUBSIDY RECAPTURE

ESTIMATION OF SUBSIDY (continued)

Loan	$31,400	$31,400	$31,400	$31,400	$31,400	$31,400
Pay at 12%	$3,843	$3,843	$3,843	$3,843	$3,843	$3,848
-Pay at 1%	$1,118	$1,118	$1,118	$1,118	$1,118	$1,118
SUBSIDY 2	$2,725	$2,725	$2,725	$2,725	$2,725	$2,725

Because Subsidy 1 is smaller, borrower receives Subsidy 1 during all years.

ESTIMATION OF EFFECTIVE RATE PAID BY BORROWER

Pay w/sub.	$1,723	$1,833	$2,162	$2,382	$2,549	$2,673
Effec. rate	4.04%	4.52%	5.89%	6.77%	7.41%	7.87%

Because the borrower's payment with the subsidy is less than interest payments at note rate (above), borrower pays off no principal.

ESTIMATION OF UNPAID INTEREST

Int. pay @ 12%	$3,768	$3,759	$3,749	$3,738	$3,725	$3,711
Payment w/subsidy	$1,723	$1,833	$2,162	$2,382	$2,549	$2,673
Unpaid interest	$2,045	$1,926	$1,587	$1,355	$1,177	$1,038

TABLE A.1

EXAMPLE OF ESTIMATION OF UNPAID LOAN BALANCE
AND SUBSIDY RECAPTURE

ESTIMATION OF UNPAID BALANCE AND SUBSIDY RECAPTURE

Sale price	$34,683
less unpaid price	$31,400
less unpaid interest	$9,128
	($5,845)

(no sales costs are assumed)

Conventional loan to value	$31,400/$34,683	90.53%
Loan to value w/recapture	($31,400+$9,128)/$34,683	181.07%

There is no equity left for the borrower.
There is no value appreciation.

Original equity	$1,600
Percent equity at origination	4.85%
Value appreciation	$0
Factor from Table A.2 (72 months, 6.08% effective rate)	0.21
Value appreciation to government ($0*0.21)	$0 (the lesser)
Total subsidy granted	$13,795

Government and borrower get nothing from value appreciation.
None of the subsidy is repaid or recaptured.

TABLE A.2

FmHA SECTION 502 PROGRAM
PERCENT OF SUBSIDY RECAPTURE BY LENGTH OF RESIDENCE
AND EFFECTIVE INTEREST RATE PAID BY BORROWER

Months of Loan Outstanding	Average Effective Interest Rate Paid by Borrower							
	<1%	1.1-2%	2.1-3%	3.1-4%	4.1-5%	5.1-6%	6.1-7%	7.1%+
0-59	0.78	0.68	0.60	0.51	0.44	0.32	0.22	0.11
60-119	0.75	0.66	0.58	0.49	0.42	0.31	0.21	0.11
120-179	0.73	0.63	0.56	0.46	0.40	0.30	0.20	0.10
180-239	0.66	0.56	0.49	0.42	0.36	0.26	0.18	0.09
240-299	0.59	0.51	0.46	0.38	0.33	0.24	0.17	0.09
300-359	0.53	0.45	0.40	0.34	0.29	0.21	0.14	0.09
360-396	0.47	0.40	0.31	0.31	0.26	0.19	0.13	0.09

Source: HAC 1987. p.48.

References

Epperson, J., J. Kau, D. Keenan, and W. Muller. 1985. Pricing Default Risk in Mortgages. <u>AREUEA Journal</u> 13 (3):152-67.

Foster, C., and R. Van Order. 1984. An Option Based Model of Mortgage Default. <u>Housing Finance Review</u> 3 (4):351-72.

_____. 1985. FHA Termination: A Prelude to Rational Mortgage Pricing. <u>AREUEA Journal</u> 13 (3):273-91.

Housing Assistance Council (HAC). 1989. <u>A Home of Our Own</u>. Washington, DC.

Housing Assistance Council (HAC). 1987. FmHA Section 502 Rural Homeownership Loans. Washington, DC. Mimeo.

Kravitz, L. and A. Collings. 1986. Rural Housing Policy in America: Problems and Solutions. In <u>Critical Perspectives on Housing</u>, edited by R. Bratt, C. Hartman, and A. Meyerson, 325-34. Philadelphia: Temple University Press.

Kau, J., D. Keenan, and T. Kim. 1991. Default Probabilities for Mortgages. Department of Insurance, Legal Studies and Real Estate, Terry College of Business, University of Georgia. Mimeo.

Morton, T.G. 1975. A Discriminant Function Analysis of Residential Mortgage Delinquency and Foreclosure. <u>AREUEA Journal</u> 3 (1):73-90.

Quercia, R.G. and M.A. Stegman. 1992. Residential Mortgage Default: A Review of the Literature. <u>Journal of Housing Research</u> 3 (2):341-79.

Quigley, J.M., and R. Van Order. 1991. Defaults on Mortgage Obligations and Capital Requirements for U.S. Savings Institutions: A Policy Perspective. <u>Journal of Public Economics</u> 44 (3):353-70.

_____. 1992. More on the Efficiency of the Market For Single Family Homes: Default. Center for Real State and Urban Economics. University of California, Berkeley. Mimeo.

Sandor, R., and H. Sosin. 1975. The Determinants of Mortgage Risk Premiums: A Case Study of the Portfolio of A Savings and Loan Association. <u>The Journal of Business</u> 48 (1):27-38.

Simons, R. A. 1990. Borrower Net Equity as a Decision Variable in Industrial Mortgage Default: The Experience of Subsidized Borrowers in New York State. Ph.D. diss., University of North Carolina at Chapel Hill.

Vandell, K., and T. Thibodeau. 1985. Estimation of Mortgage Defaults Using Disaggregate Loan History Data. AREUEA Journal 13 (3):292-316.

von Furstenberg, G. 1969 (June). Default Risk on FHA-Insured Home Mortgages as a Function of the Term of Financing: A Quantitative Analysis. Journal of Finance 24:459-77.

_____. 1970a. Interstate Differences in Mortgage Lending Risks: An Analysis of Causes. Journal of Financial and Quantitative Analysis 5:229-42.

von Furstenberg, G., and R.J. Green. 1974 (December). Home Mortgages Delinquency: A Cohort Analysis. Journal of Finance, 29:1545-48.

Williams, A.O., W. Beranek and J. Kenkel. 1974. Default Risk in Urban Mortgages: A Pittsburgh Prototype Analysis. AREUEA Journal 2 (2):101-12.