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AN EXAMINATION OF THREE SETS OF INDICATORS OF FINANCIAL RISK AMONG MULTIFAMILY PROPERTIES

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Abstract

A lack of information about the financial condition of multifamily properties has hindered the development of a secondary mortgage market in multifamily mortgages and federal policies to finance multifamily housing. The purpose of this paper is to improve our understanding of the financial condition of multifamily properties. The centerpiece of the analysis is the 1991 RFS [U.S. Bureau of the Census]. Three sets of indicators of financial distress are examined in this paper. The first is interest rate related risk. We find that twenty five percent of the properties with mortgages have contract interest rates at least 87 basis points above the average contract rate, which was 10 percent at the time of the survey. This places these properties at a disadvantage in the market place because their costs are above average. On the positive side, many property owners were able to refinance or otherwise renegotiate their contract interest rates during periods of interest rate decline.

The second is cash flow risk as measured by the ratio of net operating income to the mortgage payment (DCR). The measured DCR has a mean of 2.9 and a median of 1.36 among properties with a mortgage. A quarter of all properties with some mortgage debt have a DCR below unity. If one assumes our measure overstates the true DCR by 20 percent, then as many as half of the properties have DCRs at or below 1.1, which suggests that a large fraction of the multifamily stock suffers from cash flow problems. The third is risk due to low equity. Investors with little or negative equity in the property are more likely to default than are investors with a substantial equity stake in the property. Such risk is measured by the loan to value ratio (LTV). The average LTV is .43 among all properties; three quarters of all properties have at least one mortgage and the average LTV among properties with some debt is 55 percent. Higher than average LTVs are associated with several other property characteristics: properties owned by partnerships (LTVs about 5 percentage points higher than the omitted category); properties that receive some type of assistance, e.g., Section 8 (LTVs from 2 to 5 percentage points higher than non-assisted properties); and properties with ARMs, balloon mortgages, or multiple mortgages (LTVs about 6 or 7 percentage points higher than others).

AN EXAMINATION OF THREE SETS OF INDICATORS OF FINANCIAL RISK AMONG MULTIFAMILY PROPERTIES

Introduction

The need for better information about the financial condition of multifamily housing projects has become painfully obvious in recent years to some organizations active in the market. The Federal Housing Administration (FHA) is estimated to have lost over $10 billion in its co-insurance programs in the 1980s. Better information about the financial condition of its insured projects may have reduced these losses because it would have allowed FHA to intervene before the value of the property declined far below the value of the insurance claim (the amount of the mortgage). Freddie Mac also experienced serious problems in their multifamily lending portfolio in the early 1990s. In some cases the values of some of the properties involved in the foreclosures actually sank to zero before foreclosure took place. Freddie Mac has returned to the market and its new multifamily program attempts to obtain better information about properties at the time of mortgage origination and during the course of the loan than previously obtained.

Several new initiatives in the market for multifamily mortgages also highlight the need for better information about the financial condition of multifamily projects. The development of a vibrant secondary mortgage market for multifamily loans has been hindered by the lack of good and timely information about the financial condition of multifamily properties. Absent such information, investors in multifamily mortgage-backed securities are unable to assess with much accuracy the expected risk and return to such investments. DiPasquale and Cummings (1992), Follain and Szymanoski (1995), and others have made this point.[1]

Another recent initiative is also likely to benefit from better information about multifamily mortgages. HUD has recently issued affordable housing goals for both Fannie Mae and Freddie Mac. These rules indicate targets for their loan purchases in three affordable housing categories. In order to

attain these goals, the GSEs will probably have to become more active in the multifamily lending area, especially in the market for mortgages below $500,000.[2]

The ideal method with which to assess the financial risk of mortgages is to develop and estimate models that value multifamily mortgages. This approach has proven to be highly successful in understanding the riskiness associated with single family mortgages and is an important reason for the success of the secondary market for single family mortgages. Default and prepayment models are used to value the cash flows (inclusive of losses) generated by a mortgage. The models build on the theory of options developed in financial economics. They are also reliant upon the large amounts of data that have been collected in the past 15 years or so about the patterns of the single family mortgage payments and their sensitivity to changes in interest rates and the price of single family housing.[3]

Unfortunately, the development of models needed to assess financial risk for multifamily mortgages is not very far along. The bottleneck is not the theory of multifamily default or prepayment. In fact, models needed to price multifamily mortgages may actually be simpler than the single family models because investors in multifamily properties are likely to be more financially sophisticated and less mobile than the typical owner of a single family house. The primary problem is a lack of information with which to estimate these models. Part of the problem is a paucity of data on the performance of multifamily mortgages; not even Fannie Mae and Freddie Mac seem to have the long time-series information needed to estimate default models. Another part of the problem is that some historical data are based upon multifamily programs and underwriting criteria that offer little guidance about recently developed mortgage programs.

Academic papers on the subject include only a half-dozen or so papers. Follain, Ondrich, and Sinha (forthcoming) use Freddie Mac data to estimate a model of multifamily mortgage prepayment. Abraham offers some insights about Freddie Mac defaults and the problems inherent in multifamily data in two papers (1993, forthcoming); among his arguments is the importance of measures of cash flow

such as debt coverage ratios versus the dominant variable in single family studies, investor equity in the property. Goldberg (1994) uses aggregate FHA data to estimate multifamily default models; he finds evidence that properties with HUD rental assistance have lower claims than other properties and that claims are affected by equity, tax laws, and rental market conditions. Wallace (1994) develops indexes of financial distress using a small sample of FHA properties with unique information about the quality of the structures and their need for repairs and renovations.

The purpose of this paper is to improve our understanding of the financial condition of multifamily properties. The centerpiece of the analysis is the 1991 RFS (U.S. Bureau of the Census). The RFS provides substantial amounts of information about multifamily properties and the mortgages used to finance their acquisition. The information was collected by the U.S. Department of Census in 1991 for a large sample of multifamily properties. The wide coverage of the RFS, its statistical integrity, and the long list of questions asked of landlords and holders of the mortgages make it the single best source of information about the financing of the current stock of multifamily housing. The only major omission of the RFS, for our purposes, is information about whether the mortgage is currently in default. As a consequence, this study examines likely causes or indicators of financial distress and stops short of estimating an explicit model that explains multifamily mortgage default.

Three sets of indicators of financial distress are examined in this paper. They are: 1) indicators of risk related to the contract interest rate; 2) cash flow risk; and 3) risk due to low equity. All serve as indicators of the likelihood of default; the first also provides insights about the sensitivity of the rate of return on an investment in a mortgage to changes in the market rate of interest. We are especially interested in the characteristics of properties that have mortgages with above average contract interest rates. In addition, the market value of outstanding mortgage debt is also computed for properties with fixed rate mortgages in order to estimate the sensitivity of the market value of the debt to changes in the rate of interest. Cash flow risk, the second indicator, is measured by the debt coverage ratio (DCR),

which is the ratio of net operating income to the mortgage payment; the higher the ratio, the lower is the risk of default due to problems with cash flow. Because the likelihood of default increases as the amount of owner equity in the project decreases, the third indicator provides insights about financial distress by examining variations in the loan to value ratios among multifamily properties.[4]

This particular paper is one of a series of four papers that analyze the RFS in order to learn more about multifamily housing finance. Follain and Calhoun (forthcoming) use the RFS to develop indexes of the price of multifamily housing. Bogdon and Follain (1996) explore the RFS on a much wider set of issues. They compare the RFS to the American Housing Survey, analyze a variety of property and mortgage characteristics of the multifamily housing stock, and examine variations in the rent to value ratio (the "cap rate") among properties and neighborhoods. Galster, Tatian, and Wilson (1996) use the Residential Finance Survey (RFS) to calibrate a model of multifamily mortgage default. They present a number of indicators of the financial condition of the indebted multifamily stock, examine the relationships among the indicators, and simulate the performance of the indebted multifamily stock using a rent distress and a debt distress indicator. Both indicators are composite measures; the rent distress indicator is heavily weighted to measures of the amount of net operating income generated by the property relative to the payment needed to service the mortgage debt and the debt distress measure weights more heavily on borrower equity in the property. There is some overlap in this paper and the one by Galster, Tatian and Wilson. Their paper is more focused on the interrelationships among the indicators and the calibration exercise. Our goal is to provide a more detailed look at variations in the indicators and sources of their variation, especially interest rate differences and the loan to value ratio.

The next section of the paper presents some basic information about the RFS. The following section examines interest rate related risk. The fourth section measures cash flow risk, and the fifth

section examines risk related to low amounts of equity. The final section offers a brief summary and suggestions for future research.

An Overview of the 1991 Residential Finance Survey and Multifamily Mortgages

The Residential Finance Survey is conducted by the Bureau of the Census and is designed to provide data about the financing of nonfarm, privately-owned residential properties in the United States. The survey has been conducted as part of the 1950, 1960, 1970, 1980, and 1990 Censuses of Housing. The potential universe in the 1991 RFS is about 66,000,000 properties securing about 38,000,000 mortgages; about 70,000 properties were in the sample.

The collection of information about multifamily properties in the RFS begins with the identification of a sample of housing units from the recent census. The property to which a particular multifamily housing unit belongs is then identified and the property owner or manager is interviewed to obtain a variety of information about the property. If the property has one or more mortgages, then the holder of the mortgage is interviewed to obtain information about the mortgages.

The particular sample used through most of this analysis is a subset of the larger sample of rental properties. The primary restriction limits attention to nonvacant multifamily properties; a multifamily property is a rental property in a structure with five or more units. A number of other restrictions are imposed as well. Second, observations are deleted if the property was not purchased in order to eliminate non “arms length” transactions and if the land is not owned by the property owner. Third, properties with missing information about the number of units, the purchase price, and the current value of the property are deleted. Fourth, only properties in metropolitan areas are included. Fifth, a number of relatively minor restrictions are also imposed in order to eliminate observations that appear to be extreme outliers. Among these exclusions are average annual appreciation rates greater than 25

percent, current value per unit less than $5,000 or greater than $500,000, purchase price greater than $500,000 per unit, properties with more than 1,000 units, and properties with a current loan-to-value ratio greater than two or a rent-to-value ratio greater than one.

The first four restrictions reduce the sample to 11,8972; the fifth set of restrictions reduces the sample size to 8,774. 6,092 of these properties have a first mortgage.[5]

Table 1 provides information about multifamily mortgages and property characteristics. Bogdon and Follain (1996) explore a longer list of variables whereas this paper focuses on the characteristics of multifamily mortgage debt. The statistics are computed using the national mortgage weights. The number of observations indicates the number of multifamily properties (not units) for which the information is available.[6]

The number of multifamily properties represented by our sample is 332,195. The average property value is $910,000 and the average value per unit is $44,880. These properties have appreciated on average at 5.6 percent per year over their holding period. The average rent per unit per year is just under $4,700 or about $390 per month. The average number of units per property is 21.74 and the average number of years since the property was acquired by the current owner is 11 years, i.e., it was purchased in 1980. 18 percent of the mortgages have an option to prepay prior to the maturity of the loan. Just under 10 percent (9.5 percent) of the properties receive a Section 8 subsidy; other forms of assistance are rare. Bogdon and Follain (1996) provide similar information about all of these variables based upon properties and numbers of units.[7] The tables report weighted data since the RFS oversamples large properties. Most of the information in Table 1 based upon aggregation at the property level is similar to that generated by analysis at the level of the housing unit, but not all.

About three-fourths of properties (253,529) have at least one mortgage; 47,165 have a second mortgage. The average size of the first mortgage is $406,348 and the average amount of all mortgage debt is $436,947. Fully 69 percent of the first mortgages do not have any type of mortgage insurance; 3

percent are insured by the Federal Housing Administration (FHA). About one-fifth of properties (18 percent) include a prepayment option and 18 percent are assumable. The original term to maturity of the first mortgages is 21.17 years, on average, and the remaining term is 14.75 years.

The average size of the mortgage debt at the time of property acquisition was $475,068. The current loan to value (LTV) ratio is .43; the original LTV average is .78. The average contract interest rate is 9.99 percent; the average rate on an adjustable rate mortgage (ARM) is slightly higher at 10.24. More information about the distribution of the contract interest rates, the debt coverage ratio (DCR), and LTV is provided below.

Some interesting insights about multifamily mortgages are revealed by examining the distribution of first mortgage debt by the average number of years until maturity, i.e., remaining term. Such information is presented in Table 2 for the period 1992-2000. Note, first, that a relatively large amount of debt is scheduled to mature in the mid-1990s. Over $30 billion is scheduled to mature between 1994 and 1997. Second, these loans were originated, on average, in the peak years of the boom in multifamily construction (1983-1985) and the original maturities of many of these loans were short and intermediate term. This is consistent with anecdotal evidence that many of the multifamily loans during this period were "mini-perms"; that is, the loans to many of the properties were not permanent and long term mortgages because some of these properties were not fully occupied and, as a result, did not qualify for long term loans. Third, these loans seem to be relatively large; they average about twice the size of the typical first mortgage. Also, they seem relatively safe; LTVs on these properties are at or below 50 percent, on average, and DCRs are above the amounts associated with typical multifamily underwriting criteria (1.25). This in combination with the fact that current market interest rates are in the area of eight percent suggests that the financial condition of these properties was strong in 1991 and will probably become stronger since the excess supply of multifamily housing has declined in recent

years in most markets. Alternatively stated, the mid-1990s may offer some good opportunities for lenders interested in refinancing some of these properties.

Interest Rate Related Risk

A potentially important aspect of the financial risk associated with multifamily lending is the risks related to the contract interest rate. These risks are of two types; one affects the likelihood of default and the other affects the return on an investment in multifamily lending even if payments are made according to schedule. Consider, first, how the contract rate may affect the likelihood of default. If one assumes the market for rental properties is competitive, as we do, then the rental receipts depend upon the quality of the unit and not the financial characteristics of the mortgage. As a consequence, properties with above average mortgage interest rates may be more susceptible to financial distress than properties with below average mortgage rates because their cost of business is higher, all else equal. This exposes holders of such mortgages to higher default risk. Second, the return to investors in multifamily mortgages may be affected by changes in the market rate of interest even if mortgage payments are made according to schedule. This is particularly true for long-term fixed-rate mortgages, which is the dominant instrument in the multifamily market (see Table 9 below). An increase in the market rate of interest, all else equal, reduces the present value of the future payments on the mortgage and, hence, reduces the return to the investor in the mortgage. This is a dominant form of risk associated with investment in single-family mortgages. The analysis in this section sheds light on the nature and extent of these risks in the multifamily mortgage market.

Some insights about both of these risks are obtained by examining the distribution of contract interest rates for all properties with a mortgage and by the distribution of these properties by year of property acquisition and mortgage origination. Table 2 contains these distributions for first mortgages. The first point to note is that the distribution of contract rates among properties with a mortgage is

substantial. One-quarter of the mortgages are 87 basis points or more above the mean and median rate of 10 percent. If the average LTV is 50 percent, the cost of doing business on these properties is 5 percent or more higher than on the average property with a mortgage, which may be significant if the disadvantage is prolonged and the rental market is highly competitive.

Second, it appears that a substantial number of the mortgages are able to adjust their contract interest rates toward the market rate. If one assumes that all acquisitions in this sample included the use of a mortgage at the time of origination, then the ratio of originations to acquisitions in 1983 suggests that one-third of the mortgages originated in 1983 have been refinanced, matured, or renegotiated (Table 3). Some of this is explained by the existence of prepayment options; recall that 18 percent of all properties (23 percent of properties with a mortgage) have a prepayment option. Furthermore, mortgages with above average market rates are the ones most likely to refinance. This is suggested by the fact that the average rate on multifamily mortgages originated in 1983 is well below the average rate on single family mortgages originated in 1983.

To further explore the interest rate sensitivity of multifamily mortgages, the interest rate duration of mortgage debt is computed. Duration is a commonly employed measure of the interest rate sensitivity of bonds. We calculate duration by computing the difference between natural logarithm of the market value of the existing debt at 10 percent and the natural logarithm of the market value of the existing debt at 9 percent.[8] The market value of the debt is the present value of the remaining mortgage payments using a discount rate of either 10 percent or 9 percent. This is only done for first mortgages that were fixed rate mortgages and that originated since 1980.[9] Ten percent is used to approximate the market rate of interest at the time of the survey; this is the median contract rate among all properties at the time of the survey and 25 basis points above the mean among mortgages originated in 1990.

Summary information about this subsample is contained in Table 4. The sample represents about 75,000 properties or about 30 percent of all properties with some mortgage debt. The computed

market value of the first mortgage is $453,958, which exceeds the reported current or book balance on the first mortgage by about $40,000. The duration of this debt is about 11 percent; a one percentage point decline in the market rate of interest increases the market value of the mortgage debt by 11 percent. This is a substantial amount and is consistent with the duration of long-term (20 to 30 years) single family mortgages.

The calculation of the market value of debt also sheds some light on the market value of equity in multifamily properties. Using the book value of debt, we compute average equity for this sample to be $329,000. Using the market value of debt, equity is reduced to $290,000. We are reluctant to press this point too hard because it is based upon a variety of simplifying assumptions, but it does suggest that careful studies of default risk ought to focus on the market value of debt and not simply book value.

Further information about the duration of mortgage debt and its distribution is provided in Table 5. Several characteristics of mortgage debt are provided for five categories of duration; the properties are in five quintiles obtained using the unweighted sample (N=1,253). The characteristics of mortgage debt in the higher duration categories differ from those in the lower categories in several ways. First, the gap between market and book values is larger in the higher categories; the higher duration categories include mortgages with longer original terms to maturity. Second, mortgage size consistently rises as the duration increases from under $200,000 to over $3.4 million in the highest category. Third, FHA properties are disproportionately represented in the highest category; FHA mortgages tend to have longer terms to maturities than uninsured mortgages. Fourth, and most importantly, the LTV increases as the duration increases. This suggests that those most at risk of default (higher LTV) loans are also most sensitive to changes in interest rates.

The final part of this discussion seeks to shed additional light on the causes of the variations in the two measures of interest rate related risk. Three regression equations are estimated. The first two

explain variations in the interest rate differential (contract rate - .10); one uses all observations with at least one mortgage and the other uses only properties with a fixed rate first mortgage originated since 1980. The third explains variations in our measure of duration. The explanatory variables consist of both mortgage and property characteristics.

Variations in the interest rate differential are largely driven by the term to maturity of the mortgage, whether the mortgage is insured by FHA, and the value of the property, but even these explain modest proportions of the variations. The adjusted R^2 is .20 for the full sample and only .11 for the smaller FRM sample. FHA insured properties tend to have contract rates lower than non-FHA properties; the differential is 93 basis points on all properties and 67 basis points on FRMs. More expensive properties have below average rates, but the quantitative significance of the relationship is small. An increase in the value of the property by $1 million reduces the interest rate differential by less than three basis points. As noted in Table 3, properties acquired in the early 1980s have higher contract rates; for example, the differential among FRMs among properties acquired in 1984 is 39 basis points.

Of particular interest is the relationship between equity in the property and the interest rate differential. One possibility is that properties with modest amounts of equity are less able to refinance than properties with large amounts of equity. As a result, properties with low amounts of equity have higher than average interest rate differentials. The coefficient of equity suggests that this is not an important explanation of the distribution of the interest rate differential. The coefficient of equity in the full sample is actually positive and significant, which is difficult to explain. The coefficient in the FRM sample is also positive, but insignificant.

The primary determinant of duration is the term of the mortgages, which follows directly from the definition of duration. The predicted duration of a 30 year $1 million mortgage originated in 1990 with a 25 percent downpayment is 14.6 percent. More expensive properties have lower durations. As suggested by the cross-tabs in Table 5, properties with lower amounts of equity are associated with

higher duration. However, the quantitative significance of this relationship is modest; an increase in equity by $100,000 has a minuscule impact on the duration of the mortgage.

Cash Flow and the Debt Coverage Ratio

One of the two main underwriting criteria on multifamily loans is the debt coverage ratio or the debt service coverage ratio. The DCR is designed to determine whether net operating income is sufficient to cover the mortgage payments and is akin to the payment to income ratio used to underwrite loans for owner-occupied housing mortgages. Low DCRs (below unity) indicate financial distress due to cash flow difficulties. The difficulties may arise because of a low numerator caused by sagging market rents, high and unexpected vacancies, and inefficiently managed properties. Above average contract interest rates may also lower the DCR because of their impact on the denominator. This section explores variations in the DCR among multifamily properties in the RFS sample.

The RFS contains several, but not all, of the components needed to compute net operating income (NOI) and the DCR. NOI, the numerator of the ratio, is computed using actual rental receipts including and excluding nonresidential income. Because nonresidential income is zero for most properties and is usually a small component of total rental income for others, the distribution of DCR is not very sensitive to the definition. The calculations in this section rely upon rental income exclusive of nonresidential income.

A greater concern is the RFS information about operating expenses. Information from the RFS does include property taxes, insurance payments, and utility payments at the property level. Information about other operating expenses is not available in the RFS. As a consequence, net operating income is surely overstated and, hence, the DCR is overstated. A simple numerical example provides a sense of the degree of overestimation. The percentage of overestimation of DCR by the omission of some operating expenses equals the percentage of overestimation of net operating income caused by the

omission of these operating expenses.[10] Bogdon and Follain (1996) estimate the average net operating income ratio using the RFS to be 9.8 percent. Assume that operating expenses equal 45 percent of gross rent, which is within the range of estimates provided by the Institute of Real Estate Management (1991); then net operating income would be 55 percent of gross rent. Using Bogdon and Follain's estimate of the rent to value ratio (13.8 percent), this implies an alternative estimate of the DCR of 7.6 percent (.55 x 13.8). Thus, the RFS overestimates DCR by about 29 percent (9.8/7.6). The accuracy of this particular estimate of the DCR is not possible to determine without considerably more information; however, it seems safe to assume that the degree of overstatement could be 20 percent or higher.

The distribution of the DCR for all properties with a first mortgage is contained in Table 7.[11] The mean DCR for all properties is 2.9; even reducing this by 20 percent suggests that the average DCR is well above typical underwriting standards, which is often in the area of 1.25. However, a significant skewness in the distribution is suggested by the median DCR, which is 1.35. Eighty percent of this ratio is below many typical underwriting criteria. The median suggests that as many as half of the properties would have difficulty meeting current underwriting criteria. Twenty five percent are significantly below the 1.25 measure.

The distribution of the DCR among properties owned by nonprofit organizations appears to be the lowest; more than 50 percent are below unity, although this is a very small proportion of all multifamily properties. Properties owned by either limited or general partnerships appear to be above the average distribution, but at least 25 percent of partnership owned properties are well below the 1.25 measure. Since the bulk of the properties (71.9 percent) are owned by individual investors, the distribution of the DCR among these properties mirrors the distribution for all properties.

Considerable variation in the DCR does exist among mortgage types. The lowest distribution appears among the graduated payment mortgage, but mortgages of this type are rare. The distribution among adjustable rate mortgages (ARMs) appears to be considerably below the distribution among

FRMs and balloon mortgages. The median DCR for ARMs is 1.22. Using 80 percent of this median suggests that about half of the properties with ARMs have zero or negative cash flow. This is consistent with the earlier observation that the contract rate on ARMs is well above the average contract rate.

A variety of regressions were computed to learn more about the distribution of the DCR among properties. The explanatory power of the regressions were often near zero and few variables were significant. Some insights are obtained by examining the distribution for some broad categories of properties. Table 8 shows the distribution among properties among two ownership types (individual investors and partnerships), three groups defined by property size (less than 10 units, 10 to 50 units, and greater than 50 units), and three groups defined by the dollar value of vacancy losses expressed as a percent of rent (less than 5 percent, 5 to 10 percent, and greater than 10 percent).

Two patterns emerge. First, the DCR declines as vacancy rates increase. For example, the median DCR declines from 1.44 to .97 among properties with less than 10 units owned by individual investors. The declines are most notable among properties with vacancy rates in excess of 10 percent. Second, DCRs tend to be higher for larger properties. For example, the median DCR among properties with more than 50 units is typically higher for all vacancy rates and both ownership types than among properties with less than 10 units. A strong distinction among ownership types is not revealed by the information in the table.

Loan to Value (LTV) Ratio

This section focuses on the loan to value ratio associated with multifamily loans. Information about these LTVs provides insights regarding the extent and distribution of financial distress among multifamily properties. All else equal, property owners who have high LTVs on their properties are

more prone to default on their mortgages than owners with lower LTVs. By exploring the distribution of LTVs among properties, it is possible to identify those properties most prone to mortgage default.

Examination of the variation in the LTVs on properties may also shed light on the usage and benefits of debt versus equity financing. This is a commonly studied question regarding the financing of other types of commercial enterprises, but relatively little has been done in the area of multifamily financing. One of the few studies to examine this question is done by Gau and Wang (1990), who develop a model of the optimal LTV and test the model using a sample of multifamily properties from Vancouver, Canada. Among their most important hypotheses is that the optimal LTV is inversely related to the degree of the tax shield available to the investor. For example, investors with high marginal tax rates ought to use little or no equity during a tax regime in which the depreciation rate for tax purposes far exceeds the real depreciation rate, as was the case in the United States between 1981 and 1986. Investors in real estate with low marginal tax rates and less opportunity to benefit from tax shields ought to have higher LTVs. Shilling (1996) recently developed a more general model of this issue, but his conclusions on this particular point are consistent with Gau and Wang.

Our measure of the LTV is the ratio of all outstanding mortgage debt to the market value of the property at the time of the survey. The ideal measure of the numerator is the market value of the mortgage debt not the outstanding or book value of the debt, which we employ. The discrepancy between book and market value is likely to be greatest for long-term fixed rate mortgages. Indeed, the analysis in the third section focuses on such mortgages and suggests that the discrepancy ought to be given careful consideration in the analysis of properties with high LTVs. Nonetheless, the discrepancy is probably not significant for most other mortgages types since they tend to have adjustable rate mortgages or short maturities. Furthermore, the computation of the market value of all debt is a complex undertaking and the information needed to do this carefully is unavailable in the RFS. For these reasons, we employ the book value of debt. Neither is the denominator the ideal measure. We

use the owner estimate of the current market value of the property. This is a common measure of value in the study of single family owner-occupied housing. A professional investor in real estate may be expected to be more precise than a typical home owner; however, multifamily properties are probably more difficult to appraise than the typical single family property. As a consequence, we have no reason to suspect that the owner estimates are either upward or downward biased. Additional research on the accuracy of investor estimates of property value is a priority.

Table 9 contains information about the distribution of the current LTV by form of property ownership and mortgage type; the distribution is presented for all properties and for properties with a current mortgage.[12] Among all properties the average LTV is 43 percent and the median is only slightly lower at 42 percent; however, substantial variation exists around these two measures of central tendency. One quarter have LTVs in excess of 68 percent and 25 percent are below 6 percent. Over one percent of the properties have LTVs in excess of 1.50; some of these are no doubt outliers but recall that properties with LTVs in excess of two are already eliminated from this sample. The extent of the variation is also revealed in a comparison of LTVs among ownership and mortgage types. Partnerships have the highest average LTV at 61 percent and nonprofits have the lowest at 25 percent; individuals have an average LTV of 39 percent. Some variation exists among mortgage type; properties with FRMs tend to have lower LTVs.

Higher LTVs are displayed in the bottom panel of Table 9 because properties without mortgages are eliminated. The LTV distribution for this group is tighter and the average is higher; the mean and median LTVs are larger, 55 percent, and over 50 percent of the sample falls between 33 and 73 percent. The variations among ownership types also diminish. Partnerships still have the highest average, but the nonprofit average is 59 percent, which exceeds the average for individual owners and the nonprofit average in the top panel. Note, too, that 25 percent of partnerships have LTVs in excess of 83 percent.

Several regressions are estimated in order to shed more light on the causes of the wide variation in the LTV ratios. These are estimated for all properties and a sample that includes only properties with at least one mortgage.[13] A variety of specifications were estimated, but the four specifications reported in Table 10 are indicative of the major patterns obtained.

The variables in the regressions include the following.

1. **Time**. Years since acquisition is measured by the number of years since acquisition (Time) and its square. At issue is whether property owners seek to maintain anything like a constant loan to value ratio over the life of the loan, which may be expected is there is an optimal or uniquely preferred LTV. If, for example, the optimal LTV is high, as Gau and Wang and Shilling suggest is the case for high marginal tax rate investors during periods of preferential tax treatment for real estate, then one would expect a modest relationship between the LTV and the time since the mortgage was originated. A stronger negative relationship is expected for investors with low marginal tax rates who may be liquidity constrained. Our analysis does not permit an exact test of these hypotheses because the data do not include information about the tax status of the investors; however, a strong empirical finding may shed some light on how existing theories need to be revised and how future research may want to proceed.

2. **Property Characteristics**. These include the number of units in the property and its square, the value of the property, and value per unit. One reason for including these variables is to determine whether any pattern exists with respect to these traits. Another is that these variables may serve as proxies for the sophistication of the investor; the larger and more expensive properties are presumably owned by more financially sophisticated organizations.

3. **Ownership Type**. Several ownership types are considered: individual, partnerships, nonprofit, and REITs. Partnerships are thought to capture the effects of some of the tax motivated partnerships created in the early and middle 1980s. As noted by Gau and Wang, and Shilling, investors

in these partnerships may have had a motivation to leverage their equity investments (increase LTVs) because at the time of the investment their marginal tax rates probably exceeded the corporate tax rate, i.e., the shield was worth more to the partnership than for corporate equity investments. Individual investors, on the other hand, probably come from a wide variety of marginal tax rates; the pattern of their use of leverage is less clear.

4. **Mortgage Traits and Tenant Related Assistance**. We are interested in whether FHA properties are more highly leveraged than properties with uninsured mortgages. Other mortgage characteristics considered include whether the mortgage is a tax-exempt issue and whether the mortgage is assumable or has a prepayment option. In addition, we examine whether properties that receive some type of assistance, e.g., Section 8, have higher or lower LTVs.

5. **Location**. Information is available to determine whether the properties are located in one of four states: California, Florida, New York, and Texas. A dummy variable for whether the property is located in the central city is also included.

6. **Debt Coverage Ratio, Property Appreciation Rate, and Initial LTV**. A simple negative relationship exists between the LTV and DCR: higher debt means higher debt payments and a lower DCR, all else equal. However, only properties with relatively high DCRs may be able to obtain large LTVs. The appreciation rate is entered to determine whether investors seek to borrow against increased appreciation. If so, then the coefficient of the appreciation rate ought to be less than unity. Lastly, the initial LTV is included to determine whether a high starting value tends to be associated with a high current LTV.

The LTV reveals a U-shaped pattern with respect to the time since the property is acquired. It declines by about 2 percent per year in the early years of the mortgage and then begins to rise in the area of six years or so; it rises slightly after this point. This result rejects the hypothesis of a constant LTV during the life of the mortgage, but the pattern of rapid decline throughout the period of ownership is

also rejected. Indeed, the U-shaped form raises the possibility that investors do not drastically reduce the initial LTV. This result seems inconsistent with the conjecture that the optimal debt to equity ratio for multifamily investors is zero and consistent with the notion of an optimal and positive LTV.

A modest positive relationship between LTV and the size of the property generally exists; this is especially true among properties with at least one mortgage. Value of the property and value per unit are negatively related to LTV, but the relationships are also modest. For example, an increase in the value of the property by $1 million increases the LTV by less than .2 of 1 percent using the results in the last column.

Partnerships have higher LTVs than other ownership forms. The typical differential is about 5 percentage points. This result is consistent with the hypothesis that partnerships were typically more leveraged than other multifamily investors. LTVs for individual investors are usually lower than the base case, but the differential is small and often insignificant. The differentials for nonprofit and REITs are usually insignificant. These results seem consistent with the hypotheses offered by Gau and Wang and Shilling.

Among properties with a mortgage, LTVs for FHA insured properties do not appear to be significantly different than for other properties including uninsured properties. Tax exempt mortgages are associated with higher LTVs; a 5 percentage point differential is the typical estimate. Prepayment options and assumable mortgages do not appear to be associated with higher or lower LTVs. Properties that receive some type of assistance for tenants or project typically have higher LTVs by 5 percentage points or so. Properties with ARMs, balloon mortgages and properties with more than one mortgage tend to have LTVs higher than other properties by about 6 or 7 percentage points.

LTVs among properties located within the central cities of major metropolitan areas do not appear to be significantly different than those outside the central cities. Among the states, only LTVs in

Texas are significantly above the average among other states. These may still be the remnants of the decline in property values during the mid-1980s.

The coefficient of the appreciation rate variable indicates whether property owners use appreciation in the value of the property to obtain additional mortgage debt, i.e., leverage their equity more. Higher appreciation rates appear to have the opposite effect because the coefficient is negative and significantly less than negative unity for all specifications in which it is included. This suggests that investors make little or no effort to borrow against the increased equity brought about by higher rates of appreciation. The DCR bears no statistically significant relationship to the LTV. Properties with a higher initial LTV do tend to have LTVs higher by about 6 percentage points, all else equal.

The final table (Table 11) includes the results of a regression to explain variations in the initial LTV or the LTV at the time the property was acquired. Concerns about the quality of the information about the initial mortgage led us to use a restricted sample for this particular analysis; only properties acquired with the use of one and only one mortgage are included (N=2,944). The distribution of the initial LTV is tighter than the distribution of the current LTV; 50 percent are in the range of .71 to .91; the mean is .80 and the median is .79. The regression results confirm this tight distribution. The intercept is 78 percent and few variables indicate a substantial departure from the mean. Properties owned by partnerships and nonprofit organizations are above the average by a few percentage points, as are properties that receive some type of assistance. Properties with FHA insured mortgages, and properties with tax exempt mortgages. The two coefficients of property size and value are almost offsetting. For example, a $50 million property with 1,000 units has almost the same LTV as a smaller and less expensive property.

Conclusions

The purpose of this paper is to shed light on the financial condition of the stock of multifamily housing. The 1991 RFS is used to identify three major indicators of financial distress or, equivalently, the risk of default: interest rate related risk; cash flow risk; and risk due to low equity. The major conclusions of the analysis are summarized in this section; in addition, some suggestions for future research are provided.

Interest Rate Related Risk

Twenty five percent of the properties with mortgages have contract interest rates at least 87 basis points above the average contract rate, which was 10 percent at the time of the survey. This places these properties at a disadvantage in the market place because their costs are above average. Despite the wide variation in contract interest rates, the distribution of contract rates appears to be substantially less than the distribution of market interest rates during the 1980s. This suggests that many property owners were able to refinance or otherwise renegotiate their contract interest rates during periods of interest rate decline. We also examined whether properties with low amounts of equity are more likely to have above average contract rates; no evidence of this pattern is obtained.

The duration or interest rate sensitivity of multifamily mortgage debt is also examined for a sample of fixed rate mortgages. The average duration is about 10 percent; that is, a one percent decline in the market rate of interest increases the market value of the debt by 10 percent. There is also considerable variation in the duration of debt around the mean. Properties with high LTVs appear to have the highest durations; such properties are particularly prone to financial distress. Many properties with FHA insured mortgages fall into this category.

Cash Flow Risk (DCR)

Cash flow risk is measured by the debt coverage ratio, which is net operating income divided by the mortgage payment. Our measure probably omits important components of operating expenses and overstates DCR by 20 percent or so. The measured DCR has a mean of 2.9 and a median of 1.36

among properties with a mortgage. A quarter of all properties with some mortgage debt have a DCR below unity. If one assumes our measure overstates the true DCR by 20 percent, then as many as half of the properties have DCRs at or below 1.1. This ratio is below the typical underwriting criterion for the DCR and suggests that a large fraction of the multifamily stock suffers from cash flow problems. Efforts to identify the causes of the variation yield few strong conclusions. The strongest relationship pertains to vacancies; properties with higher vacancy rates have considerably lower DCRs. DCRs also tend to be lower among properties with less than 10 units than for properties with 50 or more units. DCRs for properties with an adjustable rate mortgage and for properties owned by nonprofit organizations tend to be lower as well.

Risk Due to Low Equity

Investors with little or negative equity in the property are more likely to default than are investors with a substantial equity stake in the property. Such risk is measured by the LTV. In the sample of all properties, the average LTV is .43. Three quarters of all properties have at least one mortgage and the average LTV among properties with some debt is 55 percent. All else equal, a U-shaped relationship between LTV and years since acquisition is estimated, which suggests that the LTV does not change radically over the period of property ownership for those who choose to use mortgage finance. On the other hand, properties that experience higher rates of appreciation have lower LTVs than properties with lower appreciation rates; property appreciation would not be expected to have a strong negative relationship with the LTV if a unique and optimal LTV exists. Higher than average LTVs are associated with several other property characteristics: properties owned by partnerships (LTVs about 5 percentage points higher than the omitted category); properties that receive some type of assistance, e.g., Section 8 (LTVs from 2 to 5 percentage points higher than non-assisted properties); and properties with ARMs, balloon mortgages, or multiple mortgages (LTVs about 6 or 7 percentage points higher than others). The average LTV at the time of purchase is 78 percent and the

distribution around the mean seems modest. Overall, the evidence seems to strongly reject the idea that the optimal debt to equity ratio among multifamily properties is zero for the large majority of property owners; as such the results are consistent with the hypotheses of Gau and Wang and Shilling.

The next step in the analysis of financial distress among multifamily properties ought to be the development and estimation of models of default. The wide variation in the DCR and the large number of properties with DCRs below 1.1 or so yield credence to the arguments of Abraham that the DCR ought to play an important role in multifamily default models. The analysis also suggests that prepayment cannot be ignored because a large number of properties do seem able to move their contract interest rates toward the market rate, albeit slowly, during periods of interest rate decline. What is uncertain is the source of the data for these studies. FHA data may be the best opportunity, but the portfolios of Fannie Mae and Freddie Mac are other potentially valuable sources of information. Another possibility is the emerging Multifamily Housing Institute. Until a good data base is developed and default and prepayment models are established, the growth of the secondary mortgage market for these mortgages will likely remain slow. The ability of Fannie Mae and Freddie Mac to meet the new HUD mandated housing goals will probably also be hampered because multifamily lending programs are likely to be integral part of their efforts to meet these goals.

Table 1. Characteristics of the 1990 RFS Sample of Multifamily Properties

	Number of Properties	Mean	Standard Deviation
Characteristics of Mortgage Debt			
Origination year on first mortgage	253,529	84.76	5.26
Origination year on second mortgage	47,221	86.86	3.70
Points on first mortgage	101,500	0.77	1.62
Points on second mortgage	21,430	0.42	1.57
Original term to maturity on first mortgage	250,009	21.17	9.69
Remaining term on first mortgage	225,018	14.75	9.50
Current interest rate on first mortgage	253,529	9.99	1.68
Current interest rate on ARMs	67,301	10.24	1.58
Annual cap on ARMs	73,344	1.08	1.63
Lifetime cap on ARMs	72,839	4.27	3.83
Term of seocnd mortgage	47,165	13.01	8.59
Remaining term on second mortgage	42,921	8.95	7.26
Current interest rate on second mortgage	47,221	10.05	2.25
Original LTV	332,195	0.78	0.83
Current LTV	332,195	0.43	0.36
Initial mortgage (dollars)	332,195	475,068	1,424,957
Current mortgage (dollars)	332,195	436,947	1,333,345
Current balance on first mortgage (dollars)	332,195	406,348	1,282,618
Percentage change in first mortgage	257,352	-0.23	0.49
Annual principal and interest payment (dollars)	332,195	52.24	257,363
First mortgage FHA insured	332,195	0.03	0.16
First mortgage uninsured	332,195	0.69	0.46
First mortgage tax exempt	332,195	0.01	0.09
Below market loan	332,195	0.03	0.16
Prepayment option on first mortgage	332,195	0.18	0.38
First mortgage is assumeable	332,195	0.18	0.38
Property Characteristics			
Number of years since acquisition	332,195	11.00	9.16
Number of housing units	332,195	21.74	45.65
Current value of property (dollars)	332,195	910,428	2,604,918
Current value per unit (dollars)	332,195	44,880	42,136
Average annual appreciation rate	332,195	0.06	0.07
Average rent per unit (dollars)	332,195	4,673	3,916
Equity (dollars)	332,195	504,080	1,937,257
Section 8 subsidy	332,195	0.0950	0.29
Government grant	332,195	0.0009	0.03
Property tax relief	332,195	0.0125	0.11
Low income housing tax credit	332,195	0.0040	0.06

Notes: Weighted by the national mortgage weight

Unweighted number of observations: 8,774 for all properties and 6,092 with some mortgage debt.

Source: Authors' calculations with 1991 RFS.

Table 2. Characteristics of First Mortgages by Year of Maturity, 1992-2000

Year of Maturity of First Mortgage	1992	1993	1994	1995	1996	1997	1998	1999	2000
Number of properties with first mortgage	8,492	9,578	10,966	8,025	9,635	8,974	6,136	5,243	11,862
Origination year of first mortgage	85	82	85	85	85	83	83	83	85
Term of first mortgage	7	11	9	10	11	14	15	16	15
Interest rate on first mortgage	10.50	9.77	10.27	10.65	10.09	9.57	9.65	9.82	10.40
Share of ARM loans	0.10	0.07	0.02	0.10	0.17	0.16	0.07	0.13	0.21
Average interest rate on ARMs	11.21	11.36	11.73	12.98	10.26	10.40	9.63	9.98	12.15
Years since acquisition	8.90	11.78	8.77	9.51	10.59	10.54	9.83	9.98	10.83
Current LTV	0.44	0.43	0.50	0.45	0.50	0.50	0.46	0.55	0.49
Initial mortgage (dollars)	625,033	512,262	1,097,179	867,539	723,422	872,047	774,814	893,952	523,291
Current mortgage on all mortgages (dollars)	544,188	455,713	1,055,989	811,502	646,864	801,178	709,613	831,123	482,858
Current balance of first mortgage (dollars)	520,616	440,178	1,043,766	768,779	628,405	763,580	665,181	809,140	470,555
Original balance on first mortgage (dollars)	601,141	495,318	1,080,948	825,534	702,149	830,975	728,404	870,064	509,312
Debt coverage ratio	1.43	2.04	30.25	2.31	1.83	1.67	1.57	1.93	1.61
Prepayment option	0.26	0.26	0.14	0.37	0.40	0.36	0.18	0.29	0.27
Assumeable Mortgage	0.17	0.14	0.13	0.21	0.25	0.15	0.12	0.20	0.12
Annual principal and interest payment (dollars)	66,684	52,938	145,273	99,971	123,085	117,856	79,862	93,115	58,385
First mortgage FHA insured	0.006	0.035	0.004	0.002	0.001	0.001	0.010	0.024	0.003
First mortgage uninsured	0.921	0.923	0.906	0.934	0.980	0.987	0.966	0.890	0.943
First mortgage tax exempt	0.000	0.001	0.001	0.011	0.005	0.001	0.001	0.001	0.001
Total volume of first mortgages due (dollars)	4,421,069,798	4,216,020,478	11,445,943,32	6,169,450,352	6,054,683,331	6,852,362,702	4,081,550,493	4,242,319,709	5,581,719,021

Source: Authors' calculations from the 1991 RFS.

Table 3. The Distribution of Contract Interest Rates on First Mortgages

	By Acquisition Year					By Origination Year						
Year	N	Mean	75th	50th	25th	N	Mean	75th	50th	25th	Originations/ Acquisitions	One to Four Family Contract Rate
All years	253,529	9.99	10.87	10.00	9.14	253,529	9.99	10.87	10.00	9.14		
1990	19,921	9.74	10.41	9.50	9.12	31,881	9.88	10.50	9.75	9.19	1.60	9.74
1989	19,864	10.16	10.75	10.00	9.46	25,663	10.50	11.00	10.12	9.46	1.29	9.81
1988	20,105	9.94	10.75	9.99	9.09	27,702	10.05	10.75	10.00	9.30	1.38	8.98
1987	16,950	10.04	10.80	10.00	9.24	26,990	10.04	10.68	10.00	9.24	1.59	8.95
1986	24,229	10.27	11.00	10.25	9.37	30,961	10.15	10.94	10.21	9.37	1.28	9.79
1985	23,614	10.24	11.25	10.12	9.34	23,346	10.47	11.50	10.60	9.60	0.99	11.17
1984	15,354	10.43	11.36	10.25	9.50	9,593	10.55	12.00	10.66	9.47	0.62	11.99
1983	11,818	10.29	11.51	10.34	9.40	7,778	10.32	11.51	10.50	9.50	0.66	12.26

Source: Authors' calculations from the 1991 RFS and Federal Housing Finance Board.

Table 4. Characteristics of Properties with Fixed Rate Mortgages, Originated Since 1980

Variable	N	Mean	Standard Deviation	Minimum	Maximum
Market value of first mortgage (dollars)	74,490	453,958	1,270,301	0	45,089,338
Current balance of first mortgage (dollars)	74,490	415,581	1,227,101	1,218	45,186,440
Current balance of all mortgages (dollars)	74,490	434,789	1,254,805	3,265	45,186,440
Duration of mortgage debt (percent)	74,134	10.9	6.1	0.9	36.5
Property value—Book value of debt (dollars)	74,490	329,025	1,289,595	(11,447,40)	122,489,649
Property value—Market value of debt (dollars)	74,490	290,648	1,305,027	(14,050,277)	117,213,433
Current interest rate less .10	74,134	0.006	0.017	-0.100	0.075
Prepayment option	74,490	0.170	0.376	0	1.00
First mortgage assumeable	74,490	0.119	0.324	0	1
Year of origination of first mortgage	74,490	86.2	2.9	80	91
Term of first mortgage	74,490	22.2	9.2	0	50
Remaining term on first mortgage	74,404	17.4	9.0	-1	50
Number of years since acquisition	74,490	7,320	5,593	1	74
Owned by individual	74,490	0.713	0.452	0	1
Owned by partnership	74,490	0.200	0.400	0	1
Owned by nonprofit	74,490	0.006	0.074	0	1
REIT	74,490	0.012	0.108	0	1
First mortgage FHA insured	74,490	0.051	0.219	0	1
Some type of assistance	74,490	0.158	0.365	0	1

Source: Authors' calculations from the 1991 RFS.

Table 5. Distribution of Key Variables by Duration Rank

	Duration of Mortgage Debt				
	Less than .062	**.062 to .137**	**.138 to .173**	**.174 to .205**	**Greater than .2051**
Number of properties	23,874	20,626	19,977	7,650	2,007
Duration of mortgage debt	0.041	0.096	0.158	0.186	0.255
Equity at book value (dollars)	317,426	236,993	249,031	467,500	1,642,330
Equity at market value (dollars)	319,275	192,066	178,851	440,571	1,440,211
Contract rate less .10	0.0057	0.0084	0.0074	-0.00375	-0.0068
Origination year	85.8	85.7	86.7	87.8	85.5
LTV	0.37	0.59	0.67	0.72	0.82
Size of mortgage (dollars)	196,411	305,622	414,225	813,911	3,405,808
Original term	12.4	21.4	29.1	31.9	42.5
FHA insured	0.003	0.011	0.044	0.200	0.520
Years since acquisition	9.0	7.8	5.7	4.5	7.5

Note: Unweighted number of observations equals 1,253.

Source: Authors' calculations from the 1991 RFS.

Table 6. Variations in Interest Rate Differentials and Duration

	Current Rate Less .10				Duration	
Dependent Variable/Variable	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**	**Estimate**	**T-ratio**
Intercept	0.003	4.97	0.007	4.40	-0.046	-28.70
Term of first mortgage	-0.0004	-20.03	0.000	-5.31	0.006	118.86
Years since acquisition = 1	-0.001	-1.10	-0.006	-2.26	0.042	16.84
Years since acquisition = 2	0.001	0.73	0.003	1.16	0.033	15.90
Years since acquisition = 3	-0.001	-0.98	-0.001	-0.49	0.030	16.54
Years since acquisition = 4	0.001	0.92	0.001	0.62	0.025	11.85
Years since acquisition = 5	0.003	2.94	0.001	0.58	0.018	10.74
Years since acqusition = 6	0.005	6.01	0.006	3.64	0.013	7.85
Years since acqusition = 7	0.004	4.56	0.004	2.20	0.012	6.92
Prepayment option	0.0009	1.85	0.0006	0.46	0.0067	5.96
First mortgage assumeable	0.0012	2.12	-0.0002	-0.15	-0.0013	-0.95
Value of property	-2.96E-10	-6.48	-2.65E-10	-2.18	2.50E-10	2.19
Value per unit	4.93E-09	0.74	6.25E-09	0.33	-9.96E-09	-0.56
Equity	1.51E-10	2.61	1.49E-10	0.89	-3.63E-10	-2.32
First mortgage FHA insured	-0.0093	-12.33	-0.0067	-4.92	0.0010	0.76
Root MSE	0.017		0.018		0.017	
Mean of dependent variable	-0.007		-0.003		0.144	
R^2	0.200		0.120		0.943	
Adjusted R^2	0.198		0.110		0.942	
N	6,000		1,247		1,247	

Table 7. Distribution of Debt Coverage Ratio
Properties with a First Mortgage

	N	Mean	75th	50th	25th
All	235,171	2.91	1.95	1.36	0.94
Ownership Type					
Individual	71.9	3.25	1.90	1.33	0.89
Partnership	19.5	1.94	2.04	1.55	1.15
Nonprofit	0.6	1.72	3.29	0.95	0.31
Corporation	3.2	1.38	2.00	1.24	0.97
Other	4.5	1.94	2.09	1.45	0.82
Mortgage Type					
Fixed Rate	58.3	1.86	2.19	1.44	0.97
Short-Term with Bailout	10.2	13.52	2.01	1.45	0.98
Graduated Payment	0.3	1.08	1.54	1.15	0.37
Adjustable Rate	30.9	1.34	1.63	1.22	0.84
Other	0.4	7.61	21.38	1.86	0.27

Source: Authors' calculations from the 1991 RFS.

Table 8. Debt Coverage Ratios by Ownership Type and Vacancy Losses

Number of Units	Losses as a Percent of Rent	Distribution of Units	N	Mean	75th	50th	25th
Individual Investors							
Less than 10 units	< .05	0.23	55,016	1.81	2.01	1.44	1.05
10 to 50 units	.05 to .10	0.08	19,932	1.46	1.57	1.20	0.89
More than 50 units	> .10	0.16	38,650	1.07	1.40	0.97	0.54
Less than 10 units	< .05	0.12	27,775	2.03	2.42	1.57	1.06
10 to 50 units	.05 to .10	0.05	12,801	2.25	2.66	1.67	1.08
More than 50 units	> .10	0.07	15,721	1.04	1.67	1.07	0.64
Less than 10 units	< .05	0.01	1,893	2.56	2.67	1.74	1.26
10 to 50 units	.05 to .10	0.00	989	2.30	2.78	1.78	1.34
More than 50 units	> .10	0.00	1,155	247.88	2.18	1.46	1.10
Individual Total		0.72	173,932				
Partnerships							
Less than 10 units	< .05	0.03	7,631	1.15	1.55	1.26	0.78
10 to 50 units	.05 to .10	0.00	1,125	3.65	2.45	2.45	3.45
More than 50 units	> .10	0.01	3,028	1.60	1.75	1.61	1.13
Less than 10 units	< .05	0.05	11,102	2.06	2.22	1.50	1.15
10 to 50 units	.05 to .10	0.02	4,715	1.68	1.83	1.39	1.19
More than 50 units	> .10	0.02	3,766	1.64	1.97	1.17	0.99
Less than 10 units	< .05	0.03	7,421	2.28	2.36	1.83	1.40
10 to 50 units	.05 to .10	0.02	4,419	2.83	2.17	1.68	1.35
More than 50 units	> .10	0.02	3,951	1.93	2.16	1.65	1.24
Partnership Total		0.20	47,158				

Source: Authors' calculations from the 1991 RFS.

Table 9. Distribution of Current LTV

		Mean	99th	75th	50th	25th	1st
All Properties							
Ownership Type							
Individual	72.4	0.39	1.31	0.64	0.39	0.04	0.00
Partnership	16.4	0.61	1.49	0.82	0.66	0.37	0.00
Nonprofit	1.1	0.25	0.99	0.55	0.00	0.00	0.00
Corporation	3.5	0.42	1.59	0.73	0.42	0.00	0.00
Other	6.8	0.41	1.87	0.69	0.30	0.00	0.00
Total	332,195	0.43	1.50	0.68	0.42	0.06	0.00
Mortgage Type							
Fixed Rate	41.4	0.58	1.60	0.79	0.58	0.33	0.02
Balloon	14.5	0.69	1.65	0.87	0.71	0.50	0.04
Graduated Payment	0.8	0.75	1.96	0.98	0.72	0.57	0.02
Adjustable Rate	11.9	0.69	1.62	0.82	0.68	0.54	0.08
Other	0.8	0.88	1.98	1.11	0.80	0.65	0.07
Missing	30.6	0.04	0.96	0.00	0.00	0.00	0.00
Properties with Current Mortgage Debt Greater than 0							
Ownership Type							
Individual	70.9	0.51	1.37	0.69	0.51	0.29	0.02
Partnership	19.2	0.67	1.52	0.83	0.68	0.47	0.03
Nonprofit	0.6	0.59	1.11	0.75	0.75	0.40	0.05
Corporation	3.2	0.59	1.66	0.78	0.59	0.40	0.01
Other	6.0	0.59	1.87	0.75	0.60	0.24	0.03
Total	260,228	0.55	1.46	0.73	0.55	0.33	0.02
Mortgage Type							
Fixed Rate	58.2	0.58	1.60	0.79	0.58	0.33	0.02
Balloon	20.4	0.69	1.65	0.87	0.71	0.50	0.04
Graduated Payment	1.2	0.75	1.96	0.98	0.72	0.57	0.02
Adjustable Rate	16.7	0.69	1.62	0.82	0.68	0.54	0.08
Other	1.1	0.88	1.98	1.11	0.80	0.65	0.07
Missing	2.4	0.64	1.31	0.90	0.67	0.38	0.04

Source: Authors' calculations from the 1991 RFS.

Table 10. Loan to Value Ratio (LTV) Regression Results

Variable	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio	Estimate	t-ratio
Intercept	0.305	23.124	0.312	24.881	0.867	47.690	0.831	47.461	0.7878	50.464
Time	-0.021	-24.683	-0.018	-22.473	-0.023	-21.704	-0.025	-24.413	-0.020456	-19.27
$Time^2$	2.77E-04	13.63	2.28E-04	11.73	2.26E-04	7.63	0.00	8.132	0.000173	5.849
Number of Units	1.28E-04	2.23	2.89E-05	0.53	2.77E-04	4.44	0.00	4.476	0.000405	5.984
Number of $Units^2$	-8.19E-08	-0.93	3.19E-08	0.38	-1.78E-07	-1.87	0.00	-1.864	-0.000000216	-2.269
Value									-1.79E-09	-3.105
Value/Unit	-1.51E-06	-20.05	-1.03E-06	-14.00	-1.16E-06	-13.89	0.00	-12.996	-0.000001042	-8.725
Partnership	0.051	5.870	0.055	6.723	0.058	5.936	0.054	5.730	0.064126	6.553
Nonprofit	0.009	0.496	0.018	1.023	0.027	1.351	0.033	1.711	0.03354	1.68
Individual	-0.018	-1.786	0.005	0.514	-0.003	-0.283	-0.005	-0.481	-0.004493	-0.387
REIT									-0.007583	-0.198
Assisted	0.027	3.191	0.022	2.775	0.037	4.093	0.041	4.752	0.057014	6.722
FHA	0.506	45.104	0.503	47.145	0.005	0.329	0.006	0.404	0.023964	2.273
Uninsured	0.502	74.988	0.504	79.215	0.004	0.343	0.005	0.435		
Tax Exempt	0.188	12.585	0.170	11.983	0.053	3.800	0.050	3.733		
Prepayment									-0.002	-0.340
Assume									-0.001	-0.147
Inside Central City	0.007	1.046	0.005	0.769	-0.003	-0.398	-0.001	-0.172	-0.002955	-0.442
New York	-0.073	-7.489	-0.052	-5.592	-0.070	-6.133	-0.071	-6.493		
California	-0.022	-2.634	-0.012	-1.435	-0.030	-3.357	-0.035	-4.059		
Texas	0.028	2.470	0.021	1.987	0.026	2.095	0.028	2.379		
Flirida	-0.031	-2.287	-0.036	-2.797	-0.054	-3.739	-0.050	-3.622		
Appreciation Rate			-1.288	-30.578	-1.775	-36.994	-1.966	-42.063	-1.8486	-38.225
Debt-Coverage Ratio					0.00000024	0.275	0.00000035	0.416	2.78E-08	0.323
Initial LTV							0.056	22.782		
ARM									0.078829	8.228
Balloon									0.06563	7.34
More than 1 Mortgage									0.069409	7.716
Adjusted R^2	0.51		0.56		0.45		0.49		0.46	
N	8,774		8,774		5,850		5,850		5,712	
MSE	0.28		0.27		0.25		0.24		0.24	

Source: Authors' calculations from the 1991 RFS.

Table 11. Loan to Value (LTV) Regression Results

Variable	Estimate	T-ratio
Initial LTV		
Intercept	0.78	52.63
Number of Units	0.0004	10.83
Purchase Price	-0.00000001	-13.60
Partnership	0.03	3.79
Nonprofit	0.08	5.06
Individual	0.00	0.14
Assisted	0.05	5.48
FHA	0.08	6.12
Uninsured	0.02	2.19
Tax Exempt	0.05	4.38
Inside City	0.00	-0.65
New York	-0.10	-8.92
California	-0.04	-4.29
Texas	-0.02	-1.72
Florida	-0.02	-1.73
Adjusted R^2	0.217	
N	2,944	
MSE	0.164	

Distribution of LTV for Properties Purchased with One Mortgage

		Percentile				
	Mean	**99th**	**75th**	**50th**	**25th**	**1st**
	0.80	1.12	0.91	0.79	0.71	0.24

Endnotes

1. The Multifamily Housing Institute is a newly established and privately funded organization is also calling for more information and taking steps to develop a comprehensive data base.

2. Blackley and Follain (1995) and Crews, Dunsky, and Follain (1995) discuss some of the issues related to these new affordable housing goals. The December 1, 1995 issue of the Federal Register contains a complete discussion of the new rules.

3. A recent special issue of the *Journal of Housing Research*, 6(2), 1995 contains an excellent collection of papers on the topic.

4. The linkage between the probability of default and investor equity depends upon whether the loans are nonrecourse; that is, the lender has no recourse to the other assets of the borrower in case of default. Although the RFS provides no information about this particular trait of the mortgages, it is our understanding that most multifamily loans are nonrecourse.

5. 6,242 have some mortgage debt, which means that 150 have home equity debt and no first mortgage. Most of the tables are based upon the sample with a first mortgage, but a few results are based upon the larger sample. We did not notice this distinction until after we had completed our time at the Bureau of the Census; however, a few checks suggest that differences in the statistics between the two samples are small and insignificant.

6. The RFS definition of a property includes all land and buildings covered by a single first mortgage. If not mortgaged, the property includes the land and buildings identified by the address that appeared on the Census questionnaire label. Thus, a property may include more than one structure. The unit of analysis used in this paper is the property.

7. Descriptive statistics in Bogdon and Follain (1996) may differ from those reported here since some statistics in that paper are reported for the entire multifamily sample or for different subsets of multifamily properties.

8. We express duration in percentage terms, although some discussions of duration report it in terms of years.

9. Computing duration for other balloon mortgages and some other types required more information than was available.

10. Let DCR_1 equal NOI_1/x, where NOI_1 is net operating income computed using the RFS; DCR_2 equals NOI_2/x, where NOI_2 is net operating income with a more accurate estimate of expenses. Then DCR_1/DCR_2 equals NOI_1/NOI_2. Thus, the degree of overstatement of DCR using the RFS equals the degree of overstatement of NOI.

11. The sample size used to compute the distribution by ownership type is 6,242.

12. The sample size in the bottom portion of Table 9 is 6,242.

13. Ordinary least squares (OLS) estimates of the equation with all properties is not the ideal estimator because this sample includes many with a zero LTV; a Tobit estimator would be preferred. However, the major conclusions are similar among the estimates obtained with the full sample and with the sample that only includes properties with a mortgage, i.e., LTV > 0.

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