

Alternative Measures for the Financial Condition of the Multifamily Housing Stock

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Abstract

Indicators of the financial condition of the multifamily housing stock can potentially inform several policy issues, such as the loss of affordable rental units, multifamily developers' access to capital, and the emerging secondary mortgage market for multifamily properties. Several rules of thumb exist for assessing financial condition. This article uses the Residential Finance Survey to investigate whether it matters, from a practical standpoint, which one is employed. Specifically, we ascertain how five measures—loan-to-value, debt coverage, rent-to-value, net operating income-to-value, and vacancy loss ratios—relate to each other and rank properties.

We found that Pearsonian correlations among the measures varied dramatically. Factor analysis produced two factors, one corresponding to a rent-flow measure and the other to a debt-burden measure. Spearman rank-order correlations revealed that with one exception, measures yielded noticeably dissimilar financial condition rankings. We conclude that single-dimensional measures of financial condition should not be used in isolation.

Keywords: Multifamily; Default; Mortgages

Introduction

Indicators of the financial condition of the multifamily housing stock can potentially provide crucial input to several contemporary issues. First, over the past decade concern has grown over the loss of affordable multifamily stock, due in part to abandonment and upgrading by owners who perceived bleak financial prospects for their properties in modest-quality housing submarkets (Clay 1987). Second, given the cutbacks of new Federal Housing Administration insurance, access to capital for affordable housing requires that multifamily properties meet industry standards in terms of credit quality, which can only be assessed through reference to financial

performance; the same is true for increasing equity investments in multifamily housing at all rent levels (DiPasquale and Cummings 1992). Third, expanding the fledgling secondary mortgage market for multifamily properties requires enhanced standardization of multifamily loans and documentation of the underlying underwriting and instrument, both of which presume extensive knowledge of the performance and risks of multifamily mortgages (Cummings and DiPasquale 1998; DiPasquale and Cummings 1992).

Several alternative rules of thumb exist for assessing the financial condition of the multifamily rental stock.¹ This article investigates whether it matters, from a practical standpoint, which one is employed for such an assessment.

We consider five indicators:

1. *Loan-to-value ratio (LTV)*. LTV is the amount of mortgage principal outstanding divided by the owner-assessed current value of the property. LTV is often seen as an indicator of the probability that an owner will choose to exercise the mortgage default option. LTVs close to or greater than unity are indicative of the property's weakening market competitiveness since the issuing of the mortgage (typically with an LTV of 0.70 or less), with concomitant erosions of owner equity in the property.
2. *Debt coverage ratio (DCR)*. DCR is the net operating income (NOI) per period divided by mortgage principal and interest payments per period, where NOI is the sum of total rental receipts per period (R) minus expenses of utilities, taxes, and insurance per period.² DCR is suggestive of how much net cash is being produced by the property relative to the needs for mortgage repayments. Lower values of DCR are indicative of situations with insufficient rental revenues and/or excessive expenses in one or more categories.
3. *Net operating income-to-value ratio (NOITV)*. A widely used measure of the financial condition of commercial real estate is the capitalization, or cap, rate, defined as first-year NOITV (Abraham and Theobald 1997); it is derived by dividing NOI by

¹ For different indicators of the financial condition of the U.S. Department of Housing and Urban Development (HUD)-insured multifamily stock, see Hodes et al. (1987) and Wallace et al. (1993).

² Note that DCR normally includes such expenses as administration, operation, maintenance, and repairs, but these variables unfortunately are not available in the Residential Finance Survey (RFS).

the owner-assessed current property value (V). Although our current-period NOITV is not identical to the cap rate, it is directly related to the rate of return ultimately to be earned on the given property.³

4. *Rent-to-value ratio (RTV)*. RTV, or total rental receipts (R) per year divided by V , is similar to NOITV, but the numerator of the former involves gross, not net, rental streams. In competitive markets, RTV will, in long-run equilibrium, equal the user cost of capital, a point we will draw upon later.
5. *Vacancy loss ratio (VLR)*. VLR represents rents lost due to vacant units during a year divided by the potential annual rental revenue if all units were occupied during the entire year. VLR focuses on the relative competitiveness of a property from the perspective of tenants. Properties with VLRs that significantly exceed those associated with normal turnover are operating in a weak market situation and/or are badly managed.

We operationalize these indicators of the financial characteristics of the multifamily housing stock with data from the 1991 Residential Finance Survey (RFS).⁴ We address two questions:

1. To what degree are alternative indicators of the financial condition of the multifamily stock related to each other?
2. To what degree do alternative measures of the financial condition of the multifamily stock similarly rank properties?

The article is organized as follows. We begin with a theoretical examination of the interrelationships among the five indicators from a user-cost-of-capital perspective. Next, we provide an overview of the 1991 RFS and present descriptive statistics on the alternative indicators. We then evaluate how closely associated these alternative indicators are by computing Pearsonian correlations, a factor analysis, and Spearman rank-order correlations. Finally, we conclude that different indicators of financial condition typically are not highly correlated for the multifamily stock and produce highly dissimilar rankings of financial condition.

³ Note that the cap rate is not equivalent to the return on investment because the latter includes future income from operations and the capital gain or loss from future sale of the property.

⁴ This article is part of a series of reports written about multifamily housing using the 1991 RFS, which was sponsored by HUD with a grant to the Urban Institute. For other papers in this series, see Bogdon and Follain (1996a, 1996b) and Follain and Calhoun (1997).

Interrelationships among alternative financial indicators from a user-cost-of-capital perspective

The theory of the user cost of capital for investors in multifamily property offers a straightforward vehicle for seeing the interrelationships among several financial indicators. The user-cost-of-capital equation, as modified from the seminal formulation of Follain and Ling (1988) by Bogdon and Follain (1996b), may be expressed as follows:

$$\frac{R}{V} = i\left(\frac{L}{V}\right) + c\left(1 - \frac{L}{V}\right) + d^* + p + m - \pi \frac{(1 - \lambda t_y)}{(1 - t_y)} - \frac{(d^* - d)}{(1 - t_y)} + \sigma \quad (1)$$

where

R = rent

V = property value

L = mortgage loan amount (based on the current mortgage contract interest rate)

π = anticipated inflation or expected capital gains on the property

i = mortgage interest rate

c = opportunity cost of equity (before tax)

d = actual depreciation rate

d^* = tax depreciation rate

p = property tax rate

m = rate of miscellaneous expense

t_y = tax rate on (investor) income

λ = preferential rate of taxation on capital gains

σ = measure of the risk premium associated with multifamily development

It is clear from a partial differentiation of equation (1) that RTV and LTV should be positively correlated so long as $i > c$, but the degree of correlation will depend directly on the cross-sectional similarity of interest rates (i) being paid by owners of sampled properties net of their opportunity costs for equity (c). Given that mortgages were acquired in different interest rate regimes, such similarity may be quite minimal. Moreover, property tax rates (p), rates of miscellaneous expense (m), anticipated capital gains (π), and actual depreciation rates (d) likely vary within and among local housing markets, producing additional variability that may reduce the cross-sectional association between RTV and LTV.

NOI can be symbolized in terms of the above equation as $[R - (p + m)V]$; NOITV can thus be expressed as $RTV - (p + m)V$. NOITV and RTV should therefore be highly positively correlated unless the cross-sectional variation in $(p + m)$ is substantial.

Similarly, NOITV and LTV should be positively correlated but less so inasmuch as all the locally variant parameters just cited again come into play here.

DCR is simply NOI divided by periodic loan repayments (a positive function of L): $[R - (p - mV)]/f(L)$. Thus, the relationship between DCR and LTV cannot be predicted unambiguously, depending on whether the L or V effects predominate. DCR should be positively correlated with RTV and NOITV because higher R and/or lower V should raise DCR. The correlation between DCR and NOITV should be somewhat higher, however, inasmuch as only cross-sectional variations in p , m , and/or $f(L)$ will influence NOITV, whereas all the previously mentioned parameter variations will affect RTV.

VLR is the least easily understood indicator within the context of equation (1); only R appears both in the definition of VLR (in the denominator) and in equation (1) (in the numerator). Thus, we can predict that VLR will be negatively correlated with RTV, NOITV, and DCR;⁵ its relationship with LTV is unpredictable.

About the 1991 RFS⁶

The RFS is conducted by the U.S. Bureau of the Census and is designed to provide information about the financial, ownership, and structural characteristics of nonfarm, privately owned residential properties in the United States. The RFS has been conducted as part of the decennial Censuses of Housing since 1950. Questionnaires are completed by the property owner or agent and by the holder(s) of any mortgages on the property. The potential universe in the 1991 RFS is about 66 million properties securing 38 million mortgages; the sample comprises about 70,000 properties (including all property types).

In the RFS, a property is typically not synonymous with an individual structure. Instead, if mortgaged, a property is defined as all land and buildings covered by a single first mortgage. If not mortgaged, the property is defined as the land and building(s) identified by the address that appeared on the questionnaire label. Thus, a multifamily rental property could consist of a single apartment building or a complex consisting of several apartment buildings.

⁵ This assumes a relatively constant relationship between rents and vacancy losses across different types of properties.

⁶ This section is based on Bogdon and Follain (1996b). Amy Bogdon created the RFS database used in this research and provided invaluable assistance at many stages in this article's formulation.

The property comprises the unit of observation for the analyses in this article.

The RFS public use file has several important limitations stemming from the U.S. Bureau of the Census's need to preserve the confidentiality of respondents and their properties. In particular, the file's use of ranges instead of exact values for many variables, the top coding of responses, the introduction of random noise for some responses, and the coding of mean values of an interval for all observations in that interval proved especially problematic for our analyses. To overcome these limitations and to access census tract identifiers not available on the public use file, we sought and were granted access to the internal census files.

As a result of this special access, our team created a unique database of multifamily rental properties. Of the 8,210 RFS sample renter-occupied and vacant properties with five or more units that were not condominiums or mobile homes and that had been screened for valid data ranges, 5,816 (70.8 percent) had positive mortgage debt reported.⁷ Of this subset, 4,858 had complete information on all the financial indicators and were used for the current analyses.⁸ This internal census file of the RFS was augmented with 1990 census tract information obtained from the Urban Institute's Underclass Database.

Two shortcomings of the internal RFS data files must be noted. First, information on the costs of administration, operation, maintenance, and repairs is not available. This means that measured NOI (and thus DCR and NOITV) is exaggerated. Second, property values are owners' estimates. Although previous research has indicated that owners of single-family homes estimate their properties' values in an unbiased (though often erroneous) fashion, there is no comparable research about multifamily property owners' estimates. Despite the measurement errors in our indicators, we have no reason to believe that they might be systematically related to particular values of our financial indicators in such a way that the inter-indicator measures of association we apply will be distorted.

⁷ Observations were deleted if the land was not owned by the building owner, if the property was converted from nonresidential use, and if the property was not purchased but was acquired by some other means. Observations were also excluded if they possessed one or more of the following extreme values: 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 LTV greater than 2 or an RTV greater than 1.

⁸ By far, the largest category of missing data was vacancy losses.

Descriptive statistics for various financial characteristics of multifamily properties for which complete financial information is available are presented in table 1.⁹ Table 2 presents descriptive statistics for our five alternative financial indicators.¹⁰ In both tables the statistics relate to the RFS sample weighted to make them nationally representative,¹¹ and the data are stratified into properties that have mortgage debt outstanding and those that do not. These univariate statistics, however, should be interpreted cautiously because they do not hold constant numerous other regional, neighborhood, and property characteristics.

The financial characteristics of these two groups differ on several dimensions. The indebted stock generally had (on a per unit basis) higher mean values and rents but lower mean appreciation rates, lower vacancy losses, and lower expenses-to-value ratios. On average, the indebted stock had $LTV = 0.568$, $DCR = 1.703$, $RTV = 0.137$, $NOITV = 0.096$, and $VLR = 0.111$. Compared with the indebted stock, multifamily properties without debt had, on average, very similar RTVs, NOITVs, and VLRs. However, given that two of our five indicators can be operationalized meaningfully only for the indebted stock, we focus on this segment for the remainder of the article.

All indicators of financial conditions of the indebted multifamily stock varied substantially. DCR and NOITV assumed both substantial positive and negative values. LTV ranged from nearly 0 to almost 2. RTV varied from almost 0 to 0.874. VLR extended the full range mathematically permitted: 0 to 1. The forms of the frequency distributions, though all unimodal and positively skewed for all indicators, were quite different.¹²

Empirical interrelationships among indicators of the financial condition of the indebted multifamily stock

The theoretical discussion in the previous section indicated that whereas several indicators were likely to be closely correlated, it

⁹ Descriptive statistics for the geographic, structural, and neighborhood characteristics of the sample are presented in Bogdon and Follain (1996b).

¹⁰ In this article, we do not investigate the correlates of these various measures of financial condition. This is done in Bogdon and Follain (1996a, 1996b).

¹¹ These and other data are based on the RFS sample after the national mortgage weights available in the RFS have been applied. The RFS codebook suggests applying these weights when analysis of mortgage-related information is pursued.

¹² Frequency distributions are available from George Galster.

*Table 1. Financial Characteristics of the Multifamily Housing Stock
(by Mortgage Indebtedness Status)*

Characteristic	Total (N = 6,653)	Mortgage Debt Outstanding?		
		Yes (N = 4,858)	FHA-Insured (N = 878)	No (N = 1,795)
Current property value*	\$ 1,067,362.38	\$ 1,173,111.80	\$ 3,858,097.67	\$ 570,807.19
Current value per unit	\$ 43,194.53	\$ 44,138.52	\$ 43,702.48	\$ 38,761.96
Average annual appreciation rate	5.56%	5.37%	3.55%	6.47%
Average rent per unit/year	\$ 4,655.36	\$ 4,801.75	\$ 5,297.35	\$ 3,967.95
Total rental receipts/year	\$ 137,607.56	\$ 151,332.71	\$ 511,947.60	\$ 73,160.00
Total expenses (including debt service)/year	\$ 97,164.18	\$ 113,329.98	\$ 345,728.01	\$ 21,256.32
Total annual principal plus interest on all mortgages	\$ 62,387.05	\$ 75,673.38	\$ 201,145.40	NA
Losses due to vacancies/year	\$ 13,533.17	\$ 14,252.56	\$ 32,203.15	\$ 10,155.20
Vacancy loss per unit/year	\$ 590.89	\$ 548.69	\$ 352.60	\$ 789.06
Expenses (excluding debt service)/value	4.28%	4.07%	4.61%	5.27%

Source: Normalized mortgage-weighted 1991 RFS.

Note: FHA = Federal Housing Administration. NA = not applicable.

*Assessed by owner.

**Table 2. Descriptive Statistics for Financial Condition Measures
(by Mortgage Indebtedness Status)**

Measure	Mortgage Debt Outstanding							
	Yes (N = 4,858)				No (N = 1,795)			
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.
LTV	0.568	0.320	0.001	1.960	NA	NA	NA	NA
DCR	1.703	1.887	-5.418	24.284	NA	NA	NA	NA
RTV	0.137	0.074	0.001	0.874	0.143	0.062	0.009	0.980
NOITV	0.096	0.065	-0.389	0.848	0.090	0.063	-0.704	0.904
VLR	0.111	0.123	0.000	0.987	0.147	0.120	0.0000034	0.876

Source: Normalized mortgage-weighted 1991 RFS.
Note: NA = not applicable.

was by no means an empirical certainty; other pairs of indicators appear in theory to be measuring quite distinct aspects of financial condition. Thus, the degree to which the indicators are inter-correlated and whether they rank the indebted multifamily stock similarly in terms of financial condition remain open empirical questions.

Pearsonian correlations

First, we calculated Pearsonian bivariate correlations for all pairs of indicators. The results are presented in table 3. The results conform closely to the theoretical prediction made earlier. RTV and NOITV are the two most highly correlated indicators by far (0.861); at the other extreme, LTV and VLR are virtually uncorrelated. With these two exceptions, all other correlation coefficients have absolute values in the range of 0.186 to 0.387. Although these correlations are not trivial (and are statistically significant), they suggest that different indicators do, indeed, capture some distinctive empirical dimensions of financial condition.

Factor analysis

To explore further the patterns of common variation among indicators, we next undertook a factor analysis. To maximize the explanatory power of the factor(s) estimated and the chance that all five variables might load on one factor, we used the varimax rotation procedure. The principal components analysis produced two factors with eigenvalues greater than unity; together they explained 62 percent of the variation in the data.¹³ The standardized factor-scoring coefficients produced by the varimax rotation of these components are presented in table 4.

Table 3. Pearsonian Correlations between Measures of Financial Condition (Multifamily Properties with Mortgage Debt)

	DCR	RTV	NOITV	VLR
LTV	-0.378	0.259	0.229	-0.022
DCR		0.289	0.387	-0.221
RTV			0.861	-0.186
NOITV				-0.297

Source: Normalized mortgage-weighted 1991 RFS.

¹³ Factor 1 had an eigenvalue of 2.04 and explained 41 percent of the variance; for factor 2 the corresponding figures were 1.03 and 21 percent.

Table 4. Standardized Scoring Coefficients for Generating Composite Indicators of Financial Condition

Indicator	Factor 1: Rent Flow	Factor 2: Debt Burden
LTV	0.137	0.631
DCR	0.201	-0.533
RTV	0.412	0.117
NOITV	0.427	0.047
VLR	-0.200	0.148

Source: Generated by principal components analysis with varimax rotation of normalized mortgage-weighted 1991 RFS data.

RTV and NOITV load most heavily on the first factor with, not surprisingly, roughly equal weights. The next two components, DCR and VLR, enter positively and negatively, respectively (as expected), with roughly half the weights of RTV and NOITV. All this suggests that this factor primarily involves elements dealing with the relative flows of rental revenues compared with outlays; stronger flows result in higher values for this factor index. We thus label this the rent-flow factor. Surprisingly, LTV enters this factor with a positive sign, though with small weight.

LTV and DCR load overwhelmingly on the second factor. Higher values of LTV and/or lower values of DCR produce higher values for this factor; we therefore label it the debt-burden factor. Note that unlike the rent-flow factor, the debt-burden factor measures the extent of an *undesirable* financial situation. Also note that RTV and NOITV enter this second factor with counterintuitive signs, albeit with trivial weights.¹⁴

The results of our factor analysis can be viewed as support for the arguments forwarded by Abraham (1993, 1999) and Abraham and Theobald (1997). They suggest that both a property's cash flow and its equity are important in assessing the credit quality of the commercial mortgage. Here LTV clearly evinces a separable empirical dimension from most of the indicators of cash flow, although a dimension of cash flow (DCR) loads heavily with LTV in creating the second, debt-burden factor.

Spearman's rank-order correlations

As a final investigation, we calculated Spearman's rank-order correlation coefficients for all pairwise combinations of the five individ-

¹⁴ Frequency distributions of the two factors are available from George Galster.

ual indicators as well as the two composite indicators based on the factor analysis. These coefficients indicate the extent to which two indicators similarly rank the observations in the data set. Note that even if two indicators were not highly correlated in a Pearsonian sense, they may yield nearly identical rank orderings. Thus, if one wished merely to list multifamily properties from strongest to weakest financial condition, the Spearman's test would indicate the degree to which alternative indicators produced common orderings. Results are shown in table 5, which indicates that with one exception, all the Spearman's coefficients are statistically significant. Corresponding to their high degree of Pearsonian correlation, RTV and NOITV evince the highest Spearman's coefficient (0.919), implying that these two indicators can effectively be used as substitutes for assessing financial condition. VLR produces the lowest Spearman's coefficients for all of the other four indicators, ranging (in absolute value) from only 0.017 to a maximum of 0.245, suggesting thereby that assessing financial condition through VLR alone would produce a more profoundly distinctive ranking of the indebted multifamily stock than would the use of any other single indicator. The remaining coefficients for individual indicators cluster in the absolute value range of 0.355 to 0.435, implying that although they produce a good deal of commonality in their rankings, LTV, DCR, and NOITV yield potentially important differences in how they rank the stock. The point here is not to make any claims about which ranking is *better* but rather to show that the rankings will differ, which may have practical import, depending on the analyst's purposes.

The Spearman's correlation coefficient between the rental-flow and debt-burden composite indexes is -0.226 . This modest negative value is not surprising, given that the two indexes were created from a factor analysis and that they loaded heavily only on factors indicative of stronger or weaker financial conditions, respectively. Similarly unsurprising, given how they were constructed, the in-

Table 5. Spearman's Rank-Order Correlations between Measures of Financial Condition (Multifamily Properties with Mortgage Debt)

	DCR	RTV	NOITV	VLR	Rent Flow	Debt Burden
LTV	-0.416	0.358	0.355	0.146	0.356	0.943
DCR		0.370	0.435	-0.245	0.479	-0.583
RTV			0.919	-0.017	0.940	0.291
NOITV				-0.042	0.962	0.254
VLR					-0.156	0.290
Rent-flow index						-0.226

Source: Normalized mortgage-weighted 1991 RFS.

dexes evince the highest Spearman's coefficients with the constituent components on which they load most heavily. These results show that (1) the two composite indexes of financial condition perform strongly in capturing the explanatory essence of their (heavily weighted) constituent indicators, with the possible exception of VLR; and (2) they produce quite distinctive property financial condition rankings from each other.

Conclusion

This article used the internal U.S. Bureau of the Census's files of the 1991 RFS to explore the financial characteristics of a nationally representative sample of the multifamily housing stock. Five conventional rule-of-thumb indicators were calculated from the data, and their interrelationships investigated by a variety of methods.

We found that Pearsonian correlations among the indicators varied dramatically, with RTV and NOITV being the most highly correlated (0.861) and LTV and VLR the least (-0.0222). Moreover, the Pearsonian correlation between LTV and DCR, two of the most frequently used indicators, was only -0.378 . Our factor analysis produced two factors, one corresponding heuristically to a rent-flow measure (on which RTV and NOITV are heavily loaded) and the other to a debt-burden indicator (on which LTV and DCR load heavily). The Spearman's rank-order correlations revealed that, with the exception of RTV and NOITV, all other single-dimension and factor-score indicators yielded noticeably dissimilar financial condition rankings.

Our results strongly reinforce the claim (see, for example, Colwell and Trefzger 1995) that single-dimensional, rule-of-thumb indicators should not be used in isolation to assess the financial condition of the nation's multifamily rental housing stock. But knowing which indicators are superior predictors (individually or in tandem) of default, prepayment, undermaintenance, and other behaviors of importance requires further empirical testing. The work of Vandell et al. (1993); Goldberg (1994); Mills and Lubuele (1994); Follain, Ondrich, and Sinha (1997); Goldberg and Capone (1998); and Abraham (1999) provide pioneering steps in this direction.

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References

- Abraham, Jesse. 1993. Credit Risk in Commercial Real Estate Lending. Unpublished paper. Freddie Mac.
- Abraham, Jesse. 1999. On the Use of a Cash Flow Time Series to Measure Property Performance. *Journal of Real Estate Research*, forthcoming.
- Abraham, Jesse, and H. Scott Theobald. 1997. A Simple Prepayment Model of Commercial Mortgages. *Journal of Housing Economics* 6:31–59.
- Bogdon, Amy, and James Follain. 1996a. An Examination of Three Sets of Indicators of Financial Risk among Multifamily Properties. Metropolitan Studies Program Series Occasional Paper No. 180. Syracuse University, Center for Policy Research.
- Bogdon, Amy, and James Follain. 1996b. Multifamily Housing: An Exploratory Analysis Using the 1991 Residential Finance Survey. *Journal of Housing Research* 7(1):79–116.
- Clay, Philip. 1987. *At Risk of Loss: The Endangered Future of Low Income Rental Resources*. Washington, DC: Neighborhood Reinvestment Corporation.
- Colwell, Peter, and Joseph Trefzger. 1995. Loan Underwriting Rules of Thumb. *Illinois Real Estate Letter*, Summer/Fall, pp. 11–14.
- Cummings, Jean, and Denise DiPasquale. 1998. Developing a Secondary Market for Affordable Rental Housing: Lessons from the LIMAC/Freddie Mac and EMI/Fannie Mae Programs. *Cityscape: A Journal of Policy Development and Research* 4(1):19–41.
- DiPasquale, Denise, and Jean Cummings. 1992. Financing Multifamily Housing: The Changing Role of Lenders and Investors. *Housing Policy Debate* 3(1):77–116.
- Follain, James, and Charles Calhoun. 1997. Constructing Indexes of the Price of Multifamily Housing Using the 1991 Residential Finance Survey. *Journal of Real Estate Finance and Economics* 14(1):235–55.
- Follain, James, and David Ling. 1988. Another Look at Tenure Choice, Inflation, and Taxes. *Journal of the American Real Estate and Urban Economics Association* 16:207–29.
- Follain, James, Jan Ondrich, and Gyan Sinha. 1997. Ruthless Prepayment? Evidence from Multifamily Mortgages. *Journal of Urban Economics* 41(1):78–101.
- Goldberg, Lawrence. 1994. *Claims Forecasting Models for FHA Multifamily Housing Loans*. Washington, DC: U.S. Treasury Department.

Goldberg, Lawrence, and Charles Capone. 1998. Multifamily Mortgage Credit Risk: Lessons from Recent History. *Cityscape: A Journal of Policy Development and Research* 4(1):93–113.

Hodes, Laurent, Donald Bradley, Stevenson Weitz, and James Hoben. 1987. *HUD / FHA-Insured Rental Housing: Physical and Financial Condition of Multifamily Properties Insured before 1975*. Washington, DC: U.S. Department of Housing and Urban Development, Office of Policy Development and Research.

Mills, Edwin S., and Luan' Sende Lubuele. 1994. Performance of Residential Mortgages in Low- and Moderate-Income Neighborhoods. *Journal of Real Estate Finance and Economics* 9(3):245–60.

Vandell, Kerry D., Walter Barnes, David Hartzell, Dennis Kraft, and William Wendt. 1993. Commercial Mortgage Defaults: Proportional Hazards Estimation Using Individual Loan Histories. *Journal of the American Real Estate and Urban Economics Association* (21)4:451–80.

Wallace, James, Meryl Finkel, Janine Sullivan, and Karen Rich. 1993. *Assessment of the HUD-Insured Multifamily Housing Stock, Final Report*, HUD-1412-PD. Vol. 1, *Current Status of HUD-Insured (or Held) Multifamily Rental Housing*. Washington, DC: U.S. Department of Housing and Urban Development, Office of Policy Development and Research.

