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Industrial Real Estate Mortgage Default Experience of the New York State Job Development Authority Second Loan Program: A Preliminary Investigation

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This paper explores the loan loss experience of a public industrial lending authority, employing contemporaneous borrower net equity as a link to mortgage loan default. The relationship between default, net equity and bankruptcy is tested on a small longitudinal data set of loans using nonparametric statistics and a proportional hazard model. Results show that negative net equity and firm bankruptcy are strongly associated with default among the study population. Further, the borrowers studied did not exercise the put option promptly, suggesting potential benefits from monitoring net equity one year or more prior to default.

Data on mortgage failure experience of public lending agencies are not readily available. As a result, much of the existing literature dealing with the financial consequences of real estate borrower default has focused on loans originated by private lending institutions (see Hartzell, Vandell, Barnes, Kraft and Wendt 1989; Titman and Torous 1988, and Vandell 1984, 1992 for commercial loans; and Cooperstein, Redburn and Meyers 1991; Epperson; Kau, et al., 1987; Foster and Van Order 1984, 1985; and Vandell and Thibodeau 1985 for residential loans).

Mortgage loan default rates vary substantially by lender type. This is largely attributable to public-purpose lenders serving a riskier borrower segment. Although the differing time periods and loan subordination requirements covered by the data make them difficult to compare directly, the incidence of foreclosure for private lenders (life insurance companies: 0.5 to 1.5% from 1970 to 1988; commercial banks: 1.5 to 2.0% in 1985; and savings and loans: 4.6% in 1986) were generally lower than for public real estate lenders (Connecticut Development Authority from 1972 to 1982: 3.7%).

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This research presents preliminary evidence on the industrial real estate mortgage experience of the New York State Job Development Authority's (NYJDA) Direct Second Loan program. The NYJDA functions as the state's economic development bank, extending financing to weaker industrial borrowers, often in economically depressed areas of the state. Between 1962 and 1988, the NYJDA approved a total of $477 million in direct loans and loan guarantees for nearly 1,800 projects, with an aggregate development cost of $1.4 billion. The Direct Loan Program represented over 75% of this loan activity (NYJDA 1988). Over 90% of the loans in the Direct Loan Program were for real estate purposes. Default frequencies for the NYJDA portfolio for loans originated between 1965 and 1982 averaged 4.4% (see Simons 1990). Because nearly all NYJDA loan packages included loan guarantees for the first lender, default on both first and second loans usually happened within a few months of one another. Thus, the default event here refers to both mortgages.

Results of this research show that negative net equity and firm bankruptcy are strongly associated with default among the loans sampled. Further, borrowers did not appear to exercise the put option promptly, suggesting potential benefits from monitoring net equity one year or more prior to default.

Sampling Plan and the Data Set

Extensive fieldwork was needed to build a data set containing the disaggregated longitudinal market and financial information needed for this research. A main objective was to obtain high quality estimates of market value of the property. Given resource constraints, the best available data required a retrospective matched pairs (non-random) sample plan. While the retrospective matched pair design has several important shortcomings (see Breslow and Day 1980; Lubin and Gail 1984), internal validity issues attributable to matched pairs in this research are manageable (Simons 1990, p. 230–236).

A data set of twenty defaulted loans paired with twenty non-defaults was created from the NYJDA portfolio. The loan matching process began with all fifty-one defaulted loans originated between 1965 and 1982. Loans originated after 1983 were excluded to avoid a right-truncation problem (Kiefer 1988). Confining the data gathering to predetermined geographic areas representative of the loan portfolio reduced the number of potential pairs to twenty-seven. Eliminating defaulted loans that could not be matched further reduced the number of pairs to twenty. A matching non-defaulted

loan was randomly selected from a small pool of loans meeting the matching criteria for each companion defaulted loan. All loans were followed through loan termination or 1989, whichever came later. The loan pairs (and criteria) were matched based on year of loan origination (within two years), size of loan (within 100%), location (same or contiguous county), ownership (wholly-owned subsidiary), debt levels (companion machinery and equipment loan) and industry type (durable/non-durable manufacturing). The overall matching procedure was generally successful, meeting the matching criteria 85.8% of the time. Sensitivity analysis confirmed the matching procedure did not materially affect test results.

Descriptive Statistics of the Sample

Descriptive statistics on the loan sample are presented in Table 1. The median original net equity for defaulted (case) loans is $30,900, equal to 9.2% of the original project cost, compared with $46,300, and 16.2% for non-defaulted (control) loans. This difference is consistent with the expected results.[1] As expected, defaulted loans experienced a median decrease in net equity of $60,000, compared with a median increase in net equity of $72,500 for non-defaulting loans. The median years of loan life for defaulted loans is 3.5 years. Forty percent of defaulted loans initially experienced negative net equity the year prior to default. Over 25% of defaulted loans had negative net equity for at least four years.

Bankruptcy was a common event among defaulted loans. Over half of these borrowers declared bankruptcy, compared with only one bankruptcy (5%) among non-defaulted loans.

A total of 45% of defaulted loans had one or both senior mortgage loans restructured prior to default. However, the median survival time after restructuring was only one year, indicating that loan restructuring was not very successful among defaulted loans. The consequences of waiting the additional year are substantial because 25.6% of the decrease in net equity (among all case loans) occurred during the last year of loan life.

[1] This initial difference was not controlled for by matching because net equity is not one of the matching criteria. In seven pairs, the original net equity of the case loan substantially exceeded that of the non-defaulted control. In nine pairs, the control was larger and in four pairs, original net equity was about the same. The magnitude of the difference does not materially affect the results.

Table 1 ■ Median values for selected variables related to net equity and default activity

Variable (Units)	Defaulted (Case)	Non-Defaulted (Control)
Original Total Project Cost ($000's)	$334.5	$285.8
Original Net Equity ($000's)	$30.9	$46.3
Total Change in Net Equity ($000's)	$(60.0)	$72.5
Elapsed Time Until Loan Termination* (Years)	3.5	9.5
Elapsed Time From First Negative Net Equity to Default (Years)	1.5	—
Borrower In Bankruptcy**	65%	5%
Borrower Firm Closed**	100%	45%
Loan Restructured**	45%	10%

* Between loan origination and default, prepayment, payoff at maturity, or still active in 1989

** At any time during the life of the loan

Data Collection and Variable Construction

Data collection began with a review of the project correspondence file in the NYJDA offices containing loan terms, loan repayment history of the first and second mortgages, borrower equity, original and (for defaulted loans) terminal market value, bankruptcy, firm closure and management experience of the firm.

Net Equity. The value of the borrower's contemporaneous net equity, expressed in thousands of dollars, was estimated for each year of loan life. The specification of net equity used in this research is based on the version of borrower net equity set forth in Vandell (1984), updated to consider the market value of the mortgage:

$$NETEQ_t = [MVP\text{-}CT\text{-}SC\text{-}LI\text{-}OPB\text{-}PRM]_t \quad (1)$$

where the notation is:

$NETEQ$ = borrower net equity;
t = current time period;
MVP = market value of property;
CT = capital gains tax on sale;
SC = property sales cost;
LI = liens outstanding against the property at time of sale;
OPB = outstanding principal balance; and
PRM = the premium (or discount) associated with mortgage loans issued when yields were higher (lower) than during the current period.

The market value of the property measurement technique was conducted annually on a case-by-case basis for each loan (whether default or non-default), and did not rely exclusively on generalized indices or appraisals. Original and terminal market value were generally obtained from NYJDA loan files. Market values for interim years considered property tax records, a site inspection, appraisals (if available), property-specific factors such as physical additions and fires (from building records), evaluation of comparable industrial sales and discussing the subject with the planners and tax assessors.

Estimation of capital gains tax considered original and current market value, calculation of the borrower's taxable basis in the property (yieldng taxable gain or loss) and prevailing tax laws. It was assumed that borrowers were in the maximum tax bracket. Taxable losses, if any, were not carried forward. Sales costs were calculated based on 7% of the market value of the property in each given year.

Many projects had liens placed against the real property. Lien data were obtained from NYJDA files, property tax records and scanning federal and county court records for judgments against the principals of the firm and/or the tenant company. Any liens identified were attributed to the previous year's net equity.

Outstanding principal balance (OPB) considered the senior mortgage, the NYJDA second mortgage and all other junior debt. Both junior mortgages present at loan origination and those taken out after loan origination, but prior to default, were included in the analysis. Data on late mortgages were obtained from the county clerk records for each property. OPB includes accrued principal or interest not paid.

The premium (PRM) variable represents the premium (or discount) to the borrower from having an above-market (or below-market) rate on the blended debt service of all mortgages, weighted by the outstanding principal balance. PRM was based on the prevailing bond sale prices for comparable federal bonds such as FNMA, FHLBB and U.S. Treasuries of similar duration and coupon (Simons 1990).[2]

Financial Costs of Default. The financial costs of default to the borrower represent the cost of lender enforcement of loan guarantees at the time of default. This cost is closely related to the financial condition of the firm. The financial data that were available were biased (much better for non-defaults than for defaulted loans). Therefore, a dichotomous variable indicating 1) bankruptcy of the firm or loan guarantor; and/or 2) firm closure employed as a proxy for the firm's financial health.

Age of Firm/Management Experience. The number of years the firm had been open at the time the loan was originated is used as a proxy for the expertise of firm managers.

Two Case Studies

To ensure consistent data collection, individual case studies were prepared for all forty loans. Two paired-case studies are included in Table 3, below. The matching process for the two matched pairs (numbers seven and eight) was fairly typical of the overall process. The defaulted loan was selected first, then randomly matched within a small pool (two to five) of available non-defaulted loans from a list of NYJDA loans. Pair number seven matched on four of six criteria, and number eight matched on all six.

The defaulted loan in number seven obtained several late junior mortgages, thus eroding its net equity over time despite the generally increasing property value of the building. In 1977, about ten years after loan initiation, a large civil court settlement was obtained against the firm, drastically reducing net equity and precipitating loan default on both senior mortgages.

In pair number eight, the defaulting firm experienced cash flow problems soon after the loans were originated, leading to slow erosion of net equity through delinquent property taxes and a small civil court judgment. De-

[2] Note that the market value of the mortgage = $OPB + PRM$.

fault occurred six years after loan origination, after net equity had been negative for several years.

Statistical Tests

Non-parametric Tests

Two non-parametric statistical procedures are employed in this research: the Wilcoxon signed-rank test and discordant pairs analysis. Their use in this study is consistent with the classical approach to matched pairs (see Breslow and Day 1980; Lubin and Gail 1984).

The Wilcoxon signed rank test is used to test the relationship between firm management experience and mortgage default. The test uses the sign of each pair's difference as well as its ranked sums. The hypothesis test uses a z statistic with a critical value of 1.64 at $\alpha = .05$ (see Hoel and Jessen 1982, p. 419).

Discordant pairs analysis is used to test the relationship between contemporaneous net equity, market value, bankruptcy and default among matched pairs. The procedure discards pairs with the same initial sign (concordant pairs, where both loans have, for example, either positive or negative net equity in the year of default), and evaluates the significance of an odds ratio using only the discordant pairs. The null hypothesis postulates that the odds ratio is equal to unity. The test statistic is the binomial parameter $\rho = .5$ at $\alpha = .05$ (Breslow and Day 1980, p. 165).

It is acknowledged that the retrospective matched-pairs design, where the unit of observation is the *difference within each pair*, generates biased estimators with respect to incidence of default in the overall population.

Non-parametric Test Results

Table 2 contains the results of the hypothesis tests, the expected sign or effect of each variable, the comparison of expected to actual results, the odds ratio (discordant pairs) or z statistic (Wilcoxon test) and the statistical significance of the results. Results on net equity are presented for all twenty loan pairs, plus two subsets of loans where net equity of the defaulted loan was severe (less than -10% at the time of default) and moderate (between -9% and $+10\%$ at the time of default).

Results show that net equity in the year of default for all loan pairs, and for loan pairs with severe negative net equity, have the expected sign and

Table 2 ■ Summary of non-parametric tests for selected variables and their relationship to loan default

Variable	Expected Relationship To Default	Odds Ratio of Discordant Pairs	Sign of Result From This Research
Negative Net Equity in Year of Default (all loans)	+	16:0	+ *
Severe Negative Net Equity in Year of Default (Net Equity −10% or less)	+	12:0	+ *
Moderate Net Equity in Year of Default (Net Equity −9% to +10%)	+	4:0	+ **
Net Equity Negative and Financial Cost Of Default Small (all loans)	+	15:0	+ *
Firm Closed and/or Bankrupt In Year Of Default (all loans)	+	10:2	+ *
Decrease in Market Value of Property from Loan origination to Default (all loans)	+	9:0	+ *
Management Experience Of Firm Principals (all loans)	−	1.62***	− **

* Statistically significant at $\alpha = .05$

** Significant at $\alpha = .10$

*** z statistic

The unit of observation is the difference within each pair

are statistically significant at the 5% level. The odds ratio for net equity was strongest for all twenty pairs. Due in part to the small number of discordant pairs, the analysis for loans with moderate net equity is also statistically significant, but at the 10% level.

For the other variables, financial costs in the year of default, a variable combining both net equity and financial costs of default and change in market value (independent of overall net equity), all having the expected

sign, being statistically significant at the 5% level. The odds ratio for financial costs has two pairs performing contrary to expectations. Results for the management experience proxy have the expected sign, but are only significant at the 10% level.

The main results of the nonparametric tests imply that a borrower's negative contemporaneous net equity and mortgage default are related. This relationship, which holds for all levels of net equity tested, is explored below.

Different Specifications of Borrower Net Equity

In addition to the version of net equity set forth in (1), two other specifications of net equity are tested as indicators of default: partial net equity and simple net equity. Partial net equity (PNETEQ) or (MVP-CT-SC-LI-OPB), omits the less tangible component related to the market value of the mortgage. Simple net equity (SNETEQ), is defined as the market value of the property, less the outstanding principal balance.

Both NETEQ and PNETEQ correctly indicated default one year prior to the event in 80.0% of the cases. PNETEQ is slightly superior to NETEQ in the year of default (95.0% vs. 85.0%). SNETEQ is substantially less accurate, correctly indicating only 50.0% of the cases in the year of default. Two years prior to default, the accuracy of all three indicators decreases markedly, to below 45.0%. For non-defaulted loans, all three versions of net equity correctly indicated the non-default outcome for all three years of study, with scores ranging between 94.4 and 100.0%.

These observations imply that the interest rate spread component PRM may be misspecified. A non-linear relationship between PRM and the default outcome may be evident. Alternatively, the borrower may not fully value the market value of the mortgage contemporaneously.[3]

[3] This may be attributable to several reasons distinct from measurement issues. First, *PRM* may not have the same value to an ongoing concern as it would to a firm about to close down. This is because the relative savings or losses associated with debt service expense to the firm affects their cash flow position as well as the real estate. *PRM*'s value to the borrower may also be affected if the mortgage were not assumable by an outside party. Finally, *PRM* is different from other items in the net equity variable specification because it is not explicitly recognized as a line item on a real estate closing statement. For these reasons, respecification of the *PRM* component of the net equity variable to a different functional form such as a logarithm may be appropriate.

Proportional Hazard Model

A proportional hazard model is applied to defaulted loans to examine how changes in borrower net equity alter the apparent default probabilities. The model is readily applied to defaulted loans from this study because there are no right truncation or censored loan problems.[4] The model considered in this research includes contemporaneous and lagged borrower net equity for each year over the life of the twenty defaulted loans in the data set. Time was measured in years beginning at loan origination. Hence, different calendar years are covered.

The economic duration data in this research is modeled using the proportional hazard approach suggested by Kiefer (1988, p. 664–665). The model assumes an exponential distribution for the hazard function. The estimated coefficients in this model can be interpreted as the constant proportional effect on the conditional probability of default. The model as formulated is estimated using OLS.

Table 3 presents the results of estimating various proportional hazard models of default, with alternative forms of lagged and contemporaneous net equity. Here, %PNETEQ is the ratio of PNETEQ to original project cost.[5] The results suggest the following. First, as expected, there is a negative relationship between net equity and the probability of default. Moreover, this relationship appears to show up with a significant lag. For Models 2 and 3, with lagged net equity, both have constant terms, F-statistics and estimated coefficients that are significant at the 5% level. Model 2, with a one-year lag using twenty observations, also had the highest adjusted R^2 of any model tested, at .33.

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[4] The estimators are not biased as long as the results are applied *only to defaulted loans*. The estimators would, however, be biased if applied to the general population.

[5] In general, model runs are shown only when results on the explanatory variables are statistically significant at $\alpha = .10$ or better. All runs with the smaller subset of defaulted loans having moderate net equity failed due to insufficient degrees of freedom. An attempt was also made to use multiple variables, utilizing the corresponding survivor function, $S(t)$:

$$S(t) = \exp[-\Lambda_0(t)\exp(x\beta_1)\exp(x\beta_2)] \quad (2)$$

where:

$\Lambda_0 = \int \lambda_0 du$
β_1 = net equity
β_2 = bankruptcy of firm or guarantor

Model runs using equation (2) did not show statistically significant results for the explanatory variables. Because non-defaulted loans were excluded from all proportional hazards runs, the survival probabilities would be affected.

Table 3 ■ Summary of proportional hazard model runs

Model and Variable Form	Constant Term	Current Year Net Equity	Lagged 1 Year Net Equity	Lagged 2 Years Net Equity
ALL 20 DEFAULTED LOANS				
1 NETEQ	−1.56 (12.59)*	−.00025 (0.28)	—	—
F-Statistic: 0.08 Adjusted R^2: 0.05 (D.F. = 18)				
2 NETEQ	−1.40 (12.46)*	—	−.00141 (3.24)*	—
F-Statistic: 10.48* Adjusted R^2: 0.33 (D.F. = 18)				
3 NETEQ	−1.56 (14.67)*	—	—	−.00183 (2.91)**
F-Statistic: 8.44** Adjusted R^2: 0.30 (D.F. = 16)				
4 %PNETEQ	−1.52 (13.21)*	−1.08 (1.95)***	—	—
F-Statistic: 3.20*** Adjusted R^2: 0.13 (D.F. = 18)				
LOANS WITH SEVERELY NEGATIVE NET EQUITY (LESS THAN −10%)				
5 NETEQ	−1.43 (7.36)*	—	−.00159 (2.11)**	—
F-Statistic: 4.43** Adjusted R^2: 0.22 (D.F. = 11)				
6 PNETEQ	−1.41 (8.22)*	—	−.00158 (2.05)**	—
F-Statistic: 4.21** Adjusted R^2: 0.19 (D.F. = 13)				

Absolute value of t-statistics in parentheses.

* Significant at $\alpha = .01$

** Significant at $\alpha = .05$

*** Significant at $\alpha = .10$

Similar results were obtained for the smaller pool of thirteen to fifteen loans having severely negative net equity (−10% or less) at the time of default. Again, the constant terms, F-statistics and estimated coefficients are all significant at the 5% level.

The observed lag implies that under-exercising of the default option is occurring. Recall that Foster and Van Order (1984, 1985) found that only 3 to 4% of residential loans with severely negative net equity defaulted. Vandell (1992, p.74) observed that 5 to 8% of loans with severely negative net equity resulted in foreclosure. In this small, non-random forty-loan sample, all of the loans that ever had severely negative net equity eventually did default. However, the lag time in exercising the option was substantial. For example, pooling all thirty-nine observation periods where there was severely negative net equity, default only occurred in only 28% of these periods. In other words, the implicit put option was not immediately exercised 72% of the time.

This apparent lag could be partly attributed to increased patience on the part of public lenders, whose willingness to engage in loan workouts (45% of defaulted loans were restructured prior to default) could indicate the importance of other objectives besides retaining principal, for example, job retention.[6]

Conclusions

This preliminary investigation has detailed the mortgage default experience of the NYJDA. The most important result is that the expected negative relationship between net equity and default is supported by both the nonparametric results and proportional hazard models. In the context of other mortgage default studies (Foster and Van Order 1984, 1985; Cooperstein, Redburn and Meyers 1991; and Vandell 1992), this finding is supportive of the causal relationship between net equity and default suggested by theory. Further, the borrowers studied did not exercise the put option promptly, even when net equity was severely negative.

This research also found that a relationship between bankruptcy and default is evident in nonparametric analysis, although the result from the

[6] Note that the lag in exercising the implicit put option based on negative net equity is still observed when transaction costs are accounted for. Therefore, they may tentatively be ruled out as the sole source of the delay in exercising the option. Also, market value estimates did include individual property data over time.

proportional hazard model is inconclusive. Default appears to be most likely when both negative net equity and bankruptcy are occurring at about the same time. Market value of the property is also associated with default, consistent with Vandell and Thibodeau (1985). This relationship is apparently unrelated to a firm's financial problems. Finally, a weaker relationship between management experience and the default outcome is apparent.

Implications for the NYJDA are offered in the context of its public purpose: economic development. The agency serves a riskier borrower segment and has a correspondingly higher loan default rate than most private commercial mortgage borrowers. The strong relationship between negative net equity (usually persisting for several years) and default suggests that the NYJDA could benefit from systematically monitoring net equity, at least for high risk loans. Potential benefits could include preservation of lending capital, more cost-effective loan workouts and job retention.

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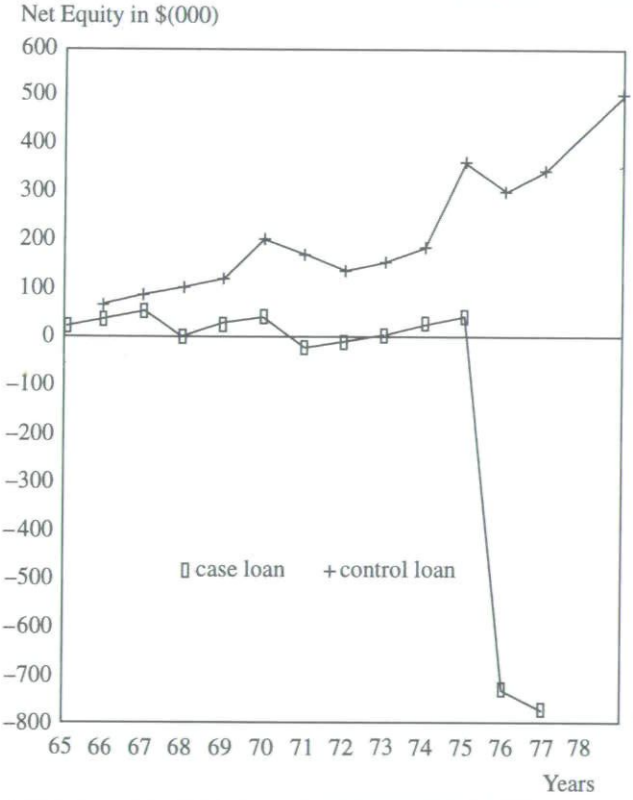
Case Study Appendix 1 ■ Change in net equity over time matched pair #7.

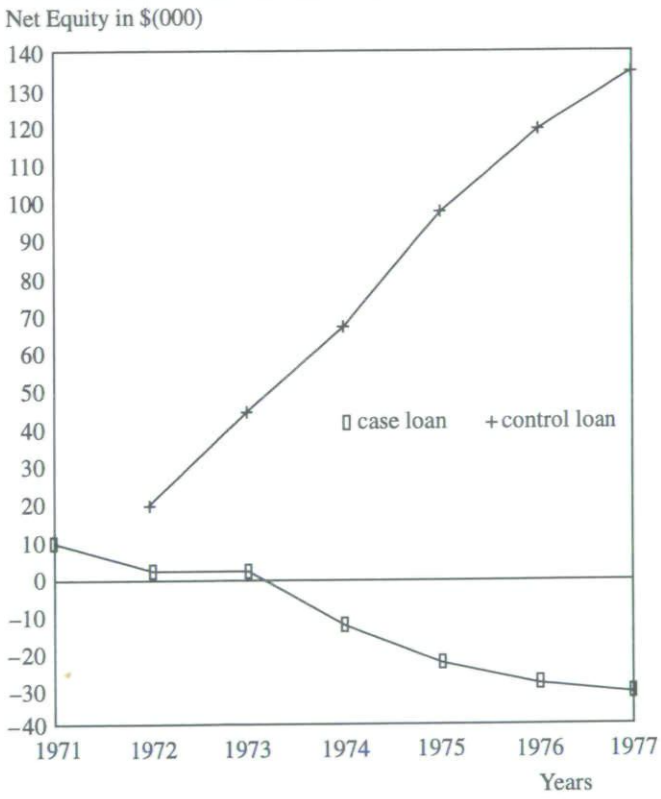


Market value appreciation—both loans—moderate—slightly increasing

Default case #7—Red Hook section of Brooklyn, NY
* $100,000 project—wholesale coffee business
* $50,000 first mortgage—commercial bank—1965
* $30,000 second mortgage—JDA—1965
* $20,000 net equity position
* $35,000 third mortgage—1968
* $35,000 fourth loan—1971
* sales down 50% after mid-1970s
* civil court judgments against firm—1977
* $19,000 property tax delinquency
* foreclosure by first lender in 1977

Non-default control #7—E. New York section of Brooklyn, NY
* $283,000 project—manuf. & distrib. cheese, tea & other foods
* $141,500 first mortgage—commercial bank—1966
* $84,900 second mortgage—JDA—1966
* $56,600 net equity position
* $35,000 third mortgage—1968
* $112,000 first mortgage assumed in 1974
* $524,000 second loan—1974
* strong sales growth
* borrower still in business

Case Study Appendix 2 ■ Change in net equity over time matched pair #8.



Market value appreciation—both loans slightly increasing

Default case #8—Wawayanda, NY—Orange County
* $90,100 project—manufacturing plastic tubes
* $45,000 first mortgage—commercial bank—1971
* $27,000 second mortgage—JDA—1971
* $18,100 net equity position
* no other mortgages or loans placed
* financial difficulty within a year—1972
* $20,000 civil court judgments against firm—1972
* property tax delinquency—1972
* did not declare bankruptcy
* foreclosure by first lender in 1978

Non-default control #8—Middletown, NY—Orange County
* $108,000 project—manufacturing buciness
* $51,900 assumption of first mortgage—1967
* $32,000 second mortgage—JDA—1972
* $24,000 net equity position
* no other mortgages or loans placed
* sales increased moderately till mid-1970s
* business closed and property sold to another party in 1985