Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States

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The Japanese banking crisis provides a natural experiment to test whether a loan supply shock can affect real economic activity. Because the shock was external to U.S. credit markets, yet connected through the Japanese bank penetration of U.S. markets, this event allows us to identify an exogenous loan supply shock and ultimately link that shock to construction activity in U.S. commercial real estate markets. We exploit the variation across geographically distinct commercial real estate markets to establish conclusively that loan supply shocks emanating from Japan had real effects on economic activity in the United States. (*JEL* E44, F36)

The major contributions of this paper are identifying an independent loan supply disruption and establishing that this shock had effects on real economic activity in the United States. This study extends a rapidly growing literature that examines the causes and the effects of changes in bank lending (for example, Ben S. Bernanke and Cara S. Lown, 1991; Diana Hancock and James A. Wilcox, 1992, 1997; Anil K Kashyap et al., 1993; Kashyap and Jeremy C. Stein, 1994a, b; Peek and Rosengren, 1995a, b, 1997). However, such studies have suffered from two serious criticisms (see, for example, Steven Sharpe, 1995). First, while some studies have established that banking problems reduce bank lending, critics have argued that these studies may not have adequately isolated loan supply shocks from loan demand shocks. Second, even those studies that have identified loan supply shocks have not persuasively established that reductions in bank lending have real effects. For example, even if bank lending declines, other nonbank sources may fill the void, so that any effect on real economic activity is limited.

The dramatic declines in Japanese equity and commercial real estate prices in the early 1990's put strong downward pressure on the capital positions of Japanese banks. In responding to these domestic shocks by reducing their lending in the United States, Japanese banks have provided a natural experiment to test the extent to which a loan supply shock can affect real economic activity. Because the shock was external to U.S. credit markets, yet connected through the substantial penetration of U.S. commercial real estate loan markets by Japanese banks, this event allows us to identify an exogenous loan supply shock and ultimately link that shock to construction activity in major commercial real estate markets in the United States.

Using a panel data set that exploits the variation across geographically distinct commercial real estate markets in the United States, both in the degree of Japanese bank penetration and in local demand conditions, we are able to clearly identify a loan supply shock and to closely link that shock to real economic activity, a combination that has eluded most previous studies. We find that the retrenchment of Japanese lending had a substantial impact on U.S. real estate

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activity, indicating that alternative financing was not easily obtained, at least for some borrowers. This is consistent both with the idiosyncratic nature of many commercial real estate loans, which require lender understanding of the borrower and project, and with the major retreat by Japanese banks from their large penetrations in specific U.S. commercial real estate markets.

The first section of the paper describes the problems in Japan, the role these problems played in affecting Japanese bank lending in the United States, and the methodology for isolating loan supply shocks from loan demand shocks. It shows that the large, adverse shocks to the equity and real estate markets in Japan were transmitted through Japanese bank lending as a supply shock to the real estate credit markets in the United States. The second section documents that this loan supply shock had real effects on construction activity in major U.S. commercial real estate markets. The final section concludes.

I. Transmission of Japanese Shocks to U.S. Commercial Real Estate Lending

A. *Background*

A confluence of circumstances has created an opportunity not only to identify an exogenous loan supply shock to U.S. commercial real estate markets but to establish that it had effects on real economic activity. First, Japan experienced unusually large declines in stock market values and in real estate prices that sharply lowered bank capital ratios. Second, Japanese banks responded to the decline in their capital by decreasing their lending in overseas markets, including a dramatic decrease in their lending to commercial real estate markets in the United States. Third, Japanese banks had very large penetrations in selected U.S. commercial real estate markets. Fourth, commercial real estate markets in the United States remain segmented.

The Nikkei stock index peaked at the end of 1989, losing more than half its value by early 1992. The decline in Japanese commercial real estate prices from their 1990 peak was even larger. Because Japanese banks hold substantial amounts of equity in other Japanese firms and accrued gains on these holdings can be included in bank capital, the sharp decline in the Nikkei directly reduced bank capital. Similarly, because real estate serves as collateral for most bank loans in Japan, even though many support non-real-estate activities, the decline in real estate prices induced a sharp rise in problem loans that placed even more pressure on bank capital ratios.[1]

The pressure on banks to react was made even more severe by domestic and international regulatory changes in the late 1980's that made Japanese banks take satisfying capital requirements more seriously.[2] Japanese banks responded by shrinking risk-weighted assets. Perhaps because of long-standing lending relationships with domestic customers, this shrinkage was concentrated overseas (Robert N. McCauley and Stephen Yeaple, 1994; Peek and Rosengren, 1997).[3] The heterogeneity in U.S. commercial real estate markets and the uneven penetration by Japanese banks across these geographically distinct markets provide the environment that allows a relatively clean test of whether exogenous loan supply shocks can have real effects.[4]

Visual evidence that the United States may have experienced an exogenous loan supply shock is provided by Figure 1, which shows fluctuations in bank commercial real estate loans for the United States and for the three

[1] Problem loans in Japan affect bank capital only when the banks make provisions for these loans by adding to their specific loan loss reserves, through a direct write-off of the loan (when no specific reserve has been allocated for that loan), or through losses realized on sales of problem loans to the Cooperative Credit Purchasing Company.

[2] The Basle Accord, an international agreement that set common standards by which to evaluate capital adequacy, was introduced in 1988. It tried to create a "level playing field" by requiring all internationally active banks to satisfy the same minimum risk-based capital ratios. These ratios use risk-weighted assets as the denominator, with the weights related to the relative credit risk of the asset classes.

[3] Bank-firm lending relationships are particularly strong and important in Japan, making Japanese banks reluctant to reduce credit to their longtime domestic customers (Takeo Hoshi et al., 1990, 1991; Allen B. Frankel and Paul B. Morgan, 1992; Hoshi et al., 1993; Michael S. Gibson, 1995; Brian J. Hall and David E. Weinstein, 1997).

[4] Numerous studies have found that the market for residential investment is inefficient (Karl E. Case and Robert J. Shiller, 1989; David Genesove and Christopher J. Mayer, 1997), and even greater inefficiencies are likely in commercial real estate markets, which have fewer transactions, more heterogeneous characteristics and uses, and much longer lags in creating new supply.

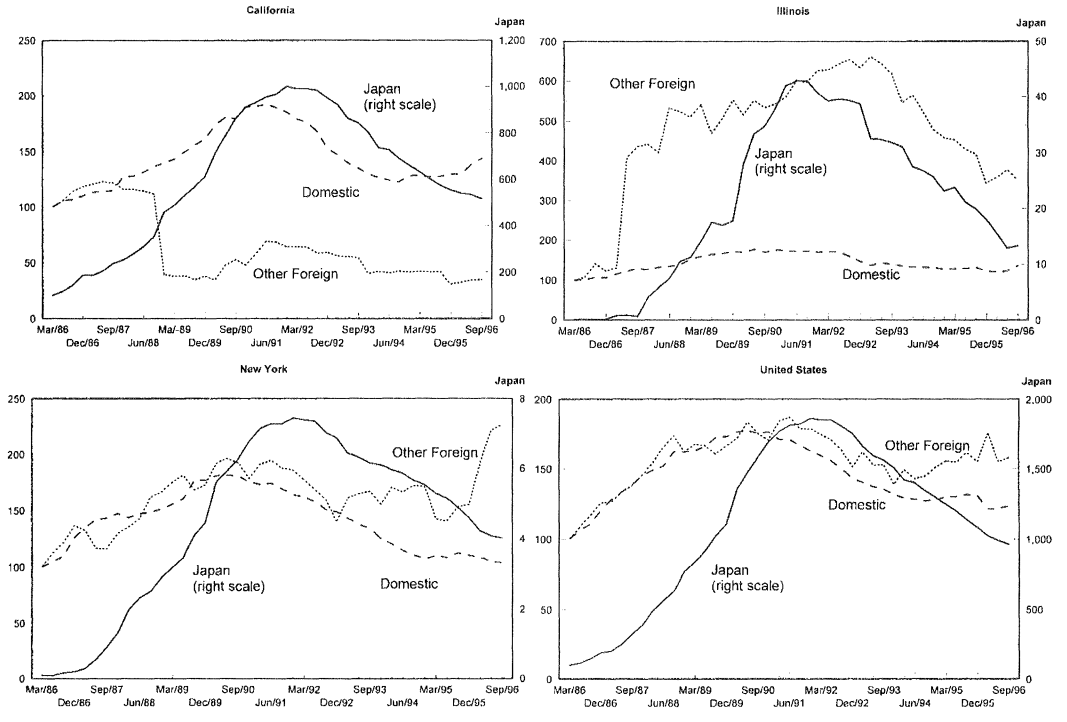

FIGURE 1. COMMERCIAL REAL ESTATE LOANS

Notes: Data are indexed, with March 1986 = 100. For Illinois and New York, the right-hand-side scale is in thousands.

commercial real estate markets with the greatest Japanese penetration: California, New York, and Illinois.[5] Commercial real estate lending by domestically owned commercial banks peaked in New York in the late 1980's and in California in the early 1990's, while Illinois shows relatively little variation over this period. In sharp contrast to the diverse lending patterns exhibited by domestic banks, the Japanese bank lending patterns are quite similar across these three markets. Japanese lending expanded dramatically in the late 1980's, peaked in late 1991, and then declined sharply, paralleling (with only a short lag) the dramatic rise and fall in Japanese equity and real estate markets. In contrast to Japanese banks, other foreign banks operating in the United States generally followed domestic patterns until recently, when they increased their commercial real estate lending both nationwide and in New York, while showing a slight decline in California and a much sharper decline in Illinois. The similarity in the patterns of commercial real estate lending by Japanese banks in all three markets, in contrast to the variations in lending patterns of other foreign and domestic competitors, suggests that supply factors relating to the fortunes of the Japanese parents, rather than local demand factors, are likely to account for these movements.

[5] At their peak in 1992, U.S. subsidiaries and branches of Japanese banking organizations accounted for one-fifth of all commercial real estate loans held by domestically owned commercial banks plus foreign bank subsidiaries and branches in the United States. In several of the major markets, the Japanese penetration was far more substantial, at its peak reaching 44 percent of commercial real estate loans by large domestic and foreign banks in California, 35 percent in New York, and 23 percent in Illinois.

B. *Data and Methodology*

The analysis in this section focuses on the three large, spatially separated markets that have experienced the greatest penetration by

Japanese banks: California, New York, and Illinois. Because commercial real estate markets are segmented, a focus on the individual markets emphasizes the idiosyncratic local demand characteristics that may be important in these markets. Furthermore, by identifying problems of parent banks in Japan rather than domestic U.S. events as the source of the shock, we are able to examine the effects of credit supply shocks to U.S. markets that are not associated with the demand for real estate loans in the United States.[6]

The panel data set includes all large (at least $300 million in assets as of the beginning of our sample) domestically owned commercial banks headquartered in any one of these three states that held commercial real estate loans in their portfolios, as well as the Japanese bank branches.[7] The domestically owned banks in these markets provide a comparison group for determining whether Japanese-owned banks, as a result of their parents' problems in Japan, behaved differently than their competitors in the local U.S. markets.[8]

Data on Japanese parent banks are available only semiannually, at the end of March and September. We use semiannual observations for the panel of banks in the three U.S. markets from March 1989, corresponding to the first date for which lagged risk-based capital ratios for Japanese parent banks are available, to September 1996. The Japanese banks include branches of city banks, long-term credit banks, and trust banks located in one of the three markets.[9] We have a total of 63 individual Japanese branches operating in any one of the three markets, with the number reduced to 56 branch operations when the Los Angeles and San Francisco branches of the same parent bank are consolidated to form a single California entity.[10] We focus on Japanese branches because they account for three-fourths of the U.S. lending by Japanese banks and because Peek and Rosengren (1997) found that they have been the most responsive to Japanese parent bank problems.[11]

The estimated equation for all large banks engaged in commercial real estate loans in one of the three markets is of the following form:

$$(1)\quad \frac{\Delta Loans_{i,j,t}}{Assets_{i,j,t-1}} = \beta_0 + \beta_1 \mathbf{JPARENT}_{i,j,t-1} + \beta_2 \mathbf{JAPAN}_{i,j,t-1} + \beta_3 \mathbf{US}_{i,j,t-1} + \varepsilon_{i,j,t}.$$

The dependent variable is the change in total commercial real estate loans (defined as nonfarm, nonresidential real estate loans plus construction loans) of banking institution i in state j from period $t-1$ to period t (a six-month period), divided by the beginning-of-period assets held by that bank in that state.[12] Thus, the

[6] One might be concerned about an indirect effect on demand in the United States operating through Japanese nonbank affiliates. However, Japanese foreign direct investment in the real estate sector shows no evidence of a sharp decline in U.S. activities. Japanese foreign direct investment in the real estate sector rose sharply between 1993 and 1994, exhibited a slight decline in 1995, and rose again in 1996.

[7] Our definition of domestic U.S. commercial banks excludes shell banks, credit card banks, trust banks, banks with risk-based capital ratios over 100 percent, banks with a loans-to-assets ratio of less than 5 percent, and banks with a ratio of transactions deposits to assets of less than 5 percent. These criteria remove banks with a commercial bank charter that do not operate as traditional commercial banks.

[8] We included only large commercial banks in our U.S. panel, since commercial real estate lending by very small banks goes primarily to small businesses rather than for the larger commercial projects of the kind that involve Japanese banks.

[9] We do not include regional banks, which account for less than 4 percent of Japanese commercial real estate loans in the United States, because the parent bank disclosure provides insufficient information on nonperforming loans in Japan.

[10] We excluded the first two years of a Japanese parent bank's U.S. branch operations as well as the first two years of operations of an individual Japanese branch. This period is likely to be dominated by rapid growth as the bank establishes a new presence in a particular region, rather than reflect problems or lack of problems at the parent banks. We also omit any observation in which a Japanese or domestic bank is involved in a merger or substantial branch acquisition, which removes the observation in which the balance sheet data increase as a result of the acquisition.

[11] The term "branches" will be used to refer to both branches and agencies. The important distinction here is whether the entity is included in the balance sheet of the parent bank (agencies and branches) or not (subsidiaries).

[12] Because real estate loan data for branches are not disaggregated by type and virtually all of the real estate lending by Japanese branches is composed of nonfarm, nonresidential real estate and construction loans, we use their total real estate loans series as our measure.

operations of a given Japanese parent bank can be represented by observations on up to three banking entities (if it has operations in all three states), with each entity corresponding to its operations in a particular state.

The first vector of variables, **JPARENT**, contains three variables based on Japanese parent bank data: the ratio of nonperforming loans to risk-weighted assets, a (0, 1) dummy variable indicating the period during which nonperforming loans were available, and the risk-based capital ratio.[13] While the reported values of nonperforming loans are widely believed to be understated, this ratio should capture the relative degree of nonperforming loan problems across Japanese parent banks cross-sectionally, as well as the deterioration over time at individual institutions.[14] We expect the sign on the nonperforming loan ratio coefficient to be negative.

Previous work has emphasized the role of risk-based capital ratios of Japanese parent banks in determining their U.S. lending (Peek and Rosengren, 1997). Most of the movements of the risk-based capital ratio of these banks during our sample period are a result of the fluctuations in Japanese stock prices, with relatively little of the nonperforming loan problem being reflected in the capital ratio. Since the portion (typically less than 100 percent) of nonperforming loans that will be charged off is likely to be reflected in a lower capital ratio eventually, we would expect the coefficient on the risk-based capital ratio to be larger (in absolute value) than that of the nonperforming loan ratio (they are each scaled by the bank's risk-adjusted assets), and to be positive.

The second set of explanatory variables, **JAPAN**, includes two Japan-related variables. The first is a (0, 1) dummy variable that has a value of one if the entity is Japanese-owned and zero otherwise. The second variable that might affect the behavior of Japanese banking operations in the United States is foreign direct investment (FDI), measured as the percentage change (at an annual rate) in foreign direct investment by Japanese companies in the United States over the prior six-month period.[15] Unlike the other Japanese-related variables, however, FDI captures loan demand as well as loan supply effects. Insofar as Japanese FDI in the United States is financed by Japanese bank branches located in the United States, an increase in Japanese FDI would increase loan demand from Japanese bank branches in the United States.

The final vector, **US**, includes variables reflecting factors related to the U.S. economy or banking environment that might affect commercial real estate lending in a particular market. We include measures of the risk-based capital ratio, nonperforming commercial real estate loans (loans 90 days or more past due plus nonaccruing loans) divided by total commercial real estate loans, the logarithm of assets, and the ratio of loans to assets. These data are included for both domestically owned banks and the U.S. branch operations of Japanese banks. However, the risk-based capital ratio has a zero value for Japanese branches, since they are not separately capitalized, relying instead on the capital of their parent banks in Japan. Each of these variables is measured as of the beginning of the period.[16]

[13] In each case, we use the beginning-of-period value (value for the previous period) for the series. Prior to March 1993, Japanese banks did not publicly disclose nonperforming loans, defined as loans to clients in bankruptcy plus loans on which no interest payments have been made for at least six months. Thus, the nonperforming loans variable has a value of zero prior to March 1993 and thereafter it is equal to the disclosed value. To account for this discontinuity, a (0, 1) dummy variable is used, with a value of zero through September 1992 and a value of one beginning in March 1993.

[14] For example, both Hokkaido Takushoku and Nippon Credit, which were frequently cited by analysts as the weakest among Japan's 20 large banks, consistently had among the highest values for the nonperforming loan ratio.

[15] FDI data are taken from various issues of the *Survey of Current Business* (U.S. Bureau of Economic Analysis). Because the FDI data are available only as annual observations, we calculate the March observation as the average of the current and previous year's values. We use the current-year value for the September observation. The FDI variable has a nonzero value only for Japanese branches and subsidiaries.

[16] We also control for differences in commercial real estate loan demand in the individual markets by including time-region dummy variables. In addition, we include a set of three (0, 1) dummy variables to control for a Japanese parent bank opening a new branch in the United States, opening a new branch in the same market, and closing a branch in the United States. It is likely that such actions could affect lending at existing branches, as the parent bank shifts lending operations between branches.

TABLE 1—COMMERCIAL REAL ESTATE LENDING BY U.S. COMMERCIAL BANKS AND U.S. BRANCHES OF JAPANESE BANKS, SEMIANNUAL OBSERVATIONS, 1989:1 TO 1996:2
ESTIMATION METHOD: VARIANCE COMPONENTS

	Combined states[a]	New York[b]	California[b]	Illinois[b]
Risk-based capital ratio at Japanese parent	0.335**	0.302*	0.168	0.617*
	(0.113)	(0.120)	(0.235)	(0.251)
Nonperforming loan ratio at Japanese parent	−0.840**	−0.489**	−1.437**	−0.456
	(0.132)	(0.141)	(0.274)	(0.252)
Nonperforming loans availability dummy	−0.432	−0.539	0.144	−1.012
	(0.529)	(0.622)	(1.130)	(0.852)
Japanese dummy	−1.593	−2.087	0.898	−5.209*
	(1.117)	(1.236)	(2.314)	(2.285)
Japanese foreign direct investment growth	0.025**	0.017*	0.026*	0.038**
	(0.006)	(0.008)	(0.013)	(0.009)
U.S. risk-based capital ratio	0.007	−0.046	0.045	−0.029
	(0.020)	(0.031)	(0.032)	(0.034)
U.S. nonperforming commercial real estate loan ratio	−0.414**	−0.438**	−0.476**	−0.266**
	(0.047)	(0.075)	(0.087)	(0.063)
Log (assets)	−0.142	−0.055	−0.334*	−0.132
	(0.082)	(0.095)	(0.169)	(0.104)
U.S. loans-to-assets ratio	0.007	0.002	0.019	0.009
	(0.006)	(0.008)	(0.015)	(0.009)
Sum of squared residuals	16,108	2,671	10,704	2,495
Standard error of the regression	2.991	2.241	3.970	2.092
R^2	0.309	0.310	0.348	0.174
Hausman test p-value	1.000	1.000	0.999	0.265
Number of observations	2,026	607	764	655

Note: Coefficient standard errors are in parentheses.

[a] Includes 47 state-quarter interactive dummy variables (3*16-1) to control for demand factors, as well as dummy variables to control for the opening of new branches and the closing of existing branches by a Japanese parent bank.

[b] Each equation also includes a set of individual time dummy variables, as well as dummy variables to control for the opening of new branches and the closing of existing branches by a parent bank.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

C. *Empirical Results*

Table 1 reports results from equations estimated for the three markets combined, as well as separately for New York, California, and Illinois.[17] The estimated coefficients on the risk-based capital ratio of Japanese parent banks are positive in each instance, and are significant for the combined markets, New York, and Illinois, but not for California.[18]

[17] We report the results from estimates using the variance components technique, although ordinary least-squares and fixed-effects estimates yield similar results. Furthermore, results obtained for the sum of Japanese branches and subsidiaries are similar to those reported for branches.

[18] While the estimated coefficient of 0.335 is smaller than the corresponding estimate of 0.819 in Peek and Rosengren (1997) for commercial and industrial (C&I) lending, most of the difference can be accounted for by the smaller volume of commercial real estate lending compared to that of C&I loans. Commercial real estate loans as a share of assets is less than one-half the share represented by C&I loans. Thus, if we halve the corresponding estimate for C&I lending to 0.41, it is close enough to our commercial real

The estimated coefficients on the parent bank's nonperforming loan ratio are negative in each case and significant for the combined markets and for two of the three states separately. The weaker results for Illinois (significant only at the 10-percent level) may reflect the fact that fewer Japanese banks have branch operations there. In particular, because some of the weaker Japanese banking organizations did not have operations in Illinois (including Hokkaido Takushoku and Nippon Credit), we lose some of the cross-sectional variation present in the other two markets. With less cross-sectional variation, the Japanese dummy variable may be picking up many of the behavioral differences between Japanese branches and domestic U.S. banks. Consistent with this interpretation, the estimated coefficient on the Japanese dummy variable is negative and significant in Illinois, but insignificant in the other two markets.

It is striking that in three of the four instances, the estimated effects of the parent bank risk-based capital ratio are smaller than those (in absolute value) for the nonperforming loan ratio. Since the portion (typically less than 100 percent) of nonperforming loans that are charged off will at some point be reflected in the capital position of the bank, one might expect the coefficient on nonperforming loans to be less than that on the capital ratio. In particular, if nonperforming loans had been adequately reserved for, one would expect that the nonperforming loan coefficient would be insignificant, because the problems would be fully reflected in the reduced capital ratio of the bank. Thus, the relatively larger estimated coefficient on the nonperforming loan ratio is consistent with the widely held view that problem loans at Japanese banks have been underreported (and underreserved for) substantially. Among the other control variables, the estimated coefficients on Japanese FDI are each positive and significant, while those on the U.S. nonperforming commercial real estate loan ratio are negative and significant in each case.[19]

The similarities across states indicate how robust the findings are for the risk-based capital and nonperforming loan ratios at parent banks. By estimating separate equations by state, the sample size and the power of the test are substantially diminished, particularly given the idiosyncratic features of individual Japanese branches. Nonetheless, we find that Japanese banks burdened with low capital ratios and substantial nonperforming loans reduced their U.S. commercial real estate lending not only overall, but in each of the three distinct markets. Furthermore, the fact that the problem loans are exerting additional pressure on Japanese banks to shrink lending likely reflects that they have been substantially underreported and that loan loss reserves remain insufficient for the magnitude of the problems, suggesting continued pressure on Japanese bank lending for the foreseeable future.

II. Real Effects of Declines in Japanese Commercial Real Estate Lending

A. *Data and Methodology*

Now that it has been established that stock market and real estate problems in Japan were

estate loan response of 0.335 for the difference to be attributable to differences in specification and sample, rather than to any substantial difference in the importance of risk-based capital ratios for commercial real estate lending.

[19] Although the estimated coefficients on the U.S. nonperforming commercial real estate loan ratio are consistently larger (in absolute value) than those on the U.S. risk-based capital ratio, this result does not necessarily lend itself to the same interpretation of underreported (and underreserved for) nonperforming loans as in Japan, for at least two reasons. First, the U.S. risk-based capital ratio is for the entire bank, while the nonperforming commercial real estate loan ratio is based on a particular component of the bank's loan portfolio. In contrast, both the capital ratio and the nonperforming loan ratio for Japanese banks are for the entire bank portfolio and are each scaled by risk-weighted assets. Second, while the Japanese parent bank data clearly control for loan supply effects on U.S. commercial real estate lending, the estimated coefficients on the U.S. capital ratio and U.S. nonperforming loan ratio likely reflect both loan supply and loan demand influences. Because the loan supply and loan demand effects cannot be disentangled and because loan demand effects are likely to be more highly correlated with nonperforming loans than with the capital ratio, it is not particularly surprising that we find a larger effect on U.S. commercial real estate lending emanating from the U.S. nonperforming commercial real estate loan ratio.

TABLE 2—DESCRIPTIVE STATISTICS FOR JAPANESE PARENT BANKS WITH U.S. OPERATIONS

Date	Number of banks	Mean	Standard deviation	Minimum	Maximum
		Lagged risk-based capital ratio			
89-03-31	18	10.062	1.885	5.900	13.873
89-09-30	18	11.184	2.372	8.506	16.072
90-03-31	18	11.480	2.419	8.556	15.744
90-09-30	19	9.607	1.472	8.024	12.486
91-03-31	19	7.945	0.591	7.271	9.161
91-09-30	20	9.339	0.769	8.163	11.007
92-03-31	20	9.187	0.620	8.385	10.718
92-09-30	20	8.330	0.260	7.928	9.100
93-03-31	20	8.840	0.247	8.377	9.297
93-09-30	20	9.446	0.438	8.879	10.255
94-03-31	20	9.977	0.702	9.057	11.058
94-09-30	20	9.820	0.502	9.103	10.663
95-03-31	20	9.821	0.501	9.222	10.821
95-09-30	20	9.008	0.462	8.442	10.302
96-03-31	19	9.419	0.474	8.922	10.525
96-09-30	18	9.400	0.894	8.369	10.823
Full sample	309	9.554	1.385	5.900	16.072
		Lagged nonperforming loan ratio			
93-09-30	20	3.135	1.085	1.299	4.797
94-03-31	20	3.436	1.117	1.610	4.935
94-09-30	20	3.516	1.368	1.392	6.317
95-03-31	20	3.439	1.389	1.235	6.280
95-09-30	20	3.321	1.419	1.103	6.123
96-03-31	19	3.523	1.658	1.325	6.255
96-09-30	18	3.851	2.103	1.250	9.206
Full sample	137	3.460	1.448	1.103	9.206

transmitted to U.S. commercial real estate markets in the form of reduced lending by Japanese bank affiliates, an important question remains: Did this reduction in Japanese lending have an effect on real activity in U.S. commercial real estate markets? To address this question, we investigate the effect of changes in commercial real estate loans held by U.S. affiliates of Japanese banks on four alternative measures of construction activity, using bank data aggregated to the state level. Because demand conditions varied across these geographic markets, we should be able to determine whether construction activity differed systematically in states that had a large Japanese lending presence compared to those that did not, and thus to test whether the supply shock to lending altered real activity in those states with a large Japanese lending presence.

Although moving from individual bank data to state-level data allows us to examine how changes in lending affected construction activity, it has a cost insofar as we lose some of the richness provided by the micro-banking data. Table 2 provides a sense of the information lost by aggregating data for the individual Japanese parent banks. This table shows the patterns over time for the mean, the standard deviation, and the minimum and maximum values for the lagged risk-based capital ratio and nonperforming loan ratio for individual Japanese (city, long-term credit, and trust) banks with U.S. operations. As can be seen, the changing fortunes of the best- and worst-performing banks, as well as the dispersion at any specific time, are not fully captured by the means of these variables. Thus, when the data for individual Japanese banks are compressed into a single observation representing the average value for all Japanese banks operating in a state during that time period, much of the variation exhibited by individual banks is lost. This is particularly

true for nonperforming loans, where the mean does not fully reflect how quickly nonperforming loan ratios rose at the most troubled institutions.

B. *Test for Real Effects*

Our test follows an earlier study by Hancock and Wilcox (1997). The following regression is estimated using semiannual data:

$$(2)\quad CONSTR_j = \alpha_0 + \alpha_1 \mathbf{BANK}_j + \alpha_2 \mathbf{STATE}_j + \alpha_3 \mathbf{NATIONAL} + \eta_j.$$

Four alternative measures of the dependent variable are considered. Three of the measures are based on F.W. Dodge data on new construction contracts: the value, the number, and the square footage of total new construction projects in state j.[20] We divide the value of construction contracts in each state by the GDP investment structures price deflator to create a constant dollar series. All three of the construction series are measured on a per capita basis.[21] The fourth measure is the (annualized) percentage change in employment in the construction industry in state j.

Three sets of explanatory variables are used. The first set (**BANK**) includes two variables related to commercial real estate lending activity. The explanatory variable of particular interest here is the contemporaneous change in commercial real estate loans held by all branches and subsidiaries of Japanese banks in state j, divided by state population and the GDP investment structures price deflator. We expect the estimated coefficient on this variable to be positive, indicating that a decline in Japanese bank lending in that state will cause a corresponding fall in commercial real estate activity in that market.[22]

The second variable in this vector is intended to capture the extent of problems in the commercial real estate lending sector in the state. This variable is measured as the ratio of nonperforming commercial real estate loans for all domestically owned commercial banks plus foreign-owned bank affiliates in state j, divided by total commercial real estate loans for the same time period held by the same set of institutions. We expect the estimated coefficient on this variable to be negative, as both loan demand and loan supply are likely to decline as the commercial real estate market deteriorates.

The second vector of explanatory variables (**STATE**) is intended to control for local demand conditions. This vector contains four variables, each measured at the state level. The first variable is the vacancy rate, constructed from data published by CB Commercial Real Estate Group.[23] The other three variables in this vector are the state unemployment rate, the state's population (annualized) growth rate, and the (annualized) growth rate of real state personal income per capita.

The third vector of explanatory variables (**NATIONAL**) includes three macroeconomic variables: the level of the Michigan consumer sentiment index, the interest rate on the 30-year fixed-rate mortgage, and the (annualized) CPI

[20] The value of construction contracts excludes the value of the land and architectural fees. For manufacturing buildings, the value also excludes equipment that is not part of the structure.

[21] While all three series are related to construction activity, they highlight different aspects of that activity. The value of construction contracts must be divided by a price index and thus may be distorted somewhat by differences in the timing and magnitude of commercial real estate price fluctuations across locations. Both the value and the square footage series exhibit large fluctuations associated with the lumpiness of construction projects, with discrete jumps in the series occurring as big projects are initiated. While the series for the number of construction contracts avoids this problem, it may not capture fluctuations in real activity as well if the mix between large and small projects changes over time.

[22] An earlier version of this paper was based on an alternative specification with the numerator scaled by the beginning-of-period value of commercial real estate loans held by domestically owned commercial banks plus foreign-owned bank affiliates in that state, rather than by the price index and state population. The redefinition of this variable facilitates the interpretation of the estimated coefficients. Estimates based on the previous specification produce qualitatively similar results.

[23] These data are based on a quarterly survey of major office buildings that covers multitenant office buildings, but excludes government-owned buildings. The survey data cover 49 major metropolitan areas, rather than being aggregated to the state level. Consequently, in states with only one major metropolitan area covered by the survey, that vacancy rate is used for the entire state. In states with multiple metropolitan areas covered, we take the average of the vacancy rates for those cities as the state vacancy rate.

inflation rate. To allow for possible dynamics, we include two lagged values for the nonperforming loan ratio and for each of the **STATE** and **NATIONAL** variables. However, qualitatively similar results (not shown in tables) are obtained when only a single lagged value of these variables is included in the regressions.

Since movements in the contemporaneous value for the change in commercial real estate loans by Japanese banks could reflect shocks to the demand as well as the supply of commercial real estate credit, we estimate the equation using two-stage least-squares techniques. In addition to the list of exogenous explanatory variables in the equation, we include as instruments two lagged values each of a set of variables reflecting loan supply effects emanating from Japan. These include the average risk-based capital ratio for Japanese parent banks with operations in the state, the average ratio of nonperforming loans to assets of Japanese parent banks with operations in the state, the (0, 1) dummy variable that indicates the observations for which the nonperforming loan data are available, and the (annualized) percentage change in Japanese commercial land prices, based on the series for the six largest cities constructed by The Japan Real Estate Institute.[24]

The estimation is based on semiannual observations from September 1989 through September 1996, so that the data correspond to the frequency of the Japanese parent bank data used as instruments for the contemporaneous values of the change in commercial real estate loans. The sample includes 15 observations each for the 25 states that had a complete series for the vacancy rate over the full sample period.[25] This excludes primarily rural states that had relatively few major commercial real estate construction projects and, in any case, would not be comparable to the states in which Japanese banks have been active.

C. *Empirical Results*

The Japanese-related variables that reflect the problems in Japan should be good instruments for the loan supply shock transmitted by Japanese banks to U.S. commercial real estate loan markets. However, these variables should not be good instruments for commercial real estate loans by non-Japanese banks. This is particularly true in states with no Japanese bank presence.

The first column of Table 3 provides the first-stage regression for contemporaneous Japanese bank lending used in the two-stage least-squares estimation. The sample includes the data for all 25 states and the specification includes a separate constant term for each state (fixed effects). The Japanese instruments are constructed to have zero values for the states that have no Japanese banking operations. This prevents the estimated coefficients on the Japanese-related instruments from being skewed because of the zero values for Japanese bank lending in the states with no Japanese bank presence.

The results show that both of the lagged values of the Japanese parent risk-based capital ratio have effects of the predicted sign (positive) that are significant. Although only one of the two estimated coefficients on the lagged values of the nonperforming loan ratio at Japanese parent banks has the predicted (negative) sign, neither is significant. However, this lack of significance is not particularly surprising, given the evidence in Table 2. Not only is information lost by using the average value across individual banks, but the nonperforming loan series is available for only part of the sample period and the nonperforming loans dummy variable likely picks up much of the average effect on Japanese lending.

Although the direct effect of problem real

[24] We have not included Japanese FDI as one of the Japanese-related instruments because we want instruments that reflect only loan supply effects. As noted above, changes in FDI likely reflect loan demand as well as loan supply effects. However, the results are unaffected if we include FDI among the Japanese-related instruments.

[25] Eight states have Japanese-bank-affiliate operations: California, Florida, Georgia, Illinois, New York, Oregon, Texas, and Washington. The remaining 17 states do not: Arizona, Colorado, Connecticut, Indiana, Kansas, Maryland, Michigan, Minnesota, Missouri, New Mexico, Nevada, North Carolina, Ohio, Oklahoma, Pennsylvania, Tennessee, and Utah. Although Massachusetts does have vacancy rate data, it has been omitted from the sample because it had a token Japanese bank presence for part of the sample period and thus did not fit cleanly into either category.

TABLE 3—COMMERCIAL REAL ESTATE LENDING BY JAPANESE AND NON-JAPANESE BANKS ESTIMATION METHOD: ORDINARY LEAST SQUARES, 1989:2 TO 1996:2

	Japanese lending	Non-Japanese lending
Excluded exogenous variables		
Risk-based capital ratio Japanese parent$_{-1}$	81.882*	117.631
	(32.783)	(67.489)
Risk-based capital ratio Japanese parent$_{-2}$	99.297**	−103.071
	(29.363)	(66.242)
Nonperforming loan ratio at Japanese parent$_{-1}$	17.170	−177.435
	(30.247)	(169.992)
Nonperforming loan ratio at Japanese parent$_{-2}$	−33.842	247.687
	(25.599)	(194.375)
Nonperforming loans availability dummy$_{-1}$	−14.081	603.579
	(63.272)	(424.340)
Nonperforming loans availability dummy$_{-2}$	−86.744	−660.400
	(57.784)	(468.004)
Change in land prices$_{-1}$	−4.921	−3.554
	(2.647)	(7.565)
Change in land prices$_{-2}$	9.114**	7.029
	(2.773)	(8.295)
Included exogenous variables		
Nonperforming commercial real estate loan ratio$_{-1}$	−4.995	−49.144**
	(5.657)	(17.927)
Nonperforming commercial real estate loan ratio$_{-2}$	−13.198*	−10.005
	(6.082)	(18.823)
Vacancy rate$_{-1}$	0.672	−2.435
	(2.021)	(10.184)
Vacancy rate$_{-2}$	1.154	−22.468
	(1.858)	(14.908)
Unemployment rate$_{-1}$	−6.762	−29.202
	(8.192)	(46.633)
Unemployment rate$_{-2}$	−24.496**	53.668
	(8.821)	(37.929)
Population growth$_{-1}$	−23.128	51.580
	(15.533)	(56.196)
Population growth$_{-2}$	−11.255	85.682
	(14.891)	(63.862)
Growth in real personal income per capita$_{-1}$	−2.764	13.956
	(2.102)	(9.145)
Growth in real personal income per capita$_{-2}$	−4.930*	14.276
	(2.047)	(7.588)
Mortgage rate$_{-1}$	2.115	86.885
	(11.180)	(70.030)
Mortgage rate$_{-2}$	11.546	−65.487
	(10.606)	(45.082)
Inflation rate$_{-1}$	2.218	−38.043
	(5.513)	(34.576)
Inflation rate$_{-2}$	−11.236	−2.430
	(7.435)	(34.574)
Consumer confidence index$_{-1}$	−3.452**	2.474
	(0.933)	(5.120)
Consumer confidence index$_{-2}$	−3.419**	1.733
	(1.004)	(5.019)
R^2	0.648	0.431
Sum of squared residuals	2,186,730	55,789,200
Standard error of the regression	81.901	413.682
Partial R^2 for excluded exogenous variables	0.368	0.056
F-statistic for set of excluded exogenous variables	41.75**	1.09
n	375	375

Notes: The equations also include a set of state dummy variables (fixed effects). Coefficient standard errors (corrected for heteroskedasticity) are in parentheses.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

estate loans does not generate a significant effect in this specification, the effect does appear indirectly through the estimated effect of the change in commercial land prices. Although only one of the two estimated coefficients has the predicted sign (positive), the sum of their effects is positive. Furthermore, only the estimated positive effect from the second lagged value is significant. Thus, falling land prices in Japan began to retard lending in the United States by Japanese banks within one year of the land price decline. That the Japanese-related variables are good instruments for the loan supply effects emanating from Japan can be seen from the two statistics reported at the bottom of

Table 3. The partial R^2 for the specification that includes only the eight Japanese-related instruments is 0.368, a value more than half that of the R^2 for the full column 1 specification. Similarly, the F-statistic value of 41.75 for the hypothesis that the eight coefficients on the Japanese loan supply instruments are each zero indicates that the hypothesis can be rejected at the 1-percent level (critical value = 2.51).

The second column replaces the dependent variable in the column 1 specification with the change in commercial real estate loans held by non-Japanese banks (domestically owned commercial banks and non-Japanese foreign-owned bank affiliates), divided by state population and the GDP investment structures price deflator. The purpose of this equation is to show that, indeed, the Japanese-related instruments are not correlated with commercial real estate lending by non-Japanese banks. As expected, none of the estimated coefficients on the Japanese-related instruments are significant. In fact, the partial R^2 for the specification that includes only the eight Japanese-related variables is only 0.056, representing less than 15 percent of that for the full column 2 specification. Similarly, the F-statistic value of 1.09 indicates that we cannot reject at the 5-percent level (critical value = 1.94) the hypothesis that all eight of the Japanese-related instruments have coefficients equal to zero.

While the non-Japanese explanatory variables account for most of the fit of the equation, only the first lagged value of the nonperforming commercial real estate loan ratio is significant. However, this lack of significance of individual coefficients is related to the collinearity induced by the large number of related state and national explanatory variables. When the equation is reestimated with a single lagged value of each of these variables, the estimated coefficient on the nonperforming commercial real estate loan ratio is significant at the 1-percent level, that for the vacancy rate is significant at the 5-percent level, and those for the growth rates of state real per capita income and state population are each significant at the 10-percent level.

Thus, the results in Table 3 confirm that the Japanese-related variables, especially parent bank risk-based capital ratios and the change in Japanese commercial land prices, are good instruments for U.S. lending by Japanese banks, but not for lending by non-Japanese banks. In fact, the value of the Japanese instruments for the change in Japanese bank loans is reflected in the much higher R^2 in the first column (both for the overall equation and for the specification that includes only the Japanese-related instruments) compared to the second column. This evidence is consistent with fluctuations in U.S. lending by Japanese banks being driven, in large part, by a supply shock emanating from Japan.[26]

Table 4 provides the results from the two-stage least-squares specification that includes fixed effects for each state. For each of the four alternative measures of construction activity, the estimated coefficient on the change in commercial real estate loans held by Japanese banks is positive (as predicted) and significant at the 1-percent level.[27] Thus, the evidence indicates that increases and declines in U.S. commercial real estate lending by Japanese banks affect construction activity in the same direction, other things equal, whether a state's construction activity is measured by the number, the value, or the square footage of new construction projects, or by employment growth in the construction industry.[28]

For example, using the specification in the third column for ease in comparison, since both the value of new construction projects and the change in commercial real estate loans by Japanese banks are scaled by the same variables

[26] To further verify that the Japanese-related instruments are, in fact, uncorrelated with lending by non-Japanese banks, we also estimated the equation for non-Japanese bank lending with an alternative specification for the Japanese-related variables. For the states with no Japanese bank presence, values for the Japanese-related variables are constructed as the average value for all Japanese banks with a U.S. presence. As expected, the results are similar to those in the second column of Table 3, insofar as none of the Japanese-related instruments have significant estimated effects on lending by non-Japanese banks.

[27] In an earlier version of this paper, we used an alternative specification that included the contemporaneous change in commercial real estate loans held by non-Japanese banks (instrumented) as an additional explanatory variable. However, the results for the estimated coefficients for the change in commercial real estate loans held by Japanese banks were almost identical to those reported in Table 4.

[28] Because the Japanese parent nonperforming loan data were not available for the entire sample period, we reestimated the equations omitting the Japanese parent nonperforming loan ratio and the associated announcement dummy variable from the instrument list. This specification produced similar results.

TABLE 4—THE DETERMINANTS OF REAL ESTATE CONSTRUCTION CONTRACTS AND EMPLOYMENT GROWTH
ESTIMATION METHOD: TWO-STAGE LEAST SQUARES, 1989:2 TO 1996:2

	Number of construction projects	Square feet of construction projects	Real value of construction projects	State construction employment growth
Change in commercial real estate loans by Japanese banks	0.005**	0.015**	1.113**	0.007**
	(0.002)	(0.005)	(0.365)	(0.002)
Nonperforming commercial real estate loan ratio$_{-1}$	0.048	0.148	28.254	−0.316
	(0.124)	(0.368)	(22.278)	(0.165)
Nonperforming commercial real estate loan ratio$_{-2}$	−0.077	−0.321	−38.976	0.331
	(0.118)	(0.355)	(24.017)	(0.172)
Vacancy rate$_{-1}$	0.013	−0.035	−1.186	0.076
	(0.072)	(0.248)	(16.776)	(0.084)
Vacancy rate$_{-2}$	−0.126	−0.387	−28.328	0.118
	(0.075)	(0.233)	(18.492)	(0.082)
Unemployment rate$_{-1}$	0.576*	1.776*	61.486	−0.190
	(0.257)	(0.707)	(53.028)	(0.327)
Unemployment rate$_{-2}$	0.003	−0.450	−48.808	1.171**
	(0.218)	(0.593)	(46.296)	(0.275)
Population growth$_{-1}$	0.922	3.491	−10.399	1.440**
	(0.680)	(2.511)	(140.748)	(0.529)
Population growth$_{-2}$	1.434**	3.124	243.190*	−1.473**
	(0.533)	(2.035)	(114.054)	(0.494)
Growth in real personal income per capita$_{-1}$	0.325**	0.833**	39.701**	0.130
	(0.059)	(0.202)	(14.499)	(0.075)
Growth in real personal income per capita$_{-2}$	0.227**	0.758**	46.810**	0.146*
	(0.058)	(0.197)	(13.597)	(0.063)
Mortgage rate$_{-1}$	0.582	1.594	165.519*	−0.943*
	(0.371)	(1.013)	(76.141)	(0.381)
Mortgage rate$_{-2}$	−1.826**	−5.341**	−480.873**	0.307
	(0.293)	(0.838)	(63.458)	(0.314)
Inflation rate$_{-1}$	−0.342	−1.500*	−122.854**	−1.235**
	(0.200)	(0.616)	(42.814)	(0.233)
Inflation rate$_{-2}$	−0.459*	−0.249	−62.348	−0.189
	(0.218)	(0.645)	(46.382)	(0.283)
Consumer confidence index$_{-1}$	0.138**	0.547**	28.251**	0.139**
	(0.026)	(0.082)	(6.035)	(0.031)
Consumer confidence index$_{-2}$	−0.148**	−0.081	−17.426**	0.065
	(0.028)	(0.087)	(6.084)	(0.037)
R^2	0.909	0.904	0.859	0.590
Sum of squared residuals	2,239.12	21,538.4	125,442,000	2,683.63
Standard error of the regression	2.593	8.042	613.762	2.839

Notes: The equations also include a set of state dummy variables (fixed effects). Coefficient standard errors (corrected for heteroskedasticity) are in parentheses.

* Significant at the 5-percent level.

** Significant at the 1-percent level.

(the GDP investment structures price deflator and the state's population), a $100 decline in loans by Japanese banks operating in a given state corresponds with a decline of $111.30 in construction activity in that state. This indicates that construction lending by Japanese banks was not easily replaced by other lending sources, resulting in a substantial decline in construction activity.[29]

With respect to the other explanatory variables, 12 of the 16 have significant estimated effects in one or more of the specifications. However, only two of the explanatory variables, the second lagged value of the growth in real personal income per capita and the first lagged value of the Michigan index of consumer confidence, have estimated coefficients that are significant (and of the predicted sign) in each of the four specifications.[30]

The results from Table 4 can be used to show that the effect of Japanese bank lending on U.S. real activity in states with a significant Japanese bank presence is economically as well as statistically significant. Again using the specification in the third column for ease in comparison, we have used the estimated coefficient on the change in commercial real estate loans by Japanese banks (1.113) to calculate the effect on the real value of construction projects in the three states with the largest Japanese bank presence. Valued in 1996 dollars, Japanese lending declined by $14.5 billion in California from the peak in September 1992 through September 1996, a decline of 53 percent. The associated decline in the value of new construction projects was $16.1 billion, representing 50.6 percent of the average annual flow of new construction projects during this period. Thus, a loss of one-half year's construction activity in California can be attributed to the reduction in Japanese bank lending during this four-year period.

In New York, the constant dollar decline in Japanese bank lending from the March 1992 peak through September 1996 was $11.3 billion (a 50.3-percent decline), contributing to a $12.6-billion decline in new construction projects. This represents an even larger decline of 86.2 percent of the average annual flow of new construction projects in New York during this period. Finally, the constant dollar decline in Illinois from September 1991 through September 1996 was $2.5 billion (a 71.3-percent decline), accounting for $2.8 billion of new construction projects. This represents 23.0 percent of the average annual flow of new construction projects in Illinois during this period.

III. Conclusion

This study finds that the collapse of the Japanese equity and real estate markets contributed to a decline in real economic activity in the commercial real estate sector in the United States. The transmission of the shock occurred through globally active Japanese banks that responded to the problems in Japan by reducing lending in the United States. Because Japanese banks had achieved such a large degree of penetration in some of the major commercial real estate markets in the United States, this decline in lending had real effects on construction activity.

An earlier study (Peek and Rosengren, 1997) showed that declines in risk-based capital ratios associated with the decline in Japanese stock prices caused Japanese commercial and industrial lending in the United States to decline. However, by focusing on the commercial real estate market rather than the C&I loan market, which is more tied to national business conditions, this study is able not only to identify an independent loan supply shock, but to provide a test for the impact of the loan supply shock on real economic activity. This is because the variation across spatially separated commercial real

[29] The estimated effect in excess of a dollar-for-dollar reduction in construction activity does not imply that none of the lending gap created by the retrenchment by Japanese banks was replaced by other sources. Because loan-to-value ratios are typically substantially less than one, a dollar reduction in new construction would correspond to less than a dollar reduction in loans outstanding. For example, with a loan-to-value ratio of 70 percent, a $100-million commercial real estate loan would correspond to a $143-million project. In this case, a $100-million decline in loans by Japanese banks operating in a state would correspond to a $143-million decline in new construction activity if none of the reduced lending by Japanese banks were replaced by other lenders.

[30] As might be expected, when the equations are estimated with only a single lagged value of the non-Japanese variables, the *t*-statistics on the associated estimated coefficients tend to rise and a larger share of the coefficients are statistically significant. However, the significance levels of the estimated coefficients on the change in loans by Japanese banks remain significant.

estate markets in the United States, as well as the variation in the degree of penetration by Japanese banks across these markets, contributes to our ability to identify the effects of the supply shock. Because the Japanese banking presence is concentrated in a few regions of the country, we are able to exploit the variation across commercial real estate markets to verify that the Japanese loan supply shock had a real effect on U.S. construction activity. We find that this loan supply shock significantly reduced construction activity in those markets with a large Japanese bank penetration, providing clear evidence that an internationally transmitted shock to credit availability can have real effects on the host country.

The evidence of the Japanese bank pullback in these commercial real estate markets may be indicative of actions by both bank management and bank regulators. To date, Long-Term Credit Bank, Nippon Credit, and Hokkaido Takushoku are the three largest Japanese depository institutions requiring nationalization as a result of their nonperforming loan problems. In March 1997, these banks had assets of $238 billion, $156 billion, and $94 billion, respectively, and were among the 100 largest banking institutions worldwide. Prior to the nationalization, each bank disclosed its intention to abandon all international operations and focus instead on core domestic operations as part of its rescue plan, a move that, based on reported comments by officials at the Bank of Japan, was supported by regulators. While these banks were extreme cases, our results indicate that less troubled banks also responded to declines in capital ratios and increases in nonperforming loans in Japan by reducing their commercial real estate lending in the United States.[31]

From a public policy standpoint, this study indicates that credit flows by global banks will be influenced by both domestic and foreign conditions. Moreover, a bank's capitalization will not be a sufficient statistic for predicting its willingness to lend. Nonperforming loans, even those yet to be reflected in capital ratios or publicly disclosed, can alter the willingness of global banks to lend.

While the Japanese have been retreating recently from the U.S. market, it must be remembered that borrowers benefited from their willingness to lend in the late 1980's and early 1990's at a time when many U.S. banks were undercapitalized and reluctant to lend. The increased integration of local commercial real estate markets through the entry of globally active banks should increase competition in these markets, providing a more diversified source of funding to the commercial real estate sector and making these markets more efficient and less sensitive to localized loan supply shocks. These benefits are likely to be even greater in countries with less developed financial markets that may be more dependent on bank financing. In that case, a foreign banking presence could provide much-needed stability to a country experiencing a severe domestic shock.

[31] Termination of international operations has an additional advantage that simply scaling back overseas operations does not have. For Japanese banks active only in domestic markets, the risk-based capital ratio requirement is only 4 percent, compared to the 8 percent Basle requirement for internationally active banks.

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