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Author(s): Diana Hancock and James A. Wilcox
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Diana Hancock and James A. Wilcox*

Abstract

Although there is considerable evidence that pressure on commercial banks' capital positions in the early 1990s reduced their real estate lending, there is little systematic evidence that real estate activity was appreciably affected by the bank capital crunch. Using data for 1986 through 1992 by state, we estimated the effects of the bank capital crunch and of national and local economic conditions on building permits, construction contracts, housing starts, mortgage originations, and sales.

We found significant effects of the capital crunch and of various economic conditions on commercial and residential real estate activity. The estimated effects on permits and construction contracts in residential real estate markets were at least as large as those in commercial real estate markets. Although lending for residential development and construction apparently was reduced by the capital crunch, secondary markets for residential mortgages at least partially shielded mortgage originations and home sales from banks' capital shortfalls.

Keywords: bank capital; capital crunch; construction contracts; secondary markets

Bank Capital and Real Estate Lending

Over the past 10 years, the composition of commercial banks' loan portfolios has shifted markedly, with the share devoted to real estate loans rising sharply during the second half of the 1980s and then remaining fairly steady during the first half of the 1990s. As figure 1 shows, the aggregate share of banks' loan portfolios devoted to home mortgages (single-family real estate loans) rose from 9 percent in 1985 to 14 percent in 1992, with an especially steep increase in 1990, and the share devoted to commercial real estate loans rose from less than 8 percent in 1985 to more than 10 percent in 1989 and then declined over the next few years.[1]

Various reasons for the change in the share of banks' loan portfolios devoted to real estate loans have been advanced. Attention has focused primarily on the role of banks' capital

[1] These data closely track Call Report data supplied by commercial banks (see Hancock and Wilcox 1994b).

Figure 1. **Real Estate Loans as a Share of Commercial Banks' Financial Assets**
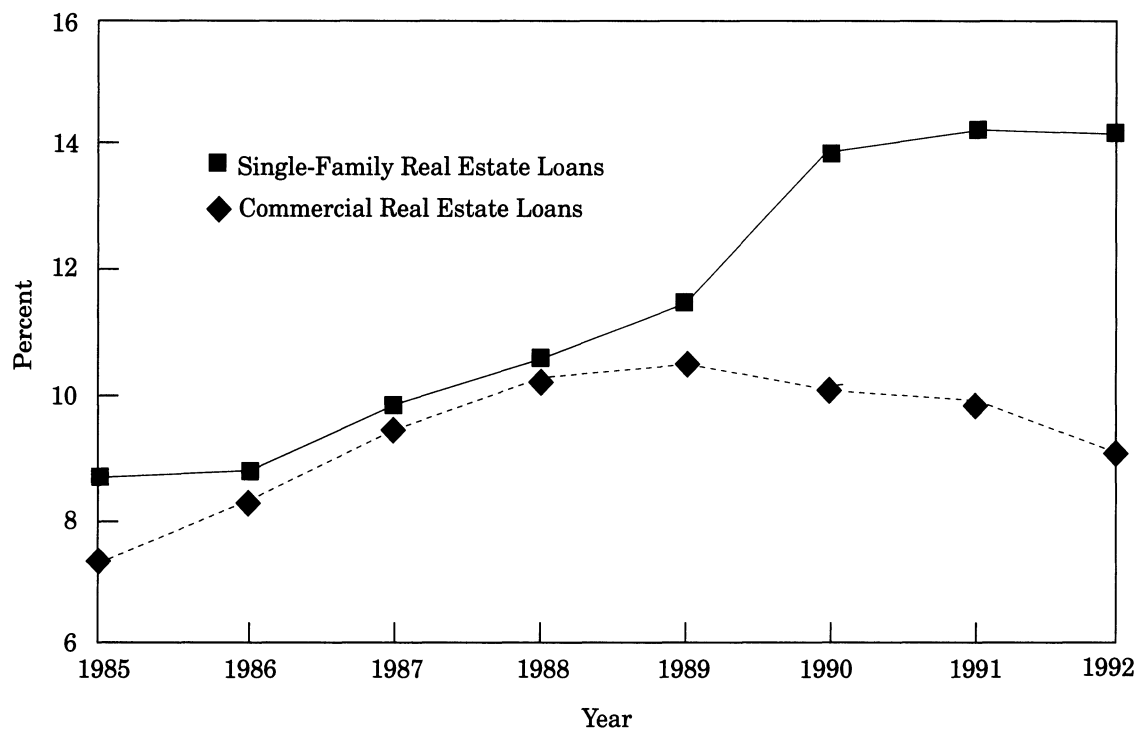
conditions in reducing their real estate lending, especially their commercial real estate lending. Enormous loan losses, associated particularly with commercial real estate loans, had lowered banks' capital-to-asset ratios substantially by the early 1990s. The implementation of the Basle Accord's risk-based capital guidelines beginning in the early 1990s raised the capital requirements for commercial relative to single-family real estate loans. Regulators allegedly also adopted more stringent accounting requirements for bank capital in the 1990s than they had used during the 1980s (Bizer 1993). That these pressures on banks' capital positions—dubbed the "capital crunch" by Peek and Rosengren (1995)—did, all else being equal, reduce banks' supplies of credit to real estate markets has econometric support (Hancock and Wilcox 1993, 1994a, 1994b; Peek and Rosengren 1994, 1995).

A capital crunch is only one of the several factors that might have affected banks' supply of credit for real estate, however. The presence of a capital crunch does not in and of itself indicate whether the total supply of bank credit for real estate rose or fell during this period. Indeed, theory does not unambiguously predict whether reduced capital at deposit-insured banks would raise or lower the proportion of their portfolios devoted to risky assets such as real estate loans. Furlong and Keeley (1989) show that capital reductions strengthen the incentive to "bet the bank" with a riskier portfolio. Keeley (1990) concludes that the evidence supports that view. Alternatively, if capital was depleted by loan losses that increased the perceived riskiness of real estate loans, then banks' desired holdings of real estate loans might well have declined in response to real estate loan losses.

What is often not recognized is that between 1985 and 1992, commercial banks in the aggregate quite steadily increased their share of the total stocks outstanding of both single-family and commercial real estate loans. From 1985 through 1992, banks increased their share of all single-family real estate loans outstanding by about 3 percentage points (figure 2). Over the same period, the thrift industry's share of home mortgages declined and government-sponsored enterprises' share mushroomed. The data in figure 3 are perhaps more surprising: From 1985 through 1992, commercial banks' share of all commercial real estate loans outstanding rose from 37 to 46 percent, an increase of more than 25 percent. Thus, the reduction of credit to the real estate sector may not have originated in banks but, rather, have been transmitted through them, when nonbank real estate lenders such as insurance companies and pension funds reduced their supplies of credit.

Figure 2. **Commercial Banks' Share of Total Single-Family Real Estate Loans Outstanding**

Despite the possibility that other lenders played a role in reducing real economic activity in real estate markets, we focused on the role of commercial banks in providing credit to the real estate sector because their portfolios responded so vigorously to the capital crunch. An important but as-yet-unresolved aspect of the bank capital crunch is whether capital shortfalls and the associated reductions in credit supplied to real estate markets by banks had appreciable effects on real economic activity in residential or commercial real estate markets. This article describes an attempt to discriminate between the effects of the bank capital crunch and the effects of other factors on activity in real estate markets: Did the bank capital crunch reduce real estate sector construction, sales, and income?
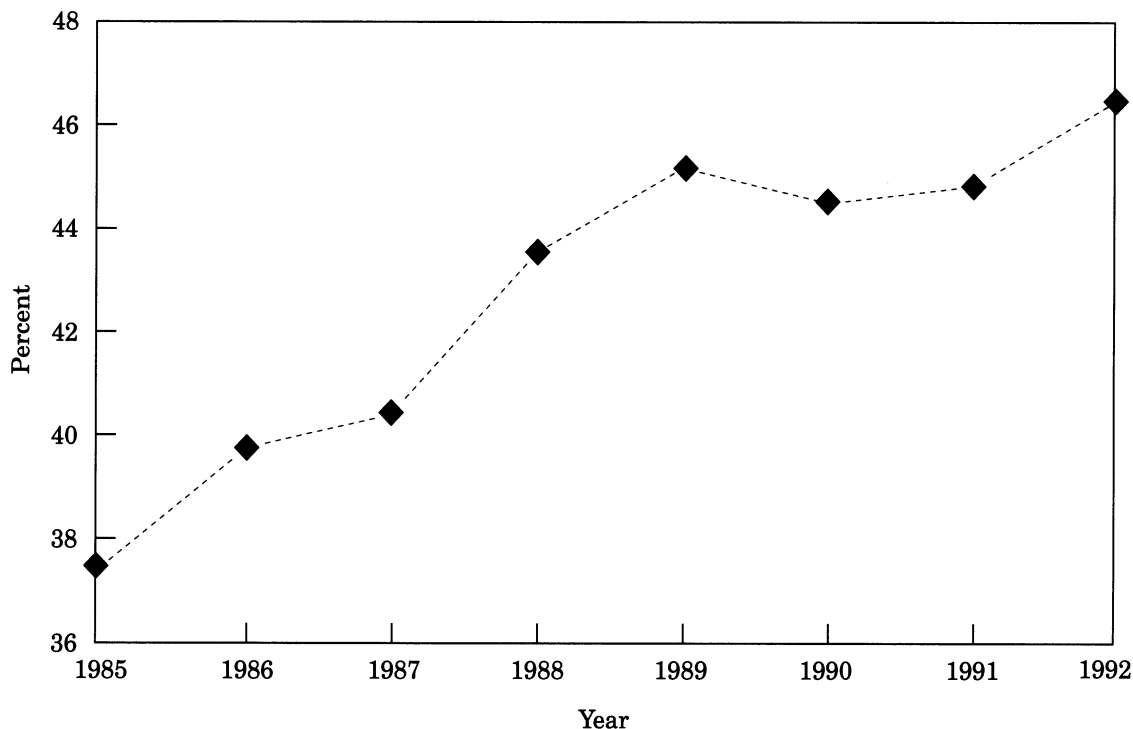
Figure 3. **Commercial Banks' Share of Total Commercial Real Estate Loans Outstanding**

Source: Board of Governors of the Federal Reserve System (1995).

Nonbank Finance

The evidence that banks reduced their supply of credit, all else being equal, in response to a capital crunch does not necessarily imply that the bank capital crunch reduced economic activity generally or real estate market activity in particular. Increased credit flows from private, nonbank institutions and from government agencies may have largely offset banks' reduced credit supply, thereby partly or even wholly insulating real estate market activity from reduced supplies of bank credit. These alternative lenders may have been under less capital pressure than commercial banks because they had suffered fewer loan losses in the recent past, did not have to contend with such severe increases in the effective amount of capital supervision, or were subject to capital requirements that had not been stiffened during this period.

The effects of bank capital pressures on real estate markets may also have been ameliorated by the existence of private sector secondary markets for real estate loans. Capital-pressured banks could originate loans, particularly single-family real estate loans, so long as they could sell them to banks that were not capital constrained. Thus, one advantage of secondary markets for loans may be that they allow banks not under capital pressure to indirectly fund loans originated by banks that are under capital pressure.

Issuance of mortgage-backed securities by government-sponsored enterprises such as Fannie Mae and Freddie Mac also may have tempered the effects of capital pressures on real estate markets. Bradley, Gabriel, and Wohar (1995) argue that by the second half of the 1980s, disruptions in the thrift industry no longer had a perceptible effect on mortgage interest rates or, by implication, on activity in the real estate sector. They attribute this insulation of the real estate sector from thrift industry disruptions largely to the development of the secondary mortgage market. To the extent that these enterprises were willing to purchase bank-originated mortgages, banks' capital pressures may have had little effect on residential mortgage interest rates or volume.

The Basle Accord's lower capital weights on mortgages and mortgage-backed securities provided banks with a way to maintain their residential real estate lending while reducing their required capital. The Basle Accord allowed banks to hold less capital against mortgages than against business loans and allowed them to hold even less capital against mortgage-backed securities issued by government agencies than against the mortgages that backed those securities. Rather than reducing their mortgage originations or holdings of real estate loans in the wake of a loss of capital, banks may have reduced the amount of capital they were required to hold by reducing their holdings of business loans or by selling mortgages to agencies and then buying equivalent amounts of mortgage-backed securities. In that case, the amount of credit flowing to, and presumably the amount of activity in, the real estate sector would have been unaffected by the bank capital crunch.

Real Effects on Real Estate

If real estate credit supplied by government-sponsored enterprises, pension funds, insurance companies, and finance companies was not a perfect substitute for bank-supplied credit, then reduced supplies of bank credit would have reduced the total amount of credit supplied to the real estate sector. Such a decline would be expected to lead to declines in activity in the residential and nonresidential construction sectors, construction contracts, housing starts, home sales, mortgage originations, and other measures of real estate market activity.

Though there is considerable evidence that bank capital pressures reduced the supply of bank credit to real estate markets, there is scant evidence that bank capital pressures had appreciable effects on real economic activity. Bernanke and Lown (1991), for example, estimated that capital pressures did affect bank loan growth but did not significantly affect aggregate employment growth. Friedman and Kuttner (1993) found little evidence that the capital crunch either caused or contributed to the national recession that began in the middle of 1990.

We examined the extent to which conditions in local banks and in local economies affected financial and real activity in local real estate markets. First we looked at whether commercial bank portfolios, aggregated to the statewide level, were affected by the kinds of local economic and bank conditions previously identified in bank-level data as having affected banks' holdings of commercial and single-family real estate loans (Hancock and Wilcox 1994a, 1994b). We found that in states in which banks were under capital pressure, banks' holdings of real estate loans declined. Next we estimated whether

various measures of real economic activity in the real estate sector were affected by those same local economic and bank conditions. We found that activity in real estate markets was also reduced by bank capital pressures.

In the following sections we describe a model of the supply of and demand for the outstanding stock of real estate and describe the data we used. Subsequent sections lay out the specifications we used for our empirical tests and present our regression results.

A Model of Activity in Real Estate Markets

In our simple model of the demand for and supply of the stock of real estate, we did not distinguish between developed and undeveloped real estate, or between commercial and single-family real estate, because the basic features and implications of our model apply to each type of real estate. Nor did we distinguish between banks and other sources of financing.

We assumed that the demand for real estate by potential buyers depended negatively on P, the price of real estate relative to the price of other goods and services. We also assumed that potential buyers' demand for real estate was a decreasing function of R, the interest rate on mortgages, and an increasing function of N, the nonprice terms on mortgages.[2] The nonprice terms mitigated the problems of adverse selection and moral hazard that were prevalent in financial contracting. Ceilings on the loan-to-value ratio and on the ratio of interest payments to cash flows were among the most common nonprice terms; increases in either ceiling would have been expected to raise the demand for real estate.

In our model, demand for real estate was also affected by potential buyers' perceptions of current conditions and by their expectations about future conditions—for themselves and in real estate markets. We labeled the vector of variables that buyers used to inform themselves about these conditions $\mathbf{X}$. In $\mathbf{X}$ we included measures of consumer sentiment, recent rates of change of real estate prices, unemployment rates, and a number of other variables, including the capital condition of banks.

Lenders were also likely to adjust their price and nonprice terms for mortgages according to their knowledge of the current conditions and their expectations about the future conditions of borrowers, real estate markets, and banks. We assumed that during the period studied lenders used the same information used by buyers—that contained in $\mathbf{X}$— to inform themselves about the likely present and future conditions of borrowers, real estate markets, and banks and to adjust mortgage interest rates and nonprice mortgage terms. Thus, the demand for real estate was driven directly by $\mathbf{X}$ and indirectly via the effect of $\mathbf{X}$ on the terms of financing. In addition, lenders that were under capital pressure, whether from regulators or from financial markets, may have curtailed their lending to potential real estate buyers and builders to restore their capital-to-asset ratios. We expressed the demand for real estate as

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[2] Peek and Wilcox (1991) specified the demand for housing as a function of a real after-tax interest rate. During our 1985–92 sample period, the expected inflation rate varied little relative to nominal interest rates, so the nominal rate and real mortgage rates were fairly highly correlated. As Wilcox (1989) notes, when borrowers find themselves constrained by lenders' ceilings on payment-to-income ratios, the nominal and the real after-tax interest rates independently influence household demand.

$$Q^D = f(P, \mathbf{X}, R, N(\mathbf{X})). \tag{1}$$

The stock of real estate supplied in the current period was the sum of the stock carried over from the prior period, Q_{-1} (the prior period's stock less depreciation), and the flow of newly produced real estate. We assumed that the flow of newly produced real estate responded positively to the relative price of real estate P: When the price of real estate was above its replacement cost, construction flows were positive, raising the stock supply of real estate. In addition, we assumed that the flow supply of real estate depended on the mortgage interest rate (R) and on nonprice terms (N) of financing real estate construction. The flow of new construction, and thus the stock, responded negatively to higher construction financing costs and to stricter financing terms. The flow supply of real estate also likely depended on $\mathbf{X}$: In deciding whether to supply more real estate, builders were likely to use the same information deemed relevant by buyers and lenders. Thus, we expressed the supply of real estate as[3]

$$Q^S = g(Q_{-1}, P, \mathbf{X}, R, N(\mathbf{X})). \tag{2}$$

Combining equations (1) and (2) and substituting $\mathbf{X}$ for N produced a reduced form for the quantity of real estate[4]

$$Q = h(Q_{-1}, R, \mathbf{X}). \tag{3}$$

We assumed that we could reasonably approximate the reduced form in equation (3) with a linear specification,

$$Q = \beta_0 + \beta_1 Q_{-1} + \beta_2 R + \boldsymbol{\beta}_3 \mathbf{X}, \tag{4}$$

where $\boldsymbol{\beta}_3$ is the vector of coefficients conformable with $\mathbf{X}$.

Solely estimating the reduced-form equation (4) cannot, however, inform us about the magnitude or significance of the separate responses of buyers, lenders, and builders to changes in R or in $\mathbf{X}$. The coefficient β_2 represents the net effect of the responses of buyers and builders to the relevant mortgage interest rate. Similarly, the coefficients in $\boldsymbol{\beta}_3$ represent the net effects on the quantity of real estate of the responses of buyers, builders, and lenders to changes in the elements of $\mathbf{X}$. We expected that the direction of responses to changes in mortgage interest rates or in any of the elements of $\mathbf{X}$ would be the same for each segment of the real estate market. For example, all else being equal, higher unemployment rates were likely to (1) reduce demand by potential buyers, (2) further reduce demand as lenders tightened the nonprice terms on mortgages, and (3) reduce the supply of real estate if builders expected less demand in the future.

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[3] Peek and Wilcox (1991) found that the relative price of construction materials significantly affected the relative prices of houses over the past several decades. However, from 1985 to 1989, the relative price of construction materials was the least important of the several influences they studied. During our sample period, the relative price of construction materials changed little; it rose by less than 0.5 percent per year. Thus, we omitted it from our supply function.

[4] For a model of the supply of and demand for real estate that developed a reduced form for the price rather than the quantity of real estate, see Peek and Wilcox (1991).

Data

Our data measured various aspects of real estate sector activity and of conditions in real estate markets, in the national and local economies, and at commercial banks.

Sample Period and Measures of Macroeconomic, Real Estate, and Banking Conditions

We collected data by state for each year from 1984 through 1992. Having cross-section data allowed us to estimate far more coefficients than the short time series available would have permitted. The cross-sectional dimension of our data set also permitted us to estimate the effects on real estate more precisely than would have been possible with data aggregated to the national level.

Alaska, Hawaii, Nevada, and the District of Columbia were excluded from our analysis because plots and regressions indicated that many of the data for these four small-population areas were outliers. Real estate activity in these areas during our sample period was apparently dominated by local factors such as tourism, for which we had no empirical proxies. Factors specific to each of these areas may also have been important. For example, during our sample period the Hawaiian real estate market may have been affected greatly by conditions in Japan; the market in the District of Columbia, where public housing and federal government employment loom large and many employees live in Maryland or Virginia, may not have responded the same way as the rest of the nation to our proxies; the market in Alaska may have been especially sensitive to world oil markets, which were roiled by the events during 1990 that culminated in the 1991 Gulf War; and the market in Nevada may have been greatly affected by large cutbacks in defense spending and other events in the large, neighboring state of California.

After allowing for first-differencing of the data and for one-year lagging of some of the right-hand-side variables, and after omitting observations for Alaska, Hawaii, Nevada, and the District of Columbia, in our regressions we used annual observations for 1986 through 1992 for 47 states (329 observations).

Next we present some details about the data series we used as measures of economic activity in real estate markets, of relevant national and local economic conditions, of conditions in local real estate markets, and of commercial bank conditions.

Construction of Bank Data by State

To estimate banks' commercial and single-family real estate loan holdings by state, we obtained, from end-of-year Call Reports filed by roughly 11,000 individual commercial banks, data for holdings of single-family and of commercial real estate loans.[5] We classified each bank as either "small" or "large" on the basis of its assets. The small banks, those with less than $5 billion of assets, were assumed to be banks whose lending and other activities took place entirely within the state in which they were headquartered.

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[5] Call Report data pertained to both domestic and foreign offices of insured U.S.-chartered commercial banks.

The large banks, those with more than $5 billion of assets, were assumed (for each year in which they held assets at that level) to be "regional" banks that operated across the states but within one of the eight regions defined by the National Council of Real Estate Investment Fiduciaries (1992).

We apportioned the dollar amount of single-family and commercial real estate loans of a large bank among the states in its region according to the share of the total regional personal income that each state accounted for. Banks' holdings of real estate loans for each state were the sum of the dollar holdings across the small banks and the dollar holdings attributed to that state for the large banks.

Measures of Real Economic Activity in the Real Estate Sector

Because no single annual data series available by state seemed adequate to summarize activity in the real estate sector, we used several measures of economic activity in commercial and residential real estate markets. These measures pertained to various stages of processing and aspects of real estate activity: permits, construction contracts, starts, mortgage originations, home sales, personal income generated in the construction sector, and personal income generated in the finance, insurance, and real estate (FIRE) sector. Unless otherwise noted, these data were available by state.

Permits. Data for permits came from *Current Construction Reports* (U.S. Bureau of the Census 1981–93), which surveys 17,000 permit-issuing places nationally. For commercial real estate construction, the data included information on the dollar value of projects, based on building permits issued.[6] For residential construction, the data included the dollar value of projects and the number of units authorized. These data reflected permits for single-family construction and for total residential construction, which included both single-family units and privately owned structures with more than a single unit. The vast majority of permits for residential construction were for single-family structures.

Construction Contracts. Information on new construction contracts came from the *Dodge Construction Potentials Bulletin* (F. W. Dodge 1981–93), which reports, by structure type and by state, various measures of the commitment of work on residential buildings about to start. Residential buildings include one- and two-family houses and apartment buildings. Statewide estimates of the value, number of dwellings, and square footage (excluding basements) of residential construction projects under contract to build are constructed from monthly reports from places that issue at least 50 permits annually, along with various published data and survey information.[7] The value of construction contracts excludes land and architectural fees. Not surprisingly, the correlation between the value of permits authorized for privately owned units in permit-issuing places and the value of residential construction contracts was quite high (0.89). The correlation between the number of units authorized and the number contracted for was also high (0.87).

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[6] These data were available only for the 1988–92 period.

[7] For areas that did not require building permits, construction was prorated by population.

The *Dodge Construction Potentials Bulletin* also contains estimates of the dollar value, number of projects, and square footage contracted for in commercial real estate projects.[8] Commercial real estate includes stores and other mercantile buildings, warehouses, office and bank buildings, commercial garages and service stations, manufacturing plants, laboratories, schools and college buildings, libraries, museums, government buildings, and religious buildings. As with the residential data, values exclude land and architectural fees. In addition, the value of construction contracts for manufacturing buildings excludes the cost of equipment that is not an integral part of the building.

Starts. Estimates of the number of starts of new, privately owned single-family housing units came from the National Association of Home Builders (1993). The correlation between the number of single-family permits and the number of single-family housing starts was 0.90; the correlation between the number of single-family dwellings under contract and the number of housing starts was 0.96.

Mortgage Originations. For estimates of mortgage originations, we used unpublished data from the U.S. Department of Housing and Urban Development (n.d.), which surveys many of the financial institutions that provide residential finance to construct an estimate of the dollar value of originations of one- to four-family mortgages. Our measure of mortgage originations consisted of mortgages originated at commercial banks, mutual savings banks, savings and loan associations, life insurance companies, private pension funds, mortgage companies, private mortgage-backed securities conduits, state and local retirement funds and housing authorities, and 12 federal credit agencies, including Fannie Mae and the Government National Mortgage Association. Mortgages on both new and existing homes, whether for purchase of property, for refinancing, or for home equity loans, were included.

Home Sales. We used data from *Existing Home Sales* (National Association of Realtors [NAR] 1981–93). NAR estimates the number of existing single-family houses, apartment condominiums, and cooperatives sold.

Personal Income from the Real Estate and Construction Sectors. Data for the dollar value of personal income generated in the FIRE sector and in the construction sector—supplemental measures of the amount of activity in real estate markets—came from the U.S. Department of Commerce (1994).

National and Local Economic Conditions

Our proxy for consumers' (and presumably bankers' and builders') views about current and future economic conditions was the national index of consumer sentiment produced by the Survey Research Center at the University of Michigan. We also used national average data for interest rates—secondary-market yields on fixed-rate and adjustable-rate home mortgages from Fannie Mae.

As measures of general economic activity in each of the states, we used total personal income data from the U.S. Department of Commerce (1994) and the unemployment rate

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[8] A project was defined as a single entry for a single structure code. An exception was made for apartment buildings, where each building was counted as a project.

from the U.S. Department of Labor (1981–93). As our estimate of population growth by state, we used the percentage change in the number of midyear residents, data for which came from the U.S. Bureau of the Census (1993).

Real Estate Market Conditions

The return on commercial real estate was calculated as the total return (income plus capital gain), in percentage points, on commercial real estate as measured by the National Council of Real Estate Investment Fiduciaries (1992). These data were available for eight multistate regions. Each state was assigned the return reported for its region.

The growth rates of house prices by state were calculated as the percentage changes in NAR's median sales prices of existing single-family homes in metropolitan areas, which are published in *Existing Home Sales* (NAR 1981–93). Prices for metropolitan areas were aggregated to form statewide prices by taking an unweighted average of the data for the cities in each state. States that had no city in the NAR database were assigned the median price in an economically similar, typically neighboring, state.

Commercial Bank Conditions

Our estimates of banks' capital shortfalls and surpluses were based on Call Report data. We calculated the capital pressure on each bank as the difference between the bank's actual (reported) tier 1 capital and a target level of tier 1 capital for the bank. Determining a bank's capital target for each year was problematic because the definition of capital on which regulators focused changed over time, the minimum capital ratios that regulators imposed changed over time, and banks often were not told precisely what their minimum required capital ratio was.

Between 1981 and 1985, regulators phased in a uniform minimum requirement for "primary capital" (equity plus loan loss reserves) of 5.5 percent of assets. This requirement prevailed until 1989, when regulators began to require a minimum ratio of tier 1 capital to assets of 3 percent. Tier 1 capital excluded loan loss reserves and a portion of preferred equity. Additional capital was required for organizations that exhibited operational weaknesses or that had riskier portfolios and off-balance-sheet activities, including but not limited to interest rate risk, credit risk, and liquidity risk. For all but the highest rated banks, the minimum tier 1 capital ratio was raised at least 100 basis points above the 3 percent minimum (Board of Governors of the Federal Reserve System 1994). In the early 1990s, regulators phased in minimum risk-based capital ratios in two steps, in keeping with the Basle Accord, while maintaining their existing capital regulations. Thus, some banks were presumably bound by the Basle Accord's risk-based capital guidelines, while others were bound by the capital standards already in place (Hancock and Wilcox 1994a).

Unfortunately, during much of our sample period, regulators did not provide a bank with a specific dollar value for its minimum required capital but only indicated whether the capital held was sufficient under the prevailing guidelines. As a consequence, we did not

have data for the target amount of capital for each bank. Moreover, regulators apparently changed over time the way they evaluated banks' financial conditions (Bizer 1993). For example, beginning in the late 1980s, regulators apparently adopted a more stringent attitude toward delinquent loans and even toward loans on which payments were still current but that were expected to become delinquent in the future. In addition, market pressures for holding capital apparently changed over time, quite apart from regulatory requirements. As a consequence, capital pressure changed even when stated regulations were unchanged.

We calculated the capital shortfall of bank i as the difference between its target amount of tier 1 capital K_i^T and its actual capital K_i:

$$K_i^T - K_i = k^T A_{i,-1} - K_i, \tag{5}$$

where k^T is the target capital-to-asset ratio and $A_{i,-1}$ is the assets at bank i in the previous period, $t - 1$. We set each bank's target capital-to-assets ratio at 4.75 percent. This proxy was constant through time and across banks.[9]

Each bank's assets at time $t - 1$, $A_{i,-1}$, were multiplied by 4.75 percent to determine its dollar capital target.[10] We took the actual level of capital that the bank had at time t as our proxy for how much capital the bank expected, as of time $t - 1$, to have at time t. A bank's capital pressure reflected its target capital relative to how much capital it expected to have. A bank with a capital shortfall as defined here would have to reduce its assets between time $t - 1$ and time t to reach its target capital-to-assets ratio at time t, given the capital it expected at time $t - 1$ to have at time t. A bank with a capital surplus—that is, one having more capital than required to reach its capital target—would have been able to increase its asset holdings and still reach the target. By construction, each bank was calculated to have either a surplus or a shortfall of capital (both measured positively), unless actual capital equaled required capital. Banks with capital surpluses were assigned shortfalls equal to zero; those with capital shortfalls were assigned surpluses equal to zero.

We used the same method that we used for real estate loans to construct statewide aggregates of the dollar value of banks' capital shortfalls and surpluses: A large bank's capital shortfalls and surpluses were apportioned to each state in its region according to the state's share of regional personal income.

Specification of the Regression Equations

The implicit disturbance term in equation (4) was thought likely to contain a state-specific component as well as year-specific and completely random components. To remove state-specific fixed effects, we first-differenced the specification in equation (4).

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[9] Using target capital ratios over the range 4.0 percent to 5.5 percent (0.75 percentage point below and above the 4.75 percent we used to produce the results shown) produced results similar to those presented in this article.

[10] Using this measure of banks' capital targets preserved comparability of our results with those presented earlier (Hancock and Wilcox 1993, 1994a). Hancock and Wilcox (1994b) estimated a target capital level for each bank based on its individual characteristics. Those results were similar to the results that we obtained here using the uniform target capital-to-assets ratio of 4.75 percent.

The first-differenced version of equation (4) implied that the *flow* of real estate activity (the level of annual starts, new contracts, and the like) depended on first differences of the variables in equation (4)—population, income, interest rates, and so on. Indeed, it seemed quite natural that the annual flows of real estate activity depended on the flow of population, for example. Less obvious was whether the levels or first differences of interest rates, unemployment rates, and the other explanatory variables were most appropriate empirically. In choosing whether to specify the remaining explanatory variables as levels or first differences, we used the criterion of empirical performance— the overall goodness of fit of the regressions and the statistical significance of the levels or first differences of variables relative to the flows of real estate activity.[11]

Though we did not include lagged reactions or adjustments in our model, we faced the empirical issue of whether to include lagged values of the dependent and independent variables. Equation (4) implied that the one-year-lagged values of the dependent variable should appear in the regressions, but preliminary results suggested that we should not include a lagged dependent variable, so we did not: The regressions generally ascribed almost all explanatory power to the lagged dependent variables and almost none to the other variables called for by our model or by other regression results. To reduce simultaneity biases, each of the three variables describing local economic conditions and the one describing real estate market conditions were lagged one year.

Because we used more than a dozen different measures of real estate activity and wanted to use the same specification for each of the regressions, we sometimes traded statistical significance for specification uniformity. We sacrificed little by using the same specification to explain each measure of either residential or commercial real estate. We settled on a regression specification that explained each of the flows of real estate activity as a function of the *changes* in personal income and population but of the *levels* of consumer sentiment, mortgage interest rates, the unemployment rate, the percentage returns on commercial and single-family real estate, and bank capital shortfalls and surpluses. The same explanatory variables were used in each of the regressions reported, with two exceptions: The recent percentage return on commercial real estate and the fixed-rate mortgage (FRM) interest rate were used only in the regressions for commercial real estate, and the percentage change in house prices and the adjustable-rate mortgage (ARM) interest rate were used only in the regressions for residential real estate.

The regression specifications used to generate the results presented in tables 1, 2, and 3 differ across columns only in their dependent variables—the measures of real estate market activity. The dependent variables were each expressed in real, per capita terms. The real estate series in tables 1 and 2 were converted to real terms by dividing the nominal values by the level of nominal median house prices in each state. The nominal income series in table 3 were converted to real terms by dividing them by the level of the national consumer price index. In tables 1 and 2, the dependent variables in the first columns of numbers are the changes in the commercial and single-family real estate loans held by commercial banks; the dependent variables in the remaining columns of tables 1 and 2 and in table 3 are the levels of annual flows.

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[11] Brayton and Mauskopf (1985) and Maisel (1963) used some variables specified in levels and some in first differences, apparently basing their choices on empirical performance rather than theory.

Table 1. **Estimated Effects on Commercial and Total Residential Real Estate Activity of Economic, Market, and Bank Conditions, 1986–1992**

	Dependent Variable						
	Commercial Real Estate					Total Residential Real Estate Permits*	
Explanatory Variable	Change in Commercial Real Estate Loans Held by Commercial Banks (Value)	Permits* (Value)	Construction Contracts				
			Value	Number of Projects	Square Feet	Value	Number of Units
National economic conditions							
Consumer sentiment index	0.0803 (3.36)	0.0265 (2.14)	0.0351 (2.10)	0.0105 (7.02)	0.0854 (4.33)	0.1019 (6.33)	0.1641 (7.68)
FRM interest rate	−0.5565 (−2.85)	−0.0927 (−0.89)	−0.0660 (−0.48)	−0.0488 (−3.98)	−0.2607 (−1.62)		
ARM interest rate						−0.4987 (−3.68)	−0.7979 (−4.51)
Local economic conditions							
Personal income change (lagged one year)	−0.0012 (−5.33)	0.0002 (2.28)	0.0006 (3.49)	0.0000 (3.44)	0.0013 (6.74)	0.0013 (6.15)	0.0022 (7.64)
Population growth rate (lagged one year)	−0.1937 (−4.55)	0.0452 (2.35)	0.1038 (3.48)	0.0093 (3.50)	0.2457 (6.98)	0.2648 (6.43)	0.4268 (7.94)
Unemployment rate (lagged one year)	−0.1642 (−2.54)	−0.0229 (−0.62)	0.0189 (0.42)	−0.0053 (−1.31)	−0.1319 (−2.47)	−0.1821 (−2.91)	−0.4107 (−5.02)
Real estate market conditions							
Commercial returns (lagged one year)	0.1438 (7.17)	0.0374 (3.44)	0.0231 (1.64)	−0.0029 (−2.32)	0.0163 (0.99)		
House price growth (lagged one year)						−0.0231 (−1.40)	0.0529 (2.45)

Table 1. **Estimated Effects on Commercial and Total Residential Real Estate Activity of Economic, Market, and Bank Conditions, 1986–1992** *(continued)*

Dependent Variable

Explanatory Variable	Commercial Real Estate		Construction Contracts			Total Residential Real Estate Permits*	
	Change in Commercial Real Estate Loans Held by Commercial Banks (Value)	Permits* (Value)	Value	Number of Projects	Square Feet	Value	Number of Units
Commercial bank conditions							
Bank capital shortfalls	−1.251 (−2.42)	−0.4112 (−1.46)	−0.0635 (−0.18)	−0.0407 (−1.26)	−1.028 (−2.41)	−1.669 (−3.40)	−1.664 (−2.60)
Bank capital surpluses	−0.0178 (−0.14)	0.1615 (2.52)	0.3535 (3.99)	0.0106 (1.34)	0.0143 (0.14)	0.0368 (0.33)	−0.1917 (−1.32)
Adjusted R^2	0.2892	0.8204	0.8832	0.9278	0.8930	0.8156	0.8374

Note: Figures in parentheses are t statistics.
* These data were available only for the 1988–92 period.

Table 2. **Estimated Effects on Single-Family Real Estate Market Activity of Economic, Market, and Bank Conditions, 1986–1992**

	Change in Single-Family Real Estate Loans Held by Commercial Banks (Value)	Dependent Variable								
		Permits*		Construction Contracts			Starts (Number)	Mortgage Originations (Value)	Existing Home Sales (Number)
Explanatory Variable		Value	Number	Value	Number of Dwellings	Square Feet			
National economic conditions									
Consumer sentiment index	-0.0003 (-0.02)	0.0906 (6.65)	0.1284 (8.71)	0.0987 (5.74)	0.1487 (7.37)	0.2249 (7.73)	0.1627 (7.75)	0.6253 (6.60)	0.2034 (6.31)
ARM interest rate	0.2288 (1.96)	-0.4757 (-4.14)	-0.7218 (-5.81)	-0.4033 (-2.78)	-0.7007 (-4.12)	-1.067 (-4.36)	-0.8611 (-4.87)	-3.980 (-4.58)	-0.7308 (-2.69)
Local economic conditions									
Personal income change (lagged one year)	-0.0011 (-6.01)	0.0011 (5.75)	0.0015 (7.45)	0.0014 (6.03)	0.0020 (7.37)	0.0031 (7.72)	0.0023 (8.20)	0.0023 (2.47)	0.0010 (2.19)
Population growth rate (lagged one year)	-0.1718 (-4.83)	0.2119 (6.08)	0.2958 (7.84)	0.2706 (6.15)	0.3901 (7.56)	0.5935 (7.98)	0.4478 (8.33)	0.4709 (2.66)	0.1738 (2.12)
Unemployment rate (lagged one year)	-0.1713 (-3.17)	-0.1713 (-3.23)	-0.3225 (-5.62)	-0.1343 (-2.01)	-0.3015 (-3.84)	-0.4855 (-4.29)	-0.4393 (-5.37)	-0.4293 (-1.53)	0.0254 (0.20)
Real estate market conditions									
House price growth (lagged one year)	0.0234 (1.64)	-0.0232 (-1.65)	0.0335 (2.21)	-0.0384 (-2.17)	0.0264 (1.27)	0.0455 (1.52)	0.0550 (2.54)	-0.2316 (-3.22)	0.1530 (4.61)

Table 2. **Estimated Effects on Single-Family Real Estate Market Activity of Economic, Market, and Bank Conditions, 1986–1992** *(continued)*

	Change in Single-Family Real Estate Loans Held by Commercial Banks (Value)	Permits*		Construction Contracts			Starts (Number)	Mortgage Originations (Value)	Existing Home Sales (Number)
				Dependent Variable					
		Value	Number	Value	Number of Dwellings	Square Feet			
Explanatory Variable									
Commercial bank conditions									
Bank capital shortfalls	−0.6463 (−1.53)	−1.267 (−3.05)	−0.9631 (−2.14)	−1.696 (−3.23)	−1.615 (−2.62)	−2.414 (−2.72)	−1.188 (−1.86)	−3.544 (−1.68)	−1.542 (−1.58)
Bank capital surpluses	0.2030 (2.12)	0.1257 (1.34)	0.0198 (0.19)	0.1602 (1.35)	−0.1667 (−1.20)	−0.0895 (−0.45)	0.1385 (0.96)	1.106 (2.09)	1.432 (6.42)
Adjusted R^2	0.3689	0.8177	0.8441	0.8615	0.8550	0.8717	0.8524	0.8629	0.9517

Note: Figures in parentheses are *t* statistics.
* These data were available only for the 1988–92 period.

Table 3. **Estimated Effects on Real Estate Sector Income of Economic, Market, and Bank Conditions, 1986–1992**

	Dependent Variable	
Explanatory Variable	Personal Income Generated by FIRE (Value)	Personal Income Generated by Construction (Value)
National economic conditions		
Consumer sentiment index	20.43	15.07
	(8.45)	(12.16)
ARM interest rate	–92.55	–57.68
	(–4.55)	(–4.99)
Local economic conditions		
Personal income change	–0.0038	0.0881
(lagged one year)	(–0.11)	(5.28)
Population growth rate	0.5177	17.37
(lagged one year)	(0.08)	(5.53)
Unemployment rate	–57.88	–45.81
(lagged one year)	(–6.15)	(–9.60)
Real estate market conditions		
Commercial returns		2.532
(lagged one year)		(1.55)
House price growth	1.111	
(lagged one year)	(0.45)	
Commercial bank conditions		
Bank capital shortfalls	163.8	85.90
	(2.22)	(2.16)
Bank capital surpluses	–42.98	–4.310
	(–2.58)	(–0.46)
Adjusted R^2	0.8150	0.9470

Note: Figures in parentheses are t statistics.

The explanatory variables were specified as follows: The consumer sentiment index entered the specifications as a level, and the FRM and ARM interest rates, the rate of population growth, the unemployment rate, the return on commercial real estate, and the rate of house price growth each entered in percentage points. The income change variable was first-differenced, real, per capita personal income. Bank capital shortfalls and surpluses by state were expressed as a percentage of aggregate bank assets in each state.[12]

Determinants of Real Estate Activity

The index of consumer sentiment measured households', and presumably businesses' and banks', evaluations of current and expected future economic conditions. Thus, we

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[12] We found very similar results when bank capital shortfalls and surpluses were measured as real, per capita shortfalls and surpluses.

expected various kinds of real estate activity to rise when consumer sentiment rose. Similarly, we expected increases in (the first difference of real, per capita personal) income and in population growth to stimulate both commercial and residential real estate activity. On the other hand, we expected higher unemployment rates to reduce real estate activity.

We included the one-year-lagged return on commercial or single-family real estate as a proxy for the expected increase in the prices of commercial or single-family real estate, respectively. Though the excess returns on these long-term assets could not be forecast in perfectly efficient markets, banks, businesses, and households had good reason to use recent price changes to forecast upcoming price changes.[13]

The bank capital shortfall and surplus measures were intended to measure how much capital pressure banks were under. Rather than including one variable that measured (positive and negative) deviations of bank capital from the target level of capital, we included separate variables for the shortfalls and the surpluses of capital relative to the target. This allowed us to estimate responses to capital shortfalls and surpluses separately (Hancock and Wilcox 1994a, 1994b).

At various stages of our study, we considered other variables that we ultimately did not retain in the specifications shown. Series measuring business bankruptcies, personal bankruptcies, commercial vacancy rates, and homeowner vacancy rates were omitted because they were typically statistically insignificant.[14] The drawing down of loans permitted by loan commitments that banks had previously extended to borrowers may have contributed to the low statistical significance of some variables, such as vacancy rates. As vacancies rose, for example, even a bank that sought reduced exposure to commercial real estate might have extended more credit as borrowers availed themselves of their loan commitments.

In preliminary regressions we included the delinquency rate on real estate loans as a proxy for information about conditions in real estate markets and the likely willingness of lenders to finance real estate projects.[15] We expected that higher real estate loan delinquency rates would reduce real estate activity, but in data aggregated here to the statewide level, we found little support for that hypothesis.[16]

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[13] Case and Shiller (1989) provided some evidence that such forecasting is worthwhile.

[14] We calculated statewide vacancy rates for commercial real estate and for houses that had been owner-occupied by the same method we used for house price growth. For commercial real estate, vacancy rates by state were calculated using vacancy rates published for metropolitan areas by Coldwell Banker (1992). State vacancy rates were calculated as the unweighted average of rates in each state's metropolitan areas. States that had no city in the Coldwell Banker database were assigned commercial vacancy rates on the basis of rates for similar, typically neighboring, states. Homeowner vacancy rates by state were available from 1986 through 1992 from the U.S. Department of Commerce (1992). Only regional data were available for 1984 and 1985; we assigned vacancy rates for individual states for those two years by multiplying the ratios of regional rates in 1984 and 1985 to regional rates in 1986 by the state vacancy rates in 1986.

[15] We calculated the real estate loan delinquency rate as the ratio of the dollar volume of real estate loans that were past due by 60 days or more to the dollar value of real estate loans.

[16] Hancock and Wilcox (1994b) found that real estate loan delinquencies reduced banks' holdings of real estate loans. In the data used here, we found that real estate loan delinquencies reduced banks' holdings of both commercial and residential real estate loans but that economic activity in the real estate sector was little deterred by those delinquencies.

Although some of the 47 state dummy variables were significant, we omitted all of them from the specifications shown in the tables because including them did not materially affect our assessments of the other retained variables. Year dummy variables were omitted for the same reasons. We also generally obtained statistically insignificant coefficients on variables that measured the flow of mortgages held by thrift institutions, the capital conditions of thrifts, and the commercial real estate mortgage rate and on a dummy variable that signaled the 1986 changes in federal tax law.

Regression Results for Commercial and Residential Real Estate Activity

In table 1 we present results for commercial and total residential (multifamily plus single-family) real estate activity, and in table 2 we present results for single-family real estate activity.

National Economic Conditions

Consumer sentiment was positively and very significantly related to both commercial and residential real estate activity. The only variable that did not respond significantly to consumer sentiment was (the flow of) banks' holdings of single-family mortgages. Because interest rates for residential FRMs and ARMs were determined in national markets and therefore vary little across states, we used national average data for mortgage rates. These mortgage rates were highly correlated with each other during our seven-year sample period, so we included only one of the rates in each regression. Preliminary results indicated that the FRM interest rate was more important in regressions for commercial real estate and that the ARM interest rate was more important in regressions for residential real estate. Thus, we reported the results of those specifications.

The FRM interest rate had a significant negative effect only on banks' holdings of commercial real estate loans and the number of commercial real estate construction projects; for the other measures of commercial activity, the effect was negative but insignificant. For reasons that remain unclear, a measure of the commercial real estate mortgage interest rate was generally insignificant when it replaced the (residential) FRM interest rate. One possibility is that fees and nonprice terms made the commercial real estate mortgage rate data series a poor proxy for the relevant cost of a commercial real estate mortgage.

The results indicated that activity in residential real estate was broadly, strongly, and significantly reduced by higher ARM interest rates:[17] All dependent variables except banks' holdings of single-family real estate loans reacted strongly and negatively to higher ARM interest rates.[18]

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[17] We obtained similar results when we omitted the interest rate variables. Not surprisingly, the coefficients on the national consumer sentiment variable were most affected by omitting a national variable such as interest rates. In general, omitting interest rates increased the size and significance of the consumer sentiment variable.

[18] One plausible reason that banks held more residential mortgages as ARM interest rates rose is that banks wanted to hold more mortgages as the returns on mortgages rose.

Local Economic Conditions

Local economic conditions also affected the measures of commercial and residential real estate activity quite consistently in the expected directions. Both faster income growth and faster population growth significantly raised each measure of commercial and single-family real estate activity. Again, banks' holdings of real estate loans were the exceptions: Holdings of both categories of real estate loans fell faster in response to faster income and population growth. Why these coefficients are negative remains a mystery to us, as it was in an earlier study (Hancock and Wilcox 1994a). Higher unemployment rates significantly reduced banks' accumulations of commercial and single-family mortgages and also showed some signs of reducing commercial real estate activity. They also had very significantly negative effects on nearly all the variables describing residential real estate activity.

Real Estate Market Conditions

Higher returns on commercial real estate increased the flow of banks' assets into commercial real estate loans (as measured by the change in banks' holdings) and also raised the total value of permits issued for commercial real estate. The value of construction contracts was mildly but positively related to recent returns on commercial real estate, while the number of contracts was significantly negatively related to recent returns in that sector. One reason for this pattern of results may be that contracts responded more than one year after returns. However, that explanation does not help us understand why banks' holdings responded within a year to recent returns on commercial real estate.

The results revealed no consistent relation between the measures of activity and recent returns on single-family real estate. For every positive estimated response there seems to have been an equally strong negative response:

1. The number of permits for single-family real estate responded significantly positively to recent increases in house prices, but the dollar value of those permits responded just as negatively.

2. The number of units and square feet of new single-family real estate contracted for responded somewhat positively, but the dollar value of those contracts responded even more strongly negatively.

3. Sales of existing homes rose, but mortgage originations fell.

4. The number of total residential real estate permits responded significantly positively to house price growth, but the real dollar value of those projects responded negatively, though not significantly so.[19]

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[19] To put the dollar value series in quantity terms, we divided nominal values by median house prices. Differences in those prices across states and across time surely reflect differences in land prices, which were not included in our data on project values. This omission would lead to negative correlation between the returns series and the error term in our specification. As a consequence, it is likely that the returns coefficient estimates were biased downward. This bias might be stronger for single-family real estate results.

Overall, then, bank portfolios seem to have more clearly responded positively to recent capital gains in real estate than real estate activity did.

Commercial Bank Conditions

The estimates reconfirm that banks under capital pressure reduced their holdings of commercial real estate loans (Hancock and Wilcox 1993, 1994a, 1994b; Peek and Rosengren 1994, 1995). The evidence regarding the widely held view that bank capital shortfalls reduced commercial real estate *activity* is less robust. Greater shortfalls significantly reduced the number of square feet of commercial real estate newly contracted for but had little detectable effect on the number or value of those projects. And greater shortfalls had only a mildly depressing effect on the number of new permits for commercial real estate projects. The measures of commercial real estate activity that did not respond significantly negatively to bank capital shortfalls, however, did tend to respond significantly positively to surpluses: Permits and the value of commercial real estate construction contracts were significantly raised by banks' stronger capital positions. Thus, there is mixed evidence that banks' capital positions significantly affected commercial real estate activity. Four of the 10 capital-pressure coefficients indicated significant effects on commercial real estate activity of bank capital shortfalls and surpluses.

Activity in residential real estate was at least as reliably deterred by banks' capital shortfalls and spurred by surpluses as was commercial real estate activity. Though banks' holdings of single-family real estate loans were not significantly reduced by capital shortfalls, most of the measures of activity in residential real estate activity were: Permits and contracts were significantly reduced, and starts, originations, and sales were somewhat reduced. In contrast, there is little evidence that banks' capital surpluses raised activity in single-family real estate: Banks' holdings of single-family real estate loans rose significantly in response to surpluses, but mortgage originations and sales of existing homes were the only other measures of residential real estate activity that did so.

Thus, bank capital shortfalls seem to have reduced activity in the early stages of processing of residential real estate, with contracts and permits most clearly affected. Shortfalls seem to have had a less obvious deterrent effect on later phases of production of residential real estate (starts, originations, and sales). These differential responses may help explain the pattern of bank holdings as well. Because loans for construction and development, even for residential real estate, are classified as commercial real estate loans in the Call Report data, reduced activity in the early stages of residential real estate processing probably translated into reduced flows of commercial real estate loans at banks.

The decline of activity in the early stages of processing of real estate supports the notion that secondary mortgage markets ameliorated some of the effects of the capital crunch on the real estate sector. The well-developed secondary markets for homeowner credit may have made it easier for homeowners to avoid the bank capital crunch than for developers and builders, whose secondary credit markets are less well developed.

Residential real estate, especially in its earlier stages of processing, was affected as much as commercial real estate by the bank capital crunch. Indeed, the estimated real per

capita dollar declines in permits and new contracts per percentage point of bank capital shortfall were larger in the residential real estate market than in the commercial real estate market. Activity in the later stages of processing of residential real estate, as measured by mortgage originations and home sales, was less detectably affected by the capital crunch.

We attribute the smaller impact of the capital crunch on originations and on home sales to the presence of well-developed secondary markets for residential mortgages. While the deep secondary markets apparently offset some of the contractionary effects of the reduced supply of residential mortgages from banks, the lack of secondary markets for credit typically used in the earlier stages of residential real estate by developers and builders apparently left them exposed to the bank capital crunch. Thus, even though residential mortgage originations were little affected, bank capital shortfalls apparently reduced activity in the residential real estate market by restricting credit at the permit and contract stage.

Our view that real estate activity was significantly reduced by the bank capital crunch contrasts with Bradley, Gabriel, and Wohar's (1995) conclusion that the troubles of the thrift industry during the middle and late 1980s had little effect on real estate activity. They argue that because the spread between mortgage and long-term Treasury interest rates did not rise when thrifts withdrew from the residential mortgage market during this period, real estate activity had not been reduced by the thrifts' withdrawal. We do concur that the spread might have changed very little because of the bank capital crunch. Indeed, we found only mild evidence that originations and sales were reduced by bank capital shortfalls.

The absence of a change in the spread between mortgage and Treasury interest rates did not imply, however, that residential real estate escaped the capital crunch unscathed. Our results indicate that activity in residential real estate was hampered not so much by home buyers' inability to acquire mortgages as by builders' inability to fund construction and development. We did find strong evidence that permits and construction contracts for residential real estate were reduced by the bank capital crunch.

Thus, less vibrant secondary markets for the credit required by builders seem to have meant that a bank capital crunch stifled their activities. The presence of deeper secondary markets for the credit required for development and construction might have more completely shielded residential real estate from banks' capital pressures.

How Pervasive Were Bank Capital Effects?

We present figures to illustrate how statewide real estate activity varied with the extent of the capital crunch. For each state, we plot the 1991 data for thousands of square feet per capita of new contracts for nonresidential construction against banks' capital surpluses (figure 4) and shortfalls (figure 5), expressed as a percentage of aggregate bank assets in each state. In figures 6 and 7, we plot the thousands of square feet of new residential construction contracts per capita against the same measures of banks' capital conditions. These figures, of course, indicate the total rather than the partial correlations between contracts and capital shortfalls and surpluses.

Figure 4. **Nonresidential Construction Contracts and Bank Capital Surpluses, by State, 1991**
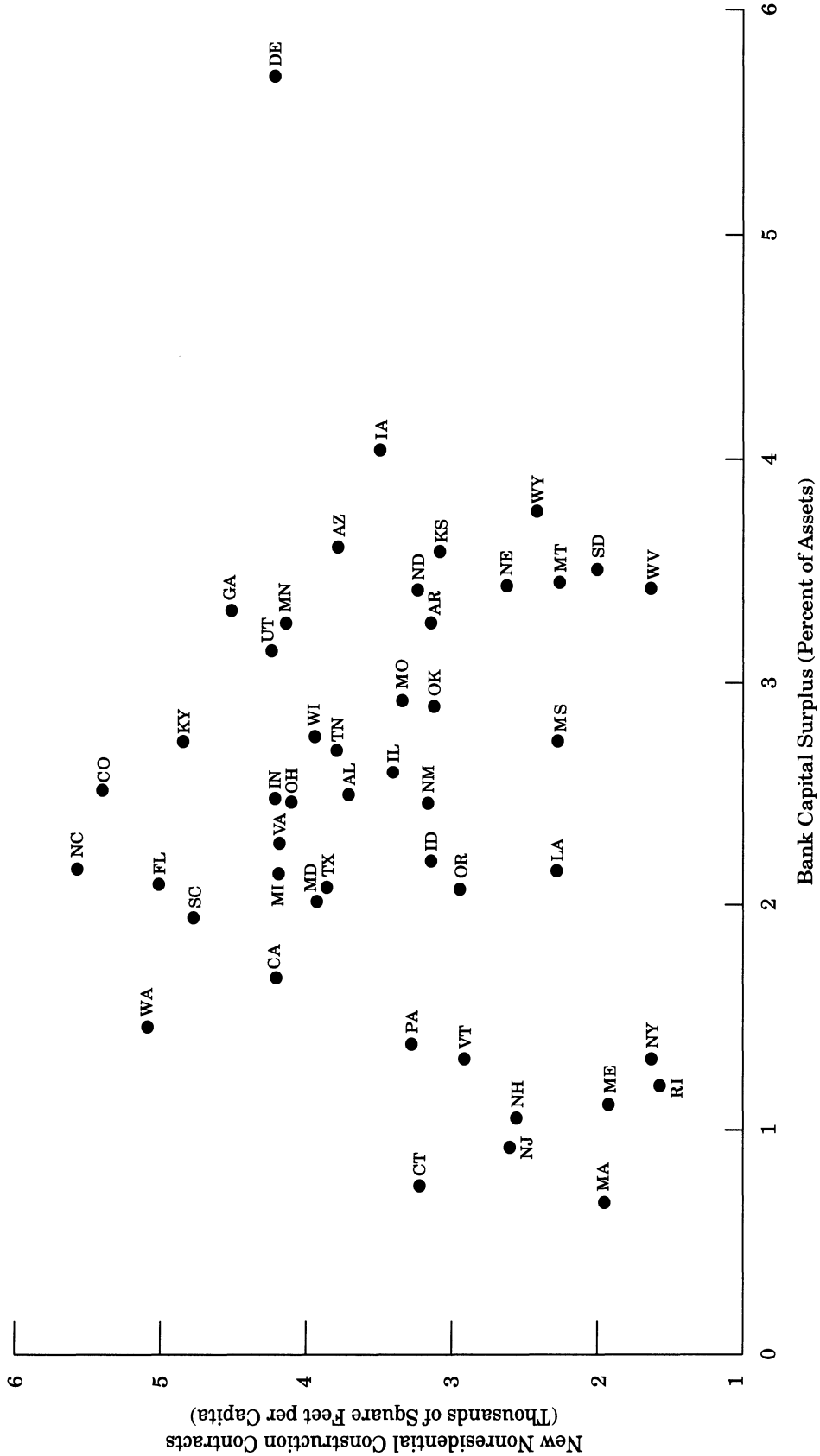
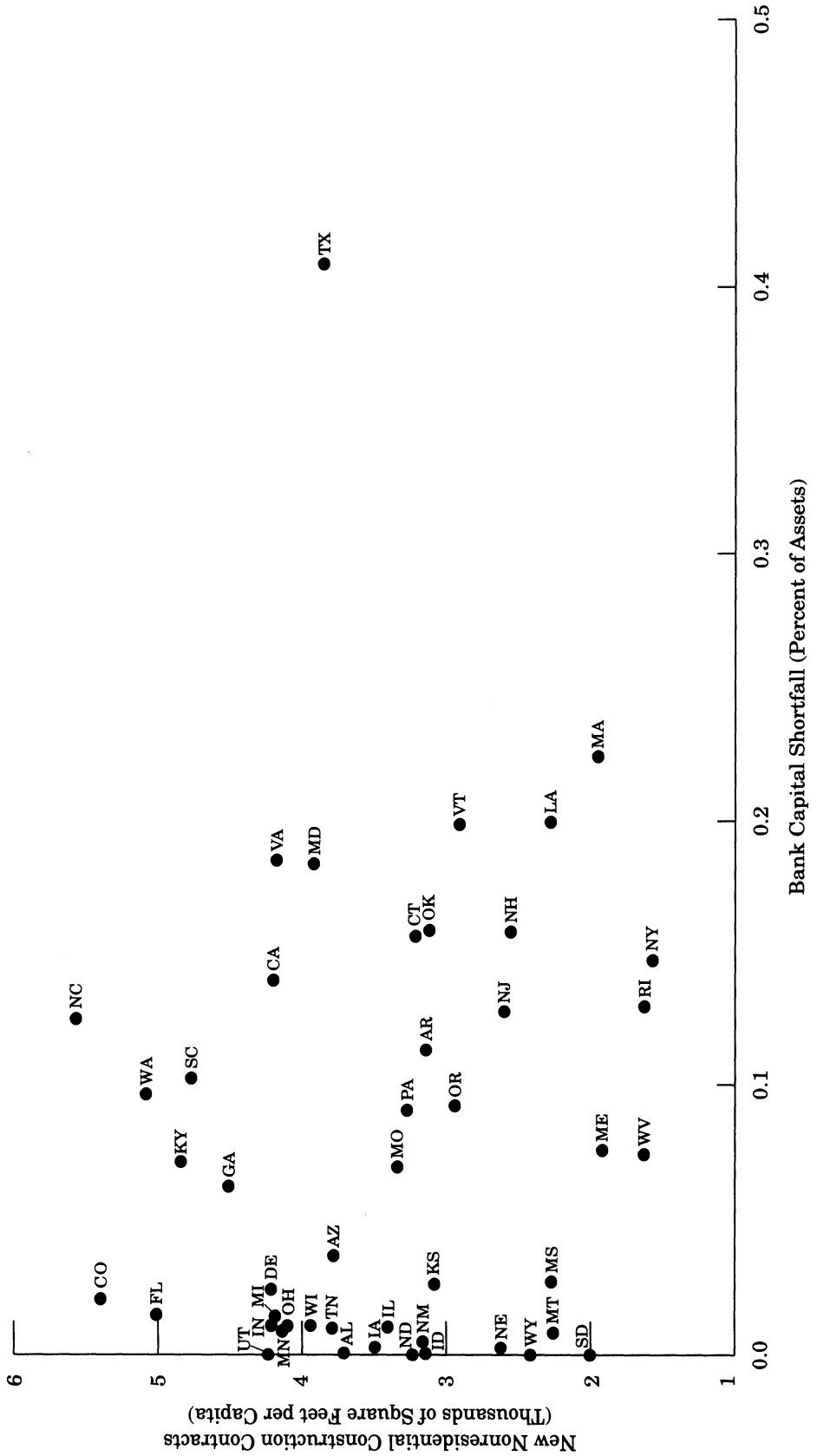Figure 5. Nonresidential Construction Contracts and Bank Capital Shortfalls, by State, 1991

Figure 6. **Residential Construction Contracts and Bank Capital Surpluses, by State, 1991**
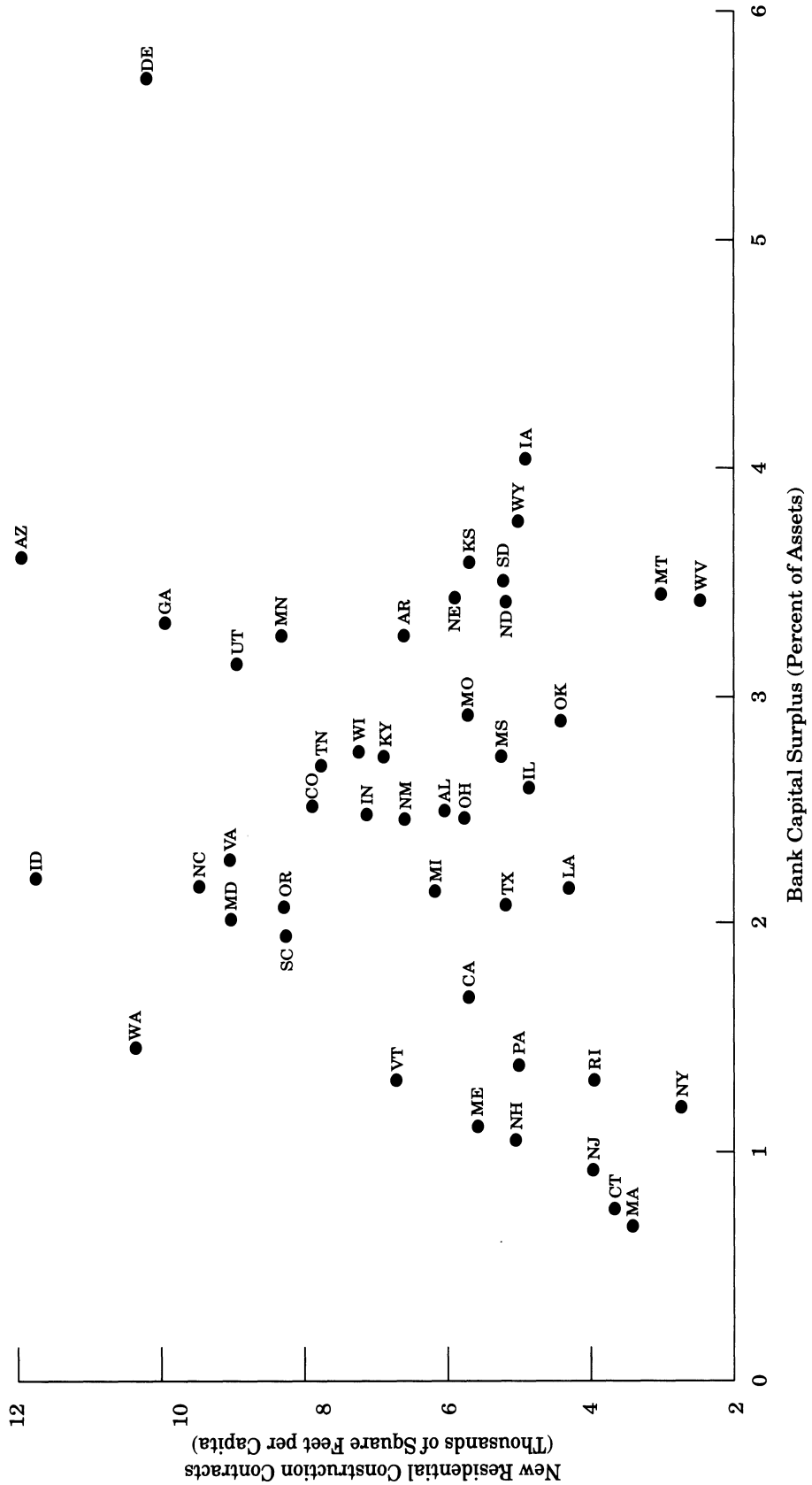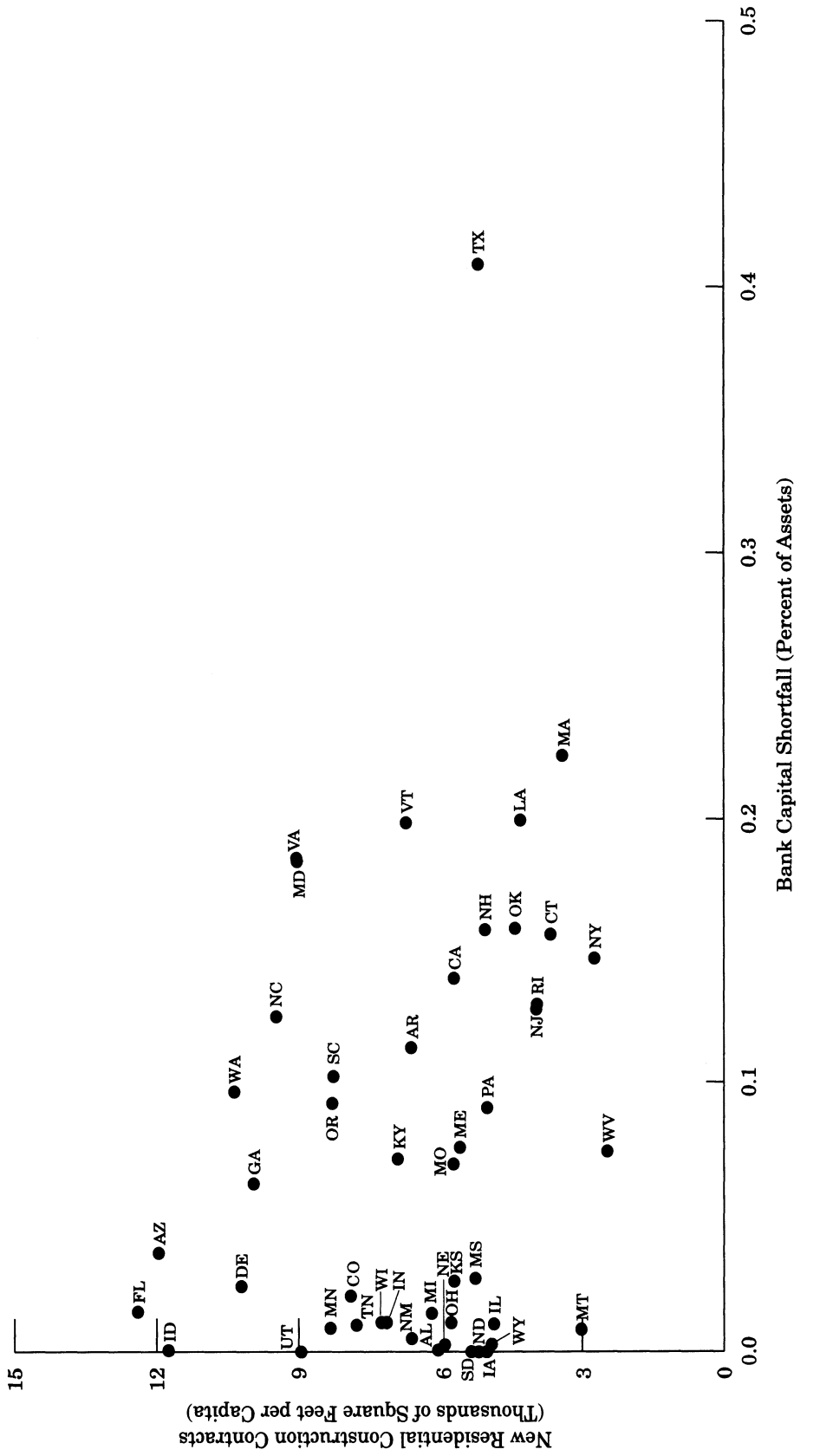
Figure 7. **Residential Construction Contracts and Bank Capital Shortfalls, by State, 1991**

New Residential Construction Contracts
(Thousands of Square Feet per Capita)

Bank Capital Shortfall (Percent of Assets)

In figures 4 and 5, the bivariate correlations between bank capital surpluses and shortfalls and the data for nonresidential construction contracts were positive and negative, respectively, but statistically insignificant. In contrast, the regressions that allowed for the effects of conditions outside the banks (table 1) revealed that bank capital shortfalls had significant effects on the number of square feet of nonresidential construction called for in new contracts, but that surpluses did not. In table 1, the real dollar value of contracts responded strongly positively to bank capital surpluses but not to shortfalls.

Nor were the bivariate (positive and negative) correlations between new contracts for residential construction and bank capital surpluses and shortfalls statistically significant.[20] The absence of significant correlations between residential contracts and bank capital pressure in figures 6 and 7 differs appreciably from the regression results that took into account the effects of economic and market conditions. As shown in table 2, we found consistently significant, negative responses of residential contracts to bank capital shortfalls but no consistent pattern of responses to surpluses. Thus, taking into account conditions outside the banks allowed us to detect the significant effects of bank capital pressures on residential construction contracts that simple correlations obscured.

Regression Results for Real-Estate-Related Income

To supplement our investigation of the effects of bank capital and other variables on real estate activity, we examined the effects of the explanatory variables in tables 1 and 2 on two measures of income that are tied to real estate. What we can learn from these series is limited because these income measures reflect activities in other areas as well. For example, FIRE income is strongly affected by changes in activity in the financial sector, which often occur for reasons unrelated to real estate.

In table 3 we present the results of applying the same regression specification to real, per capita personal income generated in the FIRE sector and in the construction sector. These income variables responded about as we expected to changes in economic conditions. As with the real estate series in tables 1 and 2, both real-estate-related income series were very significantly positively related to consumer sentiment. And both income measures were also strongly negatively related to ARM interest rates. Whereas construction income was significantly positively related to income and population growth rates, FIRE income was not significantly affected by either. Perhaps not surprisingly, both income measures were negatively related to the unemployment rate. Neither construction income nor FIRE income was strongly correlated with commercial returns or house price growth.

The evidence in table 3 regarding the effects of the capital crunch on income related to the real estate sector was perplexing. In contrast to the results in tables 1 and 2, both income series were significantly positively related to bank capital shortfalls and negatively related to surpluses. Thus, the evidence from these series, which combine incomes from real estate with those from other sectors, was mixed. Construction and FIRE income

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[20] The *t* statistics on the estimated positive and negative coefficients on bank capital surpluses and shortfalls were each a little over 1.50. Omitting the Delaware observations from the bivariate regressions on bank capital surpluses and the Texas observations from the bivariate regressions on bank capital shortfalls changed the results very little.

responded much like the other measures of real estate activity to most explanatory variables, but they responded in the opposite directions to bank capital shortfalls and surpluses.

Conclusions

In this study we estimated the extent to which commercial and residential real estate activity such as permits, contracts, starts, and sales was affected in recent years by economic conditions in general and by banks' capital pressures in particular. We found that various measures of real estate activity responded significantly to consumer sentiment, interest rates, income change, population growth, unemployment rates, and recent returns on real estate. Bank capital shortfalls and surpluses also significantly affected commercial and residential real estate activities.

Our results suggest that banks may have had a special role in residential real estate in providing credit for the development and construction phase of residential real estate, credit for which secondary markets were much less developed. When banks reduced their supply of credit, developers and builders apparently were unable to find perfect substitutes for bank credit, so real estate activity slowed. Eventually a sizable and sustained decline in new permits and contracts presumably would have slowed starts, originations, and sales of existing homes.

Though the coefficients on banks' capital shortfalls were not statistically significant, the estimates did hint that the capital crunch depressed total residential mortgage originations and home sales somewhat. Thus, banks may still have played a special role in originating and holding residential mortgages. Banks did originate and hold some mortgages that did not conform to secondary market standards. Reductions in banks' willingness to fund nonconforming mortgages in particular may have reduced the demand for real estate. In their roles of funding both the earlier and the later stages of residential real estate development, banks may still have been important to the health of the residential real estate sector. Consequently, banks' attempts to raise their capital ratios in the early 1990s by shrinking their balance sheets apparently reduced real estate activity and presumably weakened the macroeconomy.

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