NOVEMBER/DECEMBER 1989

ECONOMIC PERSPECTIVES

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ECONOMIC PERSPECTIVES is published by the Research Department of the Federal Reserve Bank of Chicago. The views expressed are the authors' and do not necessarily reflect the views of the management of the Federal Reserve Bank.

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ISSN 0164-0682

Full-blown crisis, half-measure cure

The new rescue bill provides some relief for S&Ls. Still needed to cure the ailing industry: Market-value accounting, risk-based deposit insurance, and market discipline on S&L management

Elijah Brewer III

The shortfall in the savings and loan (S&L) deposit insurance fund has been estimated to be in the $100–120 billion range, and possibly more.[1] Regulators are concerned about the adequacy of the $50 billion provided in the S&L rescue bill to resolve current insolvencies over the next three years.

The rapid deterioration in the financial condition of the S&L industry over the last decade has raised concern about the causes of the problems and the appropriate policy responses to those problems. Unfavorable economic conditions in certain sectors of the country can partially explain the weakened health of the S&L industry, but many analysts argue that other factors are also responsible. Interest-rate risk and deregulation; the broadened investment powers granted S&Ls in 1982 by the passage of the Garn–St Germain Act; inadequate supervision; mispriced deposit insurance; and the government's failure to deal with the undercapitalization in the industry have all been cited as contributing to the industry's dismal performance during the 1980s. There is a growing concern that the S&L rescue package offers little promise of providing a permanent solution to the problem.

This article discusses the S&L crisis, reviews some past research, and presents new evidence on the causes of the problems. The findings should aid legislators and regulators in further restructuring the S&L industry. The first section discusses the nature and magnitude of the S&L crisis. The second section discusses the consequences for the S&L industry of holding specialized portfolios that are exposed to interest-rate risk. The third section examines the effect of deregulation on the cost of deposits. The fourth section analyzes forbearance as a public policy response toward failing institutions. The fifth section examines the risk implications of nonmortgage investments. New evidence, as well as previous research, regarding the riskiness of mortgage and nonmortgage activities are presented in this section. A discussion of the reform legislation is contained in the final section.

The S&L crisis

Savings and loan associations have historically specialized in home mortgages, and their initial problems arose from this tradition. Until 1978 the S&L industry was (generally) profitable. Except for relatively short periods of tight money around 1966, 1969, and 1974, the average rate paid by S&Ls on short-term deposits was significantly below the average yield on their longer-term assets. Those were prosperous years for S&Ls, and their share of deposits rose steadily between 1946 and 1978.

The period after 1978 marked the beginning of an era of higher interest rates that greatly increased the cost of funds without increasing revenues from mortgage loans commensurately. The result was a period of pro-

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tracted losses for large numbers of S&Ls during the early 1980s.

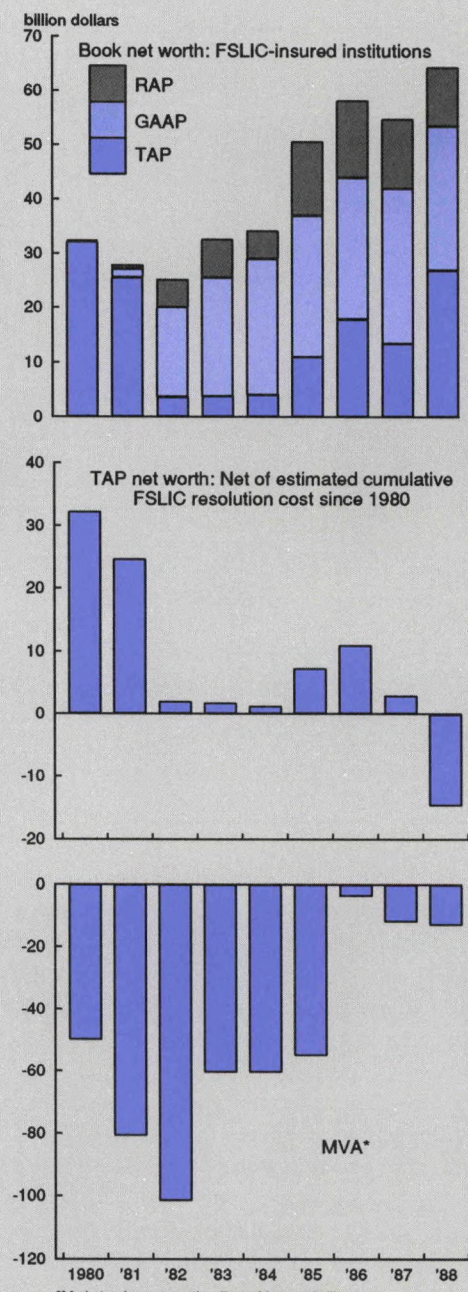
The extent of these losses was demonstrated by the events of 1982. Using regulatory accounting principles (RAP), recorded after-tax industry losses were about $4 billion in that year. This was the first time the S&L industry suffered two consecutive years of annual accounting losses since the Federal Savings and Loan Insurance Corporation (FSLIC) was established in the early 1930s. Book net worth, as calculated by RAP, fell by over 8 percent. However, this fall in book net worth understates the true decline in S&L capital.

Book net worth can be misleading when current market values of assets and liabilities differ from their historical values. Such differences can result from, for example, changes in interest rates.[2] Figure 1 depicts estimates of three book-value measures and one market-value measure of capital. The book-value measures are RAP, generally accepted accounting principles (GAAP), and tangible accounting principles (TAP), and the market-value measure is labeled MVA.

The measured decline in net worth is the least when capital is measured according to RAP. Regulatory accounting principles allow S&Ls to count as part of capital net worth certificates (paper issued by the Federal Home Loan Bank Board to increase recorded, though not economic, net worth), appraised equity capital, and qualifying subordinated debentures, and to defer losses on the sale of assets that bear below-market interest rates. At year-end 1982, regulatory net worth of the industry was $25.3 billion compared with $27.8 billion at the end of 1981. Net worth computed according to generally accepted accounting principles, however, declined from $27.1 billion in December 1981 to $20.2 billion in December 1982. When net worth is calculated by TAP standards, goodwill and other intangible assets are excluded to arrive at the tangible net worth.[3] By this capital measure, net worth declined from $25.5 billion in December 1981 to $3.7 billion at the end of 1982. Further, net worth measured in MVA terms and adjusted for goodwill shows that the industry was insolvent throughout the 1980s, reaching a deficit of $101 billion at the end of 1982 (see Box on calculation).[4]

FIGURE 1

Some measures of S&L worth



*Market-value net worth adjusted for goodwill.

During the early 1980s, Congress and regulators responded to these problems by deregulating and allowing insolvent S&Ls to remain open—a practice known as forbearance. Congress phased out the deposit-rate ceilings for S&Ls and other depository institutions, and allowed S&Ls to expand their fi-

Market-value calculation

Market value of net worth is calculated using the concept reported by Kopcke (1981). On the asset side, only fixed-rate mortgages were marked to market. Adjustable-rate mortgages were valued at book. Securities, the next largest category of assets, were not revalued because a large portion of S&L investments were eligible to satisfy liquidity requirements, suggesting that they have maturities of one year or less. The "other asset" category was valued at book. For fixed-rate mortgage loans, the average portfolio yield is used to calculated an annual payment for the fixed-rate portion of the mortgage loan portfolio (C) using a 30-year amortization formula. Then the following formula is used to mark these loans to market:

$$CVA = \sum_{i=1}^{30} \frac{c(1-x)^{i-1}}{(1+RM)^{i}} + \frac{x(1-x)^{i-1}}{(1+RM)^{i}} P_i$$

where CVA denotes current value, x the rate of prepayment of loans (5, 10, or 15 percent), RM is the current mortgage rate, and P_i is the outstanding principal i years hence according to the amortization formula's schedule. The current value of the loan portfolio is the discounted value of interest payments, scheduled principal payments, and prepayments of principal.

Liabilities were not revalued because most were either subject to immediate withdrawal, e.g., savings deposits, or paid interest rates close to market rates. Although mortgage loans commonly are written for 15 to 30 years, many loans are paid much sooner when borrowers sell their houses, refinance their loans, or prepay the loan principal. During the 1970s, many assumed that the effective maturity of an average mortgage loan ranged from 7 to 12 years. The 15 percent turnover ratio refers to a mortgage portfolio that has a 4 1/2-year half-life. The 10 percent turnover refers to a 6 1/2-year half-life and 5 percent represents a 13-year half-life. For mortgage loans, we used a 10 percent turnover ratio for each year. See Richard W. Kopcke, "The Condition of Massachusetts Savings Banks and California Savings and Loan Associations," in *The Future of The Thrift Industry*, Federal Reserve Bank of Boston Conference Series No. 24, October 1981.

nance activities beyond home mortgages. The intent was to assure adequate deposits and allow S&Ls to diversify so they could protect themselves against losses caused by volatile interest rates and housing market downturns. Beginning in 1982, congressionally mandated capital forbearance programs allowed weak (high-risk) S&Ls to continue to operate unconstrained by capital requirements applied to healthy S&Ls. This policy was initiated in the hope that these S&Ls, given time, would initiate strategies that would return them to capital adequacy. With little capital at risk, however, such S&Ls had strong incentives to engage in riskier activities funded by their insured deposits, especially with a flat-rate insurance premium and a relatively risk-insensitive capital requirement.

Since December 1982, adjusted MVA net worth has significantly improved due to lower interest rates, but still remained negative at the end of 1988. By December 1988, regulatory net worth rose to $64.5 billion, GAAP net worth rose to $53.6 billion, and TAP net worth, though showing a similar improvement, had not yet reached its 1980 level. However, capital forbearance policies were not an essential element in this improvement in capital levels. The decline in interest rates since the end of 1982 has, at least temporarily, lessened the interest rate exposure.

The deterioration in MVA net worth since the end of 1986 has come over a period of substantially greater exposure to credit risk. Unlike the larger aggregate deficit and greater number of economic S&L insolvencies of the early 1980s, the deficit and insolvencies of the late 1980s are almost entirely a reflection of poor credit quality and are unlikely, under almost any reasonable scenario, to be reversed in the near future.

The book-value measures of net worth have masked the current magnitude of the problem in the S&L industry. Market-value net worth provides a better picture of the financial difficulties and risk exposure of the deposit insurance fund.

Legislation signed by the President in August 1989 is designed to deal with these financial difficulties (see Box on the law). The Financial Institutions Reform, Recovery and Enforcement Act of 1989 (FIRREA) will substantially overhaul the regulatory mechanism to enable regulators to more effectively limit risk-taking by authorizing the Federal Deposit Insurance Corporation (FDIC) to become the administrative agency for two separate deposit insurance funds; dismantling the Federal Home Loan Bank Board (FHLBB); transferring all S&L regulatory functions to a new Treasury Department agency; separating the deposit insurer from the chartering agency; and creating a new federal government agency to oversee the Federal Home Loan Bank (FHLB) system. The act requires S&Ls to increase their emphasis on residential mortgage lending and imposes restrictions on the assets that are eligible to be purchased by S&Ls. In addition, the act greatly strengthens the civil and criminal enforcement powers of regulators. FIRREA deals with the lack of tangible capital in the industry by requiring all S&Ls to satisfy a tougher capital standard by the end of 1994. The failure in the past to close decapitalized S&Ls contributed to the magnitude of the current problems.

The rest of this article will take a look at FIRREA in light of what actually went wrong. The first step is to discuss interest-rate risk and the progress that S&Ls have made in reducing this risk exposure. Balance sheet and income/expense data will be examined for S&Ls nationwide and in six states (California, Florida, Illinois, Louisiana, Oklahoma, and Texas) that have accounted for the largest share of the total cost of all resolutions from 1980 through 1988.[5] It will be seen that portfolio specialization and high and volatile interest rates were the causes of the S&L crisis in the early 1980s. Next, by discussing implicit deposit interest rates, it will be seen that the impact of interest-rate deregulation has been overstated. S&Ls could have paid substantially higher explicit rates without an additional squeeze on profits, because some of the increased interest expense would have been offset by lower operating expenses. And finally, in discussing capital forbearance policies and portfolio investment deregulation, it will be seen that insolvent S&Ls, lacking the proper incentives to control their risk-taking, should be closed as soon as possible because they tend to run up substantial losses when left open.

Interest-rate risk

In a world where depository institutions fund long-term fixed-rate assets with short-term floating-rate liabilities, unanticipated increases in interest rates raise costs and put pressure on profits. This pressure is particularly acute for institutions that have made long-term loans at fixed rates, the traditional form of the mortgage contract in the U.S. since the 1930s. This predicament—interest-rate risk—is particularly characteristic of the S&L industry. In periods when short-term interest rates are expected to rise, S&Ls generate their greatest interest-rate spreads at the beginning of life of the mortgage when long-term interest rates are above short-term interest rates. As short-term interest rates proceed to rise as expected, interest-rate spreads decline and eventually turn negative when short-term interest rates climb above long-term interest rates. Likewise, in periods when short-term interest rates are expected to decline and current short-term interest rates exceed current long-term interest rates, S&Ls experience their greatest losses. As short-term interest rates decline, losses are reduced and turned into gains when short-term interest rates dip below long-term interest rates.[6] During periods of losses, S&Ls may be said to be experiencing technical liquidity problems—cash outflows exceed inflows. Nevertheless, in either case if their forecasts are correct, the liquidity problem is only temporary and will not adversely affect long-term earnings and solvency.

Figure 2 shows that as interest rates peaked in the early 1980s, the net operating income of S&Ls plummeted. As interest rates declined, net operating income improved. With liabilities repricing more quickly than assets, sharp and prolonged increases in interest rates can induce long-term losses and endanger the solvency of the association. Thus, a cause of the current S&L crisis is unanticipated increases in interest rates.

Judging exposure to interest-rate risk is difficult because the FHLBB does not release the data that would allow estimates of the differences in the durations of assets and liabilities. Given this limitation, exposure must be inferred from one of two characteristics of

FIRREA rescues S&L industry

The Financial Institutions Reform, Recovery and Enforcement Act of 1989 was signed into law by President Bush on August 9. It has been described as landmark legislation that will initiate wide-ranging changes in the nation's savings industry, improve supervisory controls, strengthen the federal deposit insurance funds, and bolster public confidence in the savings and loan S&L industry. Among its major provisions, the Act:

- Dismantles the Federal Home Loan Bank Board, transferring all regulatory functions to the Office of Thrift Supervision, a new Treasury Department agency.
- Establishes a five-member Federal Housing Finance Board—composed of the secretary of the Department of Housing and Urban Development and four others appointed by the President with the advice and consent of the Senate—to oversee the 12 district Federal Home Loan Banks. These banks can lend to S&Ls as before and now also to banks and credit unions that hold at least 10 percent of their assets in residential mortgages.
- Injects some $50 billion in a new corporation (Resolution Trust Corporation) to liquidate or otherwise dispose of institutions that were once insured by Federal Savings and Loan Insurance Corporation and which are placed in conservatorship or receivership in the three-year period beginning January 1, 1989.
- Amends the Bank Holding Company Act to permit the acquisition of a healthy S&L by a commercial bank holding company.
- Expands the FDIC Board from three to five members, including the Comptroller of the Currency, the Director of the Office of Thrift Supervision, and three members appointed by the President, one of whom serves as chairman.
- Gives the FDIC the responsiblity of managing a new Savings Association Insurance Fund (SAIF) and a new Bank Insurance Fund (BIF).
- Requires each deposit insurance fund to maintain reserves of 1.25 percent of estimated insured deposits, or such higher percentage of estimated insured deposits, not to exceed 1.5 percent, if the FDIC finds that there are significant risks of future losses that would justify a higher ratio.
- Provides the FDIC with greater flexibility to increase annual deposit insurance premiums to a maximum of 32.5 basis points.
- Requires banks to pay annual deposit insurance premiums of 12 basis points in 1990 and 15 basis points in 1991. Savings and loan associations must pay premiums of 23 basis points in 1991, 18 basis points in 1994, and 15 basis points in 1998. The rise in banks' annual deposit insurance premiums is expected to generate about $20 billion in additional premium income over the next 10

S&Ls. The first is the division of the mortgage portfolio between fixed- and adjustable-rate instruments. And the second is the interest-rate sensitivity of S&L stock returns.

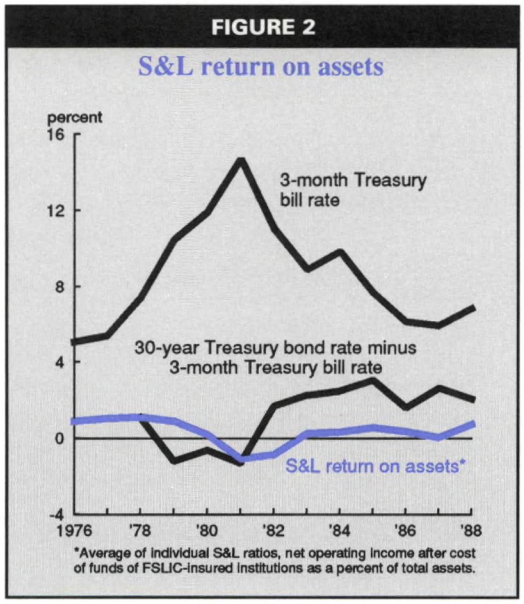
Table 1 presents data on the composition of mortgage loan portfolios. This table examines the portfolio composition of S&Ls nationwide and in six states (California, Florida, Illinois, Louisiana, Oklahoma, and Texas). In general, both in the nation and in the states examined, a greater percentage of S&Ls mortgages were adjustable-rate instruments at the end of 1988 than at the end of 1984. In December 1988, adjustable-rate mortgages (ARMs) accounted for 30 percent or more of the total mortgages held by about 78 percent of all FSLIC-insured institutions. In December 1988, the percentage of S&Ls with 30 percent or more of their mortgage portfolio in ARMs was greater in California, Florida, and Texas than in the nation as a whole, while in Illinois, Louisiana, and Oklahoma it was smaller. From these limited data, S&Ls appeared to be less exposed to interest-rate risk at the end of 1988 than at the end of 1984.

years. Premium income from the S&Ls over the next 10 years has been estimated to be in the $25–32 billion range (see Ely [1989]).

- Requires all S&Ls to maintain tangible capital of 3 percent on their total assets by the end of 1994. Purchased mortgage servicing rights—valued at 90 percent of fair market value—may be included in capital with the maximum percentage determined by the FDIC on terms no less stringent than the FDIC prescribes for state nonmember banks. Generally the FDIC allows these rights to account for up to 25 percent of capital.
- Requires S&Ls to raise by July 1, 1991 the level of housing and housing-related assets in their portfolio to 70 percent from the current 60 percent. Housing and housing-related assets include core and noncore components. Core assets must be at least 55 percent of total assets (and may account for the full 70 percent) They must consist of loans held by S&Ls to purchase, refinance, construct, repair, or improve domestic residential or manufactured housing; home equity loans; mortgage-backed securities; and FSLIC, FDIC, or RTC notes for a limited time (10 years for current holdings and 5 years for future investments). Noncore assets are limited to 15 percent of total assets. These assets include 50 percent of residential mortgage loans originated and sold within 90 days; investments in service corporations if they derive at least 80 percent of annual gross revenues from activities directly related to purchasing, refinancing, improving, or repairing domestic residential real estate or manufactured housing; 200 per cent of the dollar amount of low-income loans and investments made to acquire 1–4 family affordable housing, e.g., 60 per cent of the median value of such housing in a given geographic area; 200 percent of the dollar amount of loans for the acquisition or improvement of residential property, churches, schools, nursing homes, and small businesses located in an area servicing the needs of low- and moderate-income families; loans for the purchase or construction of churches, schools, nursing homes, and hospitals other than those listed above; and loans for personal and educational purposes (up to 5 percent of portfolio assets).
- Restricts the amount of commercial real estate loans to be no more than 400 percent of the S&L's capital. In the past, a federal S&L could devote up to 40 percent of its assets to such loans, regardless of whether the institution had any capital.
- Prohibits S&Ls from acquiring or retaining any corporate debt security that, at the time of acquisition, is not rated in one of the four highest rating categories by at least one nationally recognized statistical rating organization.
- Prohibits state-chartered S&Ls from acquiring or retaining any equity investment of a type or in an amount that is not permissible for federally-chartered S&Ls.

The sensitivity of S&L interest margins to changes in interest rates can be judged by examining the returns required by the market for S&L equities. S&L equity returns are sensitive to all the factors that affect the overall stock market as well as to factors specific to the S&L industry. For example, S&Ls are sensitive to "earnings risk" through possible defaults on their loans and investments, changes in mortgage loan demand, changes in the value of mortgage loan collateral, and potential variability in growth and profitability of their non-portfolio operations. S&L equity returns are also sensitive to movements in interest rates because S&Ls typically fail to match the interest sensitivity of their assets and their liabilities. As a result, movements in interest rates affect the market value for each side of the S&L's balance sheet, its net worth, and stock returns.

Brewer (1989) used common stock returns data to examine the interest-rate sensitivity of 64 S&Ls. The results of this study indicate that the sampled S&Ls significantly decreased their interest sensitivity. S&Ls that were mismatched in 1984 experienced at least a 70



percent decrease in their interest-rate sensitivity over the sample period. Table 2 groups the sampled S&Ls by the composition of their mortgage portfolio. In December 1988, a greater number of S&Ls had more than 30 percent of their mortgage portfolio in adjustable-rate mortgages than in December 1984. The correlation between the change in the ratio of adjustable-rate mortgages to fixed-rate mortgages (FRMs) and the change in interest-rate sensitivity over the sample period is –0.24 and is significantly different from zero. This indicates that interest-rate exposure declines as the proportion of adjustable-rate mortgages rises.

The findings in this section suggest that the causes of the initial S&L crisis in the early 1980s were 1) overexposure to interest-rate risk and 2) high and volatile interest rates. The evidence shows considerable progress in reducing S&L dependence on FRMs. However, considering the low level of equity capital in the industry to absorb losses from unanticipated changes in interest rates, S&Ls continue to hold too many FRMs.

Interest-rate deregulation

The Monetary Control Act of 1980 mandated the removal of all rate ceilings (these were specified in the Federal Reserve Board's Regulation Q) on consumer-type deposits no later than 1986. The Garn–St Germain Act of 1982, which authorized the creation of money market deposit accounts (MMDAs) with limited transactions features, accelerated progress toward the final deregulation required by the Monetary Control Act. Regulation Q was eliminated for all consumer-type deposits in March 1986.

Deposit rate ceilings, imposed on commercial banks' deposits by the Banking Act of 1933, had been extended to the S&L industry by the Interest Rate Adjustment Act of 1966. Conventional wisdom had it that deposit-rate ceilings kept down S&L deposit costs and were a source of profits to S&Ls. The corollary—that the removal of deposit-rate ceilings would involve a loss of monopoly profits—suggests that the recent widespread losses experienced by the S&L industry are partly due to the removal of deposit-rate ceilings. It is argued that the removal of the ceiling has destroyed the viability of S&Ls in the increasingly competitive market for financial services. However, this conventional wisdom ignores the incentive for S&Ls to compete for artificially cheap deposits by providing nonmonetary compensation to their depositors.

TABLE 1

Adjustable-rate mortgages (ARMS): FSLIC-insured institutions
(Percent of total mortgages)

	Total industry	California	Florida	Illinois	Louisiana	Oklahoma	Texas
Change in ARMs (1988-1984)	21.1	27.8	28.0	17.2	8.7	5.4	12.4
The proportion of institutions at year-end 1988 with ARMs over 30 percent	77.9	93.4	91.7	59.9	68.8	68.4	80.0

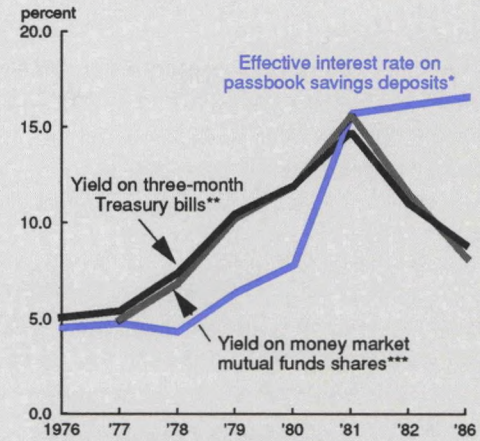
TABLE 2

Adjustable-rate mortgages: Sampled stock S&Ls

	Number of institutions	
Percent	December 1988	June 1984
0-10	2	14
10-20	6	6
20-30	8	16
30-40	10	11
40-50	10	5
50-60	6	7
Over 60	22	5
Overall	64	64

FIGURE 3

Some measures of interest rates



*Estimates obtained from Brewer (1988).

**Annual average of the yields on three-month Treasury bills were constructed from monthly figures. These figures were taken from various issues of the Federal Reserve Bulletin. The three-month yields stated on a discount basis in this source are converted to bond equivalents.

***Annualized total return net of management fees and expenses.

SOURCE: Donoghue's Money Fund Report of Holliston, Mass., various issues.

This compensation constitutes "implicit interest"—payments to depositors in some form other than cash. One form of implicit interest is the provision of deposit services—deposit taking, money orders, statement maintenance, and other services—at fees substantially below marginal and average costs. To attract profitable deposit balances without paying higher explicit rates, S&Ls also undertake a range of costly promotional activities, including advertising, offering gifts to customers opening new deposit accounts, and providing increased customer convenience. Establishing additional branch offices, installing automated teller machines, and lengthening operating hours raise S&L expenses, but they also increase convenience for existing and potential depositors. Other things the same, convenience attracts mew S&L depositors.

The true cost of deposits includes the implicit component as well as the explicit component. Brewer (1988) used a statistical cost-accounting technique to estimate the full cost of S&L regular passbook savings deposits inclusive of explicit and implicit interest. This study, using a sample of S&Ls from Illinois and Wisconsin, shows that under binding interest-rate ceilings, S&Ls have paid implicit rates of return on savings deposits that move with the rate on money market mutual funds and 3-month T-bills, in periods of both rising and falling interest rates (see Figure 3). The implicit component of interest rates was highest in periods when Regulation Q was most binding. With the removal of binding interest-rate ceilings, institutions no longer had an incentive to substitute implicit interest payments, in the form of increased convenience, service, and other means of nonprice competition, for explicit interest. The implications are that interest-rate deregulation has provided S&Ls with increased flexibility to compete for funds using explicit deposit interest rates.

Forbearance policies

Supporters of forbearance policies claim that S&Ls weakened by technical liquidity problems should be allowed the chance to recover. As the temporary problems go away with declines in interest rates, these S&Ls can use their new profits to build equity and reserves against future losses. But, in recent years, forbearance has been given to S&Ls experiencing credit quality problems.

Forbearance programs exempted some S&Ls from regulatory capital requirements for extended periods of time. Other S&Ls in forbearance programs were allowed to invent assets that artificially inflated their regulatory net worth. These include nonstandard appraisals of equity capital, income capital certificates, net worth certificates, and deferred losses. The forbearance program was made possible in part by advances from Federal Home Loan Banks. FHLB advances were

designed in 1932 to promote industry growth and to replace lost deposits. Of late, they have been increasingly used to provide lender-of-last-resort assistance to failing S&Ls that were losing deposits, particularly uninsured deposits. Advances have sometimes been provided to S&Ls that lacked the necessary collateral in exchange for a guaranty of repayment provided by FSLIC.

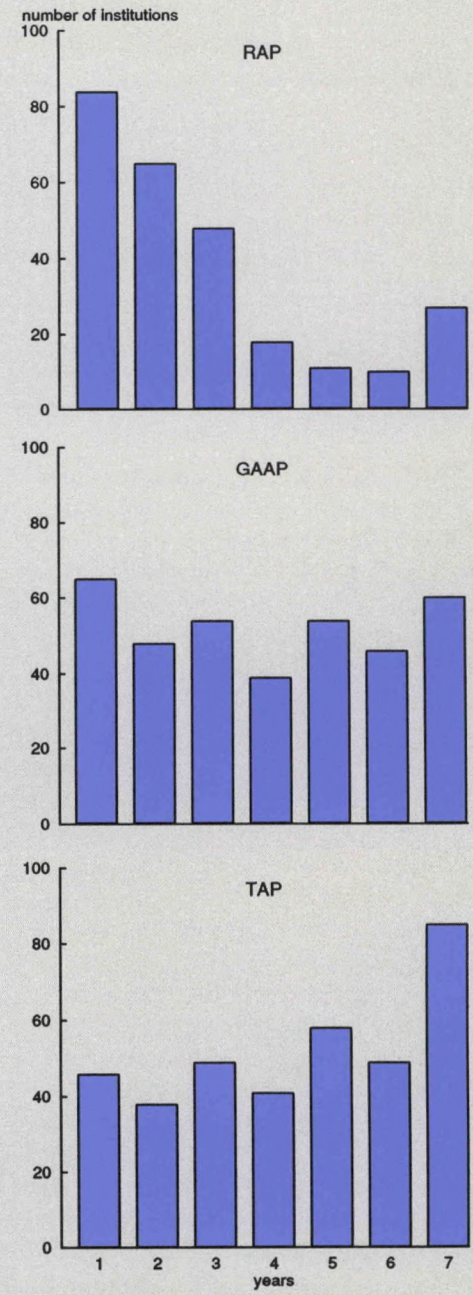
The lack of reserves in the FSLIC fund has prevented S&L regulators from closing those institutions commonly known to be beyond hope of recovery. The Competitive Equality Banking Act of 1987, among other things, required the Federal Home Loan Bank Board to give troubled S&Ls time to initiate strategies that would return them to capital adequacy. As can be seen in Figure 4, 134 (or 37 percent) of the GAAP-insolvent S&Ls in December 1988 first reported having negative TAP capital more than 5 years ago. Similarly, GAAP reveals that many of the currently insolvent S&Ls have been insolvent for quite some time. In contrast, RAP suggests that the problem is more recent.[7]

Analysis of S&L capital in MVA terms, as shown in Table 3, paints an even grimmer picture. In December 1988, 674 (or 85 percent) of the 797 market-value-insolvent S&Ls were also market-value-insolvent in December 1982. The market-value-to-asset ratio for these institutions at year-end 1982 was –17 percent compared to –13 percent for other S&Ls that were insolvent in 1982. Therefore, the least healthy institutions at the end of 1982 proved to be the least healthy at the end of 1988. Accounting measures of net worth also reveal that these 674 associations had lower book capital-to-asset ratios than the other insolvent S&Ls at year-end 1982.

The essence of this analysis is that most of today's insolvencies are among those 1982 S&Ls that had the least amount of capital relative to assets. The conclusion is that forbearance was a gamble for the FSLIC, and its cost has turned out to be significant. The risk inherent in this gamble comes from the incentive it gave managers to "gamble for resurrection" by making large volumes of high-risk, potentially high-profit loans. If the loans made good, the institutions would have reaped the profits, but if the loans soured and the lender went broke, the federal deposit insurer was liable for the losses, not the institutions' owners. Arising from the combination of deregulation, inadequate regulatory supervision, and deposit insurance premiums that are not based on risk, this incentive to take excessive risks is strongest when there is little equity left. Thus, it is likely that the magnitude

FIGURE 4

Three measures of S&L insolvency*



*Length of insolvency of GAAP- insolvent FSLIC-insured institutions as of December 31, 1988.

TABLE 3

Market-value-insolvent S&Ls at the end of both 1988 and 1982
(Capital/total assets, expressed as a percent)

	Insolvent S&Ls' net worth on December 31, 1988			
797 institutions	**MVA**	**TAP**	**GAAP**	**RAP**
	–6.0	–1.3	1.5	2.3

	S&Ls insolvent on December 31, 1988 and December 31, 1982							
674 institutions	**MVA**		**TAP**		**GAAP**		**RAP**	
	1988	**1982**	**1988**	**1982**	**1988**	**1982**	**1988**	**1982**
	–6.0	–17.0	–1.5	–1.5	1.3	–2.4	2.1	3.2

	Other insolvent S&Ls at year-end 1982			
2,457 institutions	**MVA**	**TAP**	**GAAP**	**RAP**
	–13.1	2.1	3.3	4.0

of the current S&L crisis was made larger by forbearance policies. The delays in closing insolvent S&Ls increased the value of access to deposit insurance and allowed S&Ls to shift more risk to the deposit insurer.

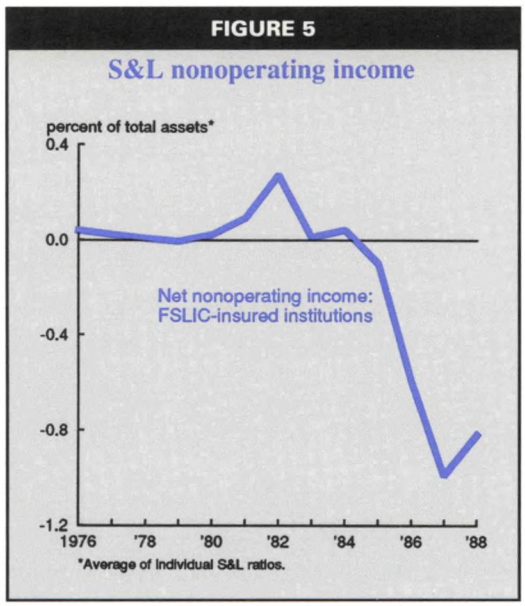
Credit risk and expanded asset powers

Whereas problems in the early 1980s were mainly interest-rate risk related, the problems in more recent years have been mainly concerned with asset quality. Figure 5 shows a sharp decline since 1985 in net nonoperating income, reflecting asset write-downs and additions to loan-loss reserves. Plunging oil prices and real estate values in certain regions of the country have contributed to the sharp deterioration in asset quality of S&Ls nationwide.

Over the 1980–88 period, 488 FSLIC-insured S&Ls failed.[8] Roughly 160 (or 30 percent) of failures occurred between 1980 and 1985, which might reasonably be referred to as the interest-rate risk period. The larger number of failures over the 1985–88 period is a consequence, in part, of credit quality problems. The sharp declines in asset quality caught some S&Ls at a time when they had been weakened by interest rate swings.

A major element of risk in holding mortgage loans is that the borrower will default or be delinquent in making mortgage payments. When a borrower is delinquent on payments, the S&L incurs a reduction in the return on the investment. Mortgage actuaries have identified two major reasons why borrowers default on fixed-rate mortgages (FRMs): insufficient equity in the property and a burdensome monthly payment in relation to income. Payment burden is often the immediate cause of delinquency. However, if there is substantial equity in a property, the borrower is more likely to sell the property and repay the mortgage than go to foreclosure. With level-payment FRMs, changes in borrower payment burden have been principally due to changes in income. The experience with FRMs over the last decade indicates that mortgage balances declined due to amortization while property values appreciated, resulting in a growing equity cushion for the average borrower.

While adjustable-rate mortgages reduce interest-rate risk for the S&Ls, they may increase credit risk, which can offset part or all of the reduction in interest-rate risk. Because ARM periodic payments can increase, a borrower may be unable to sustain the new level of payments (payment shock). Many ARMs also include provisions for rising mortgage balances (negative amortization). When property values are appreciating slowly, this provision may reduce or eliminate the equity cushion. In addition, many lenders have been using initial rate discounts to encourage borrower acceptance of ARMs. Initial-period discounts may induce payment shock, particularly if the discount is large and the loan payment is uncapped. If the discounted loan has a payment cap, there may be more default risk



due to the buildup of negative amortization that occurs early in the life of the loan.

Deregulation has also expanded the menu of risky assets available to S&Ls. The Monetary Control Act of 1980 allows S&Ls to engage in, among other things, business and consumer lending. Commercial real estate lending was restricted to 20 percent of assets, as were the combined aggregate holdings of consumer loans, commercial paper, and debt securities. Additional product lines were deregulated by the Garn–St Germain Act of 1982. In particular, the 1982 act relaxed the quantitative restrictions on commercial real estate from 20 percent to 40 percent and broadened the array of permissible investments to include time and savings deposits of other S&Ls and, most importantly, business loans. In May 1983, the FHLBB permitted federal S&Ls to invest up to 11 percent of assets in junk bonds. During the same period, many state governments enacted statutes that broadened asset powers of state-chartered S&Ls even more. State-chartered S&Ls were permitted by several states to invest considerable amounts directly in real estate, corporate equities, and subsidiary service corporations. These direct investments have been blamed by the FHLBB for the losses incurred by the FSLIC.

Table 4 examines the portfolio composition of S&Ls nationwide and in each of six states (California, Florida, Illinois, Louisiana, Oklahoma, and Texas). In the table, S&Ls are divided into three groups: 1) GAAP insolvent; 2) low capital (that is, positive net worth below 6 percent of assets); and 3) well-capitalized S&Ls (with net worth above 6 percent of assets).

The table shows that there is a substantial variation among states in the percentage of assets devoted to direct investments. Moreover, it tends to be the insolvent firms that engage most prominently in these activities. Both nationwide and in all six states, insolvent S&Ls held more direct investments than solvent institutions. At the same time, insolvent S&Ls held a smaller proportion of their assets in mortgages (Oklahoma is an exception).

The FHLBB believed that these activities were increasing S&L risk. In response to the perceived increase in S&L risk, the FHLBB took action to restrict S&L investments. On January 31, 1985, the FHLBB implemented a regulation, effective March 21, 1985, which restricted holdings of direct investments (equity investments in service corporations and real estate direct investments) by FSLIC-insured S&Ls to the greater of 10 percent of assets or twice the S&L's net worth.

Besides nonmortgage investments, capital forbearance policies may play an important role in affecting S&L risk. There is evidence that riskiness varies with the use of financial leverage.[9] How riskiness changes with financial leverage depends on the regulators' closure rule. If equity holders' position is closed out when the S&L is found to be insolvent, then, other things held constant, increases in financial leverage would be expected to increase risk. This situation raises the probability that temporary losses will reduce the S&L's net worth below the level needed to prevent the deposit insurer from closing the S&L. If the equity holders' position is not closed out when the S&L is found to be insolvent, then financial leverage increases do not necessarily imply an increase in risk to equity holders. In particular, when increases in financial leverage increase the risk borne by the deposit insurer, an increase in leverage and delays in closing insolvent S&Ls may raise the value of access to deposit insurance and so lower risk to equity holders. The longer the delay the greater the effects on risk.

The question is whether these new activities were in fact riskier. The riskiness of a

TABLE 4

Asset composition for all FSLIC-insured institutions
(December 31, 1988)

	Net worth category	Net mortgages[1]	Commercial loans	Consumer loans	Liquid assets[2]	Equity securities	Direct investments	Deferred losses[3]	Intangible assets
		(Percent of total assets)							
Total industry	Less than or = to 0%	61.2	2.6	5.7	12.0	0.2	8.9	1.3	2.5
	Between 0 and 6%	68.8	2.9	4.7	13.2	0.3	3.4	0.2	1.8
	Greater than 6%	74.8	1.3	4.0	12.7	0.5	1.8	0.1	1.5
	Total industry	69.7	2.5	4.6	13.0	0.3	2.8	0.2	1.8
CA	Less than or = to 0%	63.2	0.6	0.9	21.3	0.1	6.4	0.2	0.4
	Between 0 and 6%	74.6	4.2	2.7	10.0	0.1	3.1	0.0	1.1
	Greater than 6%	82.1	0.0	1.2	8.5	0.3	1.9	0.0	2.7
	Total state	75.4	3.6	2.5	10.0	0.1	3.0	0.0	1.3
FL	Less than or = to 0%	65.3	2.4	8.3	11.2	0.1	6.2	0.6	0.3
	Between 0 and 6%	67.2	2.7	6.8	13.7	0.6	2.4	0.2	2.0
	Greater than 6%	74.3	1.1	4.0	12.1	0.7	2.0	0.0	3.0
	Total state	68.3	2.4	6.4	13.2	0.6	2.6	0.2	2.1
IL	Less than or = to 0%	69.4	0.4	5.0	14.3	0.0	2.0	3.0	2.1
	Between 0 and 6%	70.2	0.4	4.0	15.6	0.2	1.4	0.5	3.6
	Greater than 6%	73.1	0.4	3.9	13.6	0.3	1.1	0.0	0.5
	Total state	72.1	0.4	4.1	14.9	0.2	1.4	0.6	2.3
LA	Less than or = to 0%	61.4	1.8	6.7	9.9	0.2	6.5	1.6	0.7
	Between 0 and 6%	67.6	0.3	4.1	12.8	1.4	3.9	0.5	6.1
	Greater than 6%	68.1	0.2	5.9	8.5	0.2	11.6	0.1	3.1
	Total state	66.1	0.7	5.4	10.7	0.7	7.0	0.7	3.7
OK	Less than or = to 0%	67.3	0.5	9.3	7.6	0.4	10.7	0.3	0.0
	Between 0 and 6%	61.9	1.3	4.3	20.6	0.2	6.9	0.0	1.4
	Greater than 6%	45.7	0.7	2.6	23.8	1.9	9.9	-0.0	8.4
	Total state	59.2	1.1	4.4	20.1	0.6	7.8	0.0	2.6
TX	Less than or = to 0%	51.0	3.3	3.4	11.3	0.1	19.4	0.2	4.4
	Between 0 and 6%	46.5	2.1	2.5	24.1	0.1	15.6	0.2	1.6
	Greater than 6%	53.5	1.3	8.4	21.6	0.7	5.2	0.1	2.8
	Total state	48.2	2.4	3.0	20.0	0.1	16.4	0.2	2.5

[1]Mortgage loans, contracts, and pass-through securities net of contra-assets.
[2]Cash and investment securities (excluding equity securities).
[3]Negative amount indicator deferred gains.

portfolio—that is, the variance in the return on the entire set of assets held by an S&L—can decrease when relatively risky assets are added. Portfolio riskiness depends on the covariance among assets. For example, if the returns on a relatively risky asset tend to be high when the returns on other assets are low, i.e., negative covariance, adding the relatively risky asset will reduce the overall riskiness of a portfolio.

One method of assessing the effect of nonmortgage investments on S&L risk is to examine the results of diversification efforts by S&Ls since the Monetary Control Act of 1980. Benston (1985) used accounting data to measure the relationship between risk (defined as the standard deviation of accounting returns) and S&Ls' direct investments. Data were analyzed for the three years ended June

30, 1984 for all S&Ls in the nation and in states with liberal direct investment regulations. Direct investments as a percentage of assets were found to be slightly negatively related to risk. But, a study by the FHLBB in 1984 reported that many S&Ls had diversified into direct investment in ways that increased, rather than diminished, their exposure to risk. Among other things, the FHLBB reported that S&Ls with significant direct investments in service corporations or real estate hold asset portfolios with significantly more credit risk.[10] A more recent study by Benston and Koehn (1989) used stock market data for the July 1978–December 1985 period to discern the impact of nonmortgage investments on S&L risk. Using the standard deviation of equity returns as a measure of risk, they found that direct investments tend to reduce risk, except at S&Ls with low capital. Direct investments at low capital S&Ls are significantly positively related to risk. Nontraditional loans do not appear to be significantly associated with risk.

Recent work by Brewer (1989) supports the findings of Benston and Koehn. He regressed the standard deviation of equity returns for a sample of 64 S&Ls on the ratios to market value of equity of total deposits; of traditional fixed-rate mortgage loans; of adjustable-rate mortgage loans; of direct investments; of nonmortgage loans; and of FHLB advances. Dummy variables on financial leverage are included in the model to capture the impact of delay in closing insolvent S&Ls on risk.[11] The differential behavior of high-risk S&Ls compared to low-risk S&Ls was analyzed. For high-risk S&Ls the findings indicate that direct investments and nonmortgage loans have a strong and consistent positive correlation with risk. Adjustable-rate mortgages at high-risk S&Ls are significantly positively related to risk, supporting concerns of many that the credit risk of these instruments is significant. Traditional fixed-rate mortgages do not appear to be statistically correlated with risk. The findings for the low-risk category indicate little evidence of a statistically significant association between nonmortgage activities and S&L risk. In addition, the results suggest that for insolvent S&Ls operating under capital forbearance, financial leverage has less of an impact on risk than for solvent firms. This occurs because risk-taking is being subsidized more for insolvent S&Ls than for solvent associations.

While these findings raise concern about asset deregulation, they are also consistent with the view that high-risk S&Ls are using both mortgage and nonmortgage assets to take even greater risks because they lack the proper incentives to control their risk-taking. Reregulation of investments made by high-risk S&Ls would not affect their risk preferences. The preceding discussion suggests, however, that more timely closure and meaningfully enforced capital requirements can be effective in providing the proper incentives for S&Ls to control their risk-taking.

Reform legislation

The S&L crisis suggests that piecemeal efforts to introduce financial reforms, coupled with policy efforts that focus on the symptoms of the financial problems rather than on their underlying causes, have contributed to, rather than diminished, unstable financial conditions in this country. In particular, legislative changes that have weakened constraints on risk-taking by federally insured S&Ls, without introducing changes to the nation's system of financial safety nets, have contributed to current financial difficulties.

The Financial Institutions Reform, Recovery and Enforcement Act of 1989 addresses some but not all of the problems faced by the S&L industry. The act is designed to restructure the way the S&L industry is regulated and insured, improve supervisory control, and dispose of all currently insolvent S&Ls. The lack of reserves in the FSLIC fund has prevented S&L regulators from closing those institutions commonly known to be beyond hope of recovery. FIRREA injects funds into a new corporation designed to resolve currently insolvent S&Ls in an orderly fashion. At best, the total cash outlays authorized by FIRREA will allow regulators to close currently insolvent S&Ls that are running up losses and distorting the deposit-taking and lending markets. However, the new legislation, like the Competitive Equality Banking Act of 1987, does not provide for sufficient funds to handle potentially large future insolvencies.

The act deals with the lack of tangible capital in the industry by requiring all S&Ls to

satisfy a tougher capital standard by the end of 1994. Additional capital can reduce the exposure of the federal deposit insurance fund to S&L losses. In addition, increased capital requirements probably reduce an S&L's incentive to expand asset risk and thereby increase the risk of loss to the deposit insurance fund. The empirical results of this article support this point.

But, although the act requires S&Ls to maintain minimum capital standards, it does not provide for early closure and mark-to-market accounting for evaluating S&L capital positions. The importance of measuring capital in market-value terms rather than in book-value terms is demonstrated by the results of this article.[12] The evidence reported here indicates that, while book value of capital was positive throughout the 1980s, the market value of capital was negative, reaching a low of about –$100 billion in 1982. There are difficulties in implementing a mark-to-market accounting approach to capital, particularly the problem of providing an accurate assessment of the values of assets that do not have broadly-based markets in which they are traded. Nevertheless, mark-to-market accounting has the singular advantage of making the managers of S&Ls more immediately accountable for their portfolio decisions. It will also eliminate the elements of forbearance implicit in current accounting standards that allow some institutions to carry assets at book value until those assets are removed from their balance sheet.

Another, equally important, change from current regulatory practices that should have been included in FIRREA was omitted. This is a requirement that all S&Ls, regardless of region of the country or size, that are determined to have insufficient capital must be closed, recapitalized, or otherwise restructured along the lines suggested by Benston and Kauffman (1988).

FIRREA places excessive reliance on the regulatory mechanism to prevent a recurrence of the S&L crisis. However, the federal government simply cannot substitute for market oversight in controlling risk. The federal regulatory agencies will never have the personnel or the financial resources to effectively regulate a financial system as large and diverse as ours. Adequate oversight requires not only having interested parties who are in a position to monitor managerial behavior on a regular basis, but also an environment in which the attention of depository managers is focused on making decisions that emphasize financial stability and health first.

FIRREA restricts the ability of S&Ls to make and hold nonmortgage assets and requires S&Ls to raise the level of housing and housing-related loans in their portfolio to 70 percent from the current 60 percent level. The events of the early 1980s provide evidence that such portfolio restrictions expose depository institutions to both interest-rate and credit risks. The evidence presented in this article suggests that high-risk S&Ls tend to take excessive risks of all types (both in mortgage and nonmortgage investments). Therefore, deregulation may have made it easier for high-risk S&Ls to take excessive risks, but it also reduced the risk at well-managed S&Ls. The portfolio restrictions included in FIRREA will reduce the ability of S&Ls to engage in risk-reducing diversification. In addition, this research indicates that reregulation of investments made by S&Ls would not affect their risk preferences. Risky portfolios can also be assembled with housing and housing-related loans.

What remains to be done

The existing regulatory structure creates incentives for S&Ls to hold risky portfolios. Under the current structure, depositors do not have any incentive to impose market discipline on the use of their funds because the deposits are insured. The current system allows S&Ls to use depositors' funds to engage in riskier activities than would otherwise be possible. This distortion in the existing regulatory structure can be eliminated by creating a class of creditors that is specifically available to monitor S&L risk and bear the risk of loss. An essential element in the recent Federal Reserve Bank of Chicago proposal (see Keehn [1989]) for restructuring the financial services industry is the requirement that depository institutions maintain a specified level of subordinated debt relative to their risk-adjusted assets. Like equity, the debt would serve as a cushion to depositors and the deposit insurance fund. However, the debt, properly structured, would also facilitate the imposition of market discipline on management of depository institu-

tions, prevent debtholders from "running" when the institution encountered financial difficulties, eliminate pressures for systemic bank runs, and provide for orderly closure, recapitalization, or other types of restructuring.

Policies that reduce this type of market discipline will certainly create incentives for S&Ls to take risks. The S&L crisis has revealed a fundamental problem in our system for supervising depository institutions. Despite its strengths, the Financial Institutions Reform, Recovery and Enforcement Act of 1989 does not address all of the problems of the S&L industry. It is important to remember that politically sponsored forbearance and lax supervision by themselves would probably not have created a crisis of the current magnitude. By distorting the market for depositors, the existing system of deposit insurance aided, abetted, and augmented the disaster.

FOOTNOTES

[1]See Bert O. Ely (1989).

[2]Current market values of assets and liabilities can also differ from their historical values because of changes in the value of loan collateral, or in the riskiness of unsecured loans.

[3]Goodwill consists principally of the amount over book value paid by an S&L to acquire other S&Ls.

[4]By comparison, this amount is similar to that reported by Kane in his 1985 monograph.

[5]See Barth, Bartholomew, and Labich (1989).

[6]However, the presence of prepayment options tends to hamper the ability of S&Ls to adjust their mortgage yields during periods of declining interest rates. Homeowners have the option to pay the balance of their mortgages at any time. Other than predetermined schedules of prepayment penalties, S&Ls have no control over homeowners' prepayment decisions. When new mortgage rates decline relative to old mortgage rates, homeowners have an incentive to refinance mortgage balances at a lower rate. As a result, S&Ls' potential portfolio gains from falling market interest rates are limited by prepayments.

[7]See Barth, Bartholomew, and Labich (1989) for a similar analysis.

[8]Failed S&Ls are those closed or merged with FSLIC assistance.

[9]See Ang, Peterson, and Peterson (1985).

[10]See Federal Home Loan Bank Board (1984), p. 47862.

[11]Brickley and James (1986) found that as the FHLBB relaxed insolvency rules, thereby shifting more risk to the FSLIC, the systematic risk of S&Ls fell.

[12]See Benston and Kaufman (1988) and White (1989) for a discussion of the importance of measuring capital in market-value terms.

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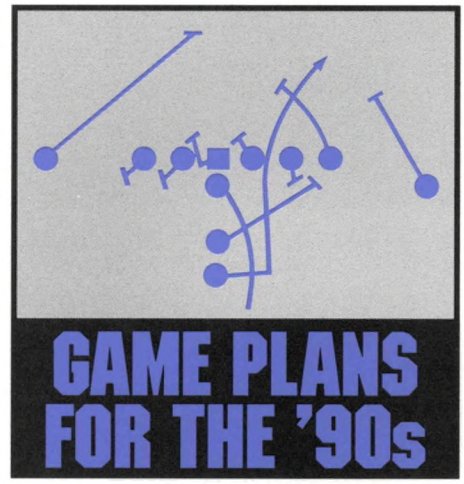

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Investment cyclicality in manufacturing industries

Industrial investment tracks the business cycle, in general; but, when you get down to particulars, the picture is more complicated and, for analysts, more meaningful

Bruce C. Petersen and William A. Strauss

It is well known that investment fluctuates proportionately by much more than total output. The evidence on this is quite dramatic. Consider for example the ratio of net investment to GNP over the period 1946 to 1985. The lowest values of this ratio all occurred during recession years; while the mean of the ratio was 5.6 percent, the ratio was 2.9 percent in 1982, 3.3 percent in 1975, 3.7 percent in 1983, and 4.0 percent in 1976. In contrast, the ratio tends to be high in boom periods.[1]

In addition, investment closely tracks the business cycle. This procyclicality of investment is extremely important in accounting for the "shortfall" of GNP during downturns in the economy. Robert Barro's calculation of the difference between actual GNP and a smoothly growing "potential" GNP series over the period 1946 to 1985 shows that if all categories of investment are added together, fluctuations in investment account for 88 percent of the GNP shortfall during recessions. Barro concludes that "as a first approximation, explaining recessions amounts to explaining the sharp contractions in the investment components."[2]

There are many competing views explaining why investment is so procyclical. Among the most widely known hypotheses are the accelerator model; the neoclassical investment model, emphasizing the cost of capital and stock adjustments; and the cash flow model under conditions of imperfect capital markets. To date, there is no widespread agreement on which view of investment is most consistent with the facts concerning the cyclicality of investment.

In this article, we do not directly test any of the competing theories of investment. Rather, we explore the cyclicality of fixed investment at the industry level within the manufacturing sector. Very little attention has been given to examining investment at this level. The lack of information about industry behavior is probably due to the fact that investment studies employing firm data typically do not have enough data points to produce estimates of cyclicality across a wide range of industries.

There are some very basic questions concerning industry investment behavior that must be addressed. Do all broadly defined industries exhibit roughly the same degree of investment cyclicality over the business cycle? If not, is there some obvious pattern in the data that permits a useful organization of industries according to their degree of cyclicality? There is no obvious pattern in cyclicality predicted by investment models that focus only on the cost of capital. On the other hand, if industries do exhibit different investment patterns over the business cycle, then theories emphasizing either firm- or industry-specific determinants of investment may be required.

Bruce C. Petersen and William A. Strauss are economists at the Federal Reserve Bank of Chicago.
The authors thank Charles Himmelberg, Ed Nash, and Steve Strongin for comments.

To investigate industry cyclicality, we use a panel of 270 industries at the four-digit Standard Industrial Classification (SIC) level for the time period 1958 to 1986. For most of the issues explored in this study, we aggregate this panel to the two-digit SIC level of disaggregation. We find that most of the 20 two-digit industries do exhibit procyclical investment behavior over the period of our study. There are, however, marked differences across these industries both with respect to investment volatility and to investment cyclicality. Industries such as food products exhibit little or no investment cyclicality. Our main finding is that industries producing non-durable goods exhibit less cyclicality in investment than industries producing durable goods. Very often the difference is quite striking.

The remainder of the article proceeds as follows: The next section briefly reviews alternative views of investment cyclicality and some of the existing evidence. The following section describes the panel database employed in the study and the method used to construct "smoothed" industry investment series. Finally, we report our results on both the volatility and cyclicality of industry investment.

Theories of investment cyclicality

There are a number of investment theories that predict that investment should be a volatile component of GNP. Space permits only a cursory overview of three of the leading contenders; we describe here the predictions of the accelerator model, the neoclassical model, and the cash flow model.[3]

The accelerator model hypothesizes that the level of net investment depends on the change in expected demand for business output. According to this theory, a business's desired stock of capital varies directly with its level of output. Thus, when there is an "acceleration" in the economy and expected output increases, net investment is positive. The opposite occurs when there is a deceleration and net investment can actually become negative. Depending on the size of the capital–output ratio, investment can be several times more volatile and procyclical than output.

Neoclassical models have a theoretical advantage over the simple accelerator model in that they include the cost of capital as one of the determinants of the desired stock of capital and thus the level of investment. Some economists explain the volatility of investment through the cost-of-capital channel.[4] Their argument is essentially that when the real rate of interest changes, all firms experience a change in their desired stock of capital. Given that any year's investment amounts to a small portion of the total capital stock, even a relatively small percentage change in the desired stock of capital can result in large percentage changes in net investment. Shocks to the real interest rate can cause firm investment to be very volatile and industry investment to be procyclical.

The cash flow model also has a long tradition in the investment literature. In a world of perfect capital markets, sources of finance are irrelevant for the investment decision. However, when there are imperfections in capital markets, then internal finance generally has a cost advantage over external finance. When this is true, then sources of finance do matter. In particular, the quantity of internal finance, or cash flow, should be positively associated with the level of investment. Since firm profits and cash flows are very procyclical, the cash flow model of investment also predicts that investment will be procyclical. Furthermore, it predicts that investment will be more procyclical for industries which experience the most procyclicality in profits.

Evidence on the cyclicality of investment

There is no widespread agreement on which of these theories is most consistent with the facts concerning the cyclicality of investment. Over the last three decades, a large number of empirical studies have been undertaken, many of them with firm data. An excellent review of the literature before 1970 can be found in Kuh (1971). A review of some of the more recent literature can be found in Fazzari, Hubbard, and Petersen (1988).

Many of the earlier empirical studies such as Kuh (1971), Meyer and Kuh (1957), and Meyer and Glauber (1964) focused on accelerator and cash flow models of investment, typically finding some support for both explanations. In the last two decades, however, empirical research has shifted toward neoclassical models of investment. The impetus for this shift in direction came from the influential work of Modigliani and Miller (1958) who demonstrated that under certain conditions,

real investment decisions can be separated from purely financial factors; that is, that financial factors such as cash flow may be irrelevant to investment decisions. Whether this separation of real investment from financial considerations exists in practice is still being debated.[5]

A review of the empirical literature on the determinants of investment reveals that almost no studies systematically consider investment behavior at the industry level. Studies typically use either aggregate investment series for the whole economy or a sector of the economy or they use firm data. Firm data has many advantages over aggregate data for examining economic behavior. However, most studies that employ firm data do not have enough data points to permit estimates of differences in investment behavior across industries. This is probably the explanation for the paucity of studies that compare the investment behavior of a large number of industries for a substantial time period.

There are, however, some potentially interesting facts that can be learned by examining investment behavior at the industry level. It is well known that industries, even within manufacturing, do not respond alike to the business cycle. For example, some industries, such as those engaged in the processing of food, experience very little variation in demand for their output over the cycle. On the other hand, industries that produce durable goods experience considerable variation in demand and cash flow.

This raises an interesting test of models of business investment. Models which emphasize only the cost of capital do not predict systematic differences in investment cyclicality across industries. However, both the cash flow and the accelerator models clearly do. In the following sections of this article, we seek to set out some of the facts about differences in investment behavior at the industry level.

The data

The primary data sources utilized in this study are the *Census of Manufactures* and the *Annual Survey of Manufactures* (U.S. Bureau of the Census). There are several reasons why these data sources are the best available for examining the cyclicality of investment at the industry level. First, the Census reports investment data at the four-digit level, which is very disaggregated. Second, Census data assign individual plants, rather than whole companies, to their primary SIC industry. Since plants are typically much more specialized than companies, the problem of contamination is negligible. Finally, the data for most Census industries are available back to at least 1958, allowing for a panel of substantial length.

The *Census of Manufactures* currently contains approximately 455 four-digit industries, of which 270 are included in our panel. Since, it is either impossible or inconvenient to work with the entire population of Census industries, we excluded industries for any of three reasons. First, because we wished to examine a balanced panel of industries covering as many business cycles as possible, we excluded all industries for which the *Census of Manufactures* began gathering data later than 1958. Second, we excluded a number of industries having large gaps in the data. Finally, we excluded industries with inconsistencies in the industry classification or definition over time.[6]

Table 1 provides a summary of the breakdown of our sample of Census industries across the 20 two-digit manufacturing industries. The first column lists the identity of the 20 industries that make up the *Census of Manufactures*. The second column lists the total number of four-digit industries which made up each of the two-digit Census industries in 1986. The third column reports the breakdown of our sample of industries across the two-digit industries. The fourth column indicates the percentage of four-digit industries contained in our database. The fifth and sixth columns state what the average real investment (1982 dollars) was for each two-digit industry both for the Census population and our sample of four-digit industries.[7] The final column indicates the percentage of real investment accounted for by our set of industries.

It can be easily ascertained from Table 1 that our sample contains some 59.3 percent of the total number of four-digit industries currently contained in the Census. This percentage varies across two-digit industries, the low being 25.3 percent in SIC 24. Our coverage of total manufacturing investment is considerably higher; over the 1958–1986 period, our sample includes 77.1 percent of all investment.

TABLE 1

FRB data base analysis: 1958 to 1986 real investment

	Total number of four digit industries in 1986	Number of four-didget industries in FRB data base	Percent of total	1958-1986 average investment	FRB data base, 1958-1986 average investment	Percent of total
Total manufacturing	**455**	**270**	**59.3**	**57,453.6**	**44,322.1**	**77.1**
SIC 20 - Food and kindred products	47	38	80.9	5,124.1	4,463.2	87.1
SIC 21 - Tobacco products	4	4	100.0	314.9	314.9	100.0
SIC 22 - Textile mill products	30	19	63.3	1,726.6	1,375.3	79.7
SIC 23 - Apparel and related products	33	15	45.5	602.8	305.0	50.6
SIC 24 - Lumber and wood products	17	4	23.5	1,618.5	984.7	60.8
SIC 25 - Furniture and fixtures	13	7	53.8	521.1	258.1	49.5
SIC 26 - Paper and allied products	17	11	64.7	3,938.3	3,602.9	91.5
SIC 27 - Printing and publishing	17	8	47.1	2,363.2	1,348.8	57.1
SIC 28 - Chemicals and allied products	33	16	48.5	7,625.1	4,585.7	60.1
SIC 29 - Petroleum and coal products	6	5	83.3	2,994.3	2,994.3	100.0
SIC 30 - Rubber & plastic products	6	4	66.7	1,992.1	1,705.4	85.6
SIC 31 - Leather and leather products	11	3	27.3	142.7	47.4	33.2
SIC 32 - Stone, clay and glass products	27	23	85.2	2,389.5	2,281.8	95.5
SIC 33 - Primary metal industries	26	18	69.2	5,736.6	5,097.7	88.9
SIC 34 - Fabricated metal products	36	19	52.8	3,076.3	1,970.2	64.0
SIC 35 - Machinery, except electrical	44	29	65.9	5,287.8	4,187.1	79.2
SIC 36 - Electrical machinery	37	25	67.6	4,522.3	2,848.8	63.0
SIC 37 - Transportation equipment	18	8	44.4	5,607.5	4,919.5	87.7
SIC 38 - Instruments & related products	13	7	53.8	1,256.5	895.2	71.2
SIC 39 - Miscellaneous manufacturing	20	7	35.0	613.4	136.1	22.2

Again, this percentage varies somewhat across the two-digit categories.

Constructing the smoothed investment series

To examine investment cyclicality, we are going to compare in the next section each industry's actual investment series to a "smoothed" investment series, where the smoothed investment series is the average of recent investment levels. The logic of our approach is quite straightforward. If an industry's actual investment tends to be above its smoothed investment series in boom times and below during economic contractions then actual investment is clearly procyclical. The degree of cyclicality is measured by the extent to which actual investment deviates from "smoothed" investment during economic expansions and contractions.

For comparison, we indexed the actual (deflated) investment for all two-digit industries, setting the value in 1958 at 100. To construct the smoothed investment series, we chose the simplest possible technique that would accomplish our objective. The method used, known as a "centered moving average smoothing" procedure, is given in the equation below:

$$1) \quad \tilde{I}_t = \frac{1}{n} \sum_{i=t-\frac{(n-1)}{2}}^{t+\frac{(n-1)}{2}} I_i$$

where I_t is actual indexed investment in year t; $\tilde{I}_t$ is the smoothed value of indexed investment in year t; and n is the number of years over which investment is averaged.[8] We experimented with alternative values for n, settling on a value of nine as a compromise for achieving the twin goals of producing a smoothed investment series which also responds reasonably quickly to changes in the growth rate or trend in industry investment.[9]

Graphs of the actual and smoothed investment series appear below for all manufacturing and selected two-digit industries. Figure 1 plots the investment series for all manufacturing over the time period 1958–1986. The actual investment series is indicated by the black line while the smoothed series is indicated by the color line. Figures 2–5 report the same information for selected two-digit industries.

Figures 2–5 all have the same vertical scale to facilitate cross-industry comparisons. The industries are as follows: food and kindred products (SIC 20); chemicals and allied products (SIC 28); industrial machinery and equipment (SIC 35); and transportation equipment (SIC 37). These industries have a large share of total investment in manufacturing, and as will become apparent, they illustrate different types of industry investment behavior.[10]

An inspection of Figures 1–5 below indicates that the procedure outlined in Equation (1) appears to do a satisfactory job of creating a smoothed investment series for each industry. To see this, compare the actual investment series for each industry with its smoothed investment series. The smoothed investment series picks up the trend in each industry's investment series without being unduly affected by the fluctuations in the actual investment series around its trend.

In Figures 1–5, the differences between the actual investment series (black line) and the smoothed investment series (color line) illustrate the cyclical behavior of industrial investment. In Figure 1, for total manufacturing, the peaks and valleys in investment over the business cycles between 1958 and 1986 are quite evident. In addition, an inspection of Figures 2–5 indicates that there is a wide range of cyclical investment behavior for SIC 20, 28, 35, and 37.

TABLE 2

Coefficient of variation of the investment ratio

	Coefficient of variation
Total manufacturing	**9.9**
SIC 20 - Food and kindred products	4.8
SIC 21 - Tobacco products	22.2
SIC 22 - Textile mill products	14.2
SIC 23 - Apparel and related products	11.7
SIC 24 - Lumber and wood products	18.0
SIC 25 - Furniture and fixtures	15.7
SIC 26 - Paper and allied products	13.3
SIC 27 - Printing and publishing	11.3
SIC 28 - Chemicals and allied products	12.9
SIC 29 - Petroleum and coal products	22.5
SIC 30 - Rubber and plastic products	18.0
SIC 31 - Leather and leather products	22.2
SIC 32 - Stone, clay and glass products	14.7
SIC 33 - Primary metal industries	18.1
SIC 34 - Fabricated metal products	11.8
SIC 35 - Machinery, except electrical	13.6
SIC 36 - Electrical machinery	12.3
SIC 37 - Transportation equipment	23.2
SIC 38 - Instruments and related products	16.2
SIC 39 - Miscellaneous manufacturing	12.5

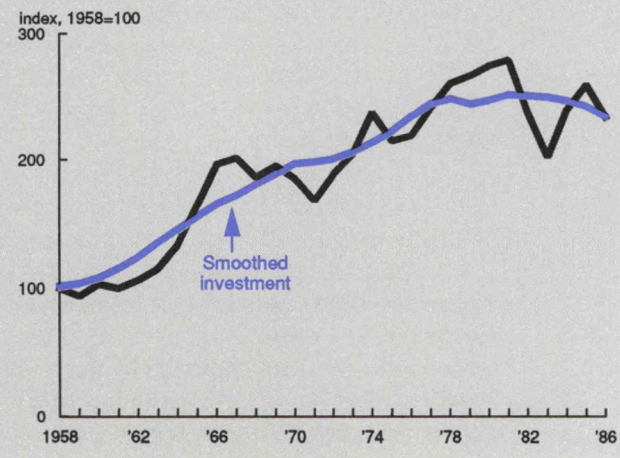
Volatility of industry investment

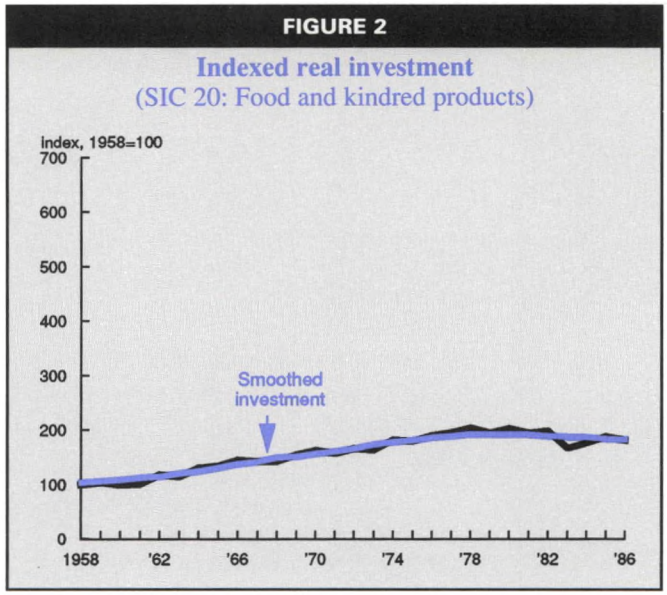
Before turning to the statistical results on the cyclicality of industry investment, it is of interest to report the differences in the volatility of industry investment. It is quite apparent from Figures 2–5 that some industries exhibit more volatile investment than others. To quantify this, we form the ratio of actual to smoothed investment ($I_t / \tilde{I}_t$) for each year for each industry and compute the coefficient of variation, reported in Table 2.[11]

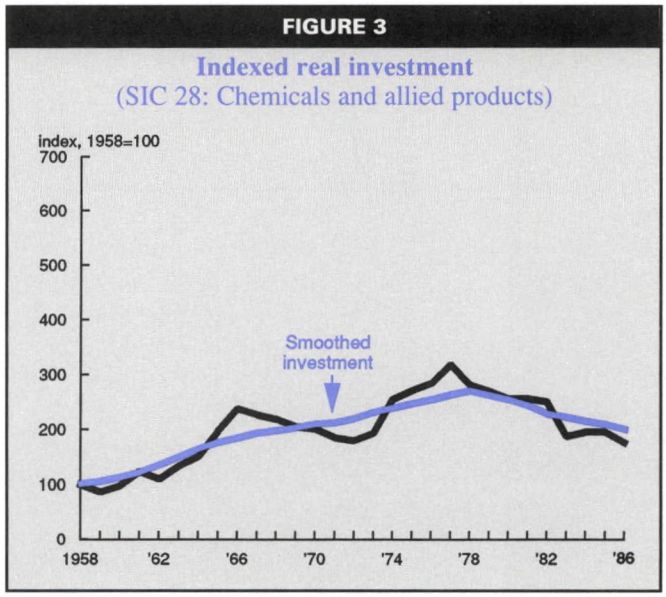
Judging by the size of the coefficients, the industry with the most volatile investment series is the transportation industry (SIC 37), closely followed by the petroleum (SIC 29) and tobacco (SIC 21) industries. At the other end of the scale, the food industry (SIC 20) has a coefficient of variation about five times smaller than that of the transportation industry. When volatility is measured by

FIGURE 1

Indexed real investment
(Total manufacturing)







output or sales, it is well known that transportation is one of the most volatile industries and that food is one of the least volatile industries. It is apparent from Table 2 that this is also true with respect to their investment.

But, high volatility is not necessarily linked to high cyclicality, as we shall see in the next section. While the two conditions are linked in the case of the transportation industry, they definitely are not in the petroleum and tobacco industries.

The cyclicality of industry investment

We turn now to the descriptive statistics on the cyclicality of industry investment. We fit the following relationship to each industry's investment series:

$$2)\quad \frac{I_t}{\tilde{I}_t} = a + bA_{t-1} + \epsilon_t$$

where I_t is actual investment in year t; $\tilde{I}_t$ is the smoothed investment series discussed above; A is a measure of the state of the aggregate economy; and ϵ is the error term. The measure of aggregate economic activity is lagged by one period because the peaks and troughs of the aggregate investment cycle typically lag slightly the peaks and troughs of aggregate GNP.[12]

We considered three alternative measures of A. One measure was the ratio of actual to potential GNP as measured by the Federal Reserve Board.[13] A second measure was the ratio of current capacity utilization in manufacturing to average capacity utilization. The final measure was the ratio of the actual rate of unemployment to the natural rate of unemployment. All three measures have potential shortcomings. Fortunately, the results were qualitatively the same for all three measures. Therefore we report results for only the first measure and briefly summarize the results for the other two measures; that is, for each industry, we report results for the following regression:

$$2A)\quad \frac{I_t}{\tilde{I}_t} = a + b\frac{GNP_{t-1}}{POTGNP_{t-1}} + \epsilon_t$$

Table 3 shows our findings for the manufacturing sector and its component two-digit industries for the regression given in Equation (2A). To economize on space, we do not report the intercept terms, which were statistically insignificant in all but one regression. For each industry, we report three statistics:

the slope coefficient for the state of the economy variable, the standard error of the variable, and the adjusted *r*-square of the regression.

We start with the obvious. For the manufacturing sector as a whole, the estimated coefficient is positive and significant at a very high confidence level. In other words, investment in manufacturing is procyclical. This is not a very surprising result; we would be hard pressed to explain a different finding. What is more interesting is that our regression results indicate that investment in manufacturing is more cyclical than aggregate GNP; our estimated coefficient of 2.23 implies that investment is approximately 2 percent above trend following a period when GNP is 1 percent above potential GNP. In addition, it is interesting to note that our single regressor is explaining a considerable fraction (40 percent) of the variation of actual investment around trend investment.

We turn now to the two-digit industry results. A cursory look at the results indicates a considerable range of point estimates across the 20 industries. The smallest coefficient, –1.36, is for SIC 21 (tobacco products), while the second smallest is for SIC 20 (food products). At the other end of the scale, SIC 37 (transportation) has an estimated coefficient of 3.79, while the next largest coefficient is for SIC 33 (primary metals). For all but SIC 21 (tobacco) the point estimate for the slope coefficient is positive. Of these nineteen industries, all but three (SIC 20, SIC 29, and SIC 39) have estimated slope coefficients of greater than one.

We believe the most interesting finding of our research is the clean separation into two groups, with respect to cyclical investment behavior, of the 20 two-digit industries. The group consisting of SIC 20 through SIC 31 as well as SIC 39 (miscellaneous manufacturing) exhibits slope coefficients of less than the overall manufacturing average of 2.23. The other group, SIC 32 through SIC 38, exhibits slope coefficients greater than the manufacturing average; that is, they exhibit more procyclical investment than average.

The first group, SIC 20 through SIC 31, can be characterized approximately as the nondurable-goods sector of manufacturing. With one exception, every one of these industries has an estimated slope coefficient of less than the all-manufacturing coefficient of 2.23. For seven of these industries, the estimated standard error is large enough that one cannot

FIGURE 4

Indexed real investment
(SIC 35: Industrial machinery and equipment)

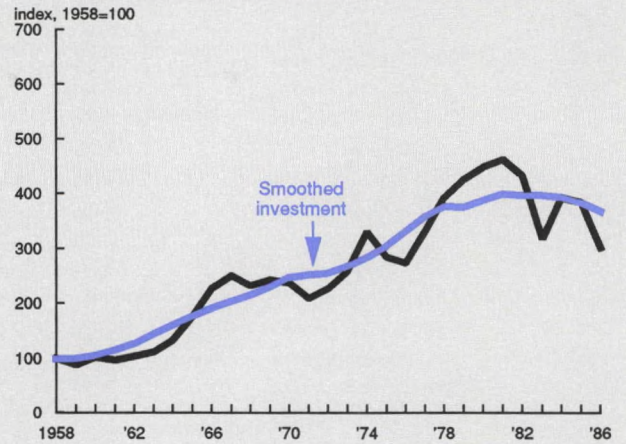


FIGURE 5

Indexed real investment
(SIC 37: Transportation equipment)

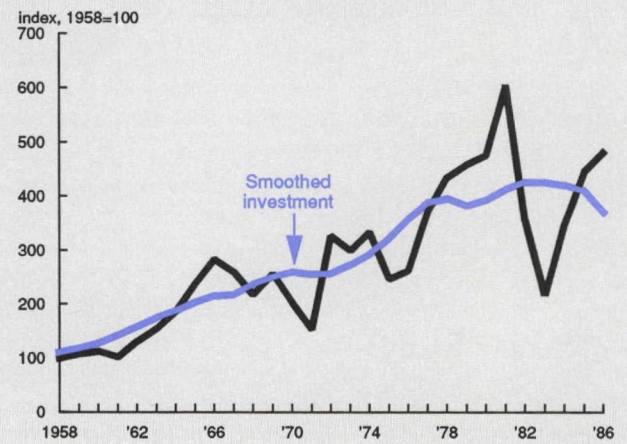


TABLE 3

Regression results: Investment ratio versus GNP ratio

	Slope coefficient	Standard error	R - Square (adjusted)
Total Manufacturing	**2.227**	**0.502**	**0.400**
SIC 20 - Food and kindred products	0.609	0.296	0.104
SIC 21 - Tobacco products	-1.361	1.450	-0.004
SIC 22 - Textile mill products	1.530	0.889	0.066
SIC 23 - Apparel and related products	1.825	0.687	0.178
SIC 24 - Lumber and wood products	1.928	1.138	0.063
SIC 25 - Furniture and fixtures	1.296	1.014	0.022
SIC 26 - Paper and allied products	2.129	0.786	0.185
SIC 27 - Printing and publishing	1.710	0.683	0.158
SIC 28 - Chemicals and allied products	1.903	0.769	0.155
SIC 29 - Petroleum and coal products	0.976	1.478	-0.021
SIC 30 - Rubber and plastic products	2.320	1.105	0.108
SIC 31 - Leather and leather products	1.228	1.448	-0.010
SIC 32 - Stone, clay and glass products	2.299	0.880	0.172
SIC 33 - Primary metal industries	3.368	1.008	0.266
SIC 34 - Fabricated metal products	2.389	0.635	0.320
SIC 35 - Machinery, except electrical	3.022	0.686	0.396
SIC 36 - Electrical machinery	2.248	0.691	0.255
SIC 37 - Transportation equipment	3.789	1.360	0.195
SIC 38 - Instruments and related products	2.528	0.959	0.175
SIC 39 - Miscellaneous manufacturing	0.760	0.813	-0.005

reject the hypothesis at a 5 percent confidence level that investment is acyclical. For SIC 23, 26, 27, 28, and 30, the estimated coefficients *are* large enough to reject the hypothesis of acyclical investment behavior. However, one cannot conclude that their investment is more cyclical than GNP. Finally, it is interesting to note that while the previous section indicated that the petroleum (SIC 29) and tobacco (SIC 21) industries have very volatile investment series, they do not exhibit procyclical investment behavior.

The other group, SIC 32 through SIC 38, consists of all durable-goods industries. All of these industries have slope coefficients greater than the manufacturing average, most noticeably for transportation (SIC 37), primary metals (SIC 33), and nonelectrical machinery (SIC 35). These three industries, along with fabricated metal products (SIC 34), have large enough coefficients relative to their standard errors such that one can reject the hypothesis that their slope coefficient is less than one. The transportation industry is particularly noteworthy, given the volatility of its investment series combined with its very high slope coefficient.

The durable-goods sector has long been known to have more cyclical output than the nondurable-goods sector. It also appears to be the case that investment across virtually all of the durable-goods two-digit industries is more cyclical than investment in the nondurable-goods industries. This pattern of results was confirmed for all measures of aggregate economic activity that were used as regressors in Equation 2, including capacity utilization and unemployment.

Conclusion

Studies of investment typically use either aggregate investment numbers or firm level data. We believe, however, that useful knowledge can be obtained by examining the investment behavior at the industry level. Using a panel database of 270 four-digit industries over the period 1958–1986, we have examined the volatility and cyclicality of investment for all 20 of the two-digit *Census of Manufactures* industries.

We find that there is a great deal of heterogeneity across these industries. Some industries, such as transportation, petroleum, and tobacco, exhibit considerable investment

volatility. We show, however, that industries which have the most volatile investment series do not necessarily exhibit the most cyclical investment series.

The major question that our article sought to answer is: Are there important differences in the cyclicality of investment across manufacturing industries? Our findings indicate that there are. With one exception, industries in SIC 20 through SIC 31 have estimated measures of cyclicality that are less than the manufacturing average for our sample. The remaining group of industries, SIC 32 through SIC 38, which consists of durable-goods manufacturers, appears to be more cyclical than the manufacturing average. The transportation industry leads the way followed by the primary metals and nonelectrical machinery.

While it has long been known that the durable-goods sector has larger cyclical swings in output and profits than the nondurable-goods sector, it also appears that the durable-goods sector has larger cyclical swings in the accumulation of capital. Thus, our results shed some doubt on the view that our economy's large swings in aggregate investment are primarily caused by firms' efforts to readjust their capital stocks in response to changes in real rates of interest. Models of investment that focus only on the cost of capital appear to be missing some important determinants of investment behavior. Given the well documented swings in output and profits in the durable-goods sector, the likely missing determinants are accelerator effects and internal finance considerations.

FOOTNOTES

[1]These values are taken from Barro (1987, p. 226), which contains a more detailed discussion of the facts concerning the cyclicality of aggregate investment.

[2]See Barro (1987, p. 229).

[3]For a more detailed discussion of these models of investment, see Gordon (1984) or Kopcke (1985).

[4]See for example Barro (1987, p. 247).

[5]Recent papers which present evidence supporting the view that fluctuations in cash flow are an important source of fluctuation in investment include Fazzari, Hubbard, and Petersen (1988), Hoshi, Kashap, and Scharfstein (1989), and Kopcke (1985).

[6]It is well known that the Census periodically changes the definitions of some industries, often by merging portions of one industry with pieces of another. This provides the biggest challenge to utilizing the *Census of Manufactures*. Since we did not want our findings to be biased by changes in reported investment arising from industry reclassification, we thought it necessary to exclude all industries that underwent a significant reclassification. More details on the construction of the panel can be found in Domowitz, Hubbard, and Petersen (1986).

[7]The current dollar investment by two-digit SIC code industries were adjusted for inflation by dividing each of the series by the producer price index for capital goods.

[8]The centered moving average approach that we utilized averages the data for the previous four years, the data for the current year and the data for the next four years. Of course, for the years near our endpoints, fewer years of data were available for computing this average. See Pindyke and Rubinfeld (1981) for details.

[9]We experimented with different n values for Equation 1 and found that the results reported in the article are robust to a wide range of different values for n.

[10]Charts for the remaining two-digit industries are available from the authors upon request.

[11]The coefficient of variation is the ratio of the standard deviation to its mean. The standard deviation is an absolute measure of dispersion measured in units of the original data. By contrast, the coefficient of variation is dimensionless and measures relative dispersion.

[12]We also considered contemporaneous A as well as A lagged by two years. The regression results for total manufacturing, based on a considerably higher adjusted r-square, prefers A lagged by one period over contemporaneous A. At the two-digit industry level the results of contemporaneous versus one-year lag were roughly the same. However, for A with a two-year lag, there is no statistically significant relationship between investment and the two-year lagged state of the economy.

[13]Potential GNP is from estimates made by staff members of the Board of Governors. For the methodology underlying these estimates see Clark (1982).

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