Is There a Broad Credit Channel for Monetary Policy?

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Using data for the U.S. manufacturing sector, we test for the existence of a broad credit channel for monetary policy, which operates through the total supply of loans. Our test focuses on the relationship between internal funds and business investment. After a monetary tightening, we find that this relationship becomes much closer for small firms but not for large firms. In contrast, after a monetary easing, the relationship is little changed for all firms. This evidence supports the existence of a broad credit channel.

In recent theoretical and empirical research, interest has been rekindled in a credit channel for the transmission of monetary shocks to real output. This line of research stresses that central bank actions affect output, in part, by causing shifts in the supply of loans. In contrast, the traditional Keynesian analysis of the transmission mechanism makes no mention of loan supply.

Two versions of the credit channel have been described in the literature. One version is a *bank lending channel*, which relies on the dual nature of banks as holders of reserve-backed deposits and as originators of loans.[1] For the bank lending channel to exist, a reduction in reserves engineered by the monetary authority must cause the volume of bank lending to decline; that is, banks must not insulate their loan supply after a shock to reserves by simply rearranging their portfolio of other assets and liabilities. Furthermore, a bank lending channel requires that some firms cannot costlessly replace losses of bank credit with other types of finance, but rather must curtail their investment spending. As highlighted by Kashyap, Stein, and Wilcox (1993), the bank lending channel makes a key prediction: After a monetary tightening, the supply of bank loans should decline *by more* than the supply of other types of debt (such as commercial paper and finance company loans). In Oliner and Rudebusch (1995, 1996), we found no evidence of this predicted differential response. Instead, after accounting for differences in the financing patterns of large and small firms, we found that the mix of bank and nonbank debt changed little after a monetary shock.

Although our earlier work found no support for a bank lending channel, we did observe a reallocation of all types of debt from small firms to large firms after monetary tightenings, which appeared consistent with what we call the *broad credit channel* for monetary policy.[2] This second version of the credit channel focuses on the supply of funds from all financial intermediaries and markets and has no special role for banks. The broad credit channel stresses

1. Descriptions of what we call the bank credit channel can be found in Blinder and Stiglitz (1983), Romer and Romer (1990), Bernanke and Blinder (1988, 1992), and Oliner and Rudebusch (1995, 1996).

2. See Gertler and Gilchrist (1993) for a discussion of similar evidence and for a survey of the bank and broad credit channels.

that all forms of external finance are imperfect substitutes for internal funds. Information asymmetries induce a cost premium for external funds as compensation to lenders for the expected costs of monitoring and evaluation. Importantly, the size of this premium depends on the stance of monetary policy. In particular, a tightening of policy can boost the premium for all types of external funds, which depresses the volume of spending. This rise in the premium occurs because the tighter policy causes the borrower's balance sheet to deteriorate, reducing the collateral that could be offered to a potential lender.

In this paper, we provide new evidence on the existence of a broad credit channel. We do so by investigating changes in the investment behavior of small and large firms after changes in monetary policy. Under a broad credit channel, investment spending will be tied more closely to internal finance after a monetary tightening than at other times. The closer link reflects the higher premium for external funds after a monetary contraction. In contrast, in the absence of a broad credit channel, we would expect the link between internal funds and capital spending to be stable over time. Thus, our test looks for shifts in the relationship between internal finance and capital spending after a monetary shock.

To enhance the power of our test, we conduct separate analyses for small and large firms. The information asymmetries that underlie a broad credit channel should be more severe for small firms than for large firms. Thus, if the broad credit channel exists, we should see its effects more strongly for small firms. Indeed, our results do indicate that the link between internal funds and investment becomes closer after a monetary contraction for small firms but not for large firms, which supports the existence of a broad credit channel.

Conversely, during episodes of monetary easing, we find no significant change in the link between liquidity and investment from that prevailing at other times. This asymmetry in the results obtained for periods of tight money and easy money is consistent with recent theoretical work on the broad credit channel (see, for example, Gertler and Hubbard (1988), Bernanke and Gertler (1989), and Stiglitz (1992)). This work indicates that the condition of a firm's balance sheet should affect its ability to borrow mainly when net worth is low; at all other times, balance sheet considerations move to the background when firms seek funding for investment projects.

How does our work fit into the rapidly growing empirical literature on the role of capital market imperfections in the transmission of monetary policy? Our test is most closely related to the one undertaken by Gertler and Hubbard (1988). For firms believed to face credit market imperfections, they showed that cash flow had a stronger effect on fixed investment during the 1974–1975 and 1981–1982 recessions than at other times. Similar evidence was provided by Kashyap, Lamont, and Stein (1994) for inventory investment. However, these results, though consistent with a broad credit channel, do not specifically tie *monetary policy* to the observed spending behavior. Moreover, the evidence is drawn from only a few episodes, and the data used are at an annual frequency. In contrast, our study examines the link between liquidity and real spending after all major shifts in monetary policy from the early 1960s through the early 1990s using quarterly data, which permits a richer dynamic structure and a more precise dating of policy changes. One other study that provides support for the broad credit channel over a long sample period is Gertler and Gilchrist (1994), who examined movements in sales, inventories, and short-term debt for small and large manufacturing firms. After a monetary contraction, they found that all three series declined more for small firms than for large firms. In addition, the sharp declines for small firms occurred when the aggregate economy was performing poorly, which suggests that liquidity problems were to blame.

The rest of our paper proceeds as follows. The next section provides an overview of the broad credit channel and the motivation for our empirical test. Section II describes the data set with which we carry out the test. Section III presents our results, and Section IV concludes with directions for future research.

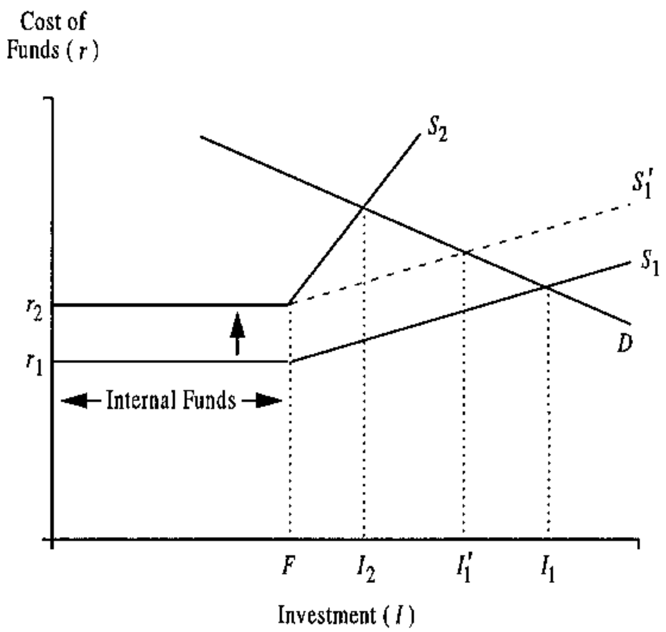
I. The Broad Credit Channel and the Cost of Funds

The broad credit channel arises from an asymmetry of information between borrowers and lenders, which induces a premium in the cost of all forms of external finance over the cost of internal funds.[3] This premium compensates lenders for the costs incurred in evaluating proposed investment projects, monitoring borrowers, and enforcing outcomes. The resulting cost of funds schedule is shown by S_1 in Figure 1, where F is the amount of internal funds that the firm has on hand. The cost of these internal funds, $\bar{r}_1$, can be decomposed into $r_1^f + \theta$, where r_1^f is the risk-free interest rate, which we take as the instrument of monetary policy, and θ is the risk adjustment appropriate for the firm. With perfect capital markets, external funds—which are the marginal source of finance when investment exceeds F —also would be available at a rate of $\bar{r}_1$. However, the asymmetry of information between borrowers and lenders produces a moral hazard, as a firm is more likely to default

3. Gertler (1988) surveys the literature on information asymmetries and their macroeconomic effects.

FIGURE 1

THE BROAD CREDIT CHANNEL: MAGNIFICATION OF AN INTEREST RATE INCREASE



on its debt to outsiders than on its (implicit) debt to itself. This moral hazard raises the cost of external funds above $\bar{r}_1$ by a premium that we denote by Ω.[4]

The size of Ω depends on two factors. First, Ω increases with the level of borrowing, as greater debt intensifies the moral hazard problem, all else equal. This link between Ω and borrowing produces the upward slope shown for S_1. We denote the total amount of external borrowing by B, which is simply investment minus internal funds ($I - F$). Second, as demonstrated by Farmer (1984) and Gertler and Hubbard (1988), Ω also increases with the level of the risk-free rate, in part because increases in the rate lower the discounted value of borrowers' collateral, thereby increasing moral hazard. These two factors are captured in the equation $\Omega = \Omega(B,r^f)$, where both $\partial\Omega/\partial B$ and $\partial\Omega/\partial r^f$ are positive.

The dependence of Ω on the risk-free rate implies that credit market imperfections can act to magnify monetary shocks—the essence of a broad credit channel.[5] In terms of Figure 1, a rise in the risk-free rate boosts the cost of external funds by $\partial\bar{r}/\partial r^f + \partial\Omega/\partial r^f$, where the second term is the magnification effect. The increase in the risk-free rate pushes the cost of funds schedule from S_1 to S_2, and investment falls from I_1 to I_2. The fall in investment is magnified by the increase in the premium for external funds, which causes the new supply schedule to be S_2 rather than S_1'. Thus, by widening the spread between the rates on bank loans and other external debt over the risk-free rate, the broad credit channel intensifies the effect of a change in r^f induced by the monetary authority.

The motivation for our empirical analysis also is evident from Figure 1. Under a broad credit channel, the cost of external finance *relative* to internal finance rises after a monetary contraction. As we demonstrate more formally below, this shift in relative finance costs causes investment to be more sensitive to fluctuations in internal funds after a monetary contraction. As a result, under the broad credit channel, the correlation between investment and internal funds for firms facing significant capital market imperfections should be closer after a monetary tightening than during normal times.

To bring the key relationship into focus, consider the equations behind the simple supply and demand schedules in Figure 1:

(demand) $r = -\kappa I + \nu$

(supply) $r = \bar{r} + \Omega(B,r^f) = r^f + \theta + (\lambda r^f)(I - F),$

where $\Omega(B,r^f) = \lambda r^f B$, $B = I - F$, and the parameters κ, λ, and ν are greater than zero. With $\lambda > 0$, Ω depends positively on r^f and B. Equating supply and demand, the sensitivity of equilibrium investment (I^e) to changes in internal funds is

$$\Phi \equiv \frac{\partial I^e}{\partial F} = \frac{\lambda r^f}{\kappa + \lambda r^f}. \quad (1)$$

Furthermore, and this is crucial for our empirical analysis, the correlation Φ varies directly with r^f because

$$\frac{\partial \Phi}{\partial r^f} = \frac{\lambda\kappa}{(\kappa + \lambda r^f)^2} > 0. \quad (2)$$

The linkage between Φ and r^f reflects the steepening of the supply schedule with a rise in r^f, depicted in Figure 1 as the rotation from S_1' to S_2.

Our empirical test for the broad credit channel is straightforward: We regress investment on cash flow—the usual proxy for internal liquidity—and a set of control variables.

4. Thus, the total risk premium embedded in the cost of external funds is $\theta + \Omega$.

5. More generally, credit market imperfections magnify any macroeconomic shock that affects borrowers' moral hazard. See, for example, Greenwald and Stiglitz (1988), Bernanke and Gertler (1989, 1990), Calomiris and Hubbard (1990), and Stiglitz (1992). In this work, the magnification effect has been termed the "financial accelerator" or the "collateral effect." Our focus on the monetary transmission mechanism leads us to describe this effect as the "broad credit channel."

Equation (2) suggests that the coefficient on cash flow, Φ, should be relatively high during the period of high risk-free rates after a monetary tightening. As r^f increases, the cost premium for external funds rises, and internal funds take on special importance as a source of finance. A significant increase in Φ after a monetary contraction would provide evidence of a broad credit channel.

The power of our test is enhanced by comparing the behavior of Φ after a monetary contraction for small and large firms. Much recent research suggests that small, relatively young firms face a significant premium for external funds.[6] This premium reflects the relatively severe asymmetry of information between small firms and their suppliers of credit; indeed, small firms are almost completely closed out of securities markets and must rely on credit from banks, finance companies, and other intermediaries. In contrast, large firms generally present outsiders with a substantial track record for the purpose of assessing credit risks. Potential investors also benefit from economies in gathering information on a single large firm rather than on many small ones. These factors work to reduce the information asymmetry between large firms and outsiders, so large firms enjoy relatively free access to organized credit markets and to intermediated debt. In terms of equation (2), we expect the value of λ to be close to zero for large firms but to be significantly greater than zero for small firms. Because of this difference, we anticipate that after a monetary contraction, the cash flow coefficient will increase only for small firms.

In our empirical analysis, we also test for shifts in the importance of liquidity for investment after a monetary *easing*. As noted in the introduction, models of information problems in capital markets suggest an asymmetric effect of monetary policy. In these models, a credit constraint arises endogenously when the net worth of a potential borrower falls relative to its desired investment spending. A tightening of monetary policy, with its attendant adverse effects on net worth, can cause the credit constraint to bind. However, with a sufficient easing of policy, the constraint is relaxed, and the link between liquidity and investment returns to that normally prevailing. Once the constraint has stopped binding, a further monetary easing would be represented in Figure 1 as a downward parallel shift of S_1. Such shifts of S_1 would not change the sensitivity of investment to internal funds; thus, we anticipate no change in the cash flow coefficient after a substantial monetary easing.

6. The classic modern study is Fazzari, Hubbard, and Petersen (1988); also see Oliner and Rudebusch (1992) and Gilchrist and Zakrajšek (1996) and the references therein. For a forceful dissenting view, see Kaplan and Zingales (1995).

II. Data Description

Our data set, which spans the period 1958.Q4 to 1992.Q4, was assembled from various issues of the *Quarterly Financial Report for Manufacturing, Mining and Trade Corporations (QFR)*, currently produced by the Census Bureau. Based on a sample of more than 7,000 manufacturing companies, the *QFR* provides a quarterly balance sheet and income statement for the U.S. manufacturing sector as a whole and for eight size classes.[7] Arrayed from smallest to largest, the reported size classes consist of companies with total assets (at book value) of less than \$5 million, \$5 to \$10 million, \$10 to \$25 million, \$25 to \$50 million, \$50 to \$100 million, \$100 to \$250 million, \$250 million to \$1 billion, and more than \$1 billion.

The *QFR* has some advantages over other sources of firm-level data, such as Compustat, which was used by both Gertler and Hubbard (1988) and Kashyap, Lamont, and Stein (1994). First, the *QFR* permits the construction of quarterly time series over the bulk of the postwar period, rather than annual time series over a much shorter period. In addition, the *QFR* includes firms at the bottom of the size distribution,which are largely omitted from Compustat and other commercial databases.

Before undertaking our analysis, we condensed the eight *QFR* size classes into one aggregate of small firms and another of large firms. The simplest method for doing this would have been to allocate a fixed number of size classes to the small-firm group and the remainder to the large-firm group. For example, the four size classes covering companies with assets of \$50 million or less could have been combined to create the small-firm group. However, because the cutoff of \$50 million is fixed in nominal terms, this procedure would have yielded an aggregate with no stable meaning over our long sample period.

Instead, we used the following procedure, which is described in more detail in Oliner and Rudebusch (1995). Let $C_t(\gamma)$ denote the cumulation of those size classes, starting from the bottom of the size distribution, that make up γ percent of the manufacturing capital stock at time t. To construct a time series for any variable for the small-firm group, we first computed the growth rate of the variable between quarters $t-1$ and t using the data for the aggregate $C_t(\gamma)$, and then repeated this process quarter by quarter.[8] We linked the resulting growth rates to the initial level

7. As indicated by its title, the *QFR* also provides data for the mining and trade sectors; however, the absence of breakdowns by size class makes these data useless for this paper.

8. The raw QFR data, it should be noted, are riddled with breaks caused by changes in accounting conventions and sampling methods. Fortu-

of the variable to obtain the desired quarterly series (in levels) for the small-firm group. The series for the large-firm group were computed simply as the difference between the levels for total manufacturing and the small-firm group.[9]

For our analysis, we used the 15th percentile of the capital stock distribution ($\gamma = 15$) as the boundary between the two size groups. With this value of γ, the largest size class used to calculate growth rates for our small-firm group in 1970 was the \$25 to \$50 million asset class; by 1990, the marginal asset class had risen to \$100 to \$250 million. This boundary was chosen as the maximum proportion of the manufacturing capital stock that could be included in the small-firm group without stretching the definition of a "small" firm. Merely raising the cutoff to the 20th percentile would have placed companies with assets of \$250 million to \$1 billion in the small-firm group in 1990.

With one exception, the *QFR* provided every series needed to estimate our investment equations. Specifically, we used *QFR* data to construct the following variables for both small and large firms: fixed investment spending, the gross stock of fixed capital, net sales, and cash flow. Although the *QFR* does not explicitly report investment spending, we were able to impute this variable as the sum of two series that are reported in the *QFR*—namely, depreciation and the change in net capital stock. Every variable was converted to 1987 dollars using deflators from the U.S. National Income and Product Accounts (NIPAs). We then seasonally adjusted each of these constant-dollar series. The only variable we constructed from non-*QFR* data was the user cost of capital. The *QFR* does not provide the necessary information on financing costs and tax parameters; therefore, our measure of the cost of capital was taken from the Federal Reserve Board's Quarterly Econometric model. The Data Appendix provides further documentation for each series and describes the method of seasonal adjustment.

III. EVIDENCE FOR A BROAD CREDIT CHANNEL

In this section, we test for a broad credit channel by looking for changes, after a monetary shock, in the importance of internal funds for explaining investment. Our baseline investment equation takes the form

$$IK_t = \alpha' X_t + \beta CFK_{t-1} + u_t \,, \quad (3)$$

where IK_t denotes gross investment in period t scaled by the capital stock at the end of period $t-1$, X_t is a vector of control variables, and CFK_{t-1} denotes cash flow in period $t-1$, scaled by the capital stock at the end of the previous period. In a strictly neoclassical model with perfect capital markets, investment spending is determined by the discounted value of expected future returns to capital (e.g., Abel and Blanchard (1986)). Empirical studies have shown that the most important empirical proxy for this unobserved variable is the historical growth of sales (the so-called accelerator effect), with a smaller role for the change in the cost of capital (see, e.g., Clark (1979) and Oliner, Rudebusch, and Sichel (1995)). Thus, X_t was specified to include eight quarterly lags of the change in net sales scaled by the capital stock at the end of the prior period (ΔYK), as well as eight quarterly lags of the change in the cost of capital (ΔCOC). To capture more fully the quarterly dynamics of investment, X_t also included four lags of the dependent variable, IK. Along with the usual neoclassical determinants of investment, we included cash flow in equation (3) to capture the effects of internal liquidity on investment. The lagged value of CFK is used to reduce problems of simultaneity.

Table 1 provides the estimates of equation (3) for our aggregates of small and large firms. For large firms, the traditional determinants of investment have the expected effects on IK and explain a large fraction of its total variation. The sum of the coefficients on the lagged output terms (ΔYK) is positive and significant, and the sum of the coefficients on the lagged cost of capital (ΔCOC) is negative, although insignificant. In contrast, these two traditional determinants of capital spending explain little of the movement in small-firm investment—the coefficients are both small and insignificant. Most interestingly, the coefficient on lagged cash flow is large, positive, and highly significant for small firms but not for large firms. This pattern is consistent with the results of Fazzari, Hubbard, and Petersen (1988) and many subsequent studies, which have found a significant cash flow coefficient in panel data for firms believed a priori to have limited access to capital markets.

As described in Section I, our main test of the broad credit channel concerns differences in the coefficient on cash flow between normal periods and those of tight money. An uncontroversial measure of the stance of monetary policy is not available. Therefore, to ensure the robustness of the results, we employ three different definitions of a significant monetary tightening.

nately, these breaks can be eliminated, as each issue of the *QFR* provides restated data for the previous four quarters. Before aggregating the individual size classes to form $C_t(\gamma)$, we level-adjusted the *QFR* data for each size class on a year-by-year basis by the ratio of the restated value to the original value of the series for the fourth quarter of that year.

9. This description is somewhat simplified in one respect. Combining the individual size classes never yielded an aggregate with exactly γ percent of the manufacturing capital stock. See Appendix A to Oliner and Rudebusch (1995) for our method of dealing with this issue.

TABLE 1

BASELINE INVESTMENT EQUATIONS

	SMALL FIRMS	LARGE FIRMS
CONSTANT	.003 (.24)	.009 (1.33)
SUM OF LAGGED *IK*	.261* (1.80)	.726** (9.63)
SUM OF LAGGED ΔYK	.013 (.18)	.219** (2.14)
SUM OF LAGGED ΔCOC	–.171 (.20)	–.357 (1.12)
CFK_{t-1}	.487** (3.02)	.095 (1.04)
$\bar{R}^2$	.285	.696
DW	1.988	2.039

NOTES: Results derived from OLS regressions over 1962.Q1 to 1992.Q4 of *IK* on a constant, four lags of *IK*, eight lags of ΔYK and ΔCOC, and one lag of *CFK*. The table entries show the estimated coefficients, with *t*-statistics (in absolute value) in parentheses.

** Significantly different from zero at the 5 percent level.

* Significantly different from zero at the 10 percent level.

The first definition is that of Romer and Romer (1989, 1994), which is based on their reading of the narrative history of the Federal Reserve. Our sample period contains five "Romer dates" of significant monetary contraction: December 1968, April 1974, August 1978, October 1979, and December 1988.

The second definition is based on large increases in the nominal federal funds rate, which is arguably the policy variable most closely targeted by the Federal Reserve over our sample (see Bernanke and Blinder (1992) and Goodfriend (1991)). Specifically, we consider a quarter in which the federal funds rate rose at least 75 basis points (on a quarterly average basis) to be the date of a monetary tightening. By this definition, there were 20 such quarters of monetary tightening during our sample period of 124 quarters. Only about half of these 20 quarters either were contemporaneous with a Romer date or occurred within 4 quarters thereafter. Thus, the dating of monetary contractions based on changes in the federal funds rate is somewhat different from that based on the Romer dates.

Although the level of the nominal funds rate reflects the stance of monetary policy, it also depends on the prevailing rate of inflation.To accommodate variations in inflation, several authors (e.g., Laurent (1988) and Goodfriend (1991)) have proposed the funds rate minus a long-term interest rate as an alternative measure of monetary policy. Thus, for our final definition, we date monetary tightenings as those quarters with increases in the term spread (defined as the funds rate minus the rate on the 10-year Treasury note) of at least 65 basis points. During our sample, there were 21 quarters during which the term spread changed by this amount (on a quarterly average basis); only thirteen of these quarters were contemporaneous with the large increases in the funds rate alone.

We consider the four quarters following the date of a monetary contraction to be a period of tight money. Let DMT_t denote a dummy variable that equals unity in the four quarters after a monetary tightening and equals zero otherwise. Then, the investment equation we estimate for each group of firms is

$$(4) \quad IK_t = \alpha' X_t + \beta CFK_{t-1} + \delta(DMT_t * CFK_{t-1}) + u_t .$$

Under a broad credit channel, δ should be positive for small firms, indicating that investment is more closely tied to internal liquidity during periods of monetary stringency. Furthermore, given the difference in the severity of capital market imperfections across the two size groups, we would expect δ to be essentially zero for large firms.

Table 2 displays the results of estimating equation (4) for small and large firms under each of the three definitions of tight money. The first column reports the coefficient on the cash flow variable (β), and the second column reports the coefficient on the tight-money dummy times this variable (δ). For small firms, there is always a significant increase in the cash flow coefficient after a monetary contraction, as shown in the second column. For the three different definitions of tight money, the average increase in the effect of lagged cash flow on investment (measured by $(\delta/\beta) - 1$) is about 17 percent. In contrast, for large firms, the interactions of lagged cash flow with the tight money dummies are always small and negative, and generally are insignificant. This evidence suggests that small firms perceive a rise in the relative cost of external funds after a monetary contraction, leading to greater reliance on retained earnings to fund investment projects. Large manufacturing firms, in contrast, apparently experience no increase in their relative cost of external funds after a monetary contraction. These

TABLE 2

IMPORTANCE OF CASH FLOW FOR INVESTMENT AFTER MONETARY TIGHTENING

	CFK_{t-1}	$DMT{*}CFK_{t-1}$	$\bar{R}^2$
AFTER ROMER DATES			
Small firms	.468**	.112**	.316
	(2.96)	(2.38)	
Large firms	.093	–.009	.693
	(1.01)	(.37)	
AFTER A LARGE INCREASE IN FUNDS RATE			
Small firms	.480**	.073**	.309
	(3.03)	(2.11)	
Large firms	.095	–.008	.693
	(1.03)	(.46)	
AFTER A LARGE INCREASE IN TERM SPREAD			
Small firms	.542**	.061*	.297
	(3.33)	(1.75)	
Large firms	.079	–.028*	.702
	(.87)	(1.74)	

NOTES: Results derived from OLS regressions over 1962.Q1 to 1992.Q4 of *IK* on a constant, four lags of *IK*, eight lags of ΔYK and ΔCOC, one lag of *CFK*, and the lag of *CFK* interacted with a dummy variable that equals one for the four quarters after a monetary tightening. There are three different definitions of a monetary tightening: a Romer date, a 75 basis point increase in the federal funds rate, and a 65 basis point increase in the spread between the funds rate and the rate on the 10-year Treasury note. The table entries show the coefficients of the cash flow terms, with *t*-statistics (in absolute value) in parentheses.

** Significantly different from zero at the 5 percent level.

* Significantly different from zero at the 10 percent level.

results provide support for the existence of a broad credit channel.

We tested the sensitivity of the results for δ in two ways. First, to see whether the estimate obtained using Romer dates hinged on just one of these dates, we reestimated equation (4) after dropping each Romer date one at a time. The estimate of δ for large firms remained insignificant in all cases. For small firms, the estimate of δ ranged from 0.087 to 0.138 and was always significant at the 10 percent level. Evidently, the results in the top part of Table 2 are not driven by a single Romer date. Our other sensitivity test used a more stringent threshold for increases in the funds rate or the term spread to define a monetary tightening. Specifically, for either variable, we dated tightenings as occurring in those quarters with at least a 100 basis point rise from the prior quarter. This alternative definition eliminated about half of the quarters of monetary tightening for both variables. For large firms, the estimates of δ were little different from those shown in Table 2. For small firms, the estimates of δ remained positive (at 0.057 for increases in the funds rate and 0.054 for increases in the term spread), but the associated *t*-statistics declined to about 1.5. Thus, the results obtained with interest rates as the signal of monetary tightening are somewhat less crisp than those obtained with Romer dates. Still, even our weakest findings are largely in line with the predictions of the broad credit channel.

One final point should be made concerning the results in Table 2. Strictly interpreted, δ should be positive only when the monetary tightening causes credit constraints to bind. A tightening that occurs from a position of loose monetary policy might leave balance sheets strong enough to prevent a rise in the premium for external funds; in this case, δ would be zero. Because our definition of a monetary tightening does not explicitly account for the initial stance of policy, the results in Table 2 could, in theory, understate the true value of δ.

However, as a practical matter, any such bias in our results probably is minor. We reach this conclusion by combining our analysis with the characterization of monetary policy in Boschen and Mills (1995). Based on their reading of historical Federal Reserve documents, Boschen and Mills constructed a monthly index of the stance of policy beginning in 1953. A value of –2 indicates the tightest stance of policy, while +2 indicates the loosest stance; zero signals neutral policy. The five Romer dates in our sample occur during quarters for which the value of the Boschen-Mills index (averaged over the three months of the quarter) is negative. In addition, the twenty quarters of tightening defined by increases in the federal funds rate all occur when the index is either zero or negative. Thus, none of these significant tightenings took place against a backdrop of initially loose policy. When the term spread is used to date tightenings, three of the tightenings do occur during quarters with a positive value for the Boschen-Mills index. However, when we constructed the *DMT* dummy variable without these three quarters, the estimate of δ for small firms was little changed from that shown in Table 2. For large firms, the estimate of δ remained negative, though it was no longer significant.

Table 3 displays the results of our tests that involved monetary easings. We estimated equation (4) for large firms and small firms, replacing the tight money dummy *DMT* with an easy money dummy (*DME*), which equals unity in

TABLE 3

Importance of Cash Flow for Investment after Monetary Easing

	CFK_{t-1}	DME^*CFK_{t-1}	$\bar{R}^2$
After a large decline in funds rate			
Small firms	.498**	.013	.279
	(2.99)	(.26)	
Large firms	.095	–.020	.695
	(1.04)	(.83)	
After a large decline in term spread			
Small firms	.484**	–.006	.278
	(2.95)	(.14)	
Large firms	.083	–.019	.696
	(.90)	(1.01)	

Notes: Results derived from OLS regressions over 1962.Q1 to 1992.Q4 of *IK* on a constant, four lags of *IK*, eight lags of ΔYK and ΔCOC, one lag of *CFK*, and the lag of *CFK* interacted with a dummy variable that equals one for the four quarters after a monetary easing. There are two different definitions of a monetary easing: a 75 basis point decline in the federal funds rate, and a 65 basis point decline in the spread between the funds rate and the rate on the 10-year Treasury note. The table entries show the coefficients of the cash flow terms, with *t*-statistics (in absolute value) in parentheses.

** Significantly different from zero at the 5 percent level.

* Significantly different from zero at the 10 percent level.

the four quarters after a monetary easing and zero otherwise. We employ two definitions of a monetary easing: (1) a 75 basis point decrease in the funds rate and (2) a 65 basis point decrease in the term spread. By these definitions, monetary easings occur about as often as the monetary tightenings defined by the nominal funds rate or the term spread. As shown in the second column of Table 3, the coefficient on $DME_t{*}CFK_{t-1}$ is never significant. That is, after a sizable monetary easing, the link between investment and cash flow remains about the same as that prevailing at other times. We interpret this result as consistent with recent theoretical work that points to the broad credit channel primarily as a factor that magnifies the impact of tight monetary policy.

As with our test based on monetary tightenings, the estimates of δ in Table 3 may depend on the initial stance of policy. Loosenings that occur from a position of tight monetary policy might not remove a binding credit constraint. The estimated value of δ then would be biased up relative to the case in which the constraint fails to bind initially. Thus, in principle, Table 3 might show δ to be zero after a monetary easing when its true value is negative. We tested for this potential bias in a manner parallel to that used for monetary tightenings. That is, we omitted the instances of monetary easing that occurred when the value of the Boschen-Mills index was negative (which indicates a tight stance of policy). The resulting estimate of δ for small firms continued to be essentially zero. In contrast, for large firms, δ became more negative and was significant at the 10 percent level. Taken literally, this result could be viewed as evidence that the broad channel operates during both monetary easings and monetary tightenings, contradicting our expectation that it comes into play only when policy is tightened. We would be inclined toward this view if the negative coefficient had been found for *small* firms, for whom there is reason to believe that a credit channel exists. However, one is hard-pressed to interpret a negative value of δ only for large firms as evidence of a reduced premium for external funds.

IV. Conclusion

At the heart of the broad credit channel is the proposition that internal and external funds are not perfect substitutes because of the information asymmetries that hamper the functioning of securities markets. Such information asymmetries are likely to be far more severe for small firms than for large firms. Thus, to examine the existence of the broad credit channel, we explore whether small firms respond to a monetary shock differently from large firms. Our results suggest that a broad credit channel does exist for the transmission of monetary policy and that it operates through small firms. Specifically, for these firms, we found that the association between internal funds and investment tightens significantly after a monetary contraction, indicating a scarcity of external finance. In contrast, for large firms, there was no change in the linkage between internal funds and investment after a tightening of monetary policy.

Looking ahead, we see several fruitful avenues for future research on monetary transmission. As stressed in Oliner (1996), the natural next step is to assess the importance of the broad credit channel. To our knowledge, no research has yet established that a broad credit channel accounts for much of the real effect of monetary policy actions. Equally important, our understanding of the nature and incidence of the broad credit channel is still seriously incomplete. Much further research, including detailed case studies, is needed to pin down the types of firms most affected by policy-induced changes in the supply of credit. In this regard, we see the potential for a high payoff from studies that explore (1) the lending behavior of nonbank financial institutions, principally finance and insurance companies,

(2) the effect of banking relationships on loan supply, and (3) the potential for trade credit to offset a contraction of lending by financial intermediaries.

DATA APPENDIX

This appendix documents the data series used in our empirical work and describes the method of seasonal adjustment. All series are quarterly, spanning the period 1958.Q4 to 1992.Q4.

Net sales (Y)

The *QFR* series "Net sales, receipts, and operating revenues," divided by the NIPA implicit price deflator for gross domestic product (GDP), was our measure of net sales in 1987 dollars.

Cash flow (CF)

Current-dollar cash flow equaled the sum of the following *QFR* series: "Net income retained in business" and "Depreciation, depletion, and amortization of property, plant, and equipment." This measure defines cash flow to be net of dividend payouts. We converted current-dollar cash flow to 1987 dollars with the GDP deflator.

Capital stock (K)

The *QFR* series "Property, plant, and equipment" provided the data on gross capital stock at book value through 1973. For later years, when this series was no longer published, we summed the two components of property, plant, and equipment: "Depreciable and amortizable fixed assets" and "Land and mineral rights." We converted the book value series to 1987 dollars with the use of capital stock series for the manufacturing sector published by the Bureau of Economic Analysis (BEA). Let KB_t denote BEA's series for the gross stock of equipment and nonresidential structures at book value, and let $K87_t$ denote the corresponding series in 1987 dollars. Both *KB* and *K87* are annual series, valued at year-end, and we used linear interpolation to fill in the missing quarters. We then multiplied the *QFR* capital stock series by the quarterly ratio $K87_t/KB_t$ to obtain gross capital stock in 1987 dollars.

Investment (I)

As noted in the text, we imputed a current-dollar series for investment spending from the following identity:

$$I_t \equiv (KNB_t - KNB_{t-1}) + DEP_t$$

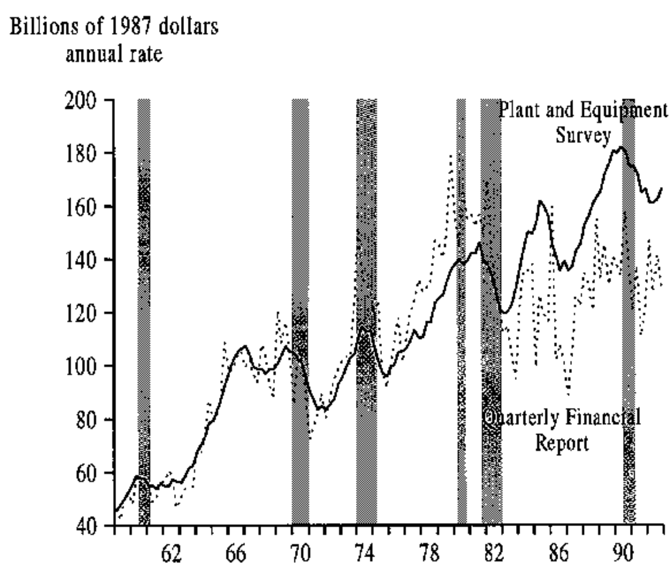
where DEP_t is the *QFR* series "Depreciation, depletion, and amortization of property, plant, and equipment," and KNB_t is the *QFR* series "Net property, plant, and equipment," which is measured at the end of period *t*. The resulting series for current-dollar investment was converted to 1987 dollars with the NIPA implicit price deflator for business fixed investment.

Figure A.1 compares the resulting investment series for total manufacturing to an independent measure of manufacturing investment from the Census Bureau's Survey of Plant and Equipment Expenditures. As shown, the two series display quite similar cyclical patterns. However, the *QFR* series is far more volatile on a quarterly basis, presumably because of inconsistencies between the measures of depreciation and net capital stock from which we imputed investment.

The *QFR* investment series for the small-firm group is even more volatile than that for total manufacturing. Moreover, the small-firm group displays a strong contemporaneous correlation between investment and the change in net sales (which is less evident either for large firms or for total manufacturing). To reduce the volatility in small-firm investment, we regressed I_t/K_{t-1} on a constant and $\Delta Y_t/K_{t-1}$,

FIGURE A.1

MEASURES OF REAL GROSS INVESTMENT IN MANUFACTURING*



* Shading shows periods of recession as dated by NBER. Current-dollar investment spending divided by implicit price deflator for business fixed investment.

and used the residuals from this regression as the dependent variable (*IK*) in our tests of the broad credit channel. For the sake of completeness, we smoothed the investment series for the large-firm group in the same way. (Note that the test results we report are very similar to those obtained when we use the unsmoothed I_t / K_{t-1} as the dependent variable in our empirical work and augment the regressors to include $\Delta Y_t / K_{t-1}$.)

Cost of capital (COC)

We relied on the cost of capital measures from the Federal Reserve Board's Quarterly Econometric Model. Specifically, we used a weighted average of the real cost of capital for equipment and for nonresidential structures:

$$COC_t = \omega_t\,(RTPD_t/PXB_t) + (1-\omega_t)(RTPS_t/PXB_t),$$

where *RTPD* is the current-dollar rental cost for producers' durable equipment; *RTPS* is the corresponding rental cost for nonresidential structures excluding petroleum drilling, mining, and public utility structures; and *PXB* is the implicit price deflator in the NIPAs for gross private domestic business product. *RTPD* and *RTPS* capture the effects of financing costs, depreciation, and corporate tax provisions. *RTPD*, *RTPS*, and *PXB* were taken directly from the Quarterly Model, and further description of these variables can be found in Brayton and Mauskopf (1985). The weight ω_t equals $IE_t/(IE_t+IS_t)$, where *IE* is investment in producers' durable equipment and *IS* is investment in nonresidential structures excluding petroleum drilling, mining, and public utility structures. *IE* and *IS*, measured in 1987 dollars, are from the NIPAs.

Seasonal adjustment

We seasonally adjusted the deflated series for investment, capital stock, net sales, and cash flow by regressing the natural log of each variable on a constant, a set of quarterly dummy variables, and a cubic time trend. The seasonally adjusted measure of each variable was calculated as the original series divided by the exponent of the estimated coefficients on the quarterly dummies. This regression was estimated over a rolling, centered 11-year window, which allows the seasonal factors to vary smoothly over time. For example, the seasonal factors for 1980 were based on estimates from a regression spanning 1975.Q1 to 1985.Q4, while the seasonals for 1981were generated from a regression spanning 1976.Q1 to 1986.Q4. For the first five years of the sample, we truncated the left-hand side of the window; similarly, for the final five years of the sample, we truncated the right-hand side of the window.

We did not seasonally adjust the series for the cost of capital, as the basic components of that series are either terms that have no seasonal variation or price data from the NIPAs that were seasonally adjusted by BEA.

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The 1980s Divergence in State per Capita Incomes: What Does It Tell Us?

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Written while the author was an economist at the Federal Reserve Bank of San Francisco. The author wishes to thank Fred Furlong, Tim Cogley, and Ron Schmidt for helpful comments. Steve Dean provided tireless research assistance.

During most of this century, state per capita incomes have converged. Researchers generally agree that incomes diverged between 1979 and 1988, but there is no consensus about what caused the divergence. This paper makes two significant contributions to the literature on the 1980s divergence and on the longer-term converging trend within the United States. First, it shows that the 1980s divergence was not primarily due to plunging oil prices, as is commonly argued. Instead, the most important reason for the divergence was a positive shock to some Northeast states, which had an unusually large effect on income. Second, this paper addresses the question of whether the 1980s divergence reflects a fundamental change in the long-term downward trend in income dispersion. The analysis suggests that state per capita incomes may be so close to their steady-state levels that they have stopped converging.

During most of the 20th century, state per capita incomes have converged. Many researchers, using a variety of techniques, have verified this empirical fact. (See, for example, Barro and Sala-i-Martin (1991), Browne (1989), and Coughlin and Mandelbaum (1988).) Researchers generally agree that incomes diverged between 1979 and 1988, but there is no consensus about what caused the divergence. Speculation about the reason for increased dispersion during the 1980s focuses on the role of falling oil prices. Most of the analysis views the increased income dispersion during the 1980s as a temporary departure from the long-run downward trend evident for most of this century.

This paper makes two significant contributions to the literature on the 1980s divergence and on the longer-term converging trend within the United States. First, it shows that the common interpretation of the 1980s divergence as the result of plunging oil prices is not consistent with the evidence. Instead, a positive shock to some Northeast states had an unusually large effect on income and was the most important reason that incomes diverged during the 1980s.

The second contribution of this paper is to address the question of whether the 1980s divergence represents a fundamental change in the long-term downward trend in income dispersion. This analysis suggests the possibility that incomes have stopped converging, which represents a significant departure from previous work on income dispersion within the United States.

The paper is organized as follows. Section I explores why incomes diverged during the 1980s. The remainder of the paper discusses broader issues related to convergence and the possibility that the 1980s episode reflects a fundamental change in the previous converging trend. Section II presents theoretical approaches to the question of whether incomes should converge across regions, while Section III discusses how convergence is operationalized empirically and examines the past 45 years in terms of these empirical constructs. Section IV looks at evidence regarding the extent to which the trend in dispersion changed during the 1970s. Section V summarizes the results and draws conclusions.

I. The 1980s Divergence

There is no dispute that convergence has been a persistent empirical fact within the U.S. through much of this century.[1] This relationship holds whether convergence is measured by an econometric relationship between income levels and growth (Barro and Sala-i-Martin (1991, 1992)) or by changes in measured dispersion over time (Browne (1989), Coughlin and Mandelbaum (1988)). It holds whether studies examine relationships among Census regions (Browne (1989), Carlino (1992)), states (Barro and Sala-i-Martin (1991, 1992), Coughlin and Mandelbaum (1988)), or metropolitan areas (Eberts and Schweitzer (1994)). Figure 1 uses a standard measure of dispersion, the weighted standard deviation of log per capita personal income, to show that since 1929 dispersion in per capita personal income tended to fall, with the exception of the period between 1978 and 1988, when it rose significantly.[2]

Given the persistence of the convergence among the United States since 1929, the divergence that lasted through most of the 1980s is somewhat puzzling.[3] One recurring hypothesis, cited by Barro and Sala-i-Martin (1991) and Carlino (1992), is that the plunge in oil prices during the early 1980s can account for the divergence. This hypothesis is based on the observation that relative incomes in oil-producing states (which tended to have low incomes) fell substantially during the 1980s. Coughlin and Mandelbaum (1988) found that the oil price decline was among the most important factors explaining the divergence.

The timing of the divergence, however, is not consistent with the timing of oil price changes. Oil prices *rose* sharply in 1980 (Figure 2).[4] Given the generally low incomes in

FIGURE 1

INCOME DISPERSION ACROSS 48 STATES

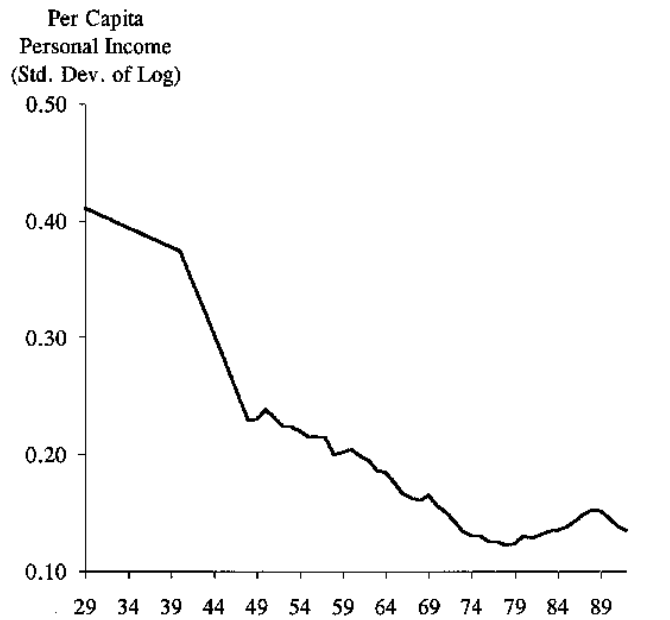
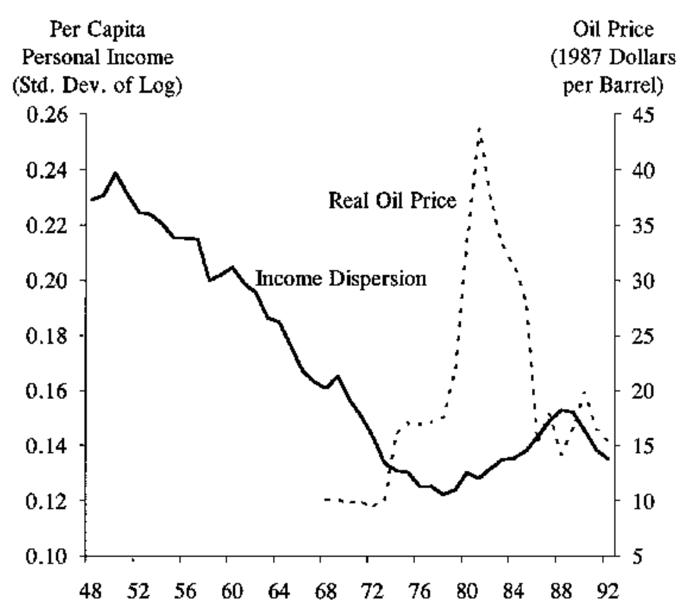


FIGURE 2

INCOME DISPERSION ACROSS 48 STATES AND OIL PRICE



1. This presents a sharp contrast with the international literature, where most studies have found that wage or income differentials tend to be relatively stable over time (Romer (1986), Lucas (1988), Quah (1993)).

2. Weights are state shares of U.S. population.

Throughout the paper, "personal income" refers to real personal income, available from the Regional Economic Information System of the U.S. Commerce Department's Bureau of Economic Analysis. Alaska, Hawaii, and the District of Columbia are omitted from the sample presented in Figure 1, and from all subsequent analysis. The geographic isolation of Alaska and Hawaii makes them unusual, and in addition data are available only starting in 1950 for Alaska, and starting in 1948 for Hawaii. Data for the District of Columbia also are problematic because of the large discrepancy between income generated in the District of Columbia and income earned by District residents.

According to some measures of dispersion, the trough was in 1979, but the standard deviation of log per capita personal income hit its low point in 1978.

3. In this section, I use the term "convergence" to describe a decline in dispersion and the term "divergence" to describe an increase in dispersion. The use of these terms should not be interpreted as implying conclusions regarding the broader issues of convergence and divergence that will be discussed in subsequent sections.

4. The oil price plotted in Figure 2 is the refiners' acquisition cost for domestic crude oil, from the U.S. Department of Energy, *Weekly Petroleum Status Report,* deflated by the GDP deflator.

energy-producing states, this increase in oil prices would have been expected to contribute to accelerating income convergence, but incomes diverged during the early 1980s. The collapse in oil prices, which is sometimes credited with generating the divergence, did not occur until 1982, four years after the divergence began. Moreover, the earlier period of sharply rising oil prices in the mid-1970s was not characterized by accelerating convergence in incomes. On the contrary, the decline in dispersion appears to have moderated somewhat during the mid-1970s. Another reason to question the oil price explanation is that omitting energy-producing states from the sample, as in Figure 3, moderates the divergence somewhat, but it still leaves a significant diverging trend through most of the 1980s.[5]

We can gain further insights into changes in dispersion during the 1980s by looking at relative per capita personal income for the individual states. Table 1 presents data on state income relative to U.S. income in 1978 and on growth in relative state income between 1978 and 1988, the period of divergence. States that had incomes 5 percent or more below the national average in 1978, and whose relative income fell more than 5 percent between 1978 and 1988 are denoted low and falling ("LF") in the right column, and states with incomes 5 percent or more above average whose relative incomes rose more than 5 percent are denoted high and rising ("HR"). These are the states that contributed significantly to the diverging trend, either positively or negatively.

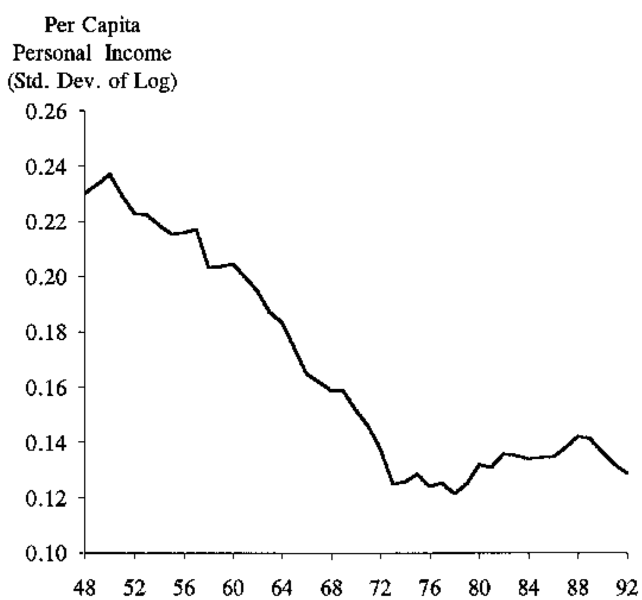
All but one of these diverging states are either energy or agricultural states, or are in the Northeast Census Region.[6] The farm and energy states tended to have low and falling incomes, while the Northeast states that contributed to the divergence had high and rising incomes.

Since we know from Figure 3 that the oil states alone do not account for the divergence, the next step is to see whether farm or Northeast states were primarily responsible for the divergence of the 1980s.[7] Figure 4 excludes farm states and Figure 5 removes the states in the Northeast Census Region from the sample. Incomes still diverge when farm states are omitted, but taking the Northeast states out of the sample yields relatively stable dispersion during the 1978 through 1988 period of divergence.[8] Indeed, without the Northeast states, dispersion appears to have stabilized around 1974. Taken together, Table 1, Figure 1, and Figure 5 suggest that a positive shock to some of the Northeast states was the most important reason that incomes diverged between 1978 and 1988. This conclusion is consistent with Wheelock and Coughlin's (1993) finding that the divergence was due primarily to strength in the high technology and producer services industries, in which several Northeast states specialize.

Several researchers have attempted to determine why Northeast states fared so well during the 1980s, with some placing the 1980s boom in the context of the subsequent deep, prolonged recession. Consistent with Wheelock and Coughlin's results, these explanations typically focus on the booming defense, high-tech, finance, and real estate sectors. Henderson (1990), for example, finds that a surge

FIGURE 3

Income Dispersion Excluding Energy States



5. See the Appendix Table for a list of energy-producing states.

6. The sole exception is Maryland. Lists of energy, agricultural, and Northeast states are provided in the Appendix Table.

7. In principle, the positive shock to the oil-consuming Northeast could have been the converse of the negative shock to the oil-producing states. However, if lower energy costs were the primary reason for the surge in growth in the Northeast, lower energy costs should have caused positive shocks to other regions that consume large amounts of energy. As Table 1 shows, that did not happen.

8. The time variable in a univariate regression run for the 1978–1988 period is positive even when Northeast states are excluded, but both the magnitude of the coefficient and the *t*-statistic are much smaller than they are with the 48-state sample. The coefficient on time is .0029 (t = 12.87) when all states are included, and .0004 (t = 2.13) when the Northeast states are omitted from the sample.

TABLE 1

STATE INCOME RELATIVE TO NATIONAL INCOME

	1978 INCOME PER CAPITA RELATIVETO U.S.	PERCENT CHANGE IN RELATIVE INCOME PER CAPITA 1978–1988	DIVERGING STATES HR = HIGH, RISING LF = LOW, FALLING
AL	77.9	0.6	
AR	78.3	–4.7	LF
AZ	90.8	–1.0	
CA	115.4	–2.2	
CO	103.1	–2.5	
CT	117.3	17.8	HR
DE	103.7	5.2	
FL	95.8	4.4	
GA	84.8	9.2	
IA	101.1	–13.2	
ID	87.5	–11.6	LF
IL	112.6	–4.3	
IN	96.7	–6.9	
KS	97.5	–2.3	
KY	81.9	–4.6	LF
LA	84.2	–10.1	LF
MA	104.2	19.2	
MD	107.5	9.7	HR
ME	81.4	12.9	
MI	107.4	–7.0	
MN	101.3	–1.7	
MO	94.7	–0.8	
MS	69.6	–3.3	
MT	91.3	–15.0	LF
NC	81.7	7.2	
ND	95.9	–24.2	
NE	97.9	–7.2	
NH	94.8	24.5	
NJ	114.3	17.9	HR
NM	82.2	–7.3	LF
NV	118.1	–11.3	
NY	108.9	7.4	HR
OH	99.7	–5.9	
OK	88.8	–8.9	LF
OR	101.6	–11.0	
PA	100.1	–1.0	
RI	93.7	9.3	
SC	75.9	4.7	
SD	86.3	–10.9	LF
TN	82.1	3.7	
TX	96.4	–7.7	
UT	82.5	–9.1	LF
VA	96.3	10.6	
VT	85.6	10.1	
WA	107.7	–8.3	
WI	99.0	–5.9	
WV	80.8	–10.6	LF
WY	111.2	–23.6	

FIGURE 4

INCOME DISPERSION EXCLUDING FARM STATES

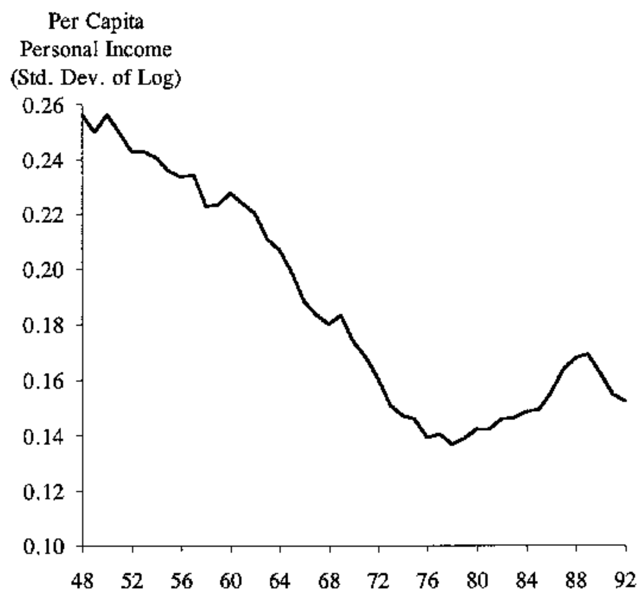
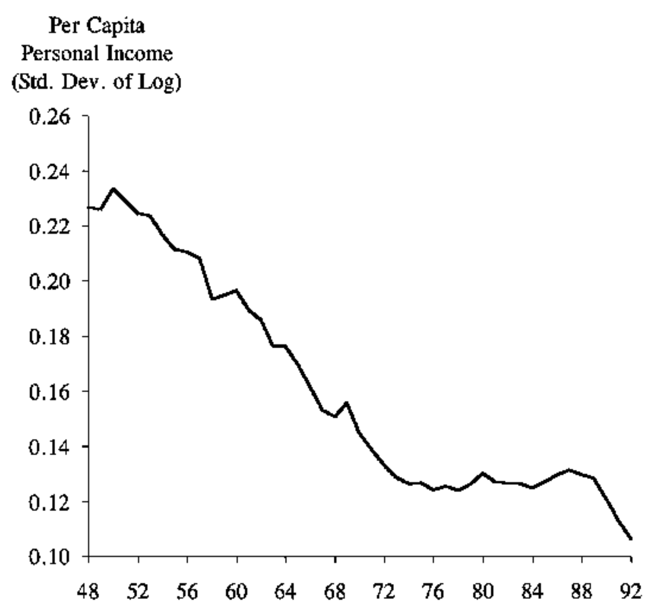


FIGURE 5

INCOME DISPERSION EXCLUDING NORTHEAST STATES



in defense-related activities coincided with the Massachusetts boom. Browne (1991) assesses the role of financial services in New England, and concludes that they probably contributed to the severity of the downturn but were not primarily responsible for it. Rosen and Wenninger (1994) point out that there is a strong correlation between total revenues of registered securities dealers and New York State income.

Blanchard and Katz (1992) find that the experience of Massachusetts during the 1980s was much more dramatic than a "typical" regional cycle. The defense and financial arguments do not explain why this episode was so atypical; many regional recessions are caused by dependence on an industry (or group of industries) that runs into trouble.

Case (1991) argues that excessive construction and real estate activity contributed to and significantly amplified the boom as well as the subsequent bust. According to this argument, sharp increases in real estate values created a boom atmosphere in which the demand for labor rose, generating increased prices and wages throughout the region's economy. Brauer and Flaherty (1992) and Rosen (1993) make arguments similar to Case's about the role of rising real estate values and general costs in exacerbating New York City's boom and bust.

There is no question that the cost of doing business in New England had risen substantially by 1987. Home prices and office rents were well above the national average, a big change from the early 1980s, when the cost of doing business in New England had been competitive with other regions. Thus, it seems plausible that a positive shock to the Northeast had an unusually large effect on income, because it was associated with an unusual run-up in the region's price level, relative to the national average.

II. SHOULD CONVERGENCE OCCUR?

According to standard, neoclassical, Solow-type growth theory, per capita incomes should converge across countries (or regions) for two reasons. First, if returns are decreasing, then additional factor inputs yield smaller increments to output in regions with higher incomes than they do in regions with lower incomes. Second, if capital and labor can move freely from one region to another, any differences in factor returns will tend to be migrated away over time. In this neoclassical view, convergence presumably would end at some point, when migration has bid away differences in factor returns across regions, and (assuming homogeneity across regions) all regions are at the same point on their production-possibilities frontier. Until this steady state is achieved, one would expect to see incomes converge.

There are, however, reasons why incomes may not converge over time. The neoclassical model relies heavily on assumptions of decreasing returns and factor mobility that may not hold. For example, Romer (1987) argues that knowledge spillovers increase the returns to human capital in regions that have large stocks of physical capital. Lucas (1988) suggests that the returns to skilled workers may be higher in locations with large concentrations of skilled workers, due to external economies of scale. In this situation, skilled workers would migrate to locations with other skilled workers, so that income differences across regions would increase over time. This result contrasts sharply with the equalizing effect of migration when workers are homogeneous or external returns to human capital are not increasing.

For these and other reasons, steady-state incomes might vary by region. Variations in family size or labor force participation yield differences in the ratio of workers to population. In this situation, per capita incomes would vary by region even if factor returns were identical. Regional variations in industry mix also could yield variations in per capita incomes, even if factor returns are equalized across regions. For example, a region specializing in high-technology production may have higher average compensation per worker than a region that specializes in low-wage service industries. That is, average returns across workers can vary by region, even if factor returns are equalized within industries and workers with comparable skills and work effort receive the same level of compensation across different regions.

In addition, people may tend to sort themselves by region in terms of the human capital they bring to the market.[9] Thus, an attorney negotiating major deals on Wall Street and an attorney writing wills on Main Street are doing two very different jobs. The knowledge they bring to the market is very different, and the returns to the skills the Wall Street attorney offers are much higher. Thus, the measured returns to labor for an attorney would be much higher on Wall Street than on Main Street, but much of the discrepancy is due to the different kinds of knowledge and skills that the two offer, rather than to a difference in the returns to lawyering that could be bid away if enough attorneys moved from Main Street to Wall Street.

Another reason why equilibrium incomes may vary across regions is that regions differ in terms of the amenities and disamenities that they offer their residents. If two regions have similar industry structures and offer similar job opportunities, but one has mild weather all year and the

9. This sorting could be driven by agglomeration economies, as in Lucas, by differences in tastes, or by some other mechanism.

other has cold winters and hot, humid summers, people would tend to sort themselves by their tastes in weather. If more people prefer mild weather year-round, land and housing costs would be higher in the mild-weather area, so that lower-valued activities would be priced out of these markets. Similar arguments could be made for other amenities, such as cultural and recreational opportunities, or disamenities, such as the risk of natural disasters.

A related argument is that per capita personal incomes may vary by region because of differences in living costs. Returns to otherwise similar workers who produce traded goods should not be higher in regions with higher costs of living, because it is unlikely that firms will be able to pass on the higher wage costs to their customers. However, if a region's industry mix, worker characteristics, or amenities result in land costs that are significantly different from land costs in other regions, workers who produce locally consumed goods (such as housing) may receive higher wages in a high-cost region than they would in a low-cost region. Equilibrium incomes therefore would vary by region if the dollar wage paid to workers in local goods industries compensates them for differences in regional amenities and costs of living.[10]

Thus, regional variations in incomes are not necessarily due to disequilibrium differences in factor returns. Steady-state incomes could vary across regions due to interregional differences in labor force participation, industry mix, worker characteristics, amenities, and costs of living. Only if the variations in factor returns are larger than these differences suggest will there be an incentive for the factor migration that tends to equalize factor returns across regions.

III. Two Measures of the Trend in Income Dispersion

The concept of convergence is operationalized in at least two different ways in the cross-sectional literature on the dispersion of incomes among regional or national economies.[11] Convergence in the standard deviation of per capita personal income or its log (as discussed earlier and displayed in Figure 1) is known as "σ-convergence."

Another convergence concept that has been used frequently in the international literature is β-convergence. In its simplest form, β-convergence means that regions that start out the sample period with below-average incomes tend to grow faster than do regions that start with above-average incomes. That is, β is negative in an equation of the following form:

$$(1) \qquad \log Y_{iT} - \log Y_{i0} = \alpha + \beta \log Y_{i0} + \varepsilon_i$$

over the time period from 0 to T, where Y is per capita personal income and i subscripts denote regions. Table 2 presents results of such regressions for the states of the U.S., both for the entire sample period (when σ-convergence held) and for the 1978–1988 period (when σ diverged rather than converged). Table 2 shows that β-convergence characterized the longer time period, but did not hold for the period of σ-divergence in the 1980s.

While this suggests that periods of σ-convergence are likely to coincide with periods of β-convergence, it is important to note that σ-convergence and β-convergence are not the same. Barro and Sala-i-Martin (1991) illustrate the difference using the example of rankings of sports teams in a league or division. In their example, β-convergence can be thought of as the tendency for champions to see their performance drop off, or teams at the bottom of the ranking to revert to the middle of the pack.[12] In this context, however, σ-convergence will not occur, because σ is based on the rankings of the teams. There will always be a first-place team, a second-place team, and so on through last place.

TABLE 2

LOG DIFFERENCE REGRESSIONS

	1929–1992	1978–1988
INTERCEPT	7.889	0.488
	(34.36)	(0.44)
LOG (Y_0)	–0.694	0.023
	(–19.25)	(0.19)
ADJUSTED R^2	0.887	–0.021

NOTE: *t*-statistics are in parentheses.

10. Consistent with this, Eberts and Schweitzer (1994) find that interregional dispersion in nominal incomes is highly correlated over time with interregional dispersion in the cost of living.

11. In addition, there is a growing convergence literature that uses time series techniques. (See, for example, Quah (1993) and Carlino and Mills (1993).) Bernard and Durlauf (1994) point out that the cross-sectional and time-series approaches are appropriate for answering different questions. Since this paper was motivated by the cross-sectional relationship shown in Figure 1, it focuses on cross-sectional rather than time-series convergence.

12. Indeed, Quah (1993) and Friedman (1992) have pointed out that equations like (1) suffer from Galton's fallacy. That is, reversion to the mean suggests that β could be estimated to be negative even if the level of dispersion remains the same. Tests of σ-convergence, in contrast, do not suffer from Galton's fallacy.

In their simplest forms, both σ-convergence and β-convergence imply that steady-state per capita personal incomes are the same in all regions. However, as discussed in the section on whether convergence should occur, different regions may have different steady-state incomes. Mankiw, Romer, and Weil (1992) call the situation when each region's income is moving toward its own steady-state level "conditional convergence." Conditional convergence does not necessarily imply that σ is falling or that β estimated in (1) is negative.[13] A test for conditional convergence would include additional information to account for the difference between the average income level across regions and the individual region's steady-state income level.

To summarize the results of the convergence tests, state per capita incomes appear to have converged in both the σ and β senses during the past 45 to 60 years. The σ and β measures both suggest that the 1978 to 1988 period was different from much of the rest of the 20th century.

IV. A Shift in the Long-run Trend?

The divergence of the 1980s generally has been treated as temporary, with little attention given to whether the long-run trend toward convergence in incomes among the states has changed. Given the long-term converging trend, the 1980s divergence, and the fact that theory does not provide a definitive answer about whether convergence should occur, there are three possible interpretations of the 1980s divergence:

(1) The 1980s divergence represents an anomaly in a long-term converging trend. In this case, the forces that might be expected to cause convergence continued to work throughout the 1980s, but they were offset for a time by a large shock (or set of shocks) that took several years to dissipate.

(2) Incomes have stopped converging. This could occur if differences among states' steady-state incomes are large relative to each state's deviation from its own steady-state income, so that σ is near its minimum level. In this case, dispersion should have little trend and β should be close to zero. Periods of convergence or divergence would be expected to occur as shocks temporarily pull states away from their steady-state incomes, or change their steady states.

(3) Incomes may now be diverging. Incomes could diverge because of agglomeration economies, as in Lucas (1988). Alternatively, it is possible that nonconvergence could look like a period of convergence, followed by a period of divergence.

It is relatively easy to show that the third possibility is unlikely. The Lucas argument suggests that agglomeration economies make the returns to workers who have accumulated substantial human capital higher in regions where there are other workers rich in human capital. In this case, workers rich in human capital will have an incentive to migrate to regions with large concentrations of like workers. In this way, income differences across regions can become more pronounced over time. However, this argument is inconsistent with the long period of income convergence in the United States. It is possible that there has been a structural change that has increased the extent of agglomeration economies. However, since technological advances have tended to make it less important, rather than more important, for people with large accumulations of human capital to be located near each other, this seems unlikely.

Figure 6 provides a stylized picture of relative income growth and relative income levels across states, in which convergence would be followed by divergence. In this case, income levels at the beginning of the sample period should be negatively correlated with income levels at the end of the sample period, and the rank-ordering of state incomes should have reversed itself. Instead, there is a strong positive correlation between relative per capita personal income in 1948 and relative per capita personal income in 1992. The simple correlation coefficient is 0.64, and it is significant at the 99.9 percent level. The Spearman rank correlation is even larger (0.66) and also significant at the 99.9 percent level.[14]

An End to Convergence?

Distinguishing empirically between the first and second possibilities is more difficult, but it is possible to generate some suggestive evidence. Returning to Figure 1, we see

13. Conditional convergence is defined by Mankiw, Romer, and Weil as a situation in which an equation like (1) yields a negative β only when it is augmented to include variables that determine each region's steady state income level. Carlino and Mills (1993) point out that conditional convergence implies that, when a steady state is reached, σ will be greater than zero.

14. The strong correlation between income levels at the beginning and end of the period is consistent with two possible patterns of convergence. First, if per capita personal incomes are still converging (possibility (1) above), states that started the period with high incomes would still have higher than average incomes. Second, if convergence in incomes ends because income differences reflect interregional differences in labor force and other characteristics (possibility (2)), states that started the period with higher than average incomes are likely to have higher than average steady-state incomes as well. The correlation is not consistent with a world in which convergence has eliminated interregional differences in per capita personal incomes, but neither is the fact that σ is still greater than zero.

FIGURE 6

HYPOTHETICAL PATTERN OF INCOME GROWTH ACROSS STATES

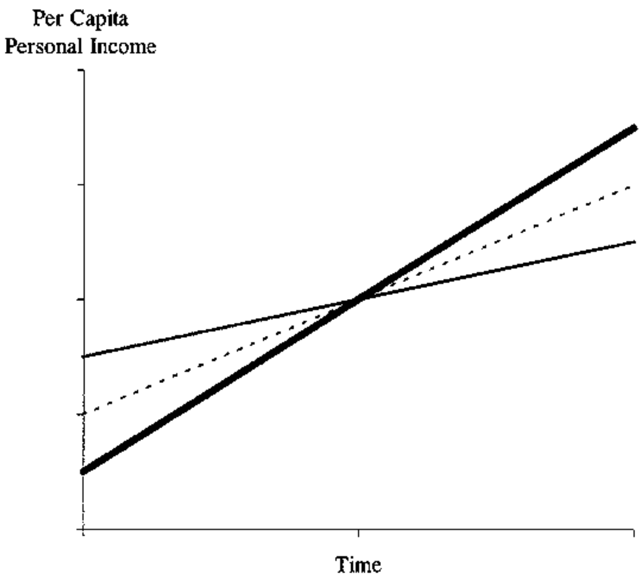


TABLE 3

LOG DIFFERENCE REGRESSIONS 1972–1992

	(1)	(2)	(3)
INTERCEPT	2.235	2.262	2.183
	(3.65)	(3.41)	(3.65)
LOG (Y_0)	–0.093	–0.181	0.049
	(–1.27)	(–1.94)	(0.57)
LOG ($n + g + d$)		–0.147	–0.046
		(–2.00)	(–0.67)
LOG (COLLEGE EDUCATION)		0.109	
		(1.44)	
LOG (HIGH SCHOOL EDUCATION)			–0.301
			(–2.69)
ADJUSTED R^2	0.013	0.065	0.159

NOTE: *t*-statistics are in parentheses.

that since about 1970, there have been roughly equal periods of increasing income dispersion and decreasing income dispersion. This "ocular regression" is confirmed by a regression of the form (1) for the 20-year period from 1972 to 1992, which is shown in the first column of Table 3. β for this regression is negative but not statistically significant, and the explanatory power of the regression is very low.[15] This suggests that it is possible that regional incomes may have gotten close to their steady-state levels.[16]

However, Mankiw, Romer, and Weil argued that similar results at the international level do not necessarily imply an end to the convergence process. Instead, omitted variables that capture steady-state differences across countries may have biased the estimation of β. That is, each country (or region) may be approaching its own (unique) steady state.

Following their methodology, I run regressions that are augmented for population growth[17] and educational attainment.[18] Other things equal, per capita incomes should grow more slowly in states with more rapid population growth,[19] and more rapidly in states with greater human capital. The second column of Table 3 shows the results for an augmented equation of this form, in which human capital is measured by the proportion of population with a college education. The augmented equation shows that β-convergence is in fact more rapid and more significant statistically, and the signs of the augmenting variables are as expected. The explanatory power of the equation, however, remains relatively poor.

Moreover, a second augmented regression, listed in the third column of Table 3, in which human capital is measured by the proportion of the working-age population that has completed high school, yields puzzling results. β essentially becomes zero, the coefficient on population growth also is essentially zero, and the human capital variable is highly statistically significant but *negative*. Nevertheless, the explanatory power of this third regression is considerably better than that of the other two.

15. Since Galton's fallacy introduces a negative bias to estimated β, it is even less likely that convergence occurred during the period.

16. This is consistent with Ram (1992), who found that the degree of dispersion in per capita personal income among U.S. states was very low.

17. Their variable is $n+g+d$, where n = rate of population growth, g = rate of technological change, and d = rate of depreciation. They assume that $g+d$ = 0.05 for all regions, so $n+g+d$ varies only with the region's rate of population growth.

18. Educational attainment data are from the 1980 decennial census, *Social and Economic Characteristics.*

19. This may be more true at the country level, where migration is restricted, than at the state level, where people are free to migrate toward regions whose economies are growing.

Sahling and Smith (1983) also looked at variables that might explain differences in steady-state per capita personal incomes across states. They found that, while nominal wages remained lower in the South than in other regions during the 1970s, these differences reflected differences in human capital and the cost of living. That is, real wages in urban areas actually were higher in the South than they were in other regions. These results suggest that secular convergence may have ended in the 1970s when regional incomes were close to their steady-state levels. The second column of Table 3, in contrast, suggests that states' incomes are still approaching their steady-state levels.

Evidence from Migration Flows

If relative earnings were close to "equilibrium" levels by the 1970s, migration patterns should have changed. Differences in income levels should have motivated much of the earlier (pre-1970) migration, if migration during that period was still competing away the differences in factor returns. Since 1970, income levels should not have been strongly associated with migration flows. Instead, economically motivated migration since 1970 should have been associated with *changes* in the relative economic fortunes of different states (i.e., changes in states' relative steady-state incomes). So, for example, when Idaho suffered economic hardships during the mid-1980s, there was substantial out-migration as people sought better opportunities in states with stronger economies. More recently, Idaho's economy has been one of the strongest in the nation, and it has experienced substantial inmigration.

These propositions can be tested using census data on population migration.[20] Table 4 presents some correlations that shed light on the changing nature of economic incentives to migration. The first set of figures in Table 4 shows the simple correlation between per capita personal income and net migration flow, for various time periods.[21] It shows

20. Ideally, one would want to test the same proposition using data on capital migration, but state-to-state data on capital movements are not available.

21. The time periods are dictated by the availability of Census data. Each decennial census includes information on moves during the previous five years. Therefore, migration data are only available for the second half of each decade.

TABLE 4

CORRELATION BETWEEN PERSONAL INCOME AND NET MIGRATION
48 STATES

Per Capita Personal Income	Net Migration Flow	Correlation	Significance
1955	1955 to 1960	0.4072	0.0041
1965	1965 to 1970	0.1831	0.2129
1975	1975 to 1980	–0.3790	0.0079
1985	1985 to 1990	0.0196	0.8947

Percent Change in Per Capita Personal Income	Net Migration Flow	Correlation	Significance
1955 to 1960	1955 to 1960	–0.2385	0.1025
1965 to 1970	1965 to 1970	0.4353	0.0020
1975 to 1980	1975 to 1980	0.3870	0.0066
1985 to 1990	1985 to 1990	0.2370	0.1049

NOTE: Net Migration Flow is defined as the number of inmigrants minus the number of outmigrants, divided by the sum of inmigrants and outmigrants. This measure was introduced as "demographic effectiveness" by Thomas (1941), and has been used extensively in recent years by Plane (1992) and others.

that there was a statistically significant, positive correlation between income in 1955 and net migration flow between 1955 and 1960. In contrast, in each of the subsequent decades the correlation was either statistically insignificant or negative.

The second set of data in Table 4 presents the simple correlation between the *change* in per capita personal income and net migration flow. It shows that, during the late 1950s, the correlation was negative and marginally significant. That is, migrants during this early period do not appear to have been motivated by short-term changes in regional economic fortunes. In contrast, changes in relative per capita personal incomes have been positively and significantly correlated with the direction of interstate migration during two of the three 5-year sample periods since 1965. In the most recent period, from 1985 to 1990, the correlation was positive but only marginally significant.

Taken together, these sets of correlations suggest that economic factors continue to be strongly associated with migration flows within the United States. However, the nature of economic influences appears to have changed during the 1960s. Prior to 1960, differences in income *levels* were strongly and positively correlated with interstate migration flows. During that earlier period, the relationship between changes in states' relative fortunes and migration flows was weak enough that it did not show up in simple correlation statistics. These patterns are consistent with economically motivated migration from low-wage regions to high-wage regions, which is the kind of migration that should cause incomes to converge over time.

In sharp contrast, the relationship between economic factors and migration after 1965 is consistent with a world in which differences in income levels reflect differences in living costs, amenities, and so forth, so that differences in income levels are not strongly associated with migration flows. The strong correlation between income changes and migration suggests that people tended to move out of regions going through hard economic times and into prospering regions. That is, income differences between regions within the U.S. appear to be small enough that the incentives for migration can be changed significantly by shocks that affect different regions differently. This is consistent with a situation in which changes in income dispersion are driven primarily by shocks that change states' steady-state incomes or that pull the state's current income away from its steady-state level.

V. SUMMARY AND CONCLUSIONS

Within the United States, state per capita personal incomes converged during much of the twentieth century, but they diverged sharply during the 1980s. This paper has addressed the significance of both the converging and diverging periods.

The analysis presented here suggests that the most important reason for the divergence of the 1980s was a positive shock to some states in the Northeast that had an unusually large effect on the region's per capita personal income. In contrast, the energy price explanation is not consistent with either the timing of the divergence or with the fact that divergence is significant even when energy-producing states are excluded from the sample.

The analysis also sheds light on questions of future convergence. Evidence on convergence during the past 20 or so years suggests that it is plausible that states' relative income levels are close enough to their steady states that short-term deviations from steady-state incomes, together with changes in steady-state incomes, may be more important in explaining future convergence and divergence than are persistent differentials between a state's current income level and its own steady-state income level. The pace of both σ-and β-convergence was considerably slower during the past 20 years than it was earlier, and augmented regressions tend to support the possibility that differences in states' steady-state income levels can explain some of the slowdown. Moreover, evidence on changing migration patterns also is consistent with the notion that secular convergence was more or less complete by the early 1970s. During the past 25 to 35 years, differences in income levels have not been correlated with interstate migration flows, as they had been earlier. However, *changes* in relative incomes are highly and positively correlated with changes in migration flows. Thus, people tend to move from states with shrinking economies to states with growing economies, and not necessarily from low-wage to high-wage states.

These findings are not conclusive, but they do suggest considering seriously the notion that state per capita personal incomes have been close to their steady-state levels since sometime in the 1970s. The 1980s divergence resulted from a combination of sectoral shocks, including a particularly unusual shock in the Northeast, but incomes might not have converged significantly during that period even if those shocks had not occurred.

APPENDIX TABLE

AGRICULTURAL STATES	ENERGY STATES	NORTHEAST STATES
Arkansas	Kansas	Connecticut
Idaho	Kentucky	Maine
Indiana	Louisiana	Massachusetts
Iowa	Mississippi	New Hampshire
Kansas	Montana	New Jersey
Kentucky	New Mexico	New York
Minnesota	North Dakota	Pennsylvania
Mississippi	Oklahoma	Rhode Island
Missouri	Texas	Vermont
Montana	Utah	
Nebraska	West Virginia	
North Dakota	Wyoming	
Oklahoma		
Oregon		
South Dakota		
Vermont		
Washington		
Wisconsin		

NOTE: Agricultural states had at least 3 percent of their Gross State Product (GSP) generated by agriculture. Energy states had energy shares of GSP greater than or equal to 3 percent. The definition of the Northeast Region is from the Census Bureau.

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Factors Influencing Community Bank Performance in California

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Community bank performance in California lagged well behind the industry and larger banks in the state during the first half of the 1990s. This paper identifies several factors that influenced the performance of these banks, which have less than $300 million in assets and typically operate in only one region of California, during the period from 1990 to 1994. The results suggest that regional conditions within California were an important factor in community bank performance. Management decisions, especially regarding loan portfolio concentration, also were a contributing factor. Community banks' increased reliance on real estate loans, and especially higher-risk commercial real estate and construction loans over the 1984 to 1994 period, played a significant role in lowering asset quality over the period studied.

The California banking industry began to rebound in 1992, well before the state's slow economic recovery took hold. Yet as late as 1994, many of the state's small or community banks still struggled with poor asset quality and weak earnings or losses—indeed, 22.5 percent of the state's 333 community banks lost money; in sharp contrast, countrywide less than 4 percent of small banks recorded losses in 1994, and outside of the West no other group of banks, whether compiled according to size or region, reported losses at more than 6 percent of banks.

This paper examines several factors that may have influenced community bank performance in California, factors that may explain why their asset quality and returns remained weak three years after the national economy began its recovery from the 1990–1991 recession and long after the banking industry had rebounded at the state and national levels.

The first of these factors is the dependence of community bank performance on local or regional economic conditions. Although the California economy is large and well-diversified, with a population of over 32 million in 1995, most community banks are small and typically operate within a limited local or regional market.

Second, in the 1990s the economic performance of several key regions of California differed significantly, as the state endured one of its longest and most severe downturns of the postwar era. Most of the sizeable decline in employment in the state following the 1990–1991 national recession occurred in Southern California, and some of the most severe real estate market problems also took place in that part of the state.

Third, California banks became much more active in real estate lending over the 1984–1994 period. Community banks nearly doubled their ratio of real estate loans to total loans, thus increasing their exposure to a real estate downturn. By 1994 nearly two-thirds of all their loans were secured by real estate, and they had the highest ratio of real estate loans to total loans of all bank size groups.

Finally, over the 1984–1994 period California banks increased their financing of relatively high-risk types of real estate lending. Community banks more than doubled their ratio of commercial real estate loans to total loans, to more than 45 percent in 1994, the highest ratio of all bank size groups in the state. Furthermore, at their peak in 1990, community banks had nearly 18 percent of their loans in the construction category, far above the ratio for either U.S. or California banks.

The first two factors are conditions related to geographic location: Community banks operate in regional markets, and there may be significant variations in regional economic conditions. The last two factors reflect a bank management's portfolio decisions, specifically, the appropriate concentration of assets in real estate lending and the appropriate mix of real estate loans between residential and commercial real estate lending.

The study is organized as follows. Section I describes community banks and presents aggregate indicators of community bank performance for the three major regions of the state—Southern California, Northern California, and the Central Valley. Aggregated regional community bank data can be used to analyze community bank performance relative to (a) the California banking industry, (b) community banks in other regions of the state, and (c) local economic conditions. Section II describes regional economic conditions in California during the 1990s. Section III tracks trends over the 1984–1994 period, both in the aggregate and by region, for community bank lending, noting especially the shift by community banks into real estate lending, and in particular into high-risk commercial real estate and construction lending. Section IV examines the performance of California community banks on a regional basis and relative to economic conditions as well as community banks' increased concentration in real estate lending. Section V presents a simple regression model to evaluate the significance over the 1990–1994 period of such factors as regional economic conditions and banks' real estate loan concentration on the performance of individual community banks in California. Section VI concludes with some observations on the importance of economic conditions and real estate loan concentration on California's community banks.

I. COMMUNITY BANKS

In this study, community banks in California are defined as smaller banks, that is, banks with under $300 million in assets. Table 1 presents data on assets and liabilities for all banks in California and compares them to data on small banks in the state in the aggregate and by major region—Northern California, Southern California, the Central Valley, and the remainder of the state ("Other"). While community banks account for over 80 percent of the state's banks, their share of assets is less than 10 percent of domestic assets at all California banks. These banks typically generate funds from retail deposits, including checking, savings, money market deposit accounts, and small certificates of deposit. These funds generally are used to make loans to small businesses and households in their local or regional market.

Table 2 presents the differences in certain loan and asset ratios between community banks and other banks in California. Community banks in the state rely more heavily on deposits for funding than do larger banks that have a higher share of nondeposit borrowings: The mean deposits-to-assets ratio for all banks in the state was 84.8 percent, for community banks the ratio was 3.1 percent above the statewide mean, and the difference was statistically significant. Community banks also have a higher ratio of loans to assets than the average bank in the state: The mean loans-to-assets ratio for all banks statewide was 55.9 percent, the ratio for community banks was 5.3 percent higher, and the difference was statistically significant.

Community banks' loan portfolio composition also differs from the mean for banks statewide. Nearly two-thirds of community bank loans are secured by real estate, a ratio about 5.4 percent higher than the mean for the state. Community banks have a significantly higher ratio of their loans in commercial real estate (5.5 percent more) than do other banks, mainly as a result of a higher ratio of construction lending (2.9 percent more). In contrast, community banks' ratio of business loans to total loans is almost 4.5 percentage points below that of larger banks in the state. These ratios indicate that community banks have a loan portfolio that is significantly more concentrated in real estate lending, i.e., that community banks' portfolios are less well-diversified by loan type than are portfolios at banks statewide.[1]

Community banks have fewer opportunities than banks operating statewide to diversify their geographic lending risk through direct lending beyond their local communities.[2] Furthermore, most community banks in California do not operate branches outside their regional market area,

1. See Shaffer (1989) on some of the pitfalls small banks face by focusing on a narrow line of business that may be unsustainable in an economic downturn. Gup and Walter (1989) supports this perspective, noting that local or regional conditions, specifically agricultural and oil, have played an important role in small bank performance. Kao and Kallberg (1994) also discuss the need for small banks to address risks associated with a concentration of assets. Levonian (1994) shows how banks might potentially reduce their risk by diversifying, in this case by combining with a bank from another western state where banking performance is either negatively correlated or not correlated with their home state.

2. See Nakamura (1994) for a discussion of small bank diversification and Laderman, Schmidt, and Zimmerman (1991) for a discussion of how laws limiting branch locations result in rural banks specializing in more agricultural lending and urban banks in nonagricultural lending.

TABLE 1

Assets and Liabilities as a Percent of Assets—December 31, 1994

(Not Seasonally Adjusted, Preliminary Data)

		All Banks	Small Banks				
		California	All	Southern	Northern	Central	Other
Assets	Total (dollar amounts)	345,178	31,406	15,715	6,865	2,655	6,171
	Foreign	12	0	0	0	0	0
	Domestic	88	100	100	100	100	100
Loans	Total	67	63	62	64	62	65
	Foreign	9	0	0	0	0	0
	Domestic	58	63	62	64	62	65
	Real Estate	34	41	43	41	38	40
	Commerical	11	14	14	15	16	12
	Consumer	6	6	4	6	4	8
	Agricultural	1	1	0	1	3	4
	Other Loans	5	1	1	1	0	1
Investment Securities	Total	14	20	19	21	20	20
	U.S. Treasuries	4	8	8	9	5	8
	U.S. Agencies, Total	4	7	7	6	9	6
	U.S. Agencies, MBS	3	1	1	1	1	1
	Other MBS	1	0	0	0	0	0
	Other Securities	5	5	5	6	6	7
Liabilities	Total	92	90	91	90	91	90
	Domestic	80	90	90	90	91	90
Deposits	Total	80	88	89	88	89	88
	Foreign	12	0	0	1	0	0
	Domestic	68	88	88	87	89	88
	Demand	20	19	21	18	20	17
	Now	7	10	9	10	11	11
	MMDA & Savings	25	29	28	30	30	30
	Small Time	11	19	19	18	17	20
	Large Time	6	10	10	12	11	9
	Other	0	0	0	0	1	0
Other Borrowings		4	1	1	1	1	1
Equity Capital		8	10	9	10	9	10
Loan Loss Reserve		2	1	2	1	1	1
Loan Commitments		34	14	10	22	15	18

so they are more likely to be dependent on the health of a much smaller local or regional market area than would a bank with operations across a larger region or with a statewide branching system.[3]

Regional Community Bank Performance Indicators

The dependence of community banks on their local or regional market suggests looking at aggregate measures of community bank performance *by region.* This is done by

3. The California regions cover large geographic areas, and most community banks operate in only one region, so that their performance will be directly tied to economic conditions in that region. In addition, for the limited number of community banks that operate in more than one region, typically two-thirds of their deposits were located in branches in the region where they maintained their head office, so that their performance also will be closely tied to regional economic conditions.

TABLE 2

DIFFERENCES IN VARIOUS LOAN AND ASSET RATIOS BETWEEN COMMUNITY BANKS AND CALIFORNIA BANKS, 1994.Q4

	PARAMETER ESTIMATES		
	Sample Mean (Intercept)	Number of Branches	Difference from Sample Mean (Community Bank Dummy)
DEPENDENT VARIABLE (as a percent of total loans)			
Total Real Estate Loans	58.501***	–0.002	5.398**
Commercial Real Estate Loans—Total	36.677***	–0.035*	5.499**
Construction Loans	5.714***	–0.006	2.922***
Other Commercial Real Estate Loans	30.962***	–0.029	2.577
Single-Family Residential Real Estate Loans	17.901***	0.035**	–0.180
Business Loans	28.178***	–0.020	–4.452**
Consumer Loans	8.831***	0.014	–0.271
DEPENDENT VARIABLE (as a percent of total assets)			
Total Loans	55.900***	0.025	5.266***
Total Deposits	84.773***	–0.016	3.085***

NOTE: The data are based on 358 observations, except for Total Loans and Total Deposits, which are based on 360 observations.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

aggregating individual community bank data for key regions of the state, for example, Southern California, Northern California, and the Central Valley.[4] Thus, regional community bank data can then be compared against data from the aggregate state banking figures, all community bank totals, or the other regions.

In this paper two community bank performance indicators, return on assets (ROA) and the ratio of problem real estate loans to total loans, are evaluated for the three major regions. These indicators represent the earnings and assets

4. Individual bank data are collected quarterly by the banking regulatory agencies. The aggregated community bank performance measures—earnings, returns, asset quality—can then be used to analyze bank performance for a specific region of the state, something that is not possible otherwise because all banks, including the large branch banks, report state-wide totals, not regional data. California has a large enough number of community banks in each region that the regional community bank performance measures may provide a useful tool for analyzing bank performance by region. See Zimmerman (1996).

components of the CAMEL ratings (**C**apital, **A**ssets, **M**anagement, **E**arnings, **L**iquidity) that regulators give banks after examining them. ROA provides an overall measure of bank earnings per dollar of assets that can be used to compare bank and industry performance over time. Asset quality is measured by the ratio of loans of a particular category (total loans, real estate loans, etc.) that are past due at least 30 days or that have fallen into nonaccrual status (loans no longer paying interest) to total loans of that type.

These regional community bank indicators can be compared with regional employment and economic performance figures to evaluate the effects of regional economic conditions on community bank performance. In addition, the relationship between community banks' concentration in real estate lending and their performance also can be examined.

II. California Recession

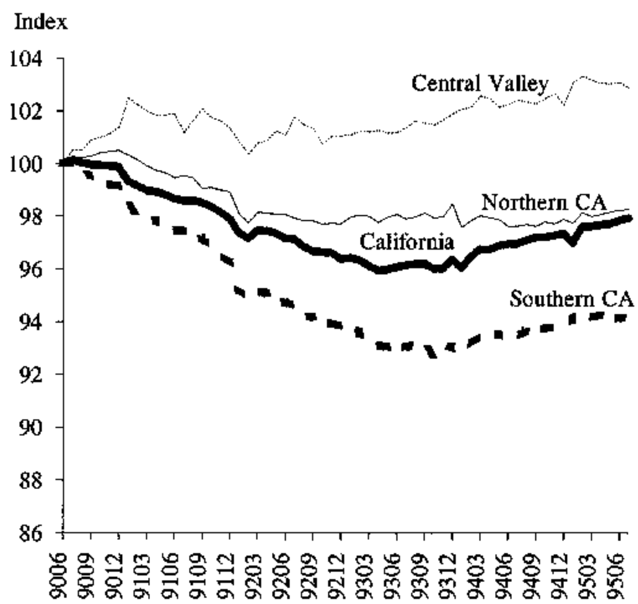
The 1990–1991 national recession hit California much harder than it did most of the rest of the country. California employment growth, a measure used to track the state's growth, turned negative along with the national economy in mid-1990.[5] By the second quarter of 1991 the national economy began to make a slow recovery; in California, however, that recovery would be long delayed. Employment continued to decline into 1993 in key industries like defense and aerospace and in large sectors like manufacturing, trade, and government.[6] Nonagricultural employment did not hit bottom until spring 1993, two full years after the national recovery began. Moreover, the recovery in California remained weak, with only 1 percent growth in employment for 1994.

Regional Disparity

The recession in California was much more severe and much longer than most had anticipated when it began in 1990. It hit Southern California the hardest (Figure 1).[7] This region, with a population of over 18 million, accounts for almost 57 percent of the state's population, but it suffered over 90 percent of the net jobs lost statewide during the downturn.[8] Job losses continued there until late 1993, long after employment had turned up in the Central Valley (early 1992) and Northern California (mid-1993).

FIGURE 1

California Employment



The metropolitan Bay Area of San Francisco–Oakland–San Jose and the counties surrounding the San Francisco Bay make up the Northern California region.[9] This region, with a population approaching 6.5 million, represents about 20 percent of the state's population. Like Southern California, it also suffered job losses and a weakened real estate market, although the downturn was less severe.

Employment growth in the inland Central Valley region, which includes the metropolitan areas of Sacramento, Stockton, Fresno, and Bakersfield, and many agricultural communities, fell slightly in 1991.[10] This region, which accounts for about 11 percent of the state's population, has a population of 3.6 million. By 1992 employment already had begun to expand, although it did so at a slower pace than before the recession.

5. See Webb and Whelpley (1989) for a discussion of employment indicators.

6. See Sherwood-Call (1993).

7. Statewide civilian employment fell by 533,300 during the period from third quarter 1990 to the second quarter of 1993. The decline in Southern California was 514,700. Northern California reported employment losses of just over 90,000 over the same period, while the Central Valley reported losses of nearly 24,000. The remainder of the state recorded increases in employment. See Sherwood-Call (1992) for a discussion of California's economic woes.

8. The Southern California region includes greater Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura Counties.

9. The Northern California region includes San Francisco, San Mateo, Santa Clara, Alameda, Contra Costa, Solano, Napa, Sonoma, Mendocino, and Marin counties.

10. The Central Valley region includes Sacramento, San Joaquin, Merced, Tulare, Fresno, and Kern Counties.

California Real Estate Markets

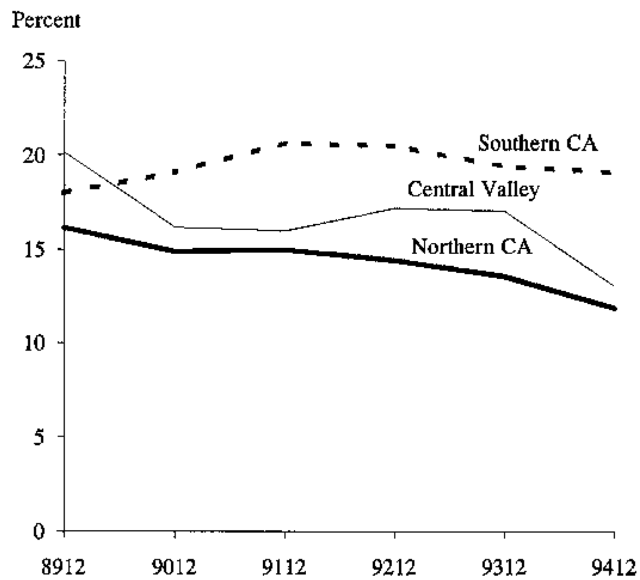
By the early 1990s many California commercial real estate markets had been beset by high vacancy rates, reduced rents, and lower prices. Vacancy rates for commercial office space in most metropolitan areas of Southern California exceeded the national average and reached over 26 percent in downtown Los Angeles in 1994. Higher vacancy rates and reduced rental income have made it more difficult for owners to continue to meet their mortgage obligations. Households also were hurt by falling housing prices as the residential real estate market deteriorated, especially in Southern California.[11]

The growing weakness in the real estate markets translated first into deterioration in the quality of banks' expanded construction and commercial real estate loan portfolios and then later into restructurings and defaults. While there was some deterioration in single-family residential loan quality over the period, it was much less severe.

The downturn in the real estate market was consistent with the weakness in the employment statistics for Southern California. From 1990–1994 the region reported the highest vacancy rate for commercial property across the three regions and one of the highest in the country, according to *CB Commercial* data (Figure 2). Vacancy rates rose in Southern California from 1989 to 1991, before reaching a peak of over 20.6 percent in 1991. This measure of conditions in the commercial real estate market, together with data on housing prices noted above, all indicate that the recession had a more severe impact on Southern California real estate markets than it did in those markets in the other two major regions of the state.[12]

FIGURE 2

VACANCY RATES
FOR CALIFORNIA OFFICE BUILDINGS



III. SHIFT TO REAL ESTATE LENDING

The 1980s real estate boom also had a profound impact on the concentration of real estate loans in banks' loan portfolios. (Concentration in this paper is measured as the ratio of real estate loans to total loans.) Over the 1984–1994 period, banks became much more active in real estate lending, both by originating and holding loans and by purchasing mortgage-backed securities. In the following discussion the focus is on the trend for banks to have a higher concentration of real estate loans in their loan portfolio.[13]

Nationally, outstanding real estate loans at commercial banks finally surpassed commercial and industrial loans as banks' largest loan category in the third quarter of 1987, the culmination of a trend that had been going on at least since the early 1970s (FDIC 1987). In the 1980s, the trend accelerated as over time banks had lost many of their best-quality borrowers to the financial markets and other nonbank competitors.[14]

Traditionally, real estate lending has been even more important to banks in California than to banks elsewhere in the nation. In California, real estate lending has accounted

11. Based on data on median single-family housing prices for selected markets from the California Association of Realtors, it would appear that the deterioration was most severe in Southern California, where home prices fell by 13.3 percent between 1989 and 1994. In Northern California and the Central Valley the median home price actually increased over the same period (0.6 and 11.3 percent, respectively), although both regions experienced declines during the period.

12. The regional vacancy rate data are constructed by averaging *CB Commercial* vacancy rates for metropolitan areas within a region weighted by the population for each metropolitan area within the region. This method gives a larger weight to the larger metropolitan areas within a region.

13. Weiland (1993) and Lyons (1994) provide nontechnical discussions of the importance of managing the risks associated with over-concentration in a bank's loan portfolio.

14. More and more large corporations found that they could get lower rates and better terms by borrowing in the open markets, typically by issuing commercial paper or debt, rather than by relying on bank financing. Competition from expanded access to the commercial paper market, finance companies, and foreign banks all have resulted in the loss of many high-quality corporate loans from commercial bank balance sheets.

for a larger share of bank loan portfolios than business lending since early 1977. California banks were especially active as the industry helped finance the state's booming real estate markets in the 1980s. This trend for California banks is evident in Figure 3, which shows the strong upward trend in real estate lending as a share of total loans nationally as well as for all California banks and all community banks in the state.[15] By the end of 1994, real estate loans at community banks accounted for 66.1 percent of total loans, versus 59.1 percent for all banks in the state. On a regional basis, community banks in Southern California reported the largest concentration in real estate lending, 69.4 percent, followed by Northern California at 64.6 percent, and the Central Valley at 61.3 percent.

Not only did community banks have a higher concentration of real estate lending than did banks statewide, but community banks also recorded the largest increase in real estate lending concentration over the 1984–1994 period. Community banks nearly doubled their real estate loan concentration, adding 32.1 percentage points to their ratio of real estate loans to total loans over the same period. For all banks in the state, the comparable increase was just 20.2 percentage points.

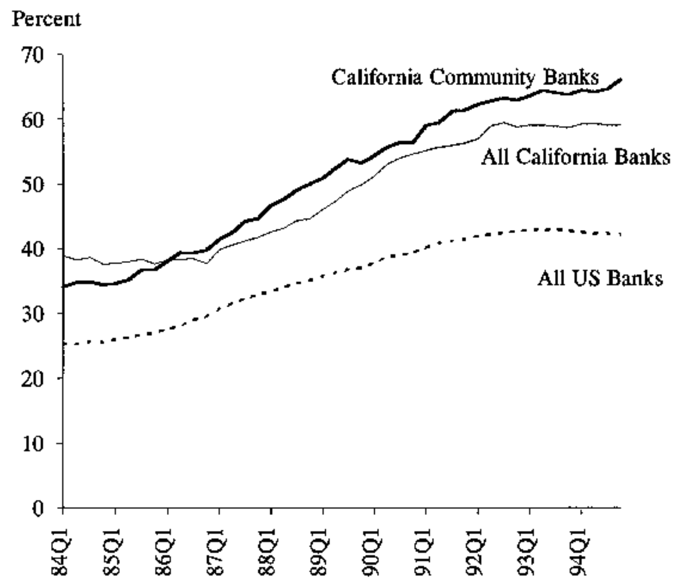
Southern California community banks more than doubled their ratio of real estate loans to total loans, as they recorded a 37.6 percentage point increase from 1984 to 1994. Northern California and the Central Valley also recorded sizeable increases, at 28.5 and 21.4 percentage points respectively.

Figures 4a and 4b show that the 1984–1994 expansion in real estate lending at small banks was primarily in loans secured by relatively higher-risk commercial real estate rather than lower-risk residential properties.[16] Figure 4a shows that, in the aggregate, community banks in the state have had a much higher concentration of loans in commercial real estate (including construction loans) than either all U.S. banks or all California banks. In 1994 banks nationally reported 16.1 percent of their total loans were made for commercial real estate purposes; in California that figure was 20.9 percent. Yet, community banks in the state held 44.5 percent of their loans in commercial real estate, more than twice the ratio for all banks in the state and nearly three times the U.S. ratio; furthermore, unlike larger banks in California or banks nationally, California community banks were not able to reduce their commercial real estate exposure following the downturn in the real estate market.

In Southern California the concentration in commercial real estate lending was 46.9 percent, which was even

FIGURE 3

REAL ESTATE LOANS
AS A PERCENT OF TOTAL LOANS



greater than in the other regions. The higher concentration in Southern California is the result of a 30.8 percentage point increase over the 1984–1994 period. Northern California recorded the next highest concentration in commercial real estate lending, 44.8 percent, and the next largest increase over the 1984–1994 period, 29.5 percentage points. In the late 1980s, community banks as a group also added dramatically to their concentration of construction loans (Figure 4b). Although community bank concentration in construction loans has fallen by more than half from its peak of 18 percent in 1990, it still remains about double that for the state as a whole or for U.S. banks.

Figure 5 illustrates why commercial real estate loans and construction loans are considered risky. These two types of real estate loans had the highest net charge-offs both during and after the 1990–1991 recession. The history of higher charge-offs on these categories of real estate loans is one reason that regulators give them a weight of 100 percent in determining risk-based capital requirements. In contrast, performing loans secured by single-family or multifamily residential property have only a 50 percent weight for risk-based capital requirements.[17]

Thus, not only did community banks increase their concentration in real estate lending over the period from 1984

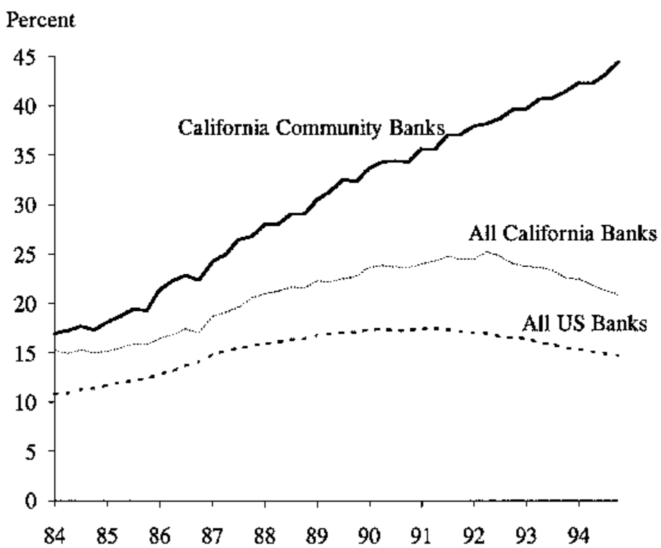
15. Community bank real estate lending grew from $4.4 billion in 1984 to $13.0 billion in 1994.

16. See Weiland (1993), p. 21.

17. O'Keefe (1993) Appendix B.

FIGURE 4A

COMMERCIAL REAL ESTATE LOANS AS A PERCENT OF TOTAL LOANS*



* Includes commercial real estate and construction loans.

FIGURE 5

NET REAL ESTATE LOANS CHARGED OFF FOR ALL U.S. COMMERCIAL BANKS

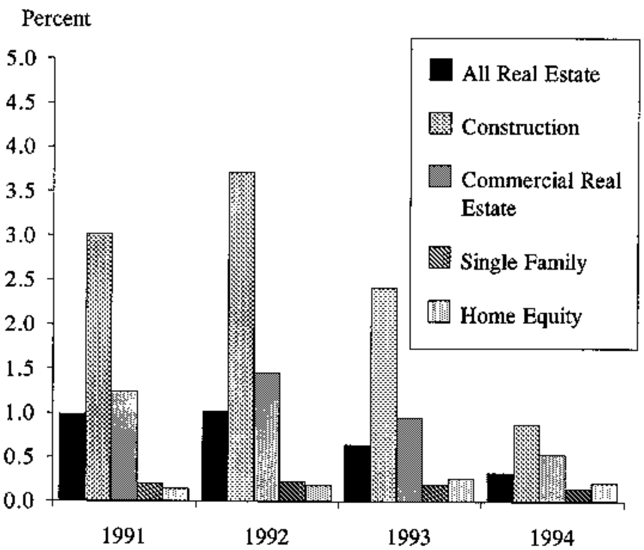
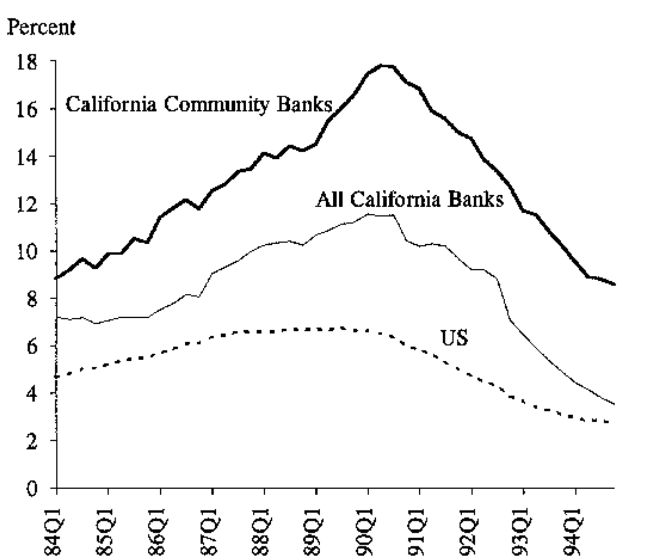


FIGURE 4B

CONSTRUCTION REAL ESTATE LOANS AS A PERCENT OF TOTAL LOANS



to 1994, but they also dramatically shifted their emphasis from a portfolio mix balanced between residential and commercial real estate loans towards a mix containing more high-risk types of commercial real estate lending, like construction.

IV. AGGREGATE COMMUNITY BANK PERFORMANCE

In this section, two regional community bank indicators of performance, asset quality and return on assets, are examined to see if their behavior is consistent with data on regional economic conditions and/or community banks' concentration in real estate lending.[18]

Problem Loans

Overall asset quality, measured here by the ratio of total problem loans (past due 30 days or more and nonaccrual loans) to total loans for community banks, shows a pattern

18. See English and Reid (1995) for their use of similarly defined measures of bank returns and problem or delinquent loans.

of deterioration consistent with the recession and the slow recovery across the key regions of the state (Figure 6). Problem loan ratios for each of the regions tend to move in the same direction, reflecting overall conditions of the state economy, although the levels vary considerably across regions. The largest divergence occurs after 1990 in Southern California, when problem loan ratios over the 1991–1993 period are nearly double those of the other regions.[19]

A similar pattern showing the most severe deterioration of community bank asset quality in Southern California is evident from key real estate asset quality measures as well (Figure 7). Problem real estate loans at California community banks actually began rising in Southern California in 1989. By 1990 the increases in both Southern and Northern California were quite steep. Problem loan ratios in the southern region of the state did not fall off until 1994.

Data on problem real estate loans by type of loan first were collected for the March 31, 1991, Call and Income Report. These asset quality measures make it much easier to evaluate the trouble spots in banks' real estate loan portfolios, and they are useful for making comparisons of asset quality across regions of the state. The problem loan ratio for combined commercial real estate and construction loans for community banks is shown in Figure 8a. Between mid-year 1991 and early 1994, problem loan ratios for Southern California community banks were nearly double those for banks in the other regions. Furthermore, similar patterns were reported for both commercial real estate loans and construction loans, although the problem loan ratios were much higher for construction lending, as can be seen from Figure 8b.

Southern California community banks also report higher problem loan ratios for single family residential lending (Figure 9), although the differential between Southern California and the other regions is not nearly so pronounced as with commercial and construction lending.

Evidence from the aggregate regional community bank asset quality data are consistent with the regional economic conditions. Deterioration in both the economy and community bank asset quality was generally most severe in Southern California. More moderate deterioration occurred in the northern sector of the state, while the impact on the Central Valley appears to have been the least severe.

19. Central Valley banks tended to report relatively high problem loan ratios for most of the period from 1985 until 1989, a period when this region's dependence on the agricultural industry probably weakened bank performance. The variability in this series also may be related to its relatively small sample size, 30 banks, as of December 1994, which also makes the series more susceptible to variations arising from adding or deleting banks from the community bank group.

FIGURE 6

PROBLEM LOANS AS A PERCENT OF TOTAL LOANS

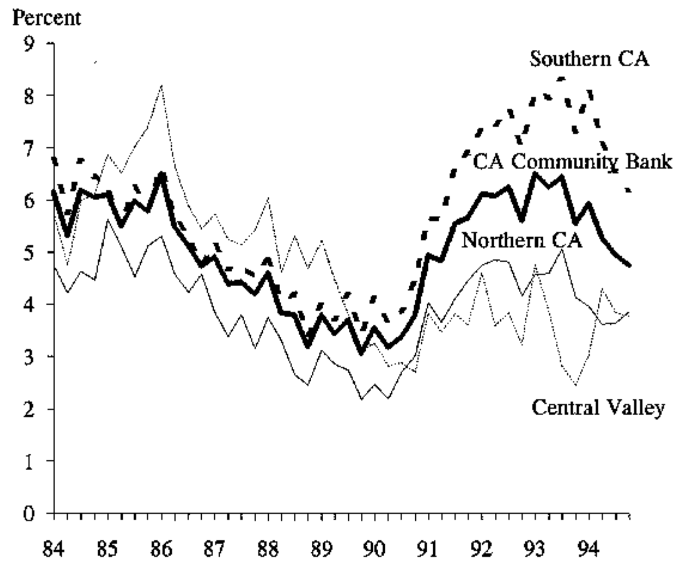


FIGURE 7

PROBLEM REAL ESTATE LOANS
AS A PERCENT OF TOTAL REAL ESTATE LOANS

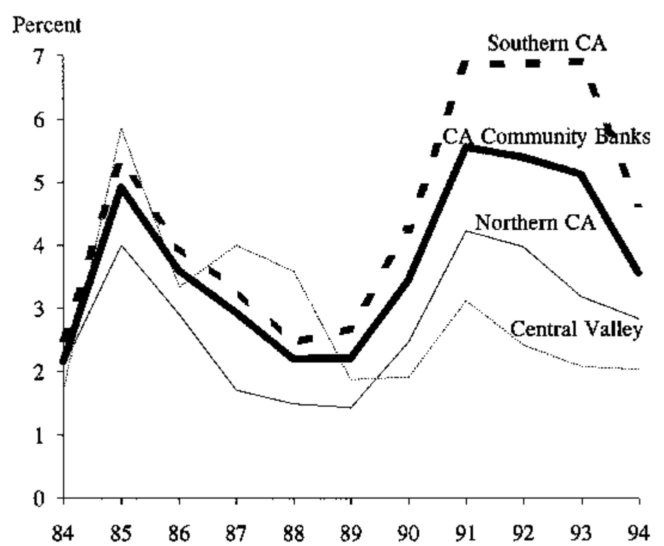
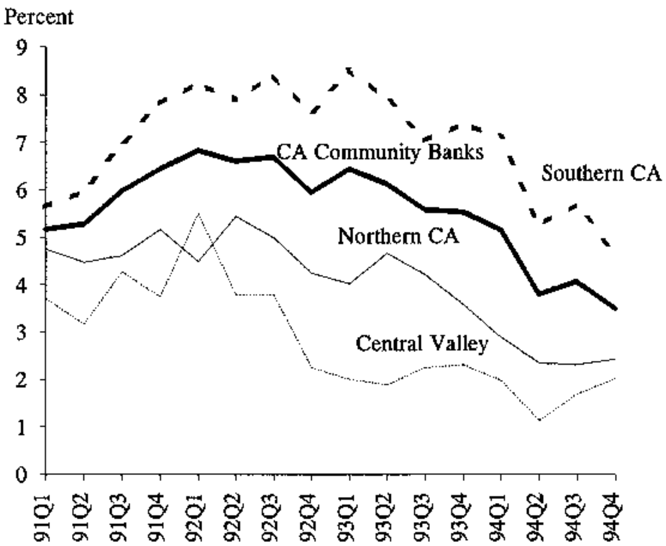


FIGURE 8A

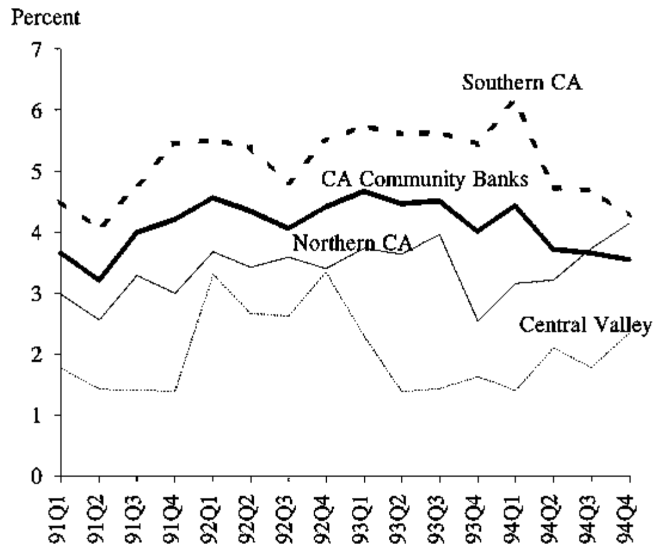
PROBLEM COMMERCIAL REAL ESTATE LOANS AS A PERCENT OF TOTAL COMMERCIAL REAL ESTATE LOANS*



* Includes commercial real estate and construction loans.

FIGURE 9

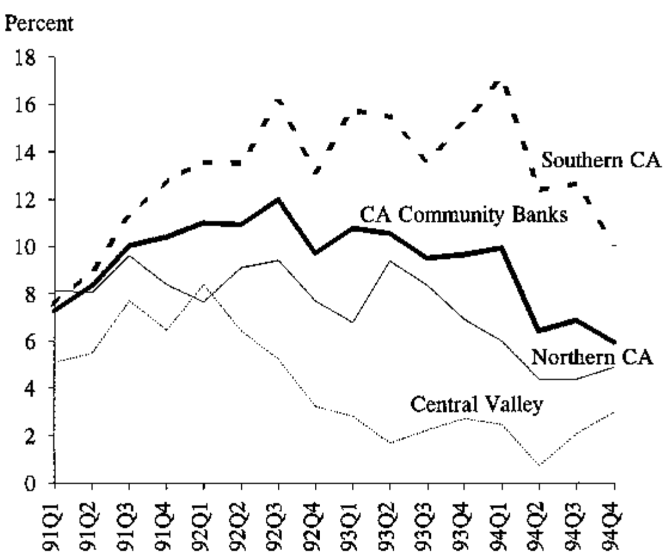
PROBLEM SINGLE-FAMILY REAL ESTATE LOANS AS A PERCENT OF TOTAL SINGLE-FAMILY REAL ESTATE LOANS*



* Includes single-family and home equity loans and lines of credit.

FIGURE 8B

PROBLEM CONSTRUCTION LOANS AS A PERCENT OF TOTAL CONSTRUCTION LOANS



The behavior of community bank asset quality measures across regions of the state following the recession also was consistent with the shift toward higher-risk real estate loans. Again, the region with the highest concentration in both real estate lending and commercial real estate lending, Southern California, reported the most severe deterioration in asset quality, and the Central Valley region, with the lowest concentration and the smallest increase, reported the least deterioration in asset quality.

Return on Assets

In terms of the broader measure of bank performance, ROA, California's community banks clearly lagged those of the statewide industry in the 1990s (Figure 10). All banks in the state also lagged behind industry performance nationally. In the aggregate, community banks reported actual losses in both 1992 and 1993 and, although earnings turned positive in 1994, they were poor.

As Figure 11 shows, community banks' ROA figures are consistent with regional economic conditions. Small banks in Southern California suffered the most severe loan quality problems and reported the weakest ROA of the major geographic regions within the state; as a group they did not

FIGURE 10

ROA FOR CALIFORNIA:
COMMUNITY BANKS AND ALL OTHER BANKS

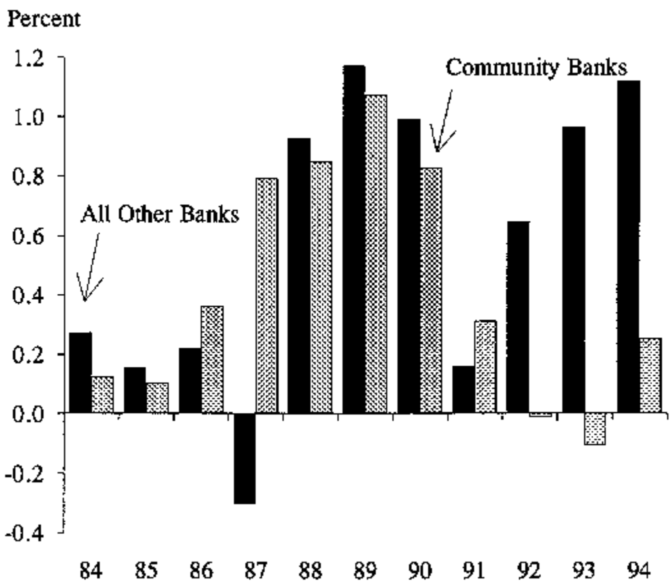
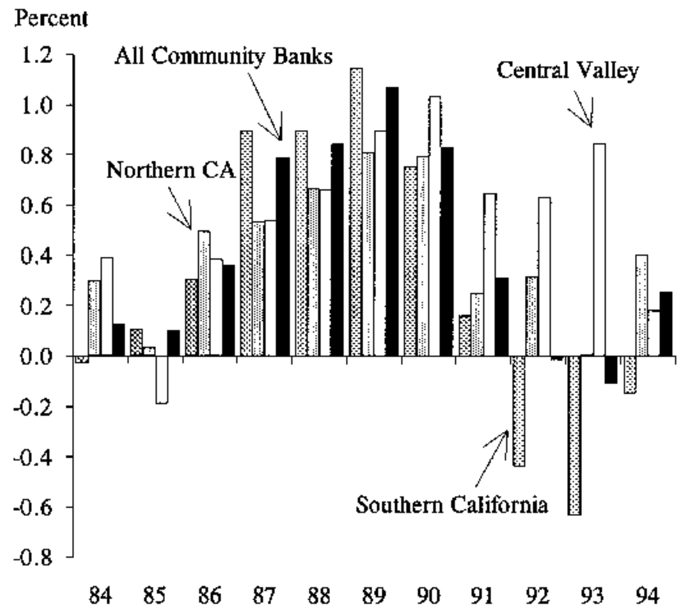


FIGURE 11

COMMUNITY BANK ROA BY REGION



earn a positive return in 1992, 1993, or 1994. Northern California community bank earnings rebounded to a weak level in 1994, following a break-even year in 1993. And while other areas, like the Central Valley, may have experienced a softening in the economy, it was not enough to dampen severely community bank ROA during the sample period; in fact, although ROA dipped in 1991 and 1992, it remained above the national average.[20]

The ROA performance of community banks aggregated by region also is consistent with their relative exposure to real estate lending and with their relative concentration in higher-risk commercial real estate lending. At the regional level, Southern California suffered the most severe economic downturn and had the weakest real estate markets, and its community banks also have suffered the most severe problems. It also was the region where community banks had the largest exposure to both real estate and commercial real estate lending. Northern California community bank performance also deteriorated noticeably, just as the region's economy weakened and as banks in the region increased their real estate exposure.

Because both the regional economic conditions and the portfolio decisions are highly correlated, it is difficult to tell whether both are significant factors in bank performance, and if they are, what their relative importance is. With this limitation in mind the study now moves to exploring these relationships at the individual bank level.

V. REGIONAL CONDITIONS, BANK PORTFOLIOS, AND PERFORMANCE

In this section a regression model using pooled time-series cross-section data for community banks is used to test for relationships between small bank performance in California and bank location, regional economic factors, and bank real estate loan portfolio decisions. The regressions estimate two of the measures of community bank performance that were used at the regional level—asset quality is measured by the problem real estate loan ratio, and earnings are measured by ROA. The model is estimated using ordinary least squares regressions and individual bank data from a panel of at least 310 California community banks that were in operation during the five years from 1990 to 1994.

20. Aggregate earnings for this region weakened substantially in 1994 as community banks began reporting an increase in problem commercial and residential real estate loans. Preliminary 1995 earnings have deteriorated even more.

The initial set of regressions controls only for regional location. As noted earlier, this test is not possible for most of the state's largest banks, because they operate in all regions of the state and report only statewide performance figures. A second set of regressions adds economic conditions and loan portfolio concentration variables. The third set breaks down the portfolio concentration into the construction and non-construction components of commercial real estate lending.

Control Variables

Several variables are included in the regressions to control for bank attributes that may create either cross-sectional or time-series influences on bank performance that are distinct from regional or real estate effects. These variables include: the logged asset size of the bank at the end of the quarter preceding the sample period (to control for differences in bank size); the growth rate of assets for the bank over the preceding three-year period (because rapid changes in bank size may reflect changes in lending standards that may lead to changes in asset quality and/or earnings); the capital-to-asset ratio at the end of the prior year (to control for differences across banks and over time in a bank's level of capitalization, leverage, and risk); the bank's loan-to-asset ratio (because it measures the bank's portfolio mix between loans and securities, which generally are lower-risk and lower-return assets).[21]

Differences in individual bank performance also may be related to other structural or organizational attributes. A dummy variable is included to control for whether a community bank is part of a bank holding company whose combined financial resources may be greater than that of the typical community bank. Banks that are part of such holding companies may have better monitoring capabilities and/or more ability to transfer problem assets to the holding company or an affiliate. Data on the number of branches a bank operates are used to proxy for differences in the provision of retail banking services across banks.[22] In the rapidly changing banking environment of the 1990s, these "brick and mortar" investments by community banks may temporarily increase overhead expenses, because banks may not be able to open, close, or adjust the level of their branch services quickly and easily as market conditions change.[23] A larger number of branches for these small banks also may increase the difficulty of evaluating lending conditions across a wider geographic market.

Performance Indicators

The regressions were run estimating two dependent variables that are indicators of bank performance, ROA and the problem real estate loan ratio. The first set of regressions included only the control variables for differences in bank attributes and dummy variables for Southern California, Northern California, and the Central Valley. If these dummy variables are significant, then the individual bank data provide additional support for the observations advanced earlier in the paper, that location is an important influence on performance at community banks in California. The results of the regressions are in Appendix A.

Location Is a Factor

The results from Set 1 using the three dummy variables for location and controlling for the bank attributes described above suggest that bank location was an important factor in determining performance. Two of the three location dummies, Southern California and Northern California, are statistically significant; the third—the Central Valley—is not statistically different from the omitted category, all community banks outside of the three major regions. In addition, all three location variables are significantly different from each other.[24] These results suggest that location in the key Southern California and Northern California regions, at least during the 1990–1994 period, was an important factor in community bank asset quality and earnings.[25] These results also are consistent with the aggregated series for community banks by region.

The coefficients for the dummy variables indicate that between 1990 and 1994, the ratio of problem real estate loans for community banks located in Southern California was 3.72 percentage points above the ratio for community banks outside of the three major regions of the state, the

21. At year-end 1990 the average size of the 385 community banks in operation at that date was nearly $86 million, and banks ranged from under $1 million to $293 million in assets. Assets at the average community bank grew at a 13.4 percent annual rate over the prior three years. The average capital-to-assets ratio was 10.0 percent and the mean loan-to-asset ratio was nearly 70 percent.

22. Only 32 banks were holding company affiliates. The number of branches ranged from 0 to 19; on average each bank had two branches.

23. Furlong and Zimmerman (1995).

24. The models were estimated with both unrestricted values for the dummy variables and versions where pairs of the dummy variables were restricted to be equal to each other. All combinations of the parameters were statistically different.

25. Samolyk (1994), p. 13, also finds that, "Bank performance does appear to reflect local economic conditions, particularly in regard to bank profitability and asset quality."

omitted group which recorded the strongest performance over the period. Northern California community banks also had a higher problem real estate loan ratio, 1.82 percentage points, and this difference also was statistically significant.

The model was then reestimated using the bank earnings indicator, ROA, rather than the asset quality measure, as the dependent variable. Not only were asset quality problems more severe at Southern California and Northern California community banks, but ROA also was significantly worse over the 1990–1994 period. The coefficient for the Southern California community dummy variable indicates that ROA for these banks was 103 basis points below that of the omitted category, all community banks outside of the three key regions, while Northern California banks were only 59 basis points lower. In the Central Valley region, ROA, like asset quality, was not statistically different from the omitted group.

These results suggest that community bank location was a key factor in determining regional bank performance in California. However, because portfolio composition also varies across regions, this form of the model does not address whether the potential causes for the significant deterioration in community bank performance were related to economic conditions, portfolio decisions, or other factors.

Regional Conditions and Real Estate Concentration

Set 2 of the regressions adds variables related to regional economic conditions and bank portfolio decisions to the model with regional dummy variables. The economic condition variable is the growth rate of nonagricultural payroll employment over the prior year for the county where the bank is headquartered. Growth in employment, reflecting favorable economic conditions, is expected to result in both improved bank performance, i.e., a higher ROA and a lower problem loan ratio.

The next two variables in Set 2 control for a bank's portfolio decisions with respect to real estate lending. One is the ratio of total residential real estate loans to total loans, a measure of a bank's concentration in residential real estate lending, defined here to include mortgages on 1- to 4-family homes and home equity lines of credit. The second portfolio choice variable is the ratio of commercial real estate loans to total loans, the measure of a community bank's total concentration in commercial real estate lending, including construction lending. This concentration measure serves as a proxy for a community bank's exposure to default risk and weakened performance from these relatively higher risk commercial real estate loans. As shown in Figure 5, relatively large net real estate loan charge-offs in both commercial real estate and construction lending have plagued commercial banks over the last several years.[26]

The regression results indicate that employment and portfolio concentration both appear to play important roles in community bank performance in this model. Regional employment conditions are a significant contributing factor for both community bank asset quality and ROA. Over the sample period there is a significant negative relationship between employment growth and problem real estate loan ratios and a positive significant relationship between employment growth and return on assets. This finding is consistent with the observations of others and with the history of employment by region in California over the course of the recession. As employment declined in the various regions of California community bank performance also suffered.

The significant effects of community banks' concentration in real estate lending appears to be more closely tied to banks' asset quality rather than the current year's ROA. At least in this simple model of bank performance, neither of the concentration measures was statistically significant in estimating ROA. However, there is a significant positive relationship between a community bank's concentration in commercial real estate lending and its level of problem real estate loans. This finding is consistent with the strong upward trend in concentration in commercial real estate for all community banks in the 1984–1994 period and the weak performance of community banks since 1990, when the real estate market deteriorated.

These results suggest that in addition to total real estate concentration, the mix of real estate lending also is important. While commercial real estate loan concentration is consistent with higher problem real estate loan levels, the results suggest that concentration in residential real estate lending resulted in fewer asset quality problems.

Construction Lending's Role

Finally, an additional refinement of the model was used to estimate performance by specifying as control variables the two main components of commercial real estate lending, loans for construction and land development and for non-construction commercial real estate purposes, and dropping the variable for total commercial real estate loans (Set 3).

This model also was estimated over the 1990–1994 period for the panel of community banks, both for the asset quality and ROA measures. As with the second set of re-

26. See Freund and Seelig, (1993) for an estimate of the huge decline in collateral values, by loan type and by region, for real estate assets under FDIC management.

gressions that included the real estate concentration variables, the concentration measures were not significant in estimating ROA. However, these regressions identify community banks' concentration in construction loans as a key source of the deterioration in asset quality. Furthermore, the ratio of concentration of construction loans to total loans was a highly significant factor in determining asset quality—the coefficient for the concentration of commercial real estate loans excluding construction loans was not statistically different from zero.

This specification provides strong evidence that community banks' concentration in construction lending was not only a key factor in asset quality problems in the 1990s, but it was significant even though the regional employment measure was not, at least at the 10 percent level. The regional dummy variables, however, continued to maintain their significance in this version of the model, suggesting that there are other regional factors in addition to the employment growth indicator that have influenced community bank asset quality performance during this period.

Earnings performance does not appear to be as closely driven by the commercial real estate loan concentration measure as was asset quality. This may be related to the lags between the time a loan might become delinquent, when it might be classified as a problem loan, when expenses for loss provisions are taken, and when it might actually result in a charge against earnings. It also may reflect a bank's ability to charge higher rates on higher-risk loans over the business or real estate cycles. In addition, aggregate community bank data suggest that overhead costs for small banks also rose over this period as these banks faced a higher level of problem loans and a rise in workout and foreclosure situations. This might be an interesting area for additional research.

Finally, in addition to the pooled time-series cross-sectional regressions, the models also were estimated as a series of five year-by-year cross-sectional regressions.[27] These regressions yielded very similar results to the time-series cross-sectional results.[28] The similarity of these results suggests that the findings are robust with respect to the pooling approach, the sample composition, and the period estimated.

VI. OBSERVATIONS

These results suggest that the trends observed in the aggregate regional community bank data for California during the 1990–1994 period are significant factors in determining community bank performance at the individual bank level as well. Overall economic conditions, especially the major recession in Southern California and the downturn in the California real estate market, have played an important role in determining community bank performance across three key regions of the state. Asset quality, a key factor in community bank performance, also appears to have a strong negative relationship to a bank's concentration on com-mercial real estate lending, and especially construction lending.

The results also suggest that while all banks face the risks associated with an economic downturn, the risks may have a more dramatic impact on smaller banks holding loan portfolios that are generally less well-diversified on a geographic basis than larger institutions with a broader branch network and access to larger regional or national credits. As the performance data for community banks over the 1990s clearly show, when California suffered a long and relatively severe recession, as a group the state's community banks were hurt much more severely than the state's larger banks.

Furthermore, in addition to facing adverse national and regional economic conditions, community banks also must face the risks associated with their own portfolio choices. Managements' decisions with respect to their banks' loan portfolio composition also appear to play a role in community bank performance. Community banks' increased reliance on real estate lending over the last decade, and especially higher-risk commercial real estate lending for construction, clearly played a key role in driving down asset quality over the 1990–1994 period.

These results also suggest that the regional indicators of community bank performance can provide industry analysts with a better understanding of community bank performance in California, especially at the regional level where comparable information on a historical basis has not

27. The year-by-year results include all community banks each year, so unlike the pooled time-series cross-sectional results for the consistent panel of banks, the year-by-year results are not biased by leaving out new banks, banks that were merged out of existence, or banks that failed. The latter two cases are of particular concern given the problems in the industry over the sample period. Still, despite the potential bias, the results for both the year-by-year and the pooled time-series regressions were similar.

28. Similar models estimating a series of annual regressions also found that location for both Southern California and Northern California were significantly related to community bank performance. Replacing the regional dummies with regional employment and portfolio concentration measures also generated similar results—growth in the employment rate had the correct sign and was significant in estimating both asset quality and ROA. The portfolio concentration measures likewise generated similar results, especially for the asset quality measure, where higher residential real estate concentration reduced asset quality problems significantly in 1990 and 1991, while higher concentration in commercial and construction lending increased it significantly in 1992 and 1993.

been previously available. Such information should prove to be important in evaluating bank performance on a regional basis and in comparing community bank performance with larger California banks.

Finally, as banking industry consolidation continues, even in California, information on the performance of community banks over time may help analysts better understand overall conditions at the state's smaller banks. In particular, it helps determine whether ups and downs in community bank performance are related to cyclical factors, regional conditions, and portfolio choices, or whether they might be associated with evolving financial services products or changing competitive circumstances.

APPENDIX A

REGRESSION RESULTS SUMMARY

	ASSET QUALITY INDICATOR			EARNINGS INDICATOR		
DEPENDENT VARIABLES	Problem Real Estate Loan Ratio			Return on Assets		
INDEPENDENT VARIABLES	Set 1	Set 2	Set 3	Set 1	Set 2	Set 3
Intercept	12.542103*** (4.350)	17.324202*** (5.810)	16.896745*** (5.746)	–0.08557*** (–6.400)	–0.090475*** (–9.495)	–0.088094*** (–9.362)
Growth Rate of Assets	0.002260 (1.355)	0.003612** (2.165)	0.003257** (1.966)	0.000002316 (0.319)	–0.000005628 (–1.158)	–0.000004427 (–0.914)
Capital/Assets Ratio	–0.144336*** (–2.803)	–0.146015*** (–2.865)	–0.125538** (–2.477)	–0.000142 (–1.261)	0.000805*** (7.420)	0.000786*** (7.277)
Bank Holding Company	–1.560512** (–2.536)	–1.865731*** (–3.052)	–2.117027*** (–3.476)	–0.003817 (–1.287)	–0.003011 (–1.530)	–0.003397* (–1.728)
Number of Branches	0.133829** (2.138)	0.171703*** (2.754)	0.210577*** (3.372)	–0.000482 (–1.608)	–0.000395** (–1.972)	–0.000309 (–1.532)
Employment Growth Rate		–0.220786*** (–3.698)	–0.064476 (–1.565)		0.000517*** (2.673)	0.000207 (1.543)
Dummy 1990	–1.385562*** (–2.911)	–1.468434*** (–3.068)	–2.314795*** (–4.610)	0.003176 (1.416)	0.004622*** (3.027)	0.003746** (2.335)
Dummy 1991	1.178046** (2.493)	1.016886** (2.124)	0.535885 (1.102)	–0.000028273 (–0.013)	0.000134 (0.088)	–0.000937 (–0.603)
Dummy 1992	1.310582*** (2.777)	0.461896 (0.857)	0.679458 (1.349)	–0.005264** (–2.349)	–0.000645 (–0.373)	–0.002612 (–1.615)
Dummy 1993	1.396022*** (2.938)	0.934938* (1.900)	1.116692** (2.340)	–0.004321* (–1.912)	–0.00304* (–1.932)	–0.004143*** (–2.706)
Log of Bank Assets	–1.141838*** (–4.889)	–1.454862*** (–6.132)	–1.528723*** (–6.466)	0.008414*** (7.709)	0.007314*** (9.613)	0.00728*** (9.595)
Loans/Assets Ratio	5.068071*** (3.847)	4.567352*** (3.494)	4.639855*** (3.576)	0.004857 (0.850)	0.015241*** (3.730)	0.014435*** (3.553)
Location: Southern CA	3.721931*** (8.570)	3.273016*** (7.123)	4.049738*** (9.031)	–0.010274*** (–4.891)	–0.009768*** (–6.564)	–0.010312*** (–7.092)
Location: Northern CA	1.816038*** (3.540)	1.696128*** (3.252)	2.20122*** (4.279)	–0.005893** (–2.393)	–0.006559*** (–3.916)	–0.00679*** (–4.098)
Location: Central Valley	–0.329489 (–0.544)	–0.365161 (–0.607)	–0.292002 (–0.489)	0.001407 (0.478)	0.000792 (0.406)	0.001233 (0.635)
1–4 Fam. Mortgages/Loans		–0.037192*** (–3.715)	–0.029469*** (–2.944)		0.000038867 (1.214)	0.000038346 (1.196)
Commercial RE/Loans		0.016319* (1.844)			–0.000017677 (–0.631)	
Construction/Loans			0.086838*** (5.763)			0.000004504 (0.093)
Other Comm. RE/Loans			–0.006266 (–0.659)			–0.000021409 (–0.708)
Adjusted R^2	0.1286	0.1471	0.1591	0.0824	0.1337	0.1353

NOTE: *t*–statistics are in parentheses.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

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