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Listening to Loan Officers: The Impact of Commercial Credit Standards on Lending and Output

- The Federal Reserve's Senior Loan Officer Opinion Survey offers information useful in forecasting commercial loan growth and overall economic activity.

- Statistical analysis reveals a strong correlation between loan officers' reports of tighter credit standards and slowdowns in commercial lending and output.

- Reported changes in credit standards can also help predict narrower measures of business activity, including inventory investment and industrial production.

- The chain of events following a tightening of standards resembles a "credit crunch": Commercial loans plummet, output falls, and the federal funds rate is lowered.

When the Federal Open Market Committee (FOMC) eased monetary policy on October 15, 1998, it noted the "growing caution by lenders and unsettled conditions in financial markets more generally. . . ." Sharply higher spreads on commercial paper and corporate bonds made it clear that the U.S. markets were unsettled, but how could policymakers tell if lenders were growing more cautious? Commercial bank loans are rarely traded, so loan rates are not instantly observable. Moreover, the "price" of commercial bank credit extends beyond the interest rate; bank loan officers set standards that firms must clear even before the rate is negotiated. These standards are decided in thousands of bank offices across the country, so how can the Federal Reserve tell if lenders are growing cautious? For that matter, how can we tell if banks are "throwing caution to the wind" and easing standards? We ask. Once each quarter, participants in the Federal Reserve's Senior Loan Officer Opinion Survey are asked whether their standards for making commercial loans have "tightened" or "eased" since the previous quarter. Loan officers at approximately sixty large domestic banks across the United States participate in the survey.

Although we praise the survey in the end, there certainly are reasons to doubt it. The survey is entirely qualitative, for one: respondents provide opinions, not hard numbers. The small

sample size is another concern: with more than 8,000 banks in the United States, can sixty bankers tell us anything useful about aggregate lending? Reporting bias is yet another concern; respondents in general may try to please surveyors, but the bias with this survey may be more severe because the loan officers work at banks that are likely supervised by the Federal Reserve. Loan officers who suspect, albeit wrongly, that their input will be used for supervisory purposes may shade their responses accordingly.

Because of these concerns, this article examines the value of the Senior Loan Officer Opinion Survey in predicting both lending and output.[1] We find that the changes in commercial credit standards reported by loan officers are indeed linked to aggregate loan growth. Commercial lending by U.S. banks slows substantially following reports of tighter standards, even after we control for other factors that might affect growth. Loan

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officers not only report accurately, they provide us with information that we could not infer from other measures of credit availability, such as loan rates, loan growth itself, or the mix of bank loans and other sources of credit. Changes in credit standards also help to predict economic growth and narrower measures of business activity such as inventory investment, a notoriously unforecastable variable that is closely tied to the banking sector.

In the end, we estimate a system of equations—a vector autoregression (VAR)—that enables us to isolate and quantify the impact of a shock to credit standards on lending output. Our VAR is an off-the-shelf model of the economy with two additional variables: commercial loans extended by banks and the change in commercial credit standards reported by bank loan officers. A shock to credit standards and its aftermath very much resemble a "credit crunch": Lenders tighten standards very abruptly, but ease up only gradually. Commercial loan volume at banks plummets immediately after the shock and does not bottom out until lenders start to ease standards again. Output also falls shortly after the tightening in standards. The

federal funds rate, which we identify with the stance of monetary policy, declines.

In the next section, we describe the Senior Loan Officer Opinion Survey and relate the motivation for the survey to the credit "availability doctrine" of the 1950s and to more recent theories of quantity credit rationing. We then examine the correlation between the changes in commercial credit standards reported by loan officers in the survey and various measures of credit availability, including lending itself. We follow this discussion with a look at the link between standards and economic activity and an analysis of the impact of a "shock" to standards in a multiple-equation framework.

The Survey: Background and Motivation

The Senior Loan Officer Opinion Survey on Bank Lending Practices, as it is officially known, was unveiled in 1967. In its most recent incarnation, the survey includes approximately twenty core questions about the supply of and demand for various types of credit, including commercial credit. Apart from these regular questions, the survey includes ad hoc questions about disruptions and trends in credit markets. The sample includes about sixty domestic banks, usually the largest in each of the twelve Federal Reserve Districts. Banks are added or replaced as needed. "Megamergers" between very large U.S. banks in recent decades, for example, have necessitated frequent changes in the sample. The response rate of lenders is very near 100 percent.[2]

In contrast to the more quantitative survey on commercial loan rates, the Senior Loan Officer Opinion Survey is, as its name suggests, more *qualitative*.[3] Loan officers are essentially asked whether their standards for approving commercial credit have tightened or eased since the quarter before:

> Over the past three months, how have your bank's credit standards for approving loan applications for C&I [commercial and industrial] loans or credit lines—excluding those to finance mergers and acquisitions—changed? 1) tightened considerably, 2) tightened somewhat, 3) remained basically unchanged, 4) eased somewhat, 5) eased considerably.

Except for a hiatus in the 1980s, when the question was dropped, and apart from minor changes in wording and emphasis in earlier years, the basic question-and-answer options have been more or less the same over various eras of the survey.

1967-77. In terms of sample size and constancy, these were the golden years. The sample numbered 121 large U.S. banks, nearly twice the size of the sample today. Sample coverage was also relatively constant, as the bank mergers that cause frequent changes in the sample these days were yet to come. The standards question was virtually identical to the question above. The answer options differed only trivially in their wording: "much" instead of "considerably," for example, and "firmer" instead of "tightened."

1978-84. To account for the growing role of the prime lending rate in allocating bank credit, the question on standards was essentially divided in two in 1978. Lenders were first asked to report changes in standards for approving loans *at* the prime rate. A second question asked about standards for loans at "spreads above" prime. The answer options for each question were not changed. The survey was expanded to include a sample of foreign banks during this period, and the number of domestic banks in the survey was reduced to sixty, about the same as today.

1984-90. Questions on commercial credit standards were dropped altogether during this period. With the deregulation of deposit and other interest rates in the early 1980s,

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policymakers and their staffs may have presumed that bankers would rely more on unfettered interest rates and less on standards in allocating loans among borrowers.

1990 to fourth-quarter 1998. The standards questions were revived because of concerns about a possible credit crunch in the spring of 1990. The question is still divided in two, as in 1978-84, but the division these days is by firm size; lenders are asked to report separately on standards for small firms (with annual sales under $50 million) versus large and middle-sized firms.

The changes in standards reported by loan officers are pieced together in Chart 1. For the 1990s, we use the standards for loans to middle-sized and large firms (as opposed to small firms) on the theory that the former matter more in terms of aggregate lending conditions. The choice is largely immaterial, however, as the correlation between the two series was 0.96. For the years 1978-84, when the question on standards distinguished between loans at prime and loans above prime, we use the average of the responses to the two questions.

Chart 1

Changes in Commercial Credit Standards Reported over Various Periods of the Senior Loan Officer Opinion Survey
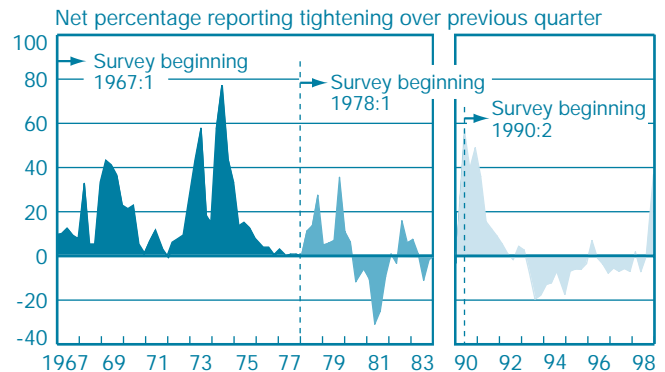
Net percentage reporting tightening over previous quarter

Source: Board of Governors of the Federal Reserve System, Senior Loan Officer Opinion Survey.

Plotted in the chart is the *net* percentage tightening: the number of loan officers reporting tightening standards less the number reporting easing divided by the total number reporting.[4] As Schreft and Owens (1991) noted, loan officers almost *never* reported a net easing of standards over the 1967-77 period; if the reported changes were summed, credit would have been *extremely* tight by the end of the period. This curious tendency to report tighter standards, at least in the early years, raises concerns about reporting bias; bank loan officers may be loath to ever tell the Federal Reserve that they are letting their standards fall.[5] The first substantial easing of standards was not reported until the 1980s. Credit standards were indeed tight in the early 1990s, after the hiatus, suggesting that credit-crunch concerns may have been well founded. The last substantial tightening reported by lenders was in 1998, after the Russian default and financial deterioration in southeast Asia.

The Importance of Standards

Why do monetary policymakers care about credit standards in the first place? Why not simply ask lenders to report loan rates and leave it at that? Because the market for credit may not operate like other markets, where prices do all the adjusting to keep the market cleared. For various reasons, loan rates may be secondary to standards of creditworthiness and other *nonprice* terms in the allocation of bank credit.

During the years leading up to the survey, interest rates were held down by government-imposed ceilings or by the Federal

Reserve's efforts to support Treasury bond prices. The stickiness of loan rates gave rise to the availability doctrine in the 1950s—the idea that the quantity of credit available from banks mattered more (for spending) than the price. While the availability doctrine has waned, modern theories of "quantity" rationing also emphasize the primacy of nonprice terms in the

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allocation of credit among competing borrowers.[6] The friction holding down interest rates in these theories is not government intervention, but the information and incentive problems that can gum up credit markets: adverse selection and moral hazard. By raising loan rates, lenders may drive off all but the least creditworthy applicants or elicit riskier behavior by borrowers. Rather than raising loan rates to curtail the supply of credit, lenders may tighten their standards and cut off credit to the marginal borrowers that do not meet the higher standards. In essence, credit markets may operate like a trendy night club in New York City: you have to clear the velvet rope before you pay the door charge.

Despite this theory, there is surprisingly little evidence that the commercial standards reported by loan officers actually matter for lending and output. Schreft and Owens (1991) noted the frequent breaks in the series and some of the curious features of the reports, but they did not actually test whether standards were informative nevertheless. Duca and Garrett (1995) and McCarthy (1997) investigate whether bankers' willingness to lend affects spending, but they focus on *consumer* credit standards and spending.

The propensity of lenders to always report tightening, especially in the early years, makes one wonder whether lenders are just "talking tough" when they say they are tightening. The link between loan growth and standards reported by senior loan officers can tell us; if their actions match their words, and if the actions of lenders in the survey are representative, then reports of tighter standards should lead to slower commercial loan growth, all else equal.

Credit Standards and Loan Growth

Loan growth does indeed slow at times when loan officers report tightening standards (Chart 2). Following the tightening reported from 1973 to 1975, for example, loan growth slowed and eventually turned negative. The sharp tightening reported during the early 1990s was also followed by much slower loan growth. Lending grew relatively rapidly in the ensuing years as loan officers began to report less tightening and eventually eased standards. The more recent tightening reported in the summer of 1998 also preceded sharply slower loan growth in the first quarter of 1999.

Table 1 confirms the negative relationship between standards and loan growth and shows that the changes in standards reported by loan officers are correlated with several other measures of credit availability as well. The correlation between loan growth and standards has been higher thus far in the 1990s, but it was also significant in the pre-1984 period.[7] In both periods, the change in standards tends to play the leading

Chart 2
Changes in Commercial Credit Standards and Loan Growth
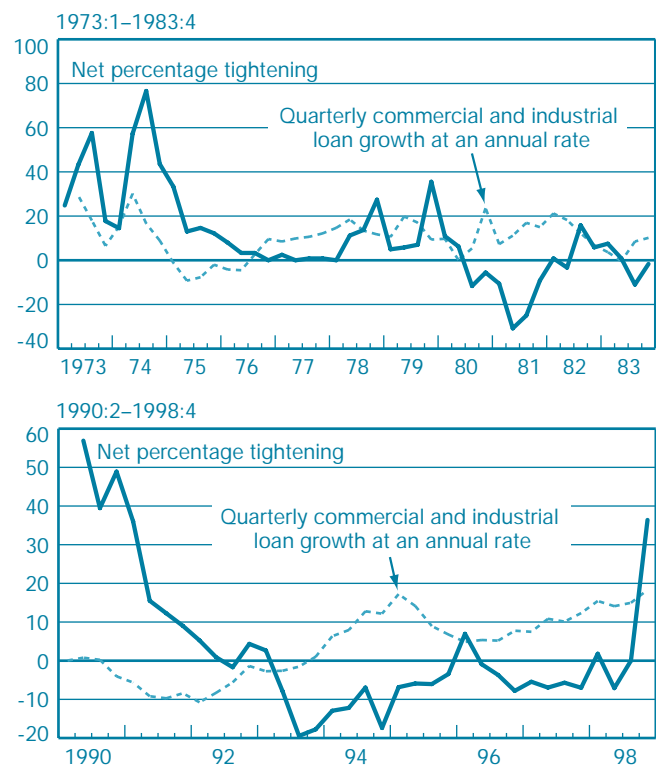
Source: Board of Governors of the Federal Reserve System, Federal Reserve Statistical Release H.8 and Senior Loan Officer Opinion Survey.

role. The loan spread—the difference between commercial loan rates and the federal funds rate—tends to rise following reports of tighter standards, as we would expect if lenders are contracting credit. Here again, standards play the leading role.

Changes in the "mix" of commercial paper and bank loans are also positively correlated with changes in standards. This mix variable was used in Kashyap, Stein, and Wilcox (1993) to identify shifts in the supply of bank loans relative to other sources of short-term credit. If loans become more expensive, owing to a monetary contraction, for instance, this mix tends to rise as the large firms that can borrow in the commercial paper market substitute paper for loans. Increases in the mix are also positively related to tightening credit standards, as Table 1 shows. This correlation is positive at both leads *and* lags, however, so we cannot say for sure whether standards lead the mix or vice versa.

In contrast to the paper-loan mix, which measures relative quantities, the paper-bill spread measures relative prices. Friedman and Kuttner (1992) and others have found that this spread is a particularly good predictor of economic activity, with higher spreads signaling slower future growth. Although researchers have different theories as to why this spread is so informative, one hypothesis is that a rise in the paper-bill spread signals disturbances in credit markets. As Table 1 shows, the spread is positively correlated with commercial bank credit standards. The strongest correlation is contemporaneous, suggesting that bankers and investors in the commercial paper market are reacting to the same news.

The last measure of credit availability in Table 1 comes from another survey, this one of firms. Once a quarter, a sample of small firms belonging to the National Federation of Independent Business is asked whether credit is "easier or harder" to get than it was in the previous quarter. As shown in the last column of the table, the net percentage of firms reporting easier credit availability falls as the net percentage of bankers reporting tightening standards rises.

Although suggestive, these correlations hardly prove that the tighter standards reported by bankers actually reduce the

Table 1

Changes in Commercial Credit Standards Reported by Bank Loan Officers and Measures of Credit Availability

Correlations at Various Leads and Lags

Standards Reported at t^a	$\Delta\ Loans_t$ $t<1983{:}4$	$\Delta\ Loans_t$ $t>1990{:}2$	Loan Spread$_t^b$	$\Delta\ Paper\text{-}Loan\ Mix_t^c$	Paper-Bill Spread$_t^d$	Reports of Eased Credit$_t^e$
-4	-0.31**	-0.80***	0.67***	0.06	0.19*	-0.16
-3	-0.36**	-0.74***	0.70***	0.01	0.13	-0.15
-2	-0.35**	-0.69***	0.60***	0.17	0.21**	-0.33***
-1	-0.17	-0.56***	0.38**	0.32***	0.39***	-0.40***
0	0.20	-0.29*	0.38**	0.14	0.49***	-0.31***
1	0.42***	-0.24	0.14	0.15	0.33***	-0.15
2	0.27*	-0.16	0.08	0.32***	0.19**	-0.08
3	0.21	-0.02	0.02	0.40***	0.15	-0.02
4	0.34**	0.10	0.15	0.22*	0.16	0.10
Memo: Sample period	1973:2-1983:4	1990:2-1998:4	1990:2-1998:4	1973:2-1983:4 1990:2-1998:4	1967:1-1983:4 1990:2-1998:4	1974:1-1983:4 1990:2-1998:4

Source: Data sources are in Table A2.

[a] Net percentage of domestic banks reporting a tightening of standards for commercial and industrial loans.

[b] Spread of the commercial loan rate over the federal funds rate.

[c] Mix = 100*(Nonfinancial CP outstanding/(Nonfinancial CP + C&I bank loans)).

[d] Spread = (Nonfinancial CP interest rate)-(T-bill interest rate). The spread was computed using six-month rates until 1971 and three-month rates from 1971 to 1998.

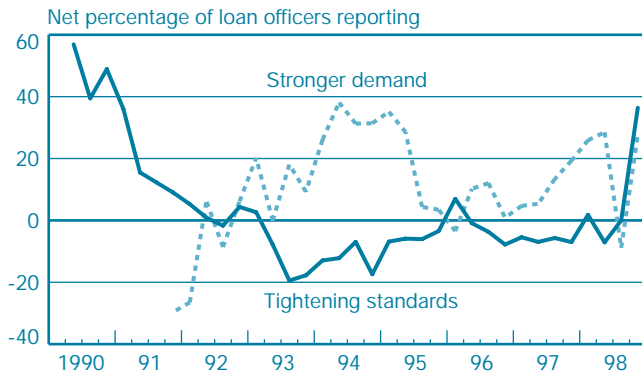[e] Net percentage of small firms reporting "easier" credit from the previous quarter.

*Statistically significant at the 10 percent level.

**Statistically significant at the 5 percent level.

***Statistically significant at the 1 percent level.

Chart 3
Changes in Commercial Credit Standards and Credit Demand

Net percentage of loan officers reporting

Source: Board of Governors of the Federal Reserve System, Senior Loan Officer Opinion Survey.

supply of bank credit. The problem with these pairwise correlations is that they fail to control for a second important determinant of loan growth: demand. Consider the 1990-91 period: did lending contract during that period because bankers were tightening standards or simply because the recession over that period slowed the demand for loans?

In fact, loan officers do tend to report weaker demand for commercial loans at the same time that they report tightening standards (Chart 3).[8] This correlation makes sense, especially when we consider the business cycle. Credit demand falls during contractions, at the same time that cautious bankers become less willing to lend. Firms demand more credit during expansions, and the good times may also make banks more willing to lend. To isolate the link between lending and credit standards, we use a regression equation to control for these multiple interactions between economic activity and the supply and demand for credit.

Regression Results

We estimate a loan growth equation of the following form:

$$(1) \quad \Delta Loans_t = \alpha + \beta Standards_{t-1} + \gamma \Delta D_{t-1} + \varepsilon_t.$$

The dependent variable, $\Delta Loans_t$, is growth in commercial and industrial loans at U.S.-chartered banks over quarter t, expressed at an annual percentage rate.[9] $Standards_{t-1}$ is the net percentage of loan officers reporting tightening standards for approving commercial loans to large and medium-sized firms. Both series are plotted in Chart 2. ΔD_{t-1} is a vector of

other variables that may influence loan growth: the lagged dependent variable ($\Delta Loans_{t-1}$), lagged real output growth ($\Delta Output_{t-1}$), and the lagged value of the commercial loan spread ($Loan\ spread_{t-1}$). The summary statistics on these and other variables that we use later are reported in the appendix (Table A1). From 1992 onward, we also have data on the net percentage of loan officers reporting strengthening demand for commercial loans in the previous quarter ($Demand_{t-1}$), the series plotted in Chart 3. Note that in the equation we are regressing loan growth in one quarter on the values of the right-hand-side variables in the previous quarter.

> *The economy does seem to grow more slowly during periods in which bankers tighten credit standards; four of the past five recessions were preceded by sharply tighter standards.*

Since the data are available over relatively short subperiods, to conserve degrees of freedom we use only one lag of each variable. The short lag length is actually conservative, since the correlation between loan growth and standards is higher at longer lags (Table 1).

The equation with demand and standards on the right-hand side is the complete specification since, in theory at least, changes in loan growth should reflect either changes in demand or changes in standards, that is, supply, or both. The question here is whether our survey measure of standards is a reasonable proxy for changes in standards and supply across the economy. If the actions of the loan officers surveyed match their words, and if loan officers across the country act likewise, reports of tighter standards should lead to slower loan growth. In terms of equation 1, we expect $\beta < 0$. We would expect a positive sign on the lagged values of loans, output, and demand to the extent that these variables are good proxies for loan demand. Lagged loan spreads could enter with either sign, depending on whether they reflect mostly supply-side or mostly demand-side factors.

Regression estimates over three distinct sample periods are reported in Table 2. Lagged loan growth is positive and significant in every specification, and the large coefficient indicates considerable momentum in the lending process. Lagged output growth is insignificant over the 1990s, but is significantly negative over 1973 to first-quarter 1984, contrary to expectations.[10] The demand variable enters negatively over the 1990s sample period, but it is statistically insignificant. The

loan spread is highly significant and enters negatively in every regression, suggesting that increases in this spread are due more to reductions in loan supply than to increases in the demand for loans.

What the regressions show, most importantly, is that the reports of tighter standards by loan officers are still associated with slower loan growth, even after controlling for other factors that affect loan growth. The standards variable enters negatively, as expected, and is significant at the 5 percent level or lower over every period and specification.

With hindsight, the strong connection between credit standards and loan growth is not really surprising. Loan growth

Commercial Loan Growth and Credit Standards: Regression Equations over Various Periods

	(1) 1990:3 – 1998:4	(2) 1992:1 – 1998:4	(3) 1973:3 – 1984:1
C	9.203* (5.167)	10.879** (4.282)	12.618*** (3.618)
$\Delta\ Loans_{t-1}$	0.803*** (0.080)	0.798*** (0.112)	0.523*** (0.102)
$\Delta\ Output_{t-1}$	0.280 (0.307)	—	-0.476** (0.219)
$Demand_{t-1}$	—	-0.029 (0.048)	—
$Standards_{t-1}$	-0.075** (0.036)	-0.225*** (0.067)	-0.237*** (0.057)
$Loan\ spread_{t-1}$	-4.641* (2.577)	-5.332** (2.309)	-3.058** (1.276)
Adjusted R^2	0.921	0.902	0.595
BG test	1.007	0.942	2.478
Observations	34	28	43

Source: Data sources are in Table A2.

Notes: Reported are regression coefficients and standard errors (in parentheses). The dependent variable is quarterly growth (at an annual rate) in commercial and industrial loans at U.S. banks. In columns 1 and 2, *Standards* is the net percentage of senior loan officers reporting tighter standards on large firms. *Demand* is the net percentage reporting stronger demand by large firms. *Loan spread* is the spread of the average commercial and industrial loan rate over the federal funds rate. For the earlier period (column 3), *Standards* is the average of the net percentage reporting tighter standards for making loans at the prime rate or above. *Loan spread* is the spread of the prime rate over the federal funds rate. The BG test is the Breusch-Godfrey test for first-order autocorrelation. The test statistic is distributed Chi-squared with one degree of freedom.

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

should depend on the supply of credit, and we suspect that the supply of loans depends on credit standards. More surprising is the result that standards matter even after we control for changes in loan rates or spreads. This finding supports the notion that bankers allocate loans not by simply raising and lowering rates, but by tightening and loosening other nonprice terms as well—the rationing concept that may have motivated the survey in the first place.

Credit Standards and Economic Activity

Credit standards may be linked to economic activity for either of two reasons. To the extent that credit availability depends on lenders' standards, a tightening of standards should cause a decline in spending by firms that depend on banks for credit. Tighter standards may also signal other disturbances that cause the economy to slow: lenders may batten down the hatches ahead of the storm. The causal impact of a change in standards and the signal provided by the change both imply a negative correlation between standards and economic activity.

The economy does seem to grow more slowly during periods in which bankers tighten credit standards; four of the past five recessions were preceded by sharply tighter standards (Chart 4). The exception was the 1981-82 recession. Loan officers were loosening standards when that recession began, but they quickly tightened as the economy contracted.

Chart 4

Change in Commercial Credit Standards, GDP Growth, and Recessions
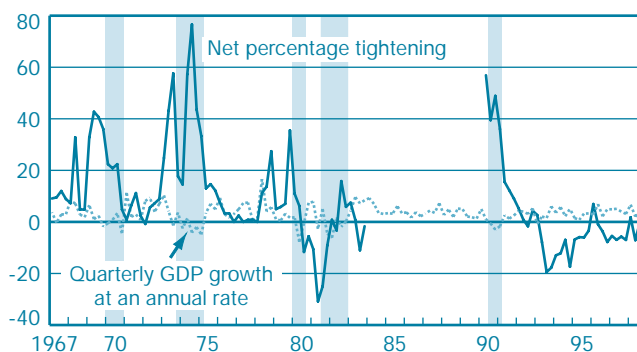
Sources: Board of Governors of the Federal Reserve System, Senior Loan Officer Opinion Survey; Bureau of Economic Analysis, Survey of Current Business.

Note: The shaded areas indicate periods designated national recessions by the NBER.

Table 3 reports regression equations relating quarterly growth in real GDP to its own lagged value and several other variables. The question is whether $Standards_{t-1}$ provides any additional information, given these other variables. Separate regressions were estimated over the early years of the survey (1967-84) and the 1990s.[11]

The results for the early years show that standards help considerably in predicting GDP growth. Lagged growth by itself explains only about 5 percent of the variation in current growth. Adding $Standards_{t-1}$ to the equation more than doubles the R^2 (column 2), and $Standards_{t-1}$ is statistically significant between the 1 and 5 percent levels. $Standards_{t-1}$ remains significant even when the equation includes two additional variables that have proved to be powerful forecasters: the federal funds rate and the spread between

rates on commercial paper and Treasury bills (column 3).[12] Adding these variables to the equation more than triples the adjusted R^2. Nevertheless, knowing whether bank lenders recently tightened or loosened their standards for commercial credit still helps in predicting GDP growth.

These results are all at least as strong over the more recent period: third-quarter 1990 to fourth-quarter 1998. $Standards_{t-1}$ is more significant over this period than it is over the earlier period, and the adjusted R^2 for the equation with $Standards_{t-1}$ is twice as high as it is for the regression without $Standards_{t-1}$ (Table 3, columns 4 and 5). $Standards_{t-1}$ remains significant at 1 percent or better when we add lags of the funds rate and the paper-bill spread (column 3).[13] $Standards_{t-1}$ wins the horse race over the more recent period—in fact, neither the funds rate nor the spread is

Table 3
The Link between Commercial Credit Standards and Output Growth

	1967:2 – 1984:1			1990:3 – 1998:4		
	(1)	(2)	(3)	(4)	(5)	(6)
C	2.255***	3.212***	10.666***	1.439**	2.748***	2.920**
	(0.658)	(0.893)	(1.875)	(0.630)	(0.481)	(1.372)
$\Delta\ Output_{t-1}$	0.259**	0.199*	-0.164	0.478**	0.027	0.032
	(0.100)	(0.103)	(0.110)	(0.184)	(0.147)	(0.163)
$Standards_{t-1}$	—	-0.067**	-0.072**	—	-0.084***	-0.080***
		(0.030)	(0.035)		(0.017)	(0.027)
$Federal\ funds\ rate_{t-1}$	—	—	0.262	—	—	-0.111
			(0.384)			(0.470)
$Federal\ funds\ rate_{t-2}$	—	—	-0.828*	—	—	—
			(0.433)			
$Paper-bill\ spread_{t-1}$	—	—	-2.029	—	—	0.874
			(1.351)			(3.719)
Adjusted R^2	0.052	0.102	0.371	0.190	0.427	0.389
BG test	0.462	0.288	0.235	1.855	0.766	0.719
Observations	69	68	68	34	34	34

Source: Data sources are in Table A2.

Notes: Reported are regression coefficients and standard errors (in parentheses). The dependent variable is quarterly growth (at an annual rate) in real GDP. *Paper-bill spread* is the spread between interest rates on commercial paper and Treasury bills. Specification tests called for the second lag of the federal funds rate in the column 3 regression. *Standards* is the net percentage of senior loan officers reporting tighter standards on large firms. For the earlier period (columns 1, 2, and 3), *Standards* is the average of the net percentage reporting tighter standards for making loans at the prime rate or above. The BG test is the Breusch-Godfrey test for first-order autocorrelation. The test statistic is distributed Chi-squared with one degree of freedom.

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

individually significant, and the adjusted R^2 with these variables included in the regression is lower.[14] The fact that standards matter at least as much or more over this period provides no support for the view that the role of banks in economic activity diminished over the 1990s.

Commercial Credit Standards and Business Activity

The regressions in Table 4 show that $Standards_{t-1}$ helps to predict three narrower measures of business activity as well:

investment in producers' durables, the change in inventory investment, and industrial production. $Standards_{t-1}$ is significant across the board, with or without the funds rate and the paper-bill spread. The adjusted R^2 actually falls when these additional variables are included, suggesting that they add little information beyond that already contained in standards.

The connection between standards and inventories is especially notable, as inventory investment is notoriously unpredictable (Blinder and Maccini 1991). Inventory investment should vary with interest rates, but researchers have never found a strong link between them. This missing link has vexed business-cycle researchers because fluctuations in

Table 4
Commercial Credit Standards and Business Activity

| | Dependent Variable | | | | | |
| | Investment in Producers' Durable Equipment | | Change in Business Inventories | | Industrial Production | |
	(1)	(2)	(3)	(4)	(5)	(6)
C	11.774***	10.657*	16.346***	10.887	4.285***	5.629**
	(2.466)	(6.093)	(4.005)	(13.693)	(0.879)	(2.166)
$\Delta\ Depvar_{t-1}$	-0.158	-0.182	0.518***	0.511***	0.130	0.144
	(0.218)	(0.231)	(0.123)	(0.137)	(0.144)	(0.146)
$Standards_{t-1}$	-0.327***	-0.357**	-0.653***	-0.689**	-0.178***	-0.159***
	(0.116)	(0.149)	(0.180)	(0.287)	(0.042)	(0.046)
$Federal\ funds\ rate_{t-1}$	—	1.162	—	-2.237	—	-0.332
		(1.532)		(3.499)		(0.479)
$Paper\text{-}bill\ spread_{t-1}$	—	-10.565	—	40.148	—	0.484
		(13.371)		(23.694)		(5.115)
Adjusted R^2	0.254	0.219	0.611	0.609	0.491	0.461
BG test	2.251	1.366	0.974	1.954	0.637	1.229
Observations	34	34	34	34	33	33

Source: Data sources are in Table A2.

Notes: Reported are regression coefficients and standard errors (in parentheses). The dependent variables *investment in producers' durable equipment* and *industrial production* are quarterly growth rates (at annual rates); *change in business inventories* is a quarterly change (at an annual rate). The equations in columns 5 and 6 include a second lag of the dependent variable (not reported). *Paper-bill spread* is the spread between interest rates on commercial paper and Treasury bills. *Standards* is the net percentage of senior loan officers reporting tighter standards on large firms. The BG test is the Breusch-Godfrey test for first-order autocorrelation. The test statistic is distributed Chi-squared with one degree of freedom. All equations are estimated from third-quarter 1990 to fourth-quarter 1998.

*Statistically significant at the 10 percent level.
**Statistically significant at the 5 percent level.
***Statistically significant at the 1 percent level.

inventory investment account for a disproportionate share of fluctuations in GDP. In their study of the 1981-82 recession, Kashyap, Lamont, and Stein (1994) suggest that "quantity rationing" by banks—that is, the allocation of loans through non-interest-rate terms—could explain the missing link. They find that during that recession the firms presumably most dependent on banks for credit—those without a lot of cash or a public bond rating—cut their inventory investment by substantially more than did the less bank-dependent firms. In the end, the authors attribute the inventory recession to tight "credit conditions" at banks. Our results seem roughly consistent.[15]

Vector Autoregression Analysis

In contrast to the single equations estimated above, a VAR is a system of equations that lets us better control for the feedback between current and past levels of output, lending, and credit standards. Controlling for this feedback is crucial. Suppose lenders tighten standards in response to weakness in the economy, both past and present. It is really weak output driving up standards in that case, not the other way around. To crack this chicken-and-egg problem, a VAR lets every variable in the system depend on past values of itself and every other variable in the system. Given estimates of these interactions, we can identify the changes in credit standards that were *not* predicted by the other variables in the system. Running these unpredicted "shocks" back through the system traces the impact of a shock to standards to all the other variables, and vice versa.

The core of our VAR, which is relatively standard, includes (in order): log real GDP, log GDP deflator, log commodity prices, and the federal funds rate. Note that these four variables make up a more or less complete model of the economy. Apart from output (real GDP) and prices (GDP deflator), we include commodity prices as a proxy for supply-side disturbances (like oil shocks). The federal funds rate provides a measure of interest rates that is tied particularly closely to the stance of monetary policy.[16] We tack two more variables to the end of the system: the log of commercial bank loans and the change in commercial credit standards. Placing standards last in the VAR tends to minimize their impact on output and the other variables. The VAR includes four lags of each variable above. We estimate the model jointly over the two periods in which we have data on loans and credit standards: first-quarter 1974 to fourth-quarter 1984 and second-quarter 1990 to fourth-quarter 1998.

Chart 5 shows the shock to standards and the subsequent dynamics. The initial increase in the net percentage of loan officers reporting tightening standards is about 8 percentage points. Lenders continue to tighten (at diminishing rates) for about a year after the initial shock. Nearly two years pass before lenders ease standards significantly, and the easing commencing then is relatively gradual compared with the tightening over preceding quarters.[17] Credit crunches appear more abrupt than credit expansions.

Chart 6 shows how shocks to other variables in the system affect credit standards. Standards seem largely independent of the other variables in the system. Shocks to commodity prices and the federal funds rate cause some tightening of standards, but the impact is short and barely significant. These findings suggest that lenders set their standards based largely on their own lending capacity and on their expectations, so that standards appear to be relatively exogenous to the other macroeconomic variables included in the system.
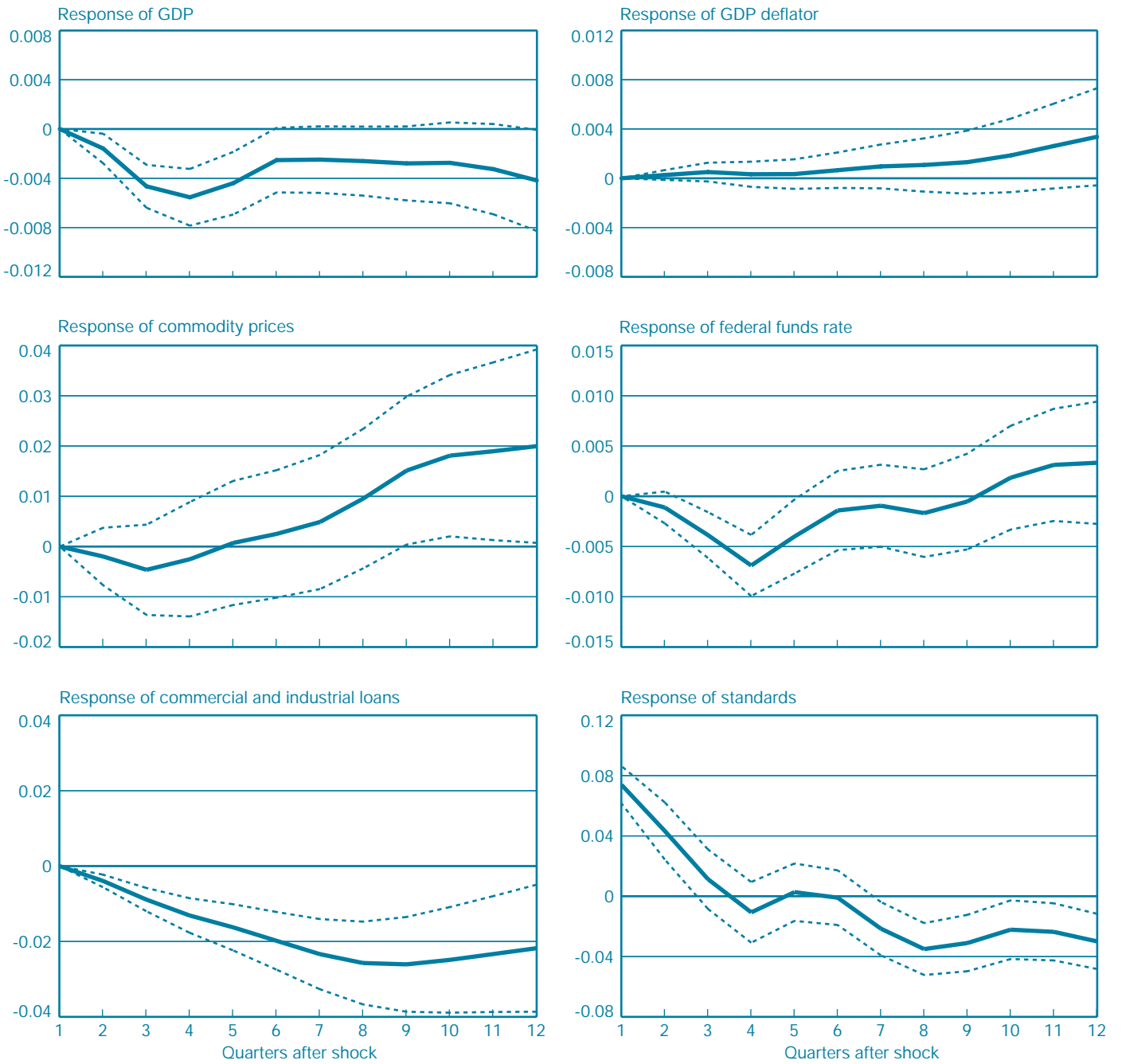
Conclusion

Off and on since 1967, the Federal Reserve has surveyed loan officers at a small sample of large banks about their commercial credit standards. The idea behind the survey is that the availability of bank credit depends not just on interest rates, but on credit standards as well. Notwithstanding the small and changing sample, the checkered pattern of questions, and the sometimes curious responses of lenders, the reports are informative. The changes in standards that they report help to predict both commercial bank lending and GDP, even after controlling for past economic conditions and interest rates. Standards matter even in the 1990s, when capital markets were supposed to have eclipsed the role of banks in the economy. Changes in standards also help to predict narrower measures of business activity, where commercial credit availability from banks seems most crucial. The connection between bank standards and inventories is especially promising, because inventory investment is notoriously unpredictable and heavily bank dependent.

A shock to credit standards and its aftermath very much resemble a "credit crunch." Loan officers tighten standards very sharply for a few quarters, but ease up only gradually: two to three years pass before standards are back to their initial level. Commercial loans at banks plummet immediately after the tightening in standards and continue to fall until lenders ease up. Output falls as well, and the federal funds rate, which we identify with the stance of monetary policy, is lowered. All in all, listening to loan officers tells us quite a lot.
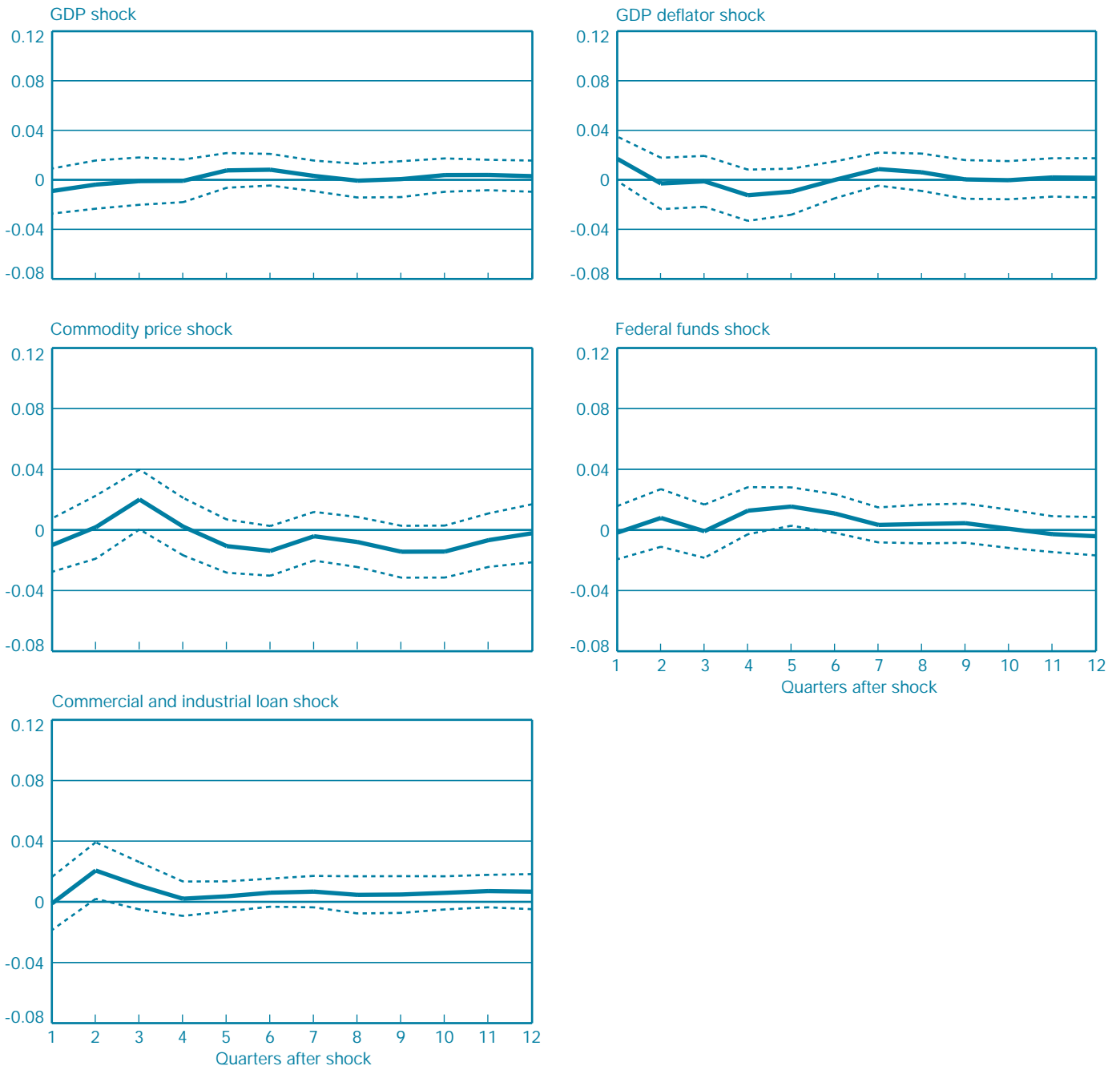
Chart 5

A Shock to Credit Standards and the Response of Other Variables

Response of GDP

Response of GDP deflator

Response of commodity prices

Response of federal funds rate

Response of commercial and industrial loans

Quarters after shock

Response of standards

Quarters after shock

Source: Authors' VAR analysis using data sources in Table A2.

Notes: Plotted is the impact on each variable of a one-standard-deviation tightening in commercial credit standards by banks. The dashed lines indicate 95 percent confidence levels.

Chart 6
Response of Credit Standards to Shocks in Other Variables

GDP shock

GDP deflator shock

Commodity price shock

Federal funds shock

Quarters after shock

Commercial and industrial loan shock

Quarters after shock

Source: Authors' VAR analysis using data sources in Table A2.

Notes: Plotted is the impact of a one-standard-deviation shock in each variable on commercial credit standards by banks. The dashed lines indicate 95 percent confidence levels.

Listening to Loan Officers

Appendix: Summary Statistics and Data Sources

Table A1
Summary Statistics

Variable	Definition	Observations	Mean	Standard Deviation	Minimum	Maximum
Δ *Loans*	Quarterly growth in commercial and industrial loans (annual rate, 1973:3-1984:1)	44	9.959	8.479	-9.233	30.128
Δ *Loans*	(1990:3-1998:4)	34	4.253	8.775	-10.964	18.230
Δ *Output*	Quarterly growth in real GDP (annual rate, 1967:2-1984:1)	69	3.025	4.703	-9.300	16.100
Δ *Output*	(1990:3-1998:4)	34	2.626	2.276	-4.000	6.100
Δ *Industrial production*	Quarterly growth in industrial production (annual rate)	34	3.504	3.612	-8.415	9.641
Δ *Business inventories*	Quarterly change in business inventories (annual rate)	34	30.803	28.593	-27.800	91.400
Δ *Producers' durable*	Quarterly growth in investment in producers' durable equipment (annual rate)	34	9.646	9.382	-14.957	34.214
Demand	Net percentage of domestic banks reporting stronger demand over the previous quarter	28	12.809	15.452	-26.500	38.100
Standards	Net percentage of domestic banks reporting tighter standards over the previous quarter. During 1978-83, *Standards* is computed by averaging changes in credit standards on loans at prime and loans above prime (1967:2-1983:4)	67	12.175	18.792	-30.833	76.613
Standards	(1990:3-1998:4)	34	1.656	16.416	-19.450	48.900
Federal funds rate	(1967:2-1984:1)	69	8.352	3.610	3.550	17.790
Federal funds rate	(1990:3-1998:4)	34	4.984	1.294	2.990	8.160
Paper-bill spread	Spread of the nonfinancial commercial paper rate over the secondary market T-bill rate. The spread was computed using six-month rates until 1971 and three-month rates from 1971 to 1998 (1967:2-1984:1)	69	0.842	0.617	0.030	3.510
Paper-bill spread	(1990:3-1998:4)	34	0.435	0.155	0.180	0.910
Loan spread	Spread of the prime rate over the federal funds rate (1973:3-1984:1)	44	1.554	0.994	-1.440	3.720
Loan spread	Spread of the commercial and industrial loan rate over the federal funds rate (1990:3-1998:4)	34	1.836	0.224	1.440	2.320
Δ *Paper-loan mix*	Quarterly growth in the ratio of nonfinancial commercial paper outstanding to the sum of nonfinancial commercial paper outstanding and commercial and industrial bank loans (1973:2-1983:4)	39	11.076	29.200	-45.397	81.706
Reports of eased credit	Net percentage of small firms that borrow money at least once every three months reporting "easier credit" compared with three months ago (1974:1-1983:4)	35	-7.629	6.174	-28.000	1.000
Δ *Paper-loan mix*	(1990:2-1998:4)	31	1.979	10.629	-18.471	24.860
Reports of eased credit	(1990:2-1998:4)	31	-5.452	2.815	-11.000	-1.000

Source: Data sources are in Table A2.

Appendix: Summary Statistics and Data Sources (Continued)

Table A2
Data Sources

Variable	Definition	Data Source
Δ *Loans*	Quarterly growth in commercial and industrial loans (annual rate)	Federal Reserve Board Statistical Release H.8: Assets and Liabilities of Commercial Banks in the U.S. (seasonally adjusted and break-adjusted, in millions of dollars)
Δ *Output*	Quarterly growth in real GDP (annual rate)	Bureau of Economic Analysis, Survey of Current Business (seasonally adjusted annual rate, in billions of dollars)
Δ *Industrial production*	Quarterly growth in industrial production (annual rate)	Federal Reserve Board Statistical Release G.17: Industrial Production and Capacity Utilization (seasonally adjusted, 1992=100)
Δ *Business inventories*	Quarterly change in business inventories (annual rate)[a]	Bureau of Economic Analysis, Survey of Current Business (seasonally adjusted annual rate, in billions of dollars)
Δ *Producers' durable*	Quarterly growth in investment in producers' durable equipment (annual rate)[b]	Bureau of Economic Analysis, Survey of Current Business (seasonally adjusted annual rate, in billions of dollars)
Demand	Net percentage of domestic banks reporting stronger demand over the previous quarter	Board of Governors of the Federal Reserve System, Senior Loan Officer Opinion Survey
Standards	Net percentage of domestic banks reporting tighter standards over the previous quarter	Board of Governors of the Federal Reserve System, Senior Loan Officer Opinion Survey
Federal funds rate	Effective overnight interbank lending rate	Federal Reserve Board Statistical Release H.15: Selected Interest Rates
Paper-bill spread	Spread of the nonfinancial commercial paper rate over the secondary market T-bill rate. The spread was computed using six-month rates until 1971 and three-month rates from 1971 to 1998	Federal Reserve Board Statistical Release H.15: Selected Interest Rates
Loan spread	Spread of the prime rate over the federal funds rate (1973:3-1984:1)	Federal Reserve Board Statistical Release H.15: Selected Interest Rates
Loan spread	Spread of the commercial and industrial loan rate over the federal funds rate (1990:3-1998:4)	Federal Reserve Board Statistical Release E.2: Survey of Terms of Business Lending (for commercial and industrial loan rate). See above for federal funds rate
Δ *Paper-loan mix*	Quarterly growth in the ratio of nonfinancial commercial paper outstanding to the sum of nonfinancial commercial paper outstanding and commercial and industrial bank loans	Federal Reserve Board Statistical Release: Commercial Paper (for nonfinancial commercial paper outstanding). See above for commercial and industrial bank loans
Reports of eased credit	Net percentage of small firms that borrow money at least once every three months reporting "easier credit" compared with three months ago	National Federation of Independent Business, Small Business Economic Survey

[a]This variable is now referred to as "private inventory" in the source data.
[b]This variable is now referred to as investment in "equipment and software" in the source data.

Endnotes

1. Academics interested in the credit effects of monetary policy—the theory that changes in policy affect spending partly through changes in the supply of bank loans—will want to know if the reports on bank credit standards are a reliable proxy for bank loan supply.

2. See Schreft and Owens (1991) for more on the history of and revisions to the survey. For current and recent surveys, see http://www.federalreserve.gov/boarddocs/snloansurvey.

3. The Survey of Terms of Business Lending collects quantitative information on commercial loan rates and other lending terms at banks.

4. Weighting the responses over the 1990s by the extent of change ("somewhat," versus "considerably") did not change the picture or the results, nor did using a diffusion index. Integrating the changes reported by lenders over time did not work as well as any of the other measures.

5. This apparent bias toward reporting tightening in these early years could reflect bankers reporting standards relative to some long-term notion. Alternatively, bankers may not have reported easier standards for fear of scrutiny by regulators. Bankers need not have feared the regulator's club, however, since the responses of individual bankers are viewed as highly confidential and would not be shared with supervisory personnel except under extreme circumstances.

6. The availability doctrine has waned since the deregulation of interest rates and the accord that relieved the Federal Reserve of an obligation to support bond prices. See Blanchard and Fischer (1989) for references to the availability doctrine (p. 486) and quantity rationing (pp. 479-88, 492-3).

7. The peak correlation between loan growth and standards in both periods is at six quarters (not shown in the table).

8. Since 1992, loan officers have been asked how the demand for commercial and industrial loans has changed over the preceding three months (apart from normal seasonal variation). The multiple-choice answers enable them to identify demand as substantially stronger, moderately stronger, about the same, moderately weaker, or substantially weaker.

9. We include only loans at U.S. banks, as the survey responses discussed above were from loan officers at domestic banks. Loan officers at branches and agencies of foreign banks are questioned separately. We use nominal loan growth in the analysis as a proxy for what we would like to use—the real value of new credit extensions, which is unavailable. The results are quite similar when real loan growth is used as the proxy instead. For a discussion of the advantages and disadvantages of each measure, see Bernanke and Lown (1991, p. 209).

10. The negative sign over this period suggests a countercyclical demand for bank credit. Although on the surface this finding appears to be contrary to expectations, previous researchers have obtained similar results while exploring other issues, arguing that firms may have a greater need for financing as the economy begins to slow (see, for example, Bernanke and Blinder [1992]).

11. The regressions for the earlier period go back farther than the loan growth regressions because we have a longer time series on GDP growth.

12. Positive shocks to the funds rate are thought to reflect tighter monetary policy (Bernanke and Blinder 1992), while a higher paper-bill spread may signal policy shocks as well as other, adverse shocks to financial markets (Friedman and Kuttner 1992). Specification tests called for the second lag of the funds rate.

13. The second lag of the funds rate was insignificant and was not necessary to reduce autocorrelation, so we dropped it from the regression.

14. Friedman and Kuttner (1998) also found that the spread did not forecast well in the 1990s. In addition, when the regression is extended to include the mix variable—the ratio of commercial paper to commercial paper plus bank loans—this variable is not significant. However, the mix variable is significant in explaining GDP growth over the earlier time period.

15. Eckstein and Sinai (1986) go further. They contend that all six of the recessions between 1957 and 1982 were caused by "credit crunches."

16. See Christiano, Eichenbaum, and Evans (1996) and Bernanke and Mihov (1998).

17. These fluctuations make sense, as lenders are reporting changes in standards; a change in one direction eventually requires an opposite and equal change to return to the initial level. Lenders seem to jerk the tail hard, and they relax their grip very gradually.

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