FRB CHICAGO

ECONOMIC PERSPECTIVES

A review from
the Federal Reserve Bank
of Chicago

MAY/JUNE 1987

ECONOMIC PERSPECTIVES
May/June 1987
Volume XI, Issue 3

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

Single-copy subscriptions are available free of charge. Please send requests for single- and multiple-copy subscriptions, back issues, and address changes to Public Information Center, Federal Reserve Bank of Chicago, P.O. Box 834, Chicago, Illinois 60690, or telephone (312) 322-5111.

Articles may be reprinted provided source is credited and The Public Information Center is provided with a copy of the published material.

ISSN 0164-0682

Contents

Why commercial banks sell loans: An empirical analysis

Christine Pavel and David Phillis

Banks are increasingly selling loans, either outright, through participations and syndications, or through "securitization."[1] Loan sales are not a new phenomenon. Commercial loan participations and overlines are quite common, but there is some evidence that commercial loan sales are increasing. In 1984, commercial banks sold roughly $148 billion of loans. By 1985, loan sales by commercial banks jumped nearly 75 percent to $258 billion. Sales of other types of loans are also picking up. The market for mortgage-backed securities has mushroomed from a $500-billion industry in 1981 to a $2-trillion industry in 1985.[2] In addition, in the last year or so, the market for "securitized" consumer installment loans has been expanding. Packages of auto loans and credit card receivables are increasingly being sold to third-party investors. In 1985, for example, only about $1 billion of auto loans were securitized, but in 1986, $10 billion were sold under this method.[3]

Several reasons for asset sales have been suggested. Asset sales may allow a bank to avoid "regulatory taxes," i.e., reserve requirements, capital requirements, and deposit insurance premiums. Also asset sales may facilitate gap management and enhance a bank's liquidity and diversification. This paper attempts to explain why banks sell loans by estimating two logit models to determine the probability that an institution will sell loans and by estimating a tobit model to determine the dollar amount of loans that the bank will sell annually.

The driving forces behind asset sales are important for the regulation of depository institutions. For example, if the avoidance of regulatory taxes is the driving force behind asset sales, then such "taxes" may be set too high, thus possibly driving high quality loans off banks' books. In that case, regulatory taxes should be lowered, rather than raised, in order to reduce the incentives for banks to sell high quality loans, or regulators should concentrate on both asset composition and asset quality by risk-adjusting capital requirements and deposit insurance premiums. If, however, asset sales are primarily influenced by other factors, such as liquidity and diversification, then perhaps asset sales should be encouraged in order to improve the soundness of the banking system.

To the authors' knowledge, no empirical or theoretical work on bank loan sales has been published to date. However, other fee-generating, off-balance-sheet activities of banks have been studied. For example, Giddy (1985) argues that capital requirements encourage banks to engage in off-balance-sheet banking. Empirical work in this area is rather limited. Koppenhaver (1986) estimates models to determine the key factors involved in a bank's decision to engage in loan commitments, standby letters of credit, and commercial letters of credit. He finds that such decisions are related to bank quality, regulatory taxes (especially reserve requirements), and customer demand.

In this paper, we find that regulatory taxes have an important impact on loan sales, but a bank's comparative advantage in originating and servicing loans and its level of diversification are the primary factors affecting loan sales by commercial banks. The first section discusses the theory behind asset sales. The second and third sections present and discuss a model for predicting whether a firm would sell assets throughout the year, sometimes during a year, or never. The fourth section presents a model to explain the dollar amount of assets that a firm would sell. Finally, the fifth section discusses conclusions and policy implications.

A theory of loan sales

There are several reasons why a commercial bank would want to sell loans. A bank may want to alter the diversification of its loan portfolio, selling certain types of loans in order

Christine Pavel is an economist at the Federal Reserve Bank of Chicago. David Phillis, formerly an economist at the Chicago Fed, is a senior consultant with American National Bank and Trust Company of Chicago.

to buy or originate other types of assets. Diamond (1984) shows that bank managers would want to diversify their portfolios in order to reduce their monitoring costs and to avoid the wrath of disappointed shareholders. A bank may also sell loans in order to fund other portions of its portfolio, rather than try to attract more retail deposits or purchase funds. In addition, a bank may sell loans because it has a comparative advantage in booking certain types of loans and, therefore, can use loan sales to fund originations of similar loans, possibly achieving economies of scale. A bank may also sell loans to avoid regulatory taxes.

Recently, a lot of weight has been given to the argument that loan sales are a response to burdensome regulatory taxes. The argument is that banks have a comparative advantage in originating loans, but a disadvantage in warehousing low-risk loans—keeping them on their books. This disadvantage stems from the regulatory taxes that banks must pay in the form of federal deposit insurance premiums, foregone interest from holding required reserves, and mandatory capital requirements that exceed those that would be maintained in the absence of regulation.

All insured commercial banks are subject to the three regulatory taxes. Banks must pay a flat premium based on their total domestic deposits to the Federal Deposit Insurance Corporation (FDIC) for deposit insurance. In the past, a portion of the premium was rebated, but in 1984 the rebate was reduced and in 1985 the rebate was suspended.[4] All banks must also hold a certain portion of their deposits on reserve at the Fed. This portion depends on the type and maturity composition of each bank's deposits. No interest is paid on these reserves.

Banks also must hold a certain amount of capital against all of its assets. Currently, this is a flat levy with no regard for risk. In other words, a loan to a start-up company is equivalent to cash or a U.S. Treasury security from a capital adequacy standpoint. In a perfect market, i.e, in a world with no taxation, information costs or transactions costs, any combination of debt and equity should be as good as any other (Modigliani and Miller, 1958). The world, however, is not perfect. Therefore, a firm's capital structure does matter. Returns to equity holders are taxable, whereas the return to debt holders is treated as an expense and therefore tax-deductible. This implies that equity is a more expensive funding source than debt. This "double" taxation implies that forcing banks to hold more capital than would be demanded of an unregulated intermediary drives up the cost of funding a loan through a bank. The greater the capital requirement, the greater the funding disadvantage.

Flannery (1987) identifies another link between capital requirements and loan sales. As a bank's capital ratio declines it becomes subject to increasing surveillance and finds itself subject to an increasing number of restrictions. These represent another type of regulatory tax. But, unlike the other regulatory taxes, it is not clear that this one creates a funding disadvantage. Flannery argues that bank regulators force banks to write down bad loans while appreciating assets must be carried at their book value. "This aspect of loan classification produces an estimate of bank equity value that understates what is truly available to absorb future losses." The only way for banks to correct this understatement and avoid the increased regulatory scrutiny is to realize the capital gain on the assets that have appreciated. This means that banks with low capital ratios or high net charge-offs ought to be more likely to sell loans than those with high capital ratios and low net charge-offs.

In return for abiding by these regulations, i.e., for paying these taxes, a bank receives federal deposit insurance and access to the Federal Reserve's discount window. These two advantages, especially deposit insurance, allow the bank to attract deposits at a lower rate than would otherwise be possible given the risks that it is taking. However, for low-risk activities, this lower rate may not be sufficiently low to compensate the bank for any funding disadvantage created by the regulatory taxes. It will then be placed at a competitive disadvantage against other financial intermediaries in funding low-risk loans. If this is the case, a bank can reduce its regulatory tax burden by selling assets without recourse.[5] Such asset sales provide a funding source that is not subject to deposit insurance premiums or reserve requirements. Also, by shrinking the balance sheet, asset sales allow a bank to reduce its capital requirement.

If the preceding argument is correct, banks should sell high-quality low-risk assets since the "after-tax" return on these assets

would be lower than that of riskier assets. Koehn and Santomero (1980) have shown that an increase in capital requirements may cause banks to "reshuffle" the composition of their balance sheets in favor of riskier assets. Flannery (1987) argues that, under the current regulatory system, banks have a comparative advantage in holding loans of a particular risk category and, in an efficient market, would hold only such loans. This, however, would not preclude banks from originating and then selling other types of loans. These other loans will include both low-quality and high-quality loans. In Flannery's model, as funding costs increase, regulated banks will have a comparative advantage in holding a smaller set of loans, and they will originate and sell a larger set of loans, including perhaps some that are already on their books.

The effect of reserve requirements on bank strategy can be seen by looking at the Federal Reserve System's membership experience of the late 1970s. At that time, as interest rates rose, the foregone earnings on required reserves became significant.[6] As the cost of membership increased, the decline in membership accelerated.[7] The decline in membership was averted by passage of the Depository Institutions Deregulation and Monetary Control Act of 1980 (DIDMCA). Required reserves were lowered; nonmembers were allowed access to services from Reserve Banks; and reserve requirements were extended to all depository institutions. Gilbert (1980) has shown that DIDMCA reduced the "tax burden" of holding required reserves because fewer banks have to hold reserves at levels which exceed the working balances they would normally hold. Also, the Federal Reserve System's clearing balance option and correspondent pass-through arrangements have further lowered the cost of holding reserves. In addition, declines in interest rates since late 1982 have further reduced the burden of reserve requirements. Thus, required reserves would be expected to have a smaller impact on a bank's decision to sell loans than the other two regulatory taxes—capital requirements and deposit insurance premiums.

Not only have regulatory taxes placed banks at a disadvantage against other financial intermediaries, but they have also placed them at a disadvantage relative to the commercial paper market. Judd (1979) argued that the growth in the commercial paper market during the 1970s "occurred largely at the expense of money center banks" who lend primarily to large corporate borrowers. Estrella (1986) found that competition provided to large banks from the commercial paper market continued through 1984, and he estimates that such competition has caused the riskiness of banks' commercial and industrial loan portfolio to have increased.

Loan sales, therefore, can be viewed as an attempt by commercial banks to compete effectively with the commercial paper market for investment grade wholesale borrowers. According to the Federal Reserve System's February 1986 Senior Loan Officer Opinion Survey, 60 large banks had approximately $26 billion in domestic commercial and industrial loans participations and sales outstanding at year-end 1985, 67 percent of which were to investment grade borrowers.

Thus, commercial banks may sell loans for several reasons. They may do so as part of their asset and liability management. Also, banks may sell loans to avoid regulatory taxes. And they may sell loans in order to become more like investment banks, in effect, underwriting loans but not warehousing them.

The question of why banks have been increasing their sales of assets recently still remains unanswered. There are, however, two possible explanations. First, the composition of regulatory taxes has shifted away from reserve requirements toward capital requirements. Reserve requirements are based on liabilities, whereas capital requirements are based on assets. Second, advances in technology may have made it less costly for banks to avoid regulatory taxes and take advantage of the other benefits of asset sales and securitization.

To sell or not to sell

A bank can sell loans all of the time, sometimes, or never. To determine the driving forces behind loan sales we estimated two logit models to predict the probability that a bank would sell loans. The first model estimates the probability that a bank will sell loans either sometimes or all the time, and the second model estimates the probability that a bank that sells loans will do so all the time. A logit model is basically a choice model that assumes that an individual, in this case a bank, is faced

Table 1
Variables in logit and tobit models

	Expected sign
Regulatory taxes	
RESERVES = reserve requirements for the last reporting period in 1984 / total assets* at year-end 1984**	positive
PRMCAP = primary capital ratio for year-end 1984	negative
BIND55 = 1 if prmcap is less than 5.5%; zero if prmcap is greater than 5.5%	positive
BIND557 = 1 if prmcap is between 5.5% and 7%; zero is prmcap is less than 5.5% greater than 7%	positive
PREMIUM = total domestic deposits / total insured deposits at year-end 1984	positive
Diversification	
LNINDEX = $(L_i^2 + ... + L_{10}^2)/1000$ where L_i is the loan to asset ratio for loan type i at year-end 1984	positive
Funding / Liquidity	
LNGROW = total loans at year-end 1984 / total loans at year-end 1983	positive
Loan quality	
NCHRGOFF = Loan charge-offs less recoveries / total loans at year-end 1984	?
Comparative advantage	
NINTEXP = noninterest expense during 1984 / total loans at year-end 1984 + loans sold during 1984	negative
Control variables	
ASSETS = total assets at year-end 1984 in billions of dollars	positive
MULTI = 1 if bank is a member of a multibank holding company; 0 otherwise	positive
Dependent variable	
SOLD = total loans sold in 1985 / assets at year-end 1984 (for Tobit)	

*Total assets include foreign and domestic assets.

**Data on required reserves were unavailable for 3,338 banks. Therefore, an OLS regression model was estimated with required reserves as the dependent variable and total deposits as the independent variable, using data for the 10,425 banks in which data on required reserves were available. The model's R2 was 97%.

with two or more alternatives and that the bank's choice is dependent upon the characteristics of the bank.[8]

The data used in this study are survey data for 13,763 banks from the *Reports of Condition* and *Reports of Income* for 1983, 1984, and 1985 filed with the appropriate regulatory agency and from the *Report of Transactions Accounts, Other Deposits and Vault Cash* as of December 24, 1984 filed with the Federal Reserve. Required reserves was the only variable calculated from data contained in the latter report. The dependent variable is from the memo item on Schedule L of the Report of Condition: "Loans originated by the reporting bank that have been sold or participated to others . . . ." This item excludes the portions of loans that have been retained by the reporting banks and loans sold with recourse "or with the reporting bank's endorsement or guarantee." The types of loan sales reported also exclude one-to-four family residential mortgages and consumer installment loans.[9]

We assume that each bank considers its position at the beginning of the year, formulates a strategy, and carries it out during the

Table 2
Description of sample

	Nonsellers			Sometimes-sellers			Always-sellers		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
RESERVES	.004	0	.054	.005	0	.041	.007	0	.036
PRMCAP	.097	0	.483	.089	.018	.364	.085	.005	.347
BIND55	.013	0	1	.022	0	1	.040	0	1
BIND557	.107	0	1	.158	0	1	.219	0	1
PREMIUM	1.141	1	67.690	1.670	1	3.028	1.221	1	6.139
LNINDEX	.941	.001	4.901	1.150	.015	4.242	1.273	.013	4.776
LNGROW	1.181	.397	83.571	1.252	.212	38.988	1.253	.430	19.003
NCHRGOFF	.009	−.050	.220	.010	−.056	.222	.010	−.055	.147
NINTEXP	.069	.008	1.960	.060	.010	.333	.051	.002	.258
ASSETS*	64	1	4626	84	2	11760	521	1	120054
MULTI	.151	0	1	.287	0	1	.356	0	1
SOLD	0	0	0	.027	0	1.345	.122	.001	4.568

*In millions of dollars.

year. Thus, the dependent variable is as of 1985, but the independent variables are for year-end 1984, i.e., the very beginning of 1985.

The sample of 13,763 banks was first divided into two categories—Sellers and Nonsellers.[10] Sellers consists of 8,190 banks that sold loans during 1985, and Nonsellers consists of banks that did not sell loans during 1985. Sellers were further broken down into "Loan merchants," those 3,214 institutions that sold loans during every quarter of 1985, and "Part-time vendors," those 4,976 sellers that sold loans during only one, two, or three quarters of 1985. Loan merchants can be viewed as those banks that are in the business of selling loans, i.e., "investment bankers."

Each model is specified as a function of the potential reasons for selling assets: regulatory taxes, diversification, funding/liquidity, and comparative advantage. Table 1 lists the variables along with the expected signs of the parameter estimates, and Table 2 describes the sample according to these variables. Two control variables were also included. The variable ASSETS controls for size, and the variable MULTI controls for multibank holding company affiliation. This latter variable was included because banks often sell or participate loans to their affiliates within a holding company structure. It is important to control for asset size because of overlines. If the coefficient of ASSETS is negative, then overlines are probably a major factor in loan sales; i.e., small banks sell portions of loans that exceed their legal lending limits. However, if overlines are not important and banks are selling loans for other reasons, then the coefficient of ASSETS should be positive. A positive sign on ASSETS may also indicate the importance of sophisticated bank management.

In general, the higher a bank's regulatory tax burden, the more likely that bank is to sell loans. Thus, if a bank has a high reserve requirement relative to assets, that bank would be more likely to sell loans than a bank with a lower reserve requirement. If a bank's primary capital ratio is low relative to that required by its regulator, then it is more likely to sell loans since doing so would raise its capital ratio.

Table 3
Multivariate logit models

	Prob(Seller)		Prob(Always-seller)	
	Parameter estimates	T-Statistics	Parameter estimates	T-Statistics
Intercept	0.175	1.191	-0.633***	-3.447
RESERVES	17.824***	4.023	−2.145	−0.412
PRMCAP	−5.383***	−6.405	1.137	0.944
BIND55	0.268*	1.744	0.567***	3.404
BIND557	0.77	1.243	0.218***	3.046
PREMIUM	0.246**	2.288	0.684***	5.753
LNINDEX	0.556***	15.089	0.133***	3.067
LNGROW	0.071**	2.295	−0.040	−1.222
NCHRGOFF	4.543***	3.605	−1.159	−0.723
NINTEXP	−9.890***	−12.279	−18.141***	−13.918
ASSETS	0.352***	3.999	0.647***	7.086
MULTI	0.706**	14.917	0.145***	2.732
Correct rate		65.5%		65.1%
False-positive rate		32.8%		33.9%
False-negative rate		39.1%		35.0%

*Significant at the 10-percent level.

**Significant at the 5-percent level.

***Significant at the 1-percent level.

Three measures for the capital requirement tax were included in the model. The first, PRMCAP, is simply the primary capital ratio. The second and third, BIND55 and BIND557, are dummy variables that measure the bindingness of the capital constraints. BIND55 takes on a value of one if a bank's primary capital ratio is less than 5.5 percent, the regulatory minimum; otherwise, it takes on a value of zero. BIND557 takes on a value of one when a bank's primary capital ratio is between 5.5 percent and 7 percent. This variable was included to capture situations in which a bank may be approaching the 5.5 percent level or, given the riskiness of its portfolio, is advised by the regulators, upon examination, to hold more capital than the 5.5-percent minimum. Banks with primary capital ratios below 5.5 percent would be expected to have a higher probability of selling loans than those with ratios between 5.5 percent and 7 percent, which in turn have a higher probability of selling loans than those with capital ratios greater than 7 percent. In a similar vein, we would expect that a bank with high net charge-offs would sell additional loans in order to maintain its existing level of capital.

Finally, if a bank pays a higher premium for deposit insurance per dollar of insured deposits, then it would be more likely to sell loans than a bank that paid a lower premium. We assume that the 1985 Continental Illinois experience has not rendered all deposits implicitly insured. Baer and Brewer (1986) present evidence that large depositors do not act as if insurance implicitly covers all deposits. They

found, as did Hannan and Hanwick (1986), that the market for large certificates of deposit does penalize risky banks by demanding higher returns.

As mentioned earlier, diversification and funding needs would also be expected to influence a bank's loan sales activity. The greater a bank's demand for loans, i.e., the faster its loan portfolio is growing, the more likely a bank would be to sell loans. If banks use loan sales to increase diversification, the less diversified a bank is, the more likely that bank would be to sell loans. Thus, the variable LNINDEX, which takes on greater values for lower degrees of diversification, would be expected to have a positive sign.

Interpretation of the model's diversification measure is complicated by the fact that the level of diversification may be the result of loan sales made in a previous period. That is, the relationship between diversification and loan sales in 1985 may be the result of loan sales during 1984. A clear interpretation of the variable cannot be made without analyzing the effect of loan sales on diversification. This is done in the section on logit results.

Finally, loan sales would be expected to be tempered by loan quality and a bank's ability to service loans.

The logit results

We estimated two models using all of the variables shown in Table 1. The first determines the probability that a bank would be a Seller, and the second determines the probability that a Seller would sell loans in each quarter of the year. The results are shown in Table 3. Ten of the 11 variables in the first model are significant at at least the 10-percent level, and each of these 10 have the expected sign.[11]

According to this model, the average bank has a 61.1 percent probability of selling loans. A bank's size, its ratio of noninterest expense to loans, and its level of diversification have the largest impact on a bank's probability of being a Seller (see Table 4). If the average bank were one standard deviation larger, it would have a probability of selling loans that is nearly 15 percentage points higher. Similarly, if the average bank's ratio of noninterest expense to loans or if its level of diversification decreases by one standard deviation, its probability of selling loans would rise by more than 7 percentage points.

Table 4
Relative impact of variables* in the logit models (one-standard-deviation change)

	Prob(Seller)	Prob(Always-seller)
	(--------percentage points--------)	
RESERVES	2.30	**
PRMCAP	−3.56	**
PREMIUM	3.76	3.97
LNINDEX	7.42	1.90
LNGROW	1.74	**
NCHRGOFF	1.63	**
NINTEXP	−9.36	−9.58
ASSETS	14.94	37.91

*Dummy variables, BIND55, BIND557 and MULTI are not included.

**Variable not statistically significant in the model.

The results in Table 3 show that undiversified banks are more likely to sell loans, but this does not mean that loan sales are being used to make the bank more diversified. Over the 1984-85 period, however, the level of diversification increased for Sellers, while it remained about the same for Nonsellers. This implies that loan sales increased the diversification of banks that sold loans during 1985 (see Table 5).

In addition to diversification, a bank's regulatory tax burden also has a large impact on its probability of selling loans. A one-standard-deviation increase in the average bank's deposit insurance premium per dollar of insured deposits or a one-standard-deviation decrease in its primary capital ratio would increase its probability of selling loans by about 4 percentage points. If the average bank's required reserves increase by one-standard-deviation, it would increase its probability of selling loans by only 2.3 percentage points.

The impact of a bank's deposit insurance premium per dollar of insured deposits implies that banks that are subject to more market discipline (i.e., banks with more uninsured de-

posits) are more likely to sell loans. As discussed earlier, Baer and Brewer found that uninsured depositors do penalize risky banks by demanding higher returns.

The second model identifies the factors which determine whether a seller will be a loan merchant—selling loans in all four quarters of 1985—or a part-time vendor. As shown in Table 3, seven of the 11 variables in this model were significant at the 1-percent level. The other four variables were not statistically significant at the 10-percent level.[12]

The average Seller has a 40.4 percent probability of selling loans in every quarter throughout the year, and size, binding capital constraints, and noninterest expense have the largest impact on a Seller's probability of selling loans in each quarter throughout the year, i.e., of acting like an "investment banker." Deposit insurance premiums and diversification have smaller impacts. If the average Seller's asset size increases by one-standard-deviation, its probability of selling loans in every quarter throughout the year would increase by almost 38 percentage points, and if its ratio of noninterest expense to loans increases by one standard deviation, its probability would decrease by more than 9 percentage points. A one-standard-deviation increase in a Seller's deposit insurance premiums would increase its probability of selling loans in every quarter by about 4 percentage points, and a one-standard-deviation decrease in a Seller's level of diversification would increase its probability by nearly 2 percentage points.

In both models, capital variables play an important role. An increase in a bank's capital ratio or a decrease in its net charge-offs both reduce its probability of selling loans. A one-standard-deviation decrease in a bank's capital ratio increases the probability of selling loans by about 4 percentage points. A one-standard-deviation increase in net charge-offs increases the probability of selling loans by one and a half percentage points. If the average bank had a primary capital ratio greater than 7 percent, it would have a 60.7 percent probability of selling loans, but a similar bank with a primary capital ratio less than 5.5 percent would have a 66.9 percent probability. A typical bank with a capital ratio between 5.5 percent and 7 percent would have a 62.5 percent probability.

Similarly, if the typical bank that sells loans had a primary capital ratio greater than 7 percent, it would have a 39.0 percent probability of selling loans in every quarter throughout the year, but a similar bank with a primary capital ratio less than 5.5 percent would have a 53.0 percent probability. A typical Seller with a capital ratio between 5.5 percent and 7 percent would have a 44.3 percent probability of selling loans in every quarter throughout the year. These results suggest that the decision to sell loans may be motivated by a desire to realize unrecognized capital gains, not a desire to avoid higher funding costs created by the double taxation of equity income.

Whether or not a bank is a member of a multibank holding company is also an important factor in determining its probability of selling loans. The average bank that belongs to a multibank holding company has a 72.8 percent probability of selling loans, while a similar bank that is not a member of a multibank holding company has only a 56.9 percent probability. Multibank holding company af-

Table 5
Diversification and net charge-offs
1984 vs. 1985

	Diversification (LNINDEX)	Net charge-offs
	(--------percentage points--------)	
Sellers		
1984	1.198	.010
1985	1.181	.016
T-statistic	1.771*	−16.500**
Nonsellers		
1984	0.941	0.009
1985	0.948	0.012
T-statistic	−0.665	−8.535**
Loan merchants		
1984	1.273	0.010
1985	1.245	0.016
T-statistic	1.805*	−11.481
Part-time vendors		
1984	1.150	0.010
1985	1.139	0.016
T-statistic	0.943	−12.012**

*Significant at the 10-percent level.

**Significant at the 1-percent level.

filiation, while still important, is less important in determining whether or not a Seller sells loans throughout a year than it is in determining whether or not a bank is a Seller. An otherwise average Seller with multibank affiliation has a 42.8 percent probability of selling loans throughout the year, while one without multibank affiliation has only a 39.3 percent probability of year-round selling.

How much to sell

A bank is not only faced with the decision of whether or not to sell loans, but it also must decide how much, if any, to sell. In order to understand the underlying factors in this decision, we estimated a tobit model, using the same data used for the logit models and based on the same variables in the logit models. The dependent variable in the tobit model is the dollar amount of loans sold in 1985 as a percent of assets at year-end 1984. A tobit model is a type of regression model in which the dependent variable is limited or constrained.[13,14]

The results are presented in Table 6. Ten of the 11 variables are significant at least at the 10-percent level and the estimated effects are consistent with the logit results. The model predicts that the average bank in our sample would sell loans equal to 5.5 percent of its assets, or $9.8 million. Noninterest expense as a percent of loans, diversification, and binding capital constraints have the largest impact on the proportion of loans that a bank sells annually. A one-standard-deviation decrease in the average bank's noninterest expense ratio, while all else is held constant, would increase the proportion of loans that it would sell by nearly 2 percentage points, and a one-standard-deviation decrease in that bank's level of diversification would increase the amount of loans that it would sell by 0.8 percentage points.

A typical bank with a binding capital constraint would be expected to sell a much higher proportion of loans than one without a binding constraint. The average bank with a primary capital ratio less than 5.5 percent would be expected to sell loans equal to 7 percent of its assets, while a similar bank with a primary capital ratio greater than 7 percent would be expected to sell loans equal to 5.4 percent of its assets. A typical bank whose primary capital ratio is between 5.5 percent and 7 percent would sell loans equal to 6.1 percent of its assets.

Table 6
Multivariate tobit model

	Parameter estimates	T-statistics	Impact of a one STD change *(percent points)*
Intercept	−0.060***	−7.097	
RESERVES	0.962***	3.488	0.25
PRMCAP	0.022	0.339	
BIND55	0.032***	3.259	
BIND557	0.015***	3.488	
PREMIUM	0.019***	5.675	0.61
LNINDEX	0.059***	23.194	1.80
LNGROW	0.005***	3.700	0.25
NCHRGOFF	0.208**	2.209	0.15
NINTEXP	−1.074***	−16.847	−1.74
ASSETS	0.002***	3.288	0.19
MULTI	0.044***	13.226	
Sigma	0.150***	123.770	

**Significant at the 5-percent level.

***Significant at the 1-percent level.

Multibank holding company affiliation is also an important determinant of the amount of loans that a bank sells. If the average bank belongs to a multibank holding company, it would be expected to sell loans equal to 7.2 percent of its assets, or $12.8 million of loans; whereas, a similar bank that had no multibank holding company ties would be expected to sell only 5 percent, or $8.9 million. This suggests that a significant portion of loans sales may be attributable to loan transfers from one bank to another within the same holding company.

A separate tobit model was estimated for the 100 largest banks in our sample. All but three of these banks sold loans in 1985. As shown in Table 7, only three of the eleven variables are significant at at least the 10-percent level. These variables measure a bank's comparative advantage in making and servicing loans, its asset size, and its deposit insurance premium. Of these three variables, asset size has the largest impact on the amount of loans that a large bank sells, followed by

Table 7
Multivariate tobit model:
Top 100 banks by asset size

	Parameter estimates	T-statistics	Impact of a one STD change *(percent points)*
Intercept	0.029	0.142	
RESERVES	1.070	0.445	
PRMCAP	0.336	0.159	
BIND55	−0.023	−0.335	
BIND557	0.003	0.065	
PREMIUM	0.088***	3.275	3.65
LNINDEX	−0.017	−0.499	
LNGROW	0.027	1.342	
NCHRGOFF	−2.286***	−1.267	
NINTEXP	−2.962***	−2.876	−3.97
ASSETS	0.003***	4.208	4.93
MULTI	−0.024***	−1.023	
Sigma	0.106***	13.961	

**Significant at the 5-percent level.

***Significant at the 1-percent level.

noninterest expense and then deposit insurance premium.

Conclusions and policy implications.

Our analysis indicates that regulation plays an important role in explaining which banks sell loans. But, regulation is not the sole driving force, nor is it the strongest. A bank's comparative advantage in originating and servicing loans, as measured by the ratio of noninterest expense to loans, has a large impact on a bank's probability of selling loans, and it has the *largest* impact in determining the amount of loans that a bank will sell. In addition, the need to diversify, and the size of the bank are also important.

The results indicate that banks are likely to start selling loans when capital ratios are low or when charge-offs are high. This appears to be the result of a regulatory policy that forces banks to sell appreciating assets in order to bring regulatory measures of equity in line with the "true" value of the firm. The regulatory taxes, deposit insurance premiums, and reserve requirements do have a significant impact on loan sales with deposit insurance premiums being the more important factor. However, this paper does not indicate that loan sales are a result of forcing banks to shift from "cheap" deposits to "expensive" capital.[15]

Even if regulatory taxes do encourage riskier banks through the use of loan sales, loan sales appear to have positive implications for bank soundness. Loan sales allow banks to profit from what they do best—originate and service loans—rather than warehouse them, and loan sales allow banks to diversify their portfolios, which will improve the safety of individual banks. A substantial portion of bank loan sales are going to investors outside of the U.S. banking system. According to Salem (1985), foreign banks and nonbank investors purchase 65 to 70 percent of all loans sold by commercial banks. Loans sales, therefore, should improve the safety of the banking system as a whole.

These management factors seem to play a dominant role in banks' decisions to sell loans. Twenty-three percent of all commercial banks act as investment banks, selling loans throughout the year. For these banks, their comparative advantage in originating and servicing loans as well as their size, i.e., level of sophistication, are more important than regulatory taxes in their decisions to sell loans. This is especially true for the 100 largest banks. Therefore, even if regulatory taxes were eliminated, loan sales should remain an important bank activity.

[1] Securitization involves the pooling and repacking of loans into securities, which are then sold to investors.

[2] "Mortgage-Exchange Proposal is studied," *Wall Street Journal*, February 26, 1986, p .6.

[3] Robert Geiger, Moodys Investor Service, telephone conversation with author, January 5, 1987, and Salomon Brothers, "Prospects for Financial Markets in 1987," December 16, 1986.

[4] FDIC rebates were actually credits against the following year's assessments for insurance coverage.

[5] If a bank sells an asset with recourse, then generally the regulators require that the asset remain on the bank's books for computing capital adequacy and that the proceeds from the sale be treated as a deposit and, therefore, reservable. See Pavel (1986).

[6] "Statements to Congress," *Federal Reserve Bulletin*, February 1979, p. 115.

[7] The 66th Annual Report of the Board of Governors of the Federal Reserve System, 1979, p. 253.

[8] In general, a logit model is based on the cumulative logistic probability function and is specified as $P_i = 1/(1 + e^{-z}).P_i$ is the probability that bank$_i$ will sell loans; e is the base of the natural logarithms; and z is equal to $\log(P_i/1 - P_i)$, which is equal to $A + \sum B_i X_j$ where X_j are the characteristics of bank$_i$. For more information, see Maddala (1983).

[9] Loans sales reported on Schedule L also exclude renewals or rollovers of loans previously sold by the reporting bank provided that no new funds were advanced and loans sold under agreements to repurchase.

[10] A sample of 14,362 banks that file Reports of Condition and Income for 1984 and 1985 were reduced to 13,763 by excluding those banks that failed to report important data items or were closed or merged with another institution during 1985.

[11] When tested against the sample, this model was correct 66 percent of the time, and had a false-positive rate of 33 percent and a false-negative rate of 39 percent.

[12] This model, when tested against the sample, was correct 65 percent of the time, and had a false-positive rate of 34 percent and a false-negative rate of 35 percent.

[13] See Amemiya (1973) and Tobin (1958).

[14] Another way to estimate a model with a truncated dependent variable is using Heckman's two-step estimator. This technique produced results similar to the Tobit analysis.

[15] Since our data set only looks at banks at a single point in time, it is not well suited for examining the effects of year-to-year changes in minimum capital requirements.

References

Amemiya, Takeshi. "Regression Analysis When the Dependent Variable is Truncated Normal." *Econometrica* Vol. 41 (1973): pp. 997-1016.

Baer, Herbert and Elijah Brewer. "Uninsured deposits as a source of market discipline: Some new evidence," *Economic Perspectives,* Federal Reserve Bank of Chicago, Vol. 10 (September/October 1986): pp. 23-31.

Buser, Stephen A., Andrew H. Chen, and Edward J. Kane. "Federal Deposit Insurance, Regulatory Policy, and Optimal Bank Capital." *Journal of Finance* Vol. 1 (March 1981): pp. 51-60.

Diamond, Douglas. "Financial Intermediation and Delegated Monitoring." *Review of Economic Studies* (1984): pp. 393-414.

Estrella, Arturo. "Domestic Banks and Their Competitors in the Prime Commercial Loan Market." In *Recent Trends in Commercial Bank Profitability*, pp. 159-74. New York: Federal Reserve Bank of New York, 1986.

Flannery, Mark J. "Deposit Insurance Capital Regulation, and the Choice of Bank Loan Default Rates." University of North Carolina at Chapel Hill, February 1987.

Giddy, Ian. "Regulation of Off-Balance Sheet Banking." In *The Search for Financial Stability: The Past Fifty Years*, pp. 165-77. San Francisco: Federal Reserve Bank of San Francisco, 1985.

Gilbert, R. Alton. "Effects of the Monetary Control Act of 1980 on Federal Reserve Membership, Operations of Federal Reserve Banks, and the Correspondent Banking System." Federal Reserve Bank of St. Louis, September 2, 1980.

Hanweck, Gerald and Timothy Hannan. "Bank Insolvency Risk and the Market for Large Certificates of Deposits." Board of Governors of the Federal Reserve System, mimeo (1985).

Judd, John P. "Competition Between the Commercial Paper Market and Commercial Banks," *Economic Review*, Federal Reserve Bank of San Francisco (Winter 1979): pp. 39-53.

Koehn, Michael and Anthony M. Santomero. "Regulation of Bank Capital and Portfolio Risk." *Journal of Finance* (December 1980): pp. 1235-44.

Koppenhaver, G. D. "The Effects of Regulation on Bank Participation in the Guarantee Market." Federal Reserve Bank of Chicago, September 1986.

Maddala, G. S. *Limited-Dependent and Qualitative Variables in Econometrics*, New York: Cambridge University Press, 1983.

Mingo, John J. "Regulatory Influences on Bank Capital Investment." *Journal of Finance* Vol. 4 (September 1975): pp. 111-21.

Modigliani, F. and M. H. Miller. "The Cost of Capital, Corporation Finance and the Theory of Investment." *American Economic Review* Vol. 48 (June 1958): pp. 261-97.

Pavel, Christine. "Securitization." *Economic Perspectives*, Federal Reserve Bank of Chicago Vol. 10 (July/August 1986): pp. 16-31.

Peltzman, Sam. "Capital Investment in Commercial Banking and its Relation to Portfolio Regulation." *Journal of Political Economy* Vol. 78 (January-February 1970): pp. 1-26.

Salem, George M. "Commercial Loans for Sale: The Marriage of Commercial and Investment Banking." *Banking*, Donaldson, Lufkin & Jenrette (September 30, 1985).

Tobin, James. "Estimation of Relationships for Limited Dependent Variables." *Econometrica* Vol. 26 (1958): pp. 24-36.

Tax reform looks low risk for economy

Thomas A. Gittings

The Tax Overhaul Bill of 1986 is the most comprehensive restructuring of federal income tax law in the past 40 years. This bill changes many of the tax rates, deductions, exemptions, and credits that affect individuals and businesses. It was designed to be "revenue neutral;" that is, it was intended neither to increase nor to cut the tax receipts of the federal government. Rather, the purpose was to shift some of the tax burden from individuals to businesses, and to reduce inequities and imbalances created by various loopholes in the system. It has been estimated that the net effect, over the next five years, will be to raise business taxes by $120 billion and to reduce personal income taxes by a like amount.

The top tax rate for individuals will be lowered from 50 percent to 28 percent by 1988, although some portion of high incomes will be subjected to a marginal tax rate of 33 percent. Most individuals will fall in a lower tax bracket of 15 percent. There were a number of other adjustments and changes, particularly in the area of deductions from income.

Of the 100 million persons who file a federal income tax, about three out of four will pay lower taxes. For individuals the average reduction will be about 6 percent of their taxes.

For businesses the biggest change is the elimination of the investment tax credit. Depreciation allowances have been scaled back somewhat and a minimum tax will affect certain corporations. Partially offsetting these changes is a reduction in the top tax rate for corporations from 46 percent to 34 percent.

Given such major changes and the numerous other provisions of this tax reform, it is natural to wonder what will be the net effect on the economy in the coming years. With almost every household and business directly affected, what will be the eventual effect on investment, output, interest rates, employment, and other measures of economic performance? Attempts to answer this question, in the form of guesses, hunches, estimates, and predictions have flooded the popular and business press in recent months.

Much of this coverage has been somewhat negative and has emphasized the adverse effects the new law could have on business investment. This has been especially true in analysis of industries that have received investment tax credits.

While we consider it virtually impossible to predict what the eventual net effects will be, our model simulations suggest that any negative effects will likely be small and we are unable to reject the possibility of a significant positive response.

This paper looks at some possible effects of the new law on the economy by studying the effects of the tax changes on a small model of the economy. Numerous simulations of this model indicate that any negative effect on output will be quite small. A number of scenarios are run, and show that modest positive adjustments in the economy could more than offset the losses in our "worst case scenario," which itself turns out not to be that bad. These offsetting adjustments could include an increase in the supply of labor due to the lowering of individual tax rates, an increase in the efficiency in investments by businesses, and a reduction in corporate dividends.

Specification of the model

The trick in building an economic model is to make it complex enough that there is a reasonable approximation to the real economy, yet simple enough that the model's economic interactions can be understood. Although the model uses only about two dozen variables, it captures many of the relationships in an economy that are affected by changes in tax rates. As is the case with any model of this type, the variables are highly aggregated— each variable lumps together a great deal of economic information. For example, labor, capital, output, prices, and interest rates are each represented by a single variable, or measure.

The model is based on standard assumptions of macroeconomics and has been "tuned" to approximate the magnitudes of the U. S. economy. It consists of some basic economic

Thomas A. Gittings is senior economist at the Federal Reserve Bank of Chicago.

definitions and accounting identities, an assumption about the financing and investment decisions of businesses, and a specification of some of the factors that critically affect interest rates and dividend yields. The equations and variables of the model are listed in the box.

The simulations start from an initial point of equilibrium; the tax rates are then changed to reflect the basic shifts of the new tax law. This leads to a new long-run equilibrium. The model is based on the 1979 paper by Martin Feldstein, Jerry Green, and Eytan Sheshinski.

Output is assumed to be produced by combining the inputs of capital and labor. The production process is such that a doubling of each input leads to a doubling of output. Workers receive a real wage rate that represents their marginal contribution to output.

The sources of income for households in this model include wages received by labor, interest earned on corporate bonds, and dividends paid by businesses. This income is used to pay personal income taxes, to buy output for consumption, and to add to savings. All savings are used to buy additional corporate bonds. Individual taxes are proportional to personal income plus capital gains. In equilibrium, personal savings equal the growth rate of the economy multiplied by the outstanding stock of bonds. Capital gains equal the growth rate multiplied by the equity value of businesses. Equity is defined as the difference between the value of the existing capital and the amount of bonds outstanding.

The Federal Reserve is assumed to conduct monetary policy so as to maintain a constant price level; that is, there is no inflation in this model. This is an assumption that monetary policy will not try to "take up the slack." For a discussion of issues associated with a more active monetary policy and the resulting inflation, see Feldstein, Green, and Sheshinski (1978).

Business' source of funds include revenue from the sale of output plus new bonds that have been issued. These funds are used to pay wages, interest payments, dividends, and corporate taxes. The remaining funds are used to purchase output for investment in additional or replacement capital.

Taxable profits equal receipts from output sold minus allowable deductions. These deductions include wages, interest payments, and a depreciation allowance. For simplicity, the depreciation allowance is assumed to equal actual depreciation in balanced growth where there is no inflation. Corporate income ("profit") taxes are a fraction of taxable profits minus any investment tax credits.

Businesses are assumed to select a debt-capital ratio that will minimize their cost of capital. As is the custom in theories of corporate finance, this cost of capital is an after-tax rate of return net of depreciation. In balanced growth equilibrium, the ratio of gross investment to the existing stock of capital equals the rate of growth plus the rate of depreciation. Under these conditions, minimizing the cost of capital is equivalent to assuming that businesses invest so as to maximize their level of output.[1]

In the absence of an investment tax credit or accelerated rates of taxable depreciation, the cost of capital is a simple weighted average of the after-tax rates of return on bonds and on equity. The weights are the debt-capital ratio and the equity-capital ratio, respectively. The rate of return on debt is the interest rate, and the gross rate of return on equity is the dividend yield plus the growth rate of capital. The after-tax return on equity is the gross rate of return divided by one minus the corporate income tax rate.

There are two factors that are assumed to affect the rate of interest in the absence of inflation. First, as corporations acquire a higher debt ratio, they must pay a higher real rate of interest. This risk adjustment factor makes it possible for the optimal investment decision to include a combination of both debt and equity financing.

The second factor that can influence the real rate of interest is the personal income tax rate. Households are assumed to be the sector that is willing to lend money to businesses by buying corporate bonds. Individuals are interested in their after-tax rates of return on bonds and equity. When the individual income tax rate is reduced, a proportional reduction in the rate of interest can generate the same after-tax rate of return. The dividend yield on equity is also positively linked to the income tax rate.

The final specification of the model is a brief description of the government sector. The government receives taxes from individuals and businesses. All of this revenue is spent on purchasing output for public consumption. The government is assumed to have no existing debt

and never to run a deficit. These simplifying assumptions focus the analysis on the effects of revenue-neutral tax changes and eliminate the need to distinguish between interest rates on government and private debt.

Estimation of the model

Before using the model to simulate the effects of a change in tax rates, it is necessary to establish the equations of the model and to estimate or specify values for each of the variables. The box lists the equations and parameters of the model. The following section briefly describes how these variables were selected so as to approximate the U. S. economy for 1984-85.

Gross National Product in the United States was approximately $4 trillion (or $4,000 billion) in 1985. The value of output in the model was set equal to 4,000 and all dollar magnitudes can be interpreted as being in billions of current dollars. The price index is initially equal one and remains constant, given the assumptions about monetary policy and inflation.

Because one of the interesting questions about the tax reform bill is the effect it would have on investment decisions by businesses, the investment numbers have been selected to approximate nonresidential fixed investment as a fraction of the overall economy. Gross investment is set equal to 12 percent of total output, with the capital consumption allowance (amount of depreciation of nonresidential capital) equal to 9 percent of total output. The difference between gross investment and depreciation represents net investment. Three percent of total output is used to increase the nonresidential stock of capital.

If the balanced growth rate of the economy is also assumed to equal 3 percent per year, then the equilibrium capital-output ratio must be equal to one.

The debt-equity ratio is initally set equal to 0.6. This ratio for nonfinancial corporations in the United States rose from 0.4 in the mid 1960s to fluctuate between 0.6 and 0.8 in the 1980s. The corresponding debt-capital ratio is 0.375.

The dividend yield on equity is assumed to be 3 percent initially and the interest rate for bonds is set at 5 percent. The gross return on equity equals the dividend yield plus the rate of growth of equity. With 3 percent balanced growth, accrued capital gains will equal 3 percent of equity. The tax rates on interest, dividends, and accrued capital gains are assumed to be the same.

The government initially purchases 10 percent of total output. This number approximates the percent of GNP that is collected by the federal government from personal and corporate profit taxes if one excludes the net earnings of the Federal Reserve System. It is slightly higher than the 8-9 percent of GNP that is federal government purchases of goods and services. (The size of the federal government would be significantly higher if we included all transfer payments.) State and local government taxes and expenditures are netted out or subsumed into consumption.

Of the $400 in government expenditures, 15 percent or $60 initially is raised by corporate profit taxes. The remaining 85 percent or $340 is collected from personal income taxes. The primary effect of the tax changes is to increase corporate taxes by approximately $20 and to lower individual taxes by an equal amount.

The investment tax credit rate is assumed to equal 6 percent. In 1985, this rate was 10 percent for most producer durable equipment, 6 percent for autos, and zero for nonresidential structures. The 6 percent rate approximates the weighted average of these rates, where the weights are the proportions of total nonresidential fixed investment.

Given these initial conditions, the equations of the model can be used to determine the corresponding corporate and personal tax rates, the coefficients of the production function, and the coefficients that link the interest rate to the debt-capital ratio.[2]

Once the model has been completely specified, it is possible to simulate the effects of a change in tax structure. The investment tax credit is eliminated and the corporate profit tax rate is reduced so as to raise an additional $20 in corporate taxes. Given the new tax structure, business calculates the new optimal mix of debt and equity financing and adjusts the capital stock accordingly.

Equations of the Simulation Model

[1] $$Q = \gamma K^{\alpha} L^{\beta}$$

[2] $$1.0 = \alpha + \beta$$

[3] $$Q = C + I + G$$

[4] $$W = \frac{\partial Q}{\partial L}$$

[5] $$T_L = \tau_L(WL + RB + \psi E + \lambda K)$$

[6] $$E = K - B$$

[7] $$\Upsilon_K = Q - WL - RB - \delta K$$

[8] $$T_K = \tau_K \Upsilon_K - \xi I$$

[9] $$I = (\delta + \lambda)K$$

[10] $$\theta = B/K$$

[11] $$\mathcal{N} = \theta R + (1 - \theta)(\psi + \lambda)/(1 - \tau_K) - \xi(\delta + \lambda)/(1 - \tau_K)$$

[12] $$\frac{\partial \mathcal{N}}{\partial \theta} = 0$$

[13] $$\frac{\partial Q}{\partial K} - \delta = \mathcal{N}$$

[14] $$R = (\rho_0 + \rho_1 \theta^2)/(1 - \tilde{\tau}_L)$$

[15] $$\psi = \psi_0/(1 - \tilde{\tau}_L)$$

[16] $$G = T_K + T_L$$

Initial Conditions

$L = 4000$	$Q = 4000$	$I = 480$	$G = 400$
$T_K = 60$	$\delta K = 360$	$\theta = 0.375$	$\tilde{\tau}_L = 0.32$
$R = 0.05$	$\psi = 0.03$	$\xi = 0.06$	$\lambda = 0.03$

Variables

B	Bonds	C	Consumption
E	Equity	G	Government
I	Gross investment	K	Capital stock
L	Labor employed	$\mathcal{N}$	Cost of capital
Q	Real output	R	Interest rate
T_K	Corporate taxes	T_L	Personal taxes
W	Nominal wage rate	Y_K	Corporate taxable income
α, β, γ	Production function coefficients	δ	Rate of depreciation
θ	Debt-capital ratio	λ	Growth rate of labor
ξ	Investment tax credit rate	ρ_0, ρ_1	Interest rate equation coefficients
τ_K	Tax rate for corporate income	τ_L	Average tax rate for personal income
$\tilde{\tau}_L$	Marginal tax rate for personal income	ψ	Dividend yield on equity
ψ_0	Dividend equation coefficient		
$\partial Q/\partial K$	Marginal product of capital	$\partial Q/\partial L$	Marginal product of labor

The individual tax rate is lowered until personal income taxes have been reduced by $20. A reduction of personal income taxes from 340 to 320 would represent lowering personal tax rates by about 6 percent on average.

With a progressive income tax, the change in the average tax rates will generally not be the same as the change in "the" marginal tax rates. It is difficult to identify what the relevant marginal tax rates are for this model. Ideally it would be a dollar-weighted average of different taxpayers' marginal income tax rates, where the weights would be proportional to the relative size of the taxpayers' savings. It is this rate that is linked to interest rates and dividend yields.

As a ballpark estimate, the change in marginal tax rates is assumed to be about 12 percent, or twice the change in the average tax rates. The marginal income tax rate for individuals is assumed to decline from 32 percent to 28 percent.

Simulation results

To demonstrate the sensitivity of this model, a series of simulations were run using different assumptions about the response of labor supplied, the dividend policies of corporations, and the magnitudes of marginal tax rates. These factors are important because they can determine whether the tax changes eventually will increase or decrease the level of real output. To provide a range of possible effects, four cases were simulated.

In the first simulation, labor and real dividend yields are held constant, i.e. there is not a supply-side labor response to the lower personal tax rates and businesses take the full hit of new corporate taxes. This simulation can be considered a "worst case" scenario since it allows for no positive responses in output and maximizes business losses.

A second simulation is run to determine how much the quantity of labor supplied would need to increase to maintain a constant level of output, i.e., how much of a labor response would be necessary to offset the hit on business. The existence of a substantial labor supply-side effect has yet to be demonstrated. Lower tax rates on wages increase the return for working. This change should motivate some people to spend less time in leisure and more time in work. On the other hand, a lowering of personal taxes will increase incomes. With higher incomes some people might prefer to work less and spend more time in leisure. Empirical studies by Hausman (1985) have not been able to resolve this ambiguity.

The third scenario has businesses passing on some of the additional taxes to their stockholders by reducing dividend yields. This is essentially one way businesses could try to pass the increased taxes back to individuals. To provide a benchmark, dividend yields are lowered by an amount such that the level of real

output is unchanged in equilibrium. In the other simulations, after-tax dividend yields are assumed to be constant.

The final simulation adjusts the production function by increasing the scale parameter. Some people expect that businesses will be more efficient in their investment decisions and with the new tax structure and thus additions to the capital stock could be more productive. This could lead to a higher level of output for a given quantity of labor employed. As a reference point, the production function is shifted so as to maintain the initial level of output.

The results of these simulations are shown in Table 1 along with the initial conditions. Corporate and personal income tax rates have been changed by an amount that would shift exactly $20 billion in taxes from individuals to corporations *if* the quantity of labor remains unchanged. Whenever there is a change in labor supplied, the new tax rates might not be revenue neutral. This is the case in the last two simulations where the net effect is to raise slightly more or slightly less than the $400 billion in taxes. The model does not try to identify the short-run adjustment paths for the different variables.

The most striking feature of these simulations is their relative uniformity. The expected, long-run effects of the tax changes appear to be quite small under all of the simulations. Even in the case where labor and after-tax dividend yields are constant, the decline in real output is only slightly over one-fourth of one percent.

Except for the quantity of labor and the production function scale parameter, the results of the second and fourth simulations are identical. This result is due to the particular production function that is used in these simulations. This production function assumes that a constant fraction of output is always paid to workers. There would be small differences between these simulations if an alternative production function is used.[3]

Real output can increase if one uses a combination of supply-side effects, some shifting in the incidence of corporate taxes, and upward shifts in the production function. The potential increase is limited only by how large these effects might be. For example, an alternative simulation was run where the 12 percent decrease in marginal income tax rates results in a 3.6 percent increase in labor. This response is consistent with the empirical studies (Killingsworth [1981]) that find a large and positive linkage between labor supply and personal tax rates. The corresponding increase in real output is approximately 3.3 percent.

For each simulation, the debt-equity and debt-capital ratios are lowered due to the reduction in corporate income tax rates. With a lower rate, the deductibility of interest payments is worth less. On the other hand, a lowering of the debt-capital ratio is assumed in this model to lead to a reduction in interest rates. Interest rates are reduced further by the lowering of marginal personal income tax rates. The reduction in interest rates varies between 55 and 70 basis points (100 basis points equals one percentage point).

Given the accuracy of economic data in general, and the ability of economists to identify causes and consequences in particular, these findings strongly suggest that the net effects of the tax changes may be very difficult to estimate in the coming years. The "noise" and irregular movements in most economic data could effectively mask any long-run changes. In his 1985 Richard T. Ely lecture, Herbert Stein described this general problem. "Macroeconomists can feel confident in wartime, because in wartime they deal with large numbers—large enough to override the noise in the data and the conditionality of the analysis. We may not predict very well the consequences of the difference between federal spending of 20 or 25 percent of GNP, or of a deficit of 2 or 3 percent of GNP. But we can give a useful, if rough, estimate of the consequences of raising federal spending from 10 to 50 percent of GNP, or of raising the deficit from 3 to 25 percent of GNP."

The overall size of the effects appears to be relatively insensitive to the estimation of the model. A large number of alternative simulations were run using different values of the parameters. For example, the initial debt-equity ratio was varied from 0.4 to 0.8. Likewise the other initial conditions were varied by plausible amounts. The results were quite similiar to the numbers reported in Table 1. The model, at least, predicts very modest net effects when there is a $20 billion shift in taxes within a $4,000 billion economy.

Table 1
Simulation results

Variables	Initial values	I Constant labor	II Increased labor	III Decreased yields	IV Production function
Capital	4000.0	3926.0	3937.8	4000.0	3937.8
Labor	4000.0	4000.0	4012.1	4000.0	4000.0
Output	4000.0	3988.0	4000.0	4000.0	4000.0
Consumption	3120.0	3116.9	3126.3	3120.2	3126.3
Investment	480.0	471.1	472.5	480.0	472.5
Government	400.0	400.0	401.2	399.8	401.2
Corporate Taxes	60.0	80.0	80.2	79.2	80.2
Income Taxes	340.0	320.0	321.0	320.6	321.0
Debt	1500.0	1390.0	1394.2	1374.9	1394.2
Equity	2500.0	2536.0	2543.7	2625.1	2543.7
Debt-Equity Ratio	60.00%	54.81%	54.81%	52.38%	54.81%
Debt-Capital Ratio	37.50%	35.40%	35.40%	34.37%	35.40%
Interest Rate	5.00%	4.45%	4.45%	4.30%	4.45%
Yields	3.00%	2.83%	2.83%	2.58%	2.83%
Interest	75.0	61.8	62.0	59.3	62.0
Dividends	75.0	71.9	72.1	67.7	72.1
Capital Gains	75.0	76.1	76.3	78.8	76.3
Investment Tax Credit	6.00%	0.00%	0.00%	0.00%	0.00%
Profits Tax Rate	42.29%	35.10%	35.10%	35.10%	35.10%
Income Tax Rate	9.50%	9.00%	9.00%	9.00%	9.00%
Marginal Income Tax Rate	32.00%	28.00%	28.00%	28.00%	28.00%
Gross Cost of Capital	16.12%	16.38%	16.38%	16.13%	16.38%
Before Tax Profits	210.0	227.9	228.6	225.7	228.6
Production Function Parameter	1.000	1.000	1.000	1.000	1.0025

Conclusion

In the coming years, the taxpayers of the United States will be adjusting to the many changes of the 1986 tax reform bill. At the individual level, these changes could be substantial. Businesses that had benefitted from investment tax credits will carefully reevaluate their investment decisions. Individuals will adjust their work efforts and savings strategies so as to maximize their expected welfare.

As these decisions are carried out in the marketplace, some new jobs will be created and others lost. Some types of goods and services will grow while others will decline. Collectively these decisions and adjustments will determine the overall level of economic activity.

At this time, it is difficult to determine what the net effect will be. Numerous simulations of the model presented in this paper predict that any negative impact on the level of output will be quite small and could easily be more than offset by a combination of stimulative factors. The three factors considered in this paper are an increase in the supply of labor due to the lowering of personal income tax rates, an increase in the efficiency of investment by business, and a possible reduction in dividends as businesses try to pass some of the increase in taxes onto stockholders. While we consider it virtually impossible to predict what the eventual net effects will be, our model simulations suggest that any negative effects will likely be small and we are unable to reject the possibility of a significant positive response.

References

Feldstein, Martin S., Jerry Green, and Eytan Sheshinski. "Inflation and Taxes in a Growing Economy with Debt and Equity Financing," *Journal of Political Economy,* Vol. 86, No. 2, Part 2 (1978), pp. S53-S70

Feldstein, Martin S., Jerry Green, and Eytan Sheshinski. "Corporate Financial Policy and Taxation in a Growing Economy," *Quarterly Journal of Economics,* Vol. 93, No. 3 (August 1979), pp. 411-432.

Hausman, J. "Taxes and Labor Supply," *Handbook of Public Economics,* ed. A. Auerbach and M. Feldstein (Amsterdam: North Holland, 1985).

Killingsworth, Mark. "A Survey of Labor Supply Models," *Research in Labor Economics,* (4) (1981).

Stein, Herbert. "The Washington Economics Industry," *American Economic Review,* Vol. 76, No. 2 (May 1986), pp. 1-9.

[1] The relationship between the cost of capital and the level of output in this model comes from the balanced growth equation for business receipts and expenditures. The sources of revenue for a business include receipts from the sale of output and the issuance of new bonds. In balanced growth, the quantity of new bonds issued in any period is equal to the growth rate of the economy multiplied by the outstanding supply of bonds.

These revenues are used to pay wages for workers, corporate income taxes, interest on outstanding bonds, and dividends on equity. The remaining money is used to purchase output for investment purposes. In equilibrium, the capital stock should be increasing at the balanced growth rate.

By rearranging some of the terms in the balanced growth equation for business and dividing by the capital stock, one obtains an equation that relates the marginal product of capital (and therefore the level of output for a given quantity of labor) to the rate of depreciation plus the cost of capital. This is equation 13 in the box.

[2] The initial conditions and equations of the model can be used to determine uniquely all of the variables in a balanced growth equilibrium. For example, since the level of government expenditures and corporate income taxes have been specified, the corresponding level of personal income taxes can be derived from the assumption that the government has a balanced budget. In a similiar manner, the other variables and coefficients can be calculated by simple substitutions.

[3] This model used a linearly homogeneous, Cobb-Douglas production function. The proportion of output that is paid to workers is constant and equal to labor's coefficient in this log-linear function.

Crosscurrents in 1986 bank performance

George Gregorash, Eileen Maloney, and Don Wilson

U.S. banking registered lower profitability in 1986, as the industry withstood another year of heavy loan losses. Problem loans, meanwhile, halted their recent relative decline.

This somewhat disappointing news comes despite a fifth consecutive year of U.S. economic expansion and it fuels the arguments of those who suggest a long-term decline in U.S. banking. A closer look at the variety of performance across the industry, however, reveals a more complex picture.

Many faces: Banking across the nation

Overall U.S. bank profitability (as measured by aggregate return on assets, or ROA[1]) dropped in 1986, resuming the decline it began in 1980 and briefly interrupted in 1985 (See Figure 1). The decline was driven principally by higher provisions for loan losses, which rose from 0.67 percent of assets in 1985 to 0.76 percent in 1986. Other revenue and expense components were either stable relative to 1985 (as in net interest margins, where less volatile interest rates prevailed) or continued their inexorable upward creep (as in fee revenue and overhead costs).

Strong regional disparities were in evidence (See Table 1). ROA declined relative to 1985 in three Federal Reserve Districts, most noticeably in the Dallas and Kansas City Districts, as banks serving the energy and agricultural economies demonstrated continuing stress. While there was modest improvement in profitability over 1985 in the other Districts, 1986 ROA's still compare unfavorably with performance measures of prior years for areas other than the eastern seaboard. The west and southwest continued to report the weakest overall earnings performance, while small midwestern banks continued to earn at rates far below their previous norms.

The decline in ROA's included many banks, as the frequency distribution illustrates (See Figure 2). Although the predominant value of ROA in 1986 remained 1.0 percent, roughly 150 fewer banks fell in this category. The number of banks losing money in 1986 rose to 2,741 or approximately 20 percent of banks. Only four percent of banks experienced losses in 1979. That number rose to eight percent in 1982 and to 17 percent in 1985.

The dramatic increase in the number of unprofitable banks, and, for that matter, the record number of bank failures, which reached a post depression high of 138 in 1986, highlights the particular degree of stress on smaller banks.

Profitability declines were indeed most prominent in the smaller bank size groups in 1986 and they have been the steepest over the last five years.[2] The aggregate ROA of banks with assets under $100 million dropped 13 basis points, from 0.65 percent in 1985 to 0.52 percent in 1986. Over 81 percent of U.S. commercial banks (11,298 banks) are at or below $100 million in assets. Similarly, banks with assets between $100 million and $1 billion saw their profitability diminish as their 1986 return on assets dropped to 0.70 percent from 0.82 percent in 1985.

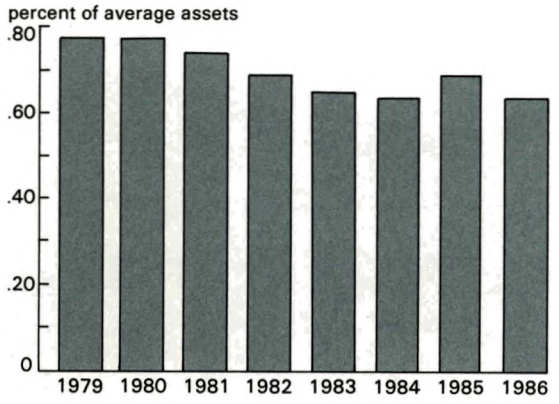
Together these two groups comprise 97 percent of U.S. commercial banks and they hold one third of the U.S. commercial banking system's $3 trillion in assets. The remaining 317 banks manage the other $2 trillion in assets. These larger banks registered a much more modest profitability decline, although the fundamental nature of their business lines and earnings sources is in rapid transition.[3] Aggregate 1986 return on assets for this group equalled 0.64 percent, a mere 2 basis points below that of 1985.

Regardless of size, many banks enjoyed one burgeoning income source in 1986. Gains from securities portfolio sales were used extensively, helping to bolster provision-battered bank revenues. Absent the portfolio gains, the trend of bank profitability is decidedly less robust (See Table 2).

In 1985, such bond gains were most common among small agricultural banks, coinciding with pressured core earnings of these banks. The bond gains were even more sizable

George Gregorash is the manager of Banking Industry Studies, Supervision and Regulation Department, Federal Reserve Bank of Chicago. Eileen Maloney and Don Wilson are senior industry analysts in the unit.

Figure 1
Return on assets—all U.S. commercial banks



and widespread in 1986. Because this is the second consecutive year in which gains from investment portfolios have figured prominently in aggregate year-to-year income variances, the future availability of these gains comes into question (See box on securities sales).

As the earnings variances indicate, asset quality considerations continued to dominate relative bank performance. The enlarged loan-loss provisions taken out of bank earnings in 1986 reflected continuing credit quality weakness. Aggregate 1986 loan charge offs totalled $16 billion or 0.92 percent of yearend loans versus $13 billion or 0.81 percent in 1985, thus continuing the consecutive annual escalations begun in 1981.

Though loan charge offs abounded in 1986, prospective asset quality measures remained flat relative to yearend 1985. The percentage of loans classified as nonperforming in 1986 totalled 2.8 percent, unchanged from 1985, halting the improvement in this measure that began in 1983.

Again, although the aggregate percentage of nonperforming loans remained stable in 1986, trends varied radically among the regions. Not surprisingly, nonperforming measures in the Federal Reserve Districts dominated by energy and agriculture remained weakest (See Table 3). Problem loan levels in the agricultural regions showed some signs of improvement, while the energy-influenced southwest regions registered continued escalations in nonperforming loans.

The year also marked the advent of significant tax reform legislation. It has been

Table 1
Return on assets
(weighted U.S. averages)

	1979	1982	1984	1985	1986
All U.S.	.77	.69	.64	.69	.64
Federal Reserve Districts					
Boston 1	.69	.72	.85	.84	.90
New York 2	.53	.58	.61	.69	.69
Philadelphia 3	.74	.75	.92	1.03	1.03
Cleveland 4	.96	.75	.83	.94	.94
Richmond 5	.91	.85	.92	.97	.99
Atlanta 6	1.00	.93	.92	.92	.83
Chicago 7	.77	.57	.29	.70	.76
St. Louis 8	.99	.87	.84	.85	.90
Minneapolis 9	.98	.88	.88	.82	.81
Kansas City 10	1.11	1.00	.62	.40	.27
Dallas 11	1.01	1.03	.66	.52	(.36)
San Francisco 12	.71	.42	.39	.32	.36

Table 2
Return on assets—
net of security gains (losses)
(weighted U.S. averages)

	1979	1982	1984	1985	1986
All U.S.	.77	.69	.64	.63	.50
Federal Reserve Districts					
Boston 1	.69	.72	.84	.79	.79
New York 2	.53	.58	.60	.63	.56
Philadelphia 3	.74	.75	.94	1.03	.97
Cleveland 4	.96	.75	.84	.85	.78
Richmond 5	.91	.85	.94	.91	.84
Atlanta 6	1.00	.93	.95	.89	.72
Chicago 7	.77	.57	.32	.65	.65
St. Louis 8	.99	.87	.85	.81	.80
Minneapolis 9	.98	.88	.89	.79	.32
Kansas City 10	1.11	1.00	.62	.30	.08
Dallas 11	1.01	1.03	.65	.41	(.56)
San Francisco 12	.71	.42	.40	.27	.28

Figure 2
Return on assets—by number of banks

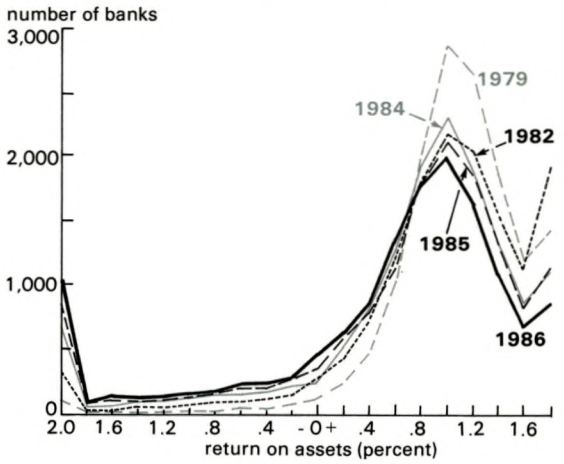


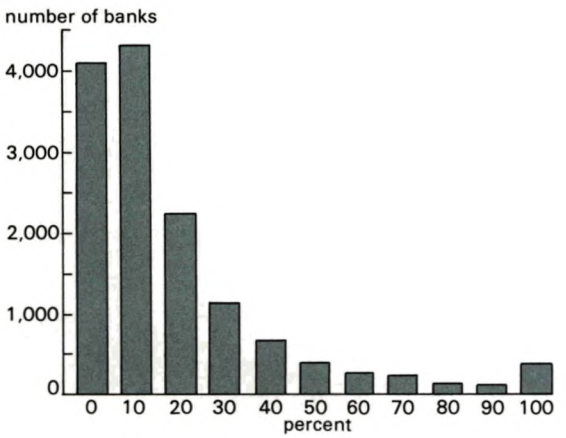
Table 3
Nonperforming assets/total loans

	1982	1984	1985	1986
All U.S.	3.4	3.0	2.8	2.8
Federal Reserve Districts				
Boston 1	2.8	2.1	1.9	1.4
New York 2	2.5	3.4	2.9	2.9
Philadelphia 3	3.8	1.8	1.6	1.5
Cleveland 4	3.3	2.4	2.2	2.0
Richmond 5	2.2	1.4	1.2	1.1
Atlanta 6	2.6	2.1	2.0	2.0
Chicago 7	4.3	2.8	2.7	2.1
St. Louis 8	2.9	2.5	2.5	2.2
Minneapolis 9	3.3	3.2	3.9	3.5
Kansas City 10	2.9	3.7	4.4	4.4
Dallas 11	3.2	3.1	3.7	5.3
San Francisco 12	4.9	4.3	3.6	3.5

suggested that the implications of higher effective taxation on banks in 1987 may have given banks incentives to accelerate loan write-offs and move more questionable credits into nonperforming status. This would exaggerate the apparent weakening of credit quality measures. Although empirical support of this contention is elusive, there is evidence that tax reform affected demand for business loans late in the year (See box on the tax reform spike).

One positive note in 1986 bank performance was the continued increase in bank loan loss reserves. Analysts view reserve building positively because it indicates that reported earnings discount prospective loan loss expectations. Whether financial capital increases through reserves or equity growth, though, the fundamental issue of solvency remains. Given

Figure 3
Nonperforming assets/primary capital—1986
(all U.S. banks)



the stress reflected in bank earnings and asset quality, it is not surprising that a sizable number of banks continue to demonstrate impaired capitalization (See Figure 3). Aggregate capitalization of U.S. commercial banks actually increased in 1986, however. This was largely a result of modest asset growth and continued external capital financings at the larger banks.

Separating cyclical variation from structural change is a difficult business. The unprecedented economic volatility of the last five years adds to the difficulty when considering bank performance. This early survey of 1986 banking results points to no clear evidence of long term industry-wide decline. The data do certainly expose sectoral imbalances that place great stress on some banks and in that sense they clearly reflect the impact of a lengthy but lopsided economic expansion.

A middle view: Midwestern banking

Bank performance in the Seventh District mirrored that of the banking industry as a whole. Profits were pressured by above normal loan loss provisions. Problem loan levels, while moderating, remained stubbornly high by historical standards. Sizable gains on the sales of investment securities were used to offset high provision levels.

Not unlike the overall U.S. picture, the financial performance of banks in the Chicago Federal Reserve District was one of "haves" and "have-nots" as the earnings of industrial banks rose while agricultural banks remained well below previous norms. Industrial banks account for slightly more than one-half the banks in the Seventh District, so aggregate District trends, based on weighted averages, have shown modest but steady improvement in the last five years.

With over 2,500 commercial banks, the Chicago District, (which consists of portions of Illinois, Indiana, Michigan, Wisconsin, and all of Iowa) has the largest number of banks in the country, making up over 18 percent of U.S. banks. This is largely a result of state legislation which has until recently, severely restricted branch banking in District states. At yearend 1986, Seventh District banks held 12 percent of U.S. banking assets.

The rate of return on Seventh District assets in 1986 continued an improving trend as gains on sales of investment securities boosted

Fewer securities rabbits left in portfolio hats

The declining interest rate environment the United States has experienced in the last three years has resulted in significant appreciation in the value of bank securities holdings. Portfolio appreciation can act as a form of hidden reserves, providing a cushion against potential future declines in operating profitability. Banks can use this market appreciation to bolster their short-term profitability. The decision to book profits now by selling the securities, or to continue to enjoy the higher yield over the remaining life of the bond usually depends on the alternative investments currently available to the bank and how much pressure the firm is under to meet specific performance measures.

During 1986, U.S. banks relied upon income from the sales of investment account securities for more than a fifth of their reported return on assets. For agricultural banks as a group, more than 75 percent of their reported ROA came from this source, as opposed to 1985, when only about a third came from this source (See Table A). In analyzing the likely future performance of banks, the amount of securities gains already taken must be viewed in the context of appreciation remaining in the portfolio. In other words, how likely is it that banks will be able to continue to pull income "rabbits" out of their portfolio "hats?"

Table A
Comparative performance measures
(weighted averages)
(all figures in percentages)

Data for	Return on assets (ROA)		Security gains		Net ROA (net of security gains)		Nonperforming loans/Total loans	
	1986	1985	1986	1985	1986	1985	1986	1985
All U.S. commercial banks	.63	.68	.14	.06	.50	.63	2.8	2.8
Federal Reserve District:								
Boston	.90	.84	.11	.05	.79	.79	1.4	1.9
New York	.70	.69	.13	.06	.56	.63	2.9	2.9
Philadelphia	1.06	1.04	.06	.00	1.00	1.04	1.5	1.5
Cleveland	.94	.94	.16	.08	.78	.85	2.0	2.2
Richmond	.99	.97	.15	.06	.84	.91	1.1	1.2
Atlanta	.83	.89	.11	.03	.72	.86	2.0	2.2
Chicago	.76	.70	.11	.05	.65	.65	2.1	2.7
St. Louis	.90	.84	.10	.04	.80	.80	2.2	2.5
Minneapolis	.81	.81	.48	.03	.32	.79	3.5	3.9
Kansas City	.22	.40	.18	.10	.04	.30	4.5	4.4
Dallas	−.37	.51	.20	.11	−.57	.40	5.4	3.7
San Francisco	.36	.32	.08	.05	.28	.27	3.5	3.6
Sector:								
Midwest-agricultural*	.29	.33	.22	.13	.07	.20	5.1	5.5
Non-agricultural	.72	.71	.17	.05	.55	.66	2.6	3.0

*Includes those areas served by the Chicago, St. Louis, Minneapolis, and Kansas City Federal Reserve Banks.

NOTE: All percentages are based on year-end assets or loans. Columns may not add due to rounding.

SOURCE: Year-end 1986 reports of condition and income filed by all U.S. commercial banks.

Schedule B of the Report of Condition presents an approximation of the difference between market and book values of investment securities for a bank. Averaging this remaining appreciation across banks provides a means of estimating the currently available, but as yet unrealized, earnings, which are potentially usable as a buffer against future earnings difficulties. By this calculation, U.S. banks, on an unweighted average, had an available pretax boost to earnings from securities gains of 0.79 percent of assets, as of yearend 1986. The effect on the agricultural banks is even more pronounced, with this sector of the industry still having an unweighted average of 1.08 percent of assets in unrealized security gains.

Since the agricultural sector of the banking industry as a whole has been experiencing financial stress in the last few years, the fact that they have significant remaining earnings hidden in their securities portfolios should be good news. Such a generalization, however, ignores significant differences in basic profitability among banks.

When all banks are divided into deciles according to levels of net ROA (so-called net operating income), a different story emerges. As Table B demonstrates, the banks that are in the lowest 10 percent group of operating performance (decile 1) have only 0.22 percent average appreciation remaining in their portfolios, as compared to 1.66 percent available to the highest 10 percent group (decile 10). We can reasonably infer from these data that poor performing banks have been the most likely to dip into the "hidden reserves" of their securities portfolios in order to raise reported income levels. These banks, therefore, have the least amount of remaining appreciation. No other factor investigated, such as differences in loan-to-asset ratios or portfolio maturity distribution, satisfactorily explains this difference in remaining portfolio appreciation.

Table B
Remaining portfolio appreciation as percentage of average assets
(unweighted averages by groups)

	1986	1985	1984
All U.S.	.79	.40	−.18
Agricultural	1.08	.66	.04
Non-agricultural	.73	.35	−.23
By decile of net ROA			
1 (lowest 10%)	.22	.13	−.24
2	.38	.23	−.18
3	.47	.30	−.23
4	.59	.27	−.22
5	.67	.35	−.20
6	.78	.36	−.20
7	.88	.43	−.17
8	.98	.53	−.13
9	1.23	.59	−.16
10 (highest 10%)	1.66	.80	−.09

This analysis suggests that the weaker banking firms would be particularly sensitive to any increases in market interest rates. If rates were to rise, the cushion of security appreciation would erode. For banks with strong operating performance, sufficient cushion still exists to absorb a large decline in market values of securities with some cushion left over. Absent further interest rate declines, poorer performing banks face a more precarious position, and are more likely to be exposed to the full buffeting of economic forces now that their "hidden reserves" have been at least partially spent.

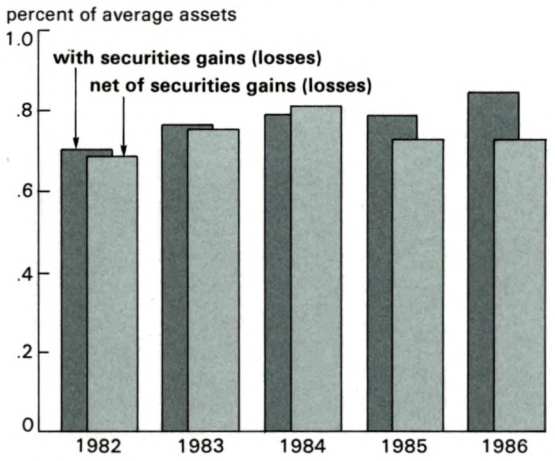
Don Wilson

reported earnings. The effect of securities gains or losses on ROA levels in the past has been negligible—one or two basis points of ROA. In 1985, by contrast, securities gains accounted for six basis points of the 0.79 percent District ROA.[4] In 1986, securities gains provided 12 basis points or 14 percent of the 0.85 percent ROA (See Figure 4).

Net of these gains, District return on assets was 0.73 percent in 1986, unchanged from 1985. In fact, for the last two years, return rates, net of gains, have actually declined from previous levels registered in 1983 and 1984.

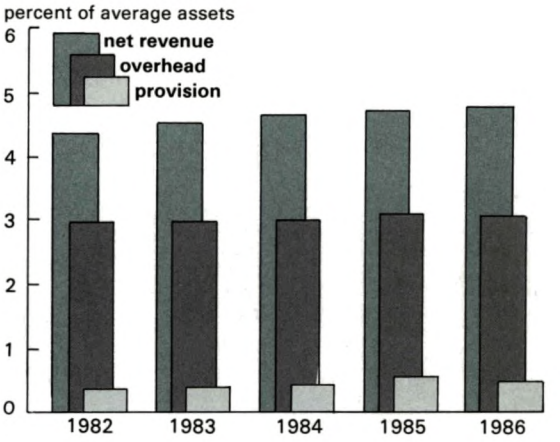
An analysis of earnings components indicates some improvement in 1986 as net revenues (net interest margin plus noninterest

Figure 4
Return on assets—Seventh District



NOTE: See footnote 4.

Figure 5
Earnings analysis—Seventh District



NOTE: See footnote 4.

income) increased and overhead expenses remained stable while provisions for loan losses declined. Net interest margins remained flat at 3.75 percent for 1986, reflecting the fact that loan demand was weak for most of the year. As an offset to margin income, banks have been concentrating their efforts on fee or off-balance sheet income, which has grown swiftly from 0.98 to 1.04 percent of average assets and accounts for the rise in 1986 net revenues (See Figure 5).

Although 1986 overhead levels stabilized, overhead costs have also been trending upwards for the past several years, eating into profits. Compounding the pressure on earnings from rising overhead costs are provision levels required to strengthen loan loss reserves. Provisions rose more sharply in 1985 than in previous years, as a result of continuing sectoral weakness in parts of the District. Although still high, 1986 provisions for loan losses moderated to 0.50 percent.

Based on the changes seen in the components of the income stream, Seventh District ROA, including securities gains, should have been higher for 1986. But, along with securities gains, banks have also been utilizing tax credits to offset current income losses against previous years' profits. The percentage of banks utilizing tax credits has grown since 1983 from 15.8 to 17.6 percent of District banks. However, for banks losing money in consecutive years, the amount of tax loss carry-backs is declining. And, as the number of tax credits are eliminated, the aggregate tax rate will reflect the absence of credits. That is indeed what happened in 1986 and accounts for the smaller than expected rise in ROA despite higher net revenues, stable overhead costs and lower provisions for loan losses. After adjusting for income on a tax equivalent basis to take into account earnings that are not fully taxable, tax rates paid between 1985 and 1986 increased from 0.36 to 0.47 percent of average assets for the District.

Despite the use of tax credits and gains on the sales of securities, 313 or 12.2 percent of Seventh District banks lost money in 1986.

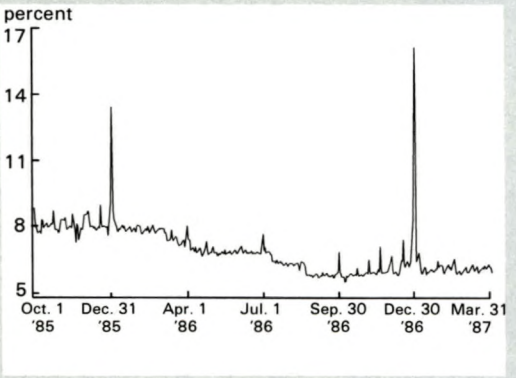
In the Seventh District, the percent of loans classified as nonperforming declined from a high of 3.06 percent in 1982 to 1.71 percent in 1986 (See Figure 6). On an individual bank basis, these results were mixed but, in general, asset quality trends showed continued improvement. Though nonperforming assets declined by nearly one third in 1986, the change resulted from both fundamental improvement and the recognition of loan losses rather than the effects of debt restructurings under FASB15, which was negligible for the Seventh District as a whole. Net loan losses for the District, high by historical standards, declined from 0.84 percent of loans in 1985 to 0.80 percent in 1986.

The percent of primary capital encumbered by nonperforming assets has declined from the roughly 20 percent level registered in 1983. Between 1985 and 1986, nonperforming

How tax reform skewed the statistics

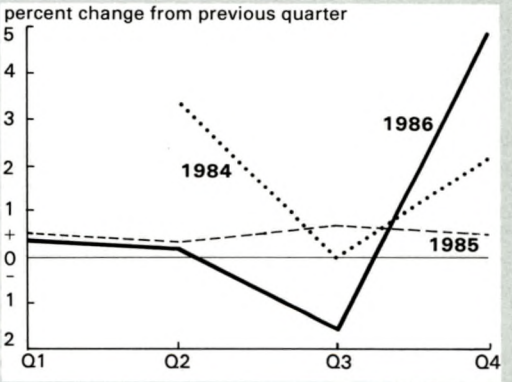
After remaining fairly constant throughout the year, the total assets of the banking industry showed a 4.8 percent increase from September 30 to December 31, 1986. This yearend flurry of activity reflects underlying increases in loan demand, as evidenced by the short-term interest rate markets. After spending most of the fourth quarter of 1986 hovering around the six percent mark, the fed funds rate increased on the last two days of the year as much as 250 percent above earlier levels, climbing as high as 16.17 percent on December 30th (Figure A). This advance represented more than the expected seasonal increase in the fed funds rate. For example, the fed funds rate went as high as 13.46 percent on December 31 of 1985, but that was from a base of around 8 percent. The late run-up in rates at the end of 1986 indicated a sudden surge in the demand for bank financing that was exerting pressure on the normal channels of funds supply.

Figure A
Fed funds rate



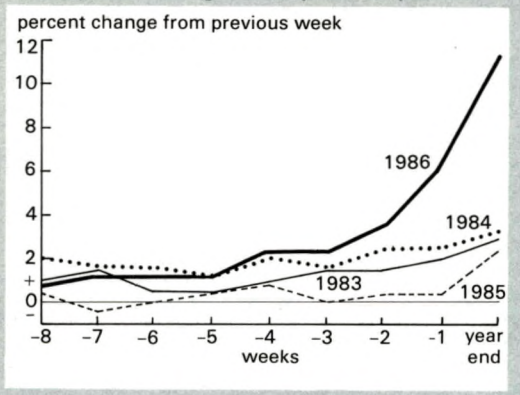
The causes of the surge in loan demand must be inferred from several sources. Anecdotal evidence suggested that business' rush to beat 1987 tax law changes drove up loan demand and, therefore, the short-term interest rates. This was particularly true for money center banks, as many of their large customers rushed to complete major purchases under the old law's more generous depreciation schedules. These customers were unable to issue commercial paper financing quickly enough and turned to their banks for short-term bridge financing. If bank asset growth is broken into its component categories, it is clear that this customer sector accounts for most of the growth. Figure B demonstrates that, indeed, significant growth occurred in the category of loans to commercial and industrial customers. In fact, after posting declining balances through the first three quarters of 1986, C&I loans grew by 4.9 percent in the fourth quarter alone.

Figure B
Quarterly C&I loan growth



The timing of the loan surge indicates a strong desire by corporate customers to complete transactions before yearend, as can be seen through the use of a more discriminating time scale. The Weekly Reports of Assets and Liabilities filed by the nation's largest banks (those over $1.4 billion in assets as of 12/31/82) show that most of the jump in C&I loan demand occurred in the last two to three weeks of the year (See Figure C). Comparison with previous years' statistics shows that this 11 percent increase is not a normal seasonal pattern.

Figure C
Weekly C&I loan growth, prior to yearend

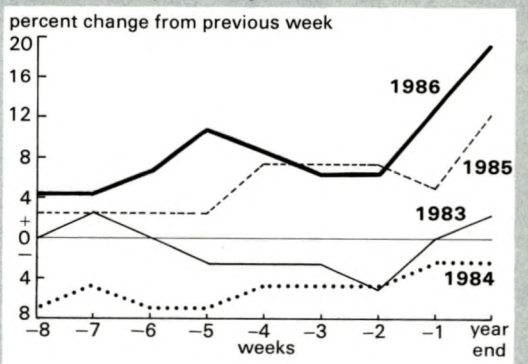


Unfortunately, weekly data is available only for the largest banks. Because smaller banks will often turn to their upstream correspondents to meet funding requirements for short term jumps in loan demand, the level of the large banks' lending to other financial institutions should show an increase if the smaller banks' also experienced tax-driven loan demand. Indeed, as Figure D shows, the week to week increases in large bank loans to financial institutions were extremely large in the last two weeks of the year.

Many measures of performance rely upon combinations of balance sheet and income statement numbers. Balance sheet numbers represent a snapshot of the firm's financial condition at a given time, while the income statement numbers are the aggregation of activity over the length of the period. It is therefore possible that the balance sheet numbers may not be representative of the financial position of the firm during the full earnings cycle. Generally, analysts are forced to assume away this problem, either because of a lack of better information, or because they believe the balance sheet does closely represent reality. Historically, this has provided reasonably good assessments of performance. But, 1986 was an unusual year for performance.

Since the denominators of such performance measures as return on assets and nonperforming loans to total loans are somewhat artificially high for 1986, the measures themselves misstate the true performance of the banking industry. This article has used average assets during the fourth quarter, as reported in Schedule K of the Report of Condition, as the denominator for performance ratios. While this figure helps to mitigate the effect of the loan spike, it does not eliminate all impact.

Figure D
Weekly growth of loans to financial institutions, prior to yearend

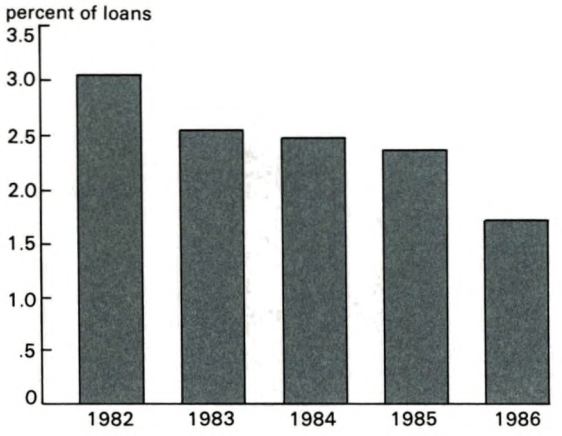


To estimate the magnitude of this understatement, some simplifying assumptions need to be made. Inasmuch as the level of C&I loans at large banks had been stable at 1 to 2 percent over the June 30 balance, until the last three weeks of the year, the actual assets available for earnings during the quarter would be approximately 2 percent over that 6/30 figure. Using this assumption, the adjusted weighted average ROA for the nation for the full year 1986 would be 3 to 4 basis points higher than indicated if only yearend balances were used.

Of course, the effect of the loan spike on individual bank measures of performance will vary with the magnitude of yearend activity for each bank. Use of simple ratio analysis to determine performance of specific banks may cause misleading conclusions if special factors, such as this loan spike, are not considered.

Don Wilson

Figure 6
Nonperforming assets/loans—Seventh District



NOTE: See footnote 4.

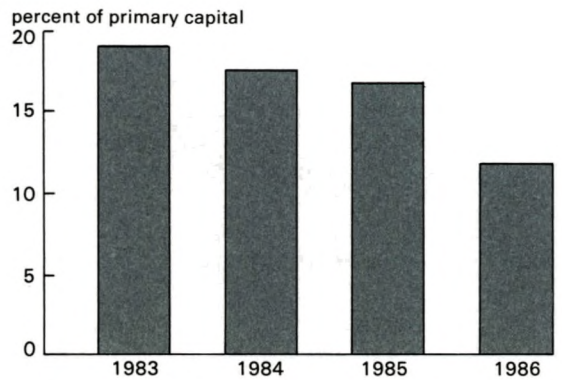
loans to primary capital moved from 16.8 to 12.0 percent, reflecting both improved asset quality and a stable primary capital base running at approximately 7.6 percent of total assets (See Figure 7). All banks however, are not affected to the same degree by nonperforming assets. At yearend 1986, 27, or 1.1 percent, of banks in the Seventh District had nonperforming assets that exceeded their primary capital. Only 82, or 3.2 percent, of Seventh District banks had over 50 percent of their capital encumbered by nonperforming assets.

As a result of the economic diversity in the region, performance levels differed substantially among Seventh District states. ROA rates varied strikingly by two factors. The first factor is the degree of dependence on securities gains to augment income. In general, each state's return on assets compared favorably to those reported for 1985. However, as Figure 8 illustrates, return rates net of securities gains have fallen from, or remained at, their 1985 levels. Illinois, as the exception, is more heavily influenced by larger banks which, on average, had stronger increases in noninterest income for 1986.

The second factor to influence overall return rates is the dependence on the state's economic base. The degree of stress in the agricultural sector, for example, is reflected in the state of Iowa, whose Return on Assets, net of securities gains, has declined from 0.97 percent in 1982 to 0.08 percent in 1986.

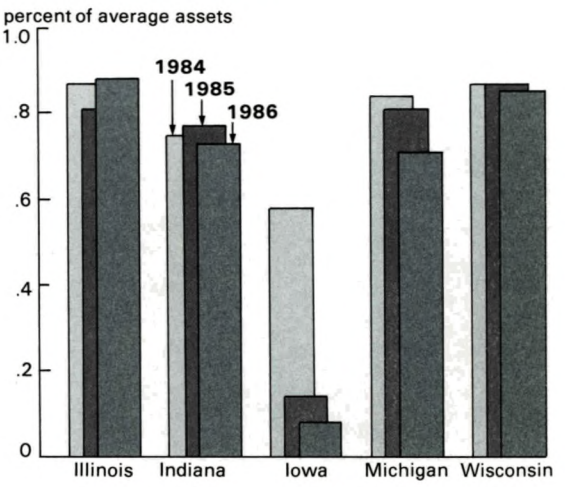
More telling still was the number of banks reporting losses in the District states (See Figure 9). The states influenced by agriculture, Iowa, and to more limited degree, Illinois, have had the greatest number of banks with losses in recent years. However, only 6 percent of Illinois banks lost money in 1986 versus 26.7 percent of Iowa banks. This can be contrasted to 10 and 4 percent of Illinois and Iowa banks, respectively, reporting losses in 1982. Despite the use of securities gains and tax credits, the number of Iowa banks that lost money in 1986 increased. However, the rate of increase in the

Figure 7
Nonperforming assets/primary capital—
Seventh District



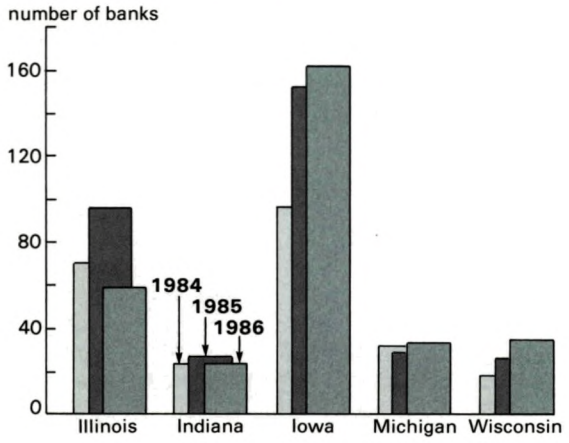
NOTE: See footnote 4.

Figure 8
Net return on assets—
Seventh District by state



NOTE: See footnote 4.

Figure 9
Banks with net losses—Seventh District by state

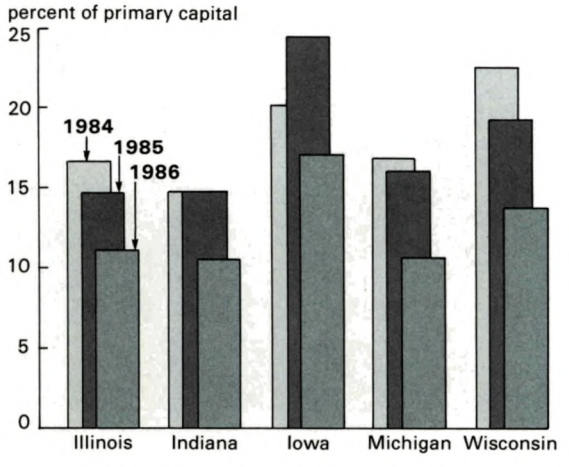


NOTE: See footnote 4.

number of Iowa banks showing losses declined substantially between 1985 and 1986.

On a state-by state basis, asset quality also reflects the dichotomous District trends. During 1985, nonperforming assets to primary capital remained stable or declined for all District states with the exception of Iowa, which continued to suffer as a result of its agricultural loan base (See Figure 10). Improvement was evident in 1986 in all District states as nonperforming assets to primary capital declined. The fact that nonperformings to capital declined in Iowa is particularly impressive, even though the state's primary capital ratio does exceed District averages by approximately one percentage point, because of Iowa's battered economic base and slight recent growth. Further, less than 8 percent of all Iowa banks have over 50 percent of their capital encumbered by nonperforming assets.

Figure 10
Nonperforming assets/primary capital—Seventh District by state



NOTE: See Figure 4.

Clearly the weakness in the District reflected the continuing problems in agriculturally based areas. Looking beyond the Seventh District, a broader prospective provides a better illustration of the agricultural situation.

Lean years revisited: Ag banks

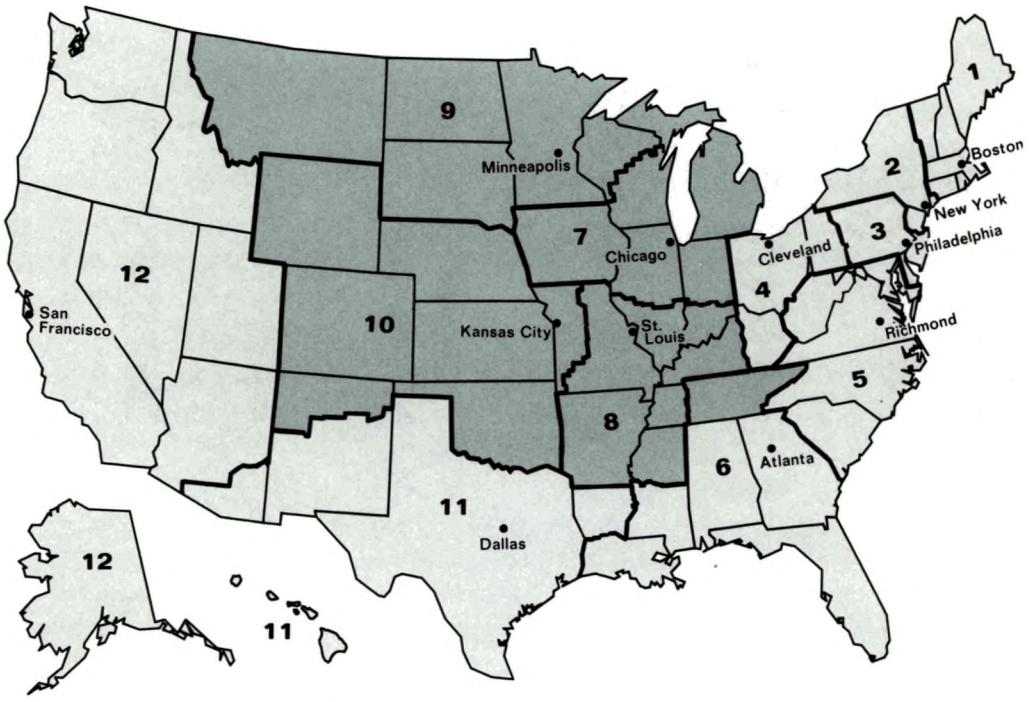
Since 1982, agriculturally oriented banks have experienced increasing levels of loan losses and problems loans, resulting in greatly reduced earnings rates. This represents a significant reversal because, through most of the 1970s, agricultural banks outperformed industry averages with traditionally high earnings, high capitalization, and low levels of problem assets.[5]

The stresses of problem assets and poor earnings continued in 1986, but unlike recent years, hopeful signals could be seen in 1986. The relative levels of loan loss provisions and nonperforming assets declined for the first time in this decade.

The following statistics compare the performance of agricultural and nonagricultural banks in the area bounded by the Chicago, Kansas City, Minneapolis and St. Louis Federal Reserve Districts (Figure 11).[6]

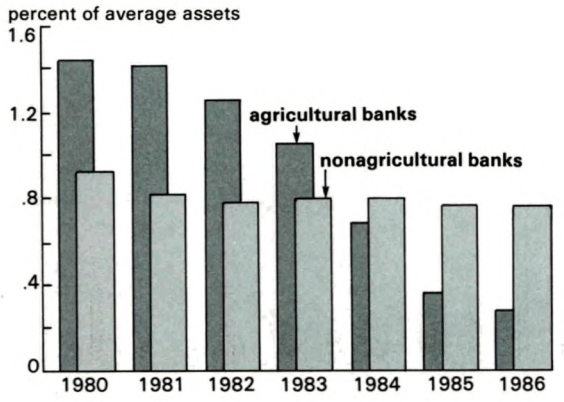
In terms of banking, this four-district area is notable not only for its location at the epicenter of the farm banking problem, but also for its large number of banks. Although the region accounts for less than 25% of the nation's banking assets, it holds over 7,600 or over 50% of the nation's commercial banks. For purposes of this comparison, slightly less than 2,000 of these banks are considered to be agriculturally oriented. In terms of asset size, ag banks in the region are most heavily represented in the less-than-$25 million category. Few ag banks in the area exceed $50 million in assets. Due to their small size, these banks, while representing 14% of the U.S. commercial banks only hold about 2 percent of U.S. banking assets.

Figure 11
The Federal Reserve Districts of the Midwest



The relative concentration of ag banks in the region varies considerably by state, with the largest number of ag banks domiciled in Iowa, Nebraska, Kansas, Minnesota, and Illinois. On a percentage basis, Iowa, Nebraska, and the two Dakotas hold the largest proportions of ag banks, in each case exceeding 65 percent of the states' banks.

Figure 12
Return on assets—all banks
(Districts 7-8-9-10—7,658 banks)



Return on assets rates at midwestern agricultural banks continued their downward spiral in 1986, further distancing their earnings performance from nonagricultural banks in the area (Figure 12). The decline in ag bank ROA

Figure 13
Return on assets—ag banks
(Districts 7-8-9-10)

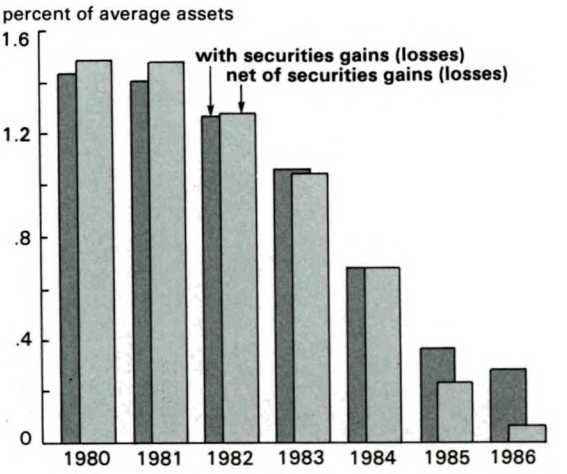


Figure 14
Nonperforming assets/loans
(Districts 7-8-9-10)

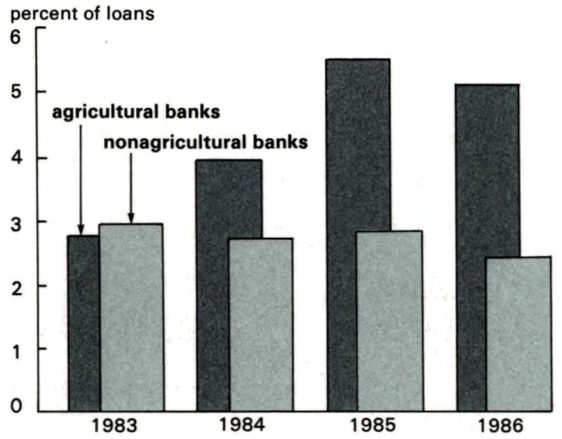
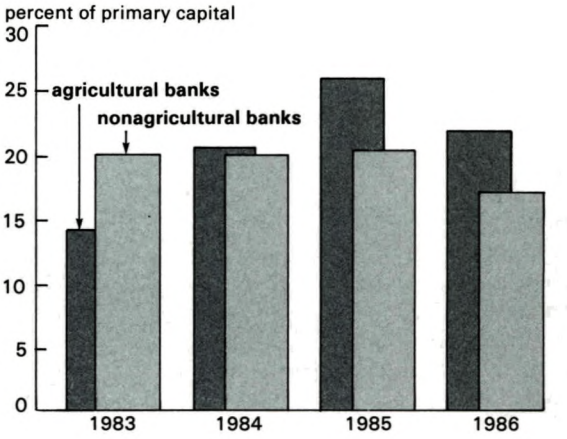


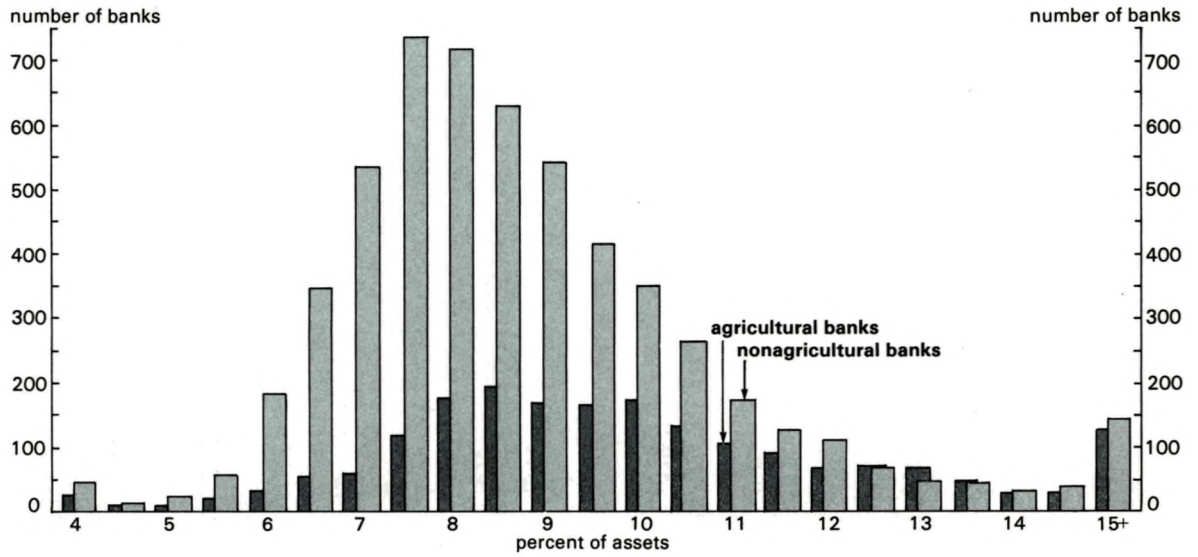
Figure 15
Nonperforming assets/primary capital
(Districts 7-8-9-10)



was less precipitous than in prior years, however, as securities gains bolstered income. Net of these gains, core ag bank earnings continued to drop, reflecting the impact on margins of slack loan demand and the drag of nonperforming assets (Figure 13). Provision levels moderated, however, as nonperforming assets declined relative to both loan outstandings (Figure 14) and primary capital (Figure 15).

The decline in nonperforming loans, along with recent firming in farm land values and farm income offers some evidence that a respite in the long slide in the fortunes of farm banks may be in the offing. The ability of most farm banks to weather the lean years of the early 1980s is testament to the strong capitalization of these firms and stable nature of their deposit base (Figure 16).

Figure 16
Primary capital/assets—1986
(Districts 7-8-9-10)



Conclusion

Although aggregate U.S. bank profitability resumed its decline in 1986, a large portion of the recent decline can be traced to banks in the energy and agricultural producing areas of the country. The high relative level of aggregate loan losses and problem loans this late in an economic expansion is unusual, however, as is the degree of investment security gains used to augment income.

Whether these abnormalities reflect a fundamental change in banking portfolio characteristics or merely the lagged effect of the volatile economics of the early 1980s remains in debate. Evidence of a long-term industry-wide decline remains inconclusive.

Bank performance in the Midwest strengthened in 1986, as improvements at banks in the industrial portions of the area teamed with moderating stresses at agriculturally based banks. In general, the decline in problem loan levels at agricultural banks offered some prospect of moderation in the stresses these firms have experienced during the disinflationary 1980s.

---

[1] All data is derived from the Quarterly Reports of Condition and Income filed by all banks with their Supervisory Agency. Average assets are calculated using memoranda item 9 on Schedule K of the Call Report.

[2] See Profitability of U.S. Commercial Banks, *Federal Reserve Bulletin*, Vol. 72, September, 1986, p. 625 Board of Governors of the Federal Reserve System, Washington, D.C.

[3] For a more detailed study of large bank earnings performance, see "Recent Trends in Bank Profitability," *Staff Study*, 1986, Federal Reserve Bank of New York.

[4] All data for the Seventh District are based on weighted averages. Because Continental Illinois National Bank and Trust Company and First National Bank of Chicago hold 19 percent of Seventh District banking assets, and therefore strongly influence performance measures, their results have been excluded from the data.

[5] For more background on the financial performance of agricultural years see George Gregorash, "Lean Years," *Economic Perspectives*, Vol. 9, November-December, 1985, pp. 17-28, Federal Reserve Bank of Chicago.

[6] Ag banks are defined as those with ag loans equal to or exceeding 30 percent of total bank loans. Ag loans in this study are derived from Call Report data, schedule RC-C, line 3, loans to farmers, and do not include real estate loans secured by farmland.

Would banks buy daytime fed funds?

Richard D. Simmons

Everyday, an average of more than $400 billion flows through Fedwire, the large dollar wire transfer system run by the Federal Reserve.[1] The wire transfers composing this flow of funds routinely cause many banks to overdraft their accounts at the Fed during the day.[2] In fact, many banks frequently incur these "daylight overdrafts" in amounts which exceed their capital. Aggregated across all banks, daylight overdrafts on Fedwire and other wire systems sum to an incredible $70-80 billion each day. These overdrafts are important because they represent substantial credit risk to the Fed for Fedwire daylight overdrafts, and to receiving banks for daylight overdrafts on other wire transfer systems.[3]

This paper considers what might happen to the fed funds markets if the limits or "caps" on Fedwire daylight overdrafts (DODs) were significantly lowered.[4] Currently, caps are not very restrictive and banks are finding relatively inexpensive ways to reduce DODs (e.g., by adjusting the timing of various intraday inflows and outflows, substituting various term fed fund instruments for overnight fed funds, etc.). However, if caps become restrictive and alternative ways to lower DODs become too expensive, the current fed funds markets would probably be supplemented. Two alternatives, a separate intraday fed funds market and a separate overnight fed funds market with 24-hour maturities, might develop to allow participants to balance their intraday funding positions with their overnight positions.[5] These two innovations could be operationally feasible, would reduce DODs and associated risks, and would maintain the efficiency and usefulness of the large dollar wire transfer systems. Finally, the paper discusses the likely effect of an intraday funds market on corporate customers.

Background

Over the last ten years, systemwide DODs and related types of overdrafts have grown quickly, causing the Board of Governors to become concerned about the associated risks. To reduce these risks, the Board issued a policy statement that allows most banks to set their DOD caps if they perform a self-analysis of their ability to control their DODs.[6] To do this, banks rate their own creditworthiness, credit policies, and operational controls according to the Board's guidelines. For any given bank, its self-assessment rating is combined with its adjusted primary capital to obtain a voluntary daily cap on the bank's DODs ranging from 0 to 300%, and an average bi-weekly cap ranging from 0 to 250% of the bank's adjusted primary capital.[7] Based on this self-assessment, relatively nonrestrictive caps came into effect on March 27, 1986, to allow banks to become accustomed to controlling DODs. The Board's policy is not meant to condone DODs below the cap, and in fact the Board has stated its intention to lower caps over time.[8]

The fed funds problem

Overnight fed funds transactions are a significant cause of DODs at many large banks. This is because most large banks borrow overnight fed funds from many different lenders as a regular source of funding and to meet their required reserves.[9] These funds are returned early the next morning, which adds to large borrowing banks' DODs until these banks reborrow overnight funds later in the day. Large banks in states that restrict branching are especially affected because such banks have limited deposit-gathering abilities and rely more heavily on overnight fed funds purchased.

With tight enough caps, some large banks would need to obtain additional funds during the day in order to remain within their caps and to continue business as usual. This could be accomplished by switching from overnight to continuing contract or term fed funds,[10] by borrowing extra overnight funds in the morning and reselling them in the afternoon, or by

Richard D. Simmons is an associate economist at the Federal Reserve Bank of Chicago. Special thanks are due to Herbert Baer, Douglas Evanoff, Robert Laurent, David Mengle, and various staff members at the Board of Governors for valuable comments. The views expressed are those of the author and do not necessarily represent those of the Federal Reserve Bank of Chicago or of the Board of Governors.

selling liquid securities in the morning and buying similar securities in the afternoon.[11] Such methods create an artificial intraday funds instrument. These banks might prefer to purchase an actual intraday instrument. At least one bank has already drafted a contract to sell intraday funds. Alternatively, large banks could lower their DODs by delaying fed fund repayments or purchasing overnight fed funds earlier in the day. Taken to its logical conclusion, a market for 24-hour fed funds would develop.

Intraday fed funds market

An intraday fed funds market would be an efficient way to redistribute daytime funds, at a price, from banks that have relatively little need for these funds to banks that have a greater need. A typical intraday funds transaction would involve funds moving from lender to borrower in the morning (e.g., at 9:00 AM) and returning later in the day (e.g., at 4:00 PM). The specific times for each transaction could vary. If caps became tight enough and an intraday fed funds market were to develop, this market would likely be a competitive, over-the-counter market.

Although some people may view the risks associated with DODs and intraday fed funds as identical because DODs and intraday fed funds are both intraday extensions of credit, it can be argued that substantial differences would exist. With DODs, the Fed accepts significant credit risk. In addition, since the bulk of the dollar value of DODs is caused by relatively few banks, this risk is poorly diversified. Further, the Fed receives no compensation either for accepting this credit risk or for eliminating the systemic risk from DODs by guaranteeing immediate and final funds over Fedwire. Moreover, individual private lenders are likely to be more adept at short term credit evaluation than Federal Reserve banks.

Credit extensions generated by an intraday fed funds market would differ in several respects from credit extensions generated by DODs at the Fed. First, the explicit pricing of intraday fed funds would permit a more efficient allocation of daytime reserve account balances than currently exists. Second, the intraday fed funds interest rate would be generated by the market, which would free the Fed of the need to identify an appropriate intraday rate to achieve such an allocation. Third, a significant reduction in credit risk from intraday credit exposures between banks and the Fed would occur because the intraday interest rate would give banks and corporations an economic incentive to rearrange the timing of their wire transfers. However, shifting a portion of the Fed's intraday exposure to the private banking system would create systematic risk that does not exist with DODs at the Fed. Fourth, intraday fed fund exposures would be spread across more banks with more capital, so aggregate intraday credit risk would be more diversified than under the current system. Finally, an intraday market would give the banking system additional flexibility in managing unexpected shifts in daytime balances.

If caps become restrictive enough and intraday funds become the least expensive means to remain within these caps, bankers will face the administrative problem of making intraday funds operationally feasible. Several ways in which bankers could overcome this problem include timing standardization, priority messages, bilateral contracts, and two-tiered pricing (See Box).

Intraday supply and demand

Many banks should be willing to supply funds to an intraday funds market, for the following reasons. First, many banks consistently have positive daytime balances in their accounts at the Fed. Since overnight fed funds are returned early in the morning, banks that currently sell overnight funds could also generally sell a similar amount of intraday funds. Typically, these banks would not lose any overnight investment opportunities, since repayment of intraday funds would be received before the end of the day. Second, to the extent that many of these banks have relatively few corporate customers, these banks may not need to hold funds during the day for unexpected corporate wire transfers. Third, extending intraday credit to large borrowing banks would represent a new opportunity for many banks to increase their interest revenues. Last, adjusting operations to supplement overnight fed funds sold with intraday fed funds sold should be relatively simple, especially for the many banks that sell all of their overnight fed funds to one or a few correspondent banks.

Operations

For an intraday market to function, funds must move in time to have the desired daylight overdraft effect. Intraday funds would be sent over Fedwire if the Fedwire DOD portion of a bank's cap were binding, and could be sent over either CHIPS or Fedwire if the CHIPS portion were binding.

With such a market, some banks may develop real time posting and monitoring capabilities to gain information in a timely fashion. These capabilities would help banks decide when to borrow or sell in the intraday market, as well as when to charge and indirectly credit corporate accounts for intraday balances. Banks would develop billing procedures for intraday charges and credits. In addition, banks would write agreements specifying terms, such as penalties or additional interest charges due if receipt of funds were late because of unexpected computer downtime or for other reasons.

One can envision the development of a fed funds market where large banks would become over-the-counter dealers for intraday funds. Banks could set up and use various timing arrangements for moving these funds. For example, the timing of borrowing and repayment could be negotiated between the buyer and seller every time a transaction occurs. Such flexibility would be helpful in adjusting to day-to-day variances, unexpected inflows or outflows, and DOD forecasting errors. Alternatively, a buyer and seller could negotiate a timing standard, and use it until either party seeks a change. This would eliminate the need to negotiate timing every time a transaction occurs. A third option could be for an industry group to recommend common times for both borrowing and repayment. In addition to eliminating the cost of renegotiating the timing of each transaction, this timing standardization alternative could increase liquidity and volume in the intraday market. Currently, standardization of risk facilitates securitization of assets such as residential mortgages. Standardization also facilitates liquidity in the secondary T-bill market. These timing arrangements would obviously be most useful for decisions planned in advance. Of course, other timing arrangements would also be feasible, and a bank would use alternatives as it deemed appropriate.

Reducing arrival uncertainty

With more restrictive DOD caps, bankers would want more certainty regarding when their funds would arrive over Fedwire. In fact, they would hesitate to buy or sell intraday funds until their uncertainty is sufficiently decreased. Therefore, an intraday funds market would likely require more timely Fedwire transfers than are now needed. Currently, arrival of funds could be delayed due to computer outages, long computer queues, human errors at either the sending bank or the Fed, or an array of other reasons. Under current operating rules, Fedwire does not make any guarantee about when funds will arrive at the receiving bank. Fedwire only guarantees that upon arrival, funds will be immediately and irrevocably available. Some combination of the following three approaches or other innovations should help minimize delays and decrease bankers' uncertainty regarding arrival times of Fedwire transfers.

One approach, development of "priority" Fedwire messages, might reduce this uncertainty by providing a separate, and on average a shorter queue time for high priority transfers than currently exists for Fedwire. Priority Fedwire messages would likely require sending and receiving banks to install additional hardware beyond that currently used for Fedwire messages. Although banks seem fairly satisfied with the timeliness of Fedwire transfers at present, if banks were to develop a strong enough

need for shorter queues, such a demand could be satisfied. Since banks' demand curve for Fedwire transfers appears to be relatively inelastic,* the price of priority Fedwire messages would probably have to be significantly above that of other Fedwire transfers to avoid having nearly all Fedwire messages eventually shift to priority messages.

A second approach to reducing the uncertainty regarding arrival times could be for the Fed to offer a new service which would allow banks to prearrange Fedwire transfers. Prearranged transfers could reduce the uncertainty by eliminating the risk that the sending bank would unintentionally cause a delay. This service could accommodate fed funds transfers or other Fedwire transactions and could be especially useful for repetitive transfers. The Fed's liability for this new service could be exactly as it currently is for Fedwire transfers. Alternatively, the Fed could guarantee the arrival time for DOD monitoring purposes only, with little additional liability, in order to stimulate development of an intraday funds market and reduce DODs. In either case, prearranged transfers would be sent even if the sending bank had computer outages or other operational problems. If funds were not sent by the Fed on time, or alternatively if funds did not arrive on time, the Fed could take this into account in monitoring a bank's DODs and imposing moral suasion costs or other charges.

A third approach could be a two-tiered pricing system which could discriminate between intraday funds returned in time to be lent out to another borrower, and those returned too late. (Two-tiered pricing could also be applied to overnight funds and full-day funds.) If a bank returned intraday funds too late for the intraday seller to lend those funds out overnight, the intraday borrower would have to pay the overnight rate plus some further penalty, in addition to the intraday rate. In that case, the seller would be compensated if the lateness unexpectedly forced it to buy overnight funds in the market. More realistically, the penalties might be added if the funds were not returned by a pre-arranged time negotiated in advance between the two banks. A bank seeking to avoid these penalties but facing uncertainty regarding arrival time could aim to have the funds arrive slightly before the specified time, with very little loss in usefulness of these funds.

*Reichert, Strauss, and Merris (1985), p. 227. In their model of Fedwire transaction volume, price changes were not statistically significant in explaining variations in volume. They concluded that demand for Fedwire was inelastic.

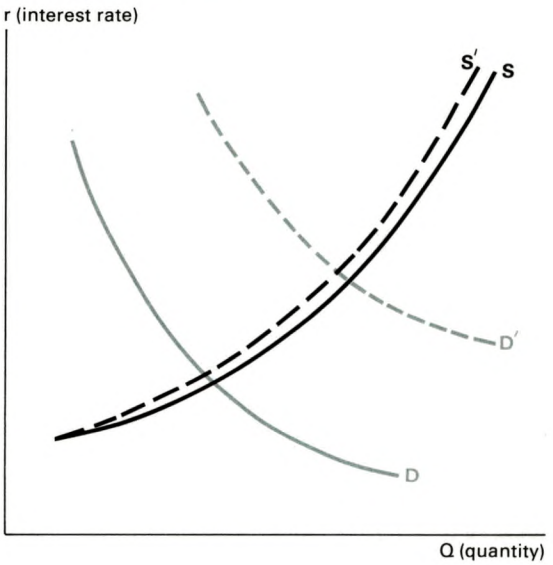
Intraday supply and demand would be determined by: 1) Banks' accuracy in forecasting DODs; 2) The shadow price of DODs, which includes an intraday interest rate as well as expected moral suasion costs imposed by the Fed; 3) The aggregate shortage of intraday funds relative to caps; 4) Aggregate unused cap capacity; 5) The value of any other intraday opportunities, or the costs of alternative means of reducing DODs; 6) The extent to which an intraday funds market gains market acceptance and 7) The transaction costs of trading intraday funds. Demand for intraday funds is currently zero because caps are so high and because less expensive means of staying within caps are still available. Therefore, a market for daytime funds has not yet developed in the industry.

Three groups of banks could participate in an intraday market.[12] Before any intraday funds trading occurs, Group 1 banks will generally have positive daytime Fed balances. Group 2 banks will generally incur DODs but will remain within their caps. Group 3 banks will frequently incur DODs in excess of their caps. Group 1 banks would be potential sellers of intraday funds, while Group 3 banks would be potential buyers. Group 2 banks could be sellers, buyers, or neither. If caps are reduced further after an intraday funds market develops, demand for intraday funds would increase, because borrowers would need more intraday funds to remain within their increasingly re-

strictive caps (see Figure 1). In addition, the supply of intraday funds would decrease, though only slightly, because most intraday funds would be supplied by unaffected Group 1 banks, and comparatively few intraday funds would be from Group 2 banks facing more restrictive caps. Since demand would increase and supply would decrease, further reducing caps would cause the intraday interest rate to rise.

An intraday fed funds market appears to be operationally feasible (See Box). Such a market would provide an effective way for banks to remain within their caps even if caps were significantly reduced, because an intraday funds market would improve the intraday allocation of funds among banks' reserve account balances. This market could reduce systemwide daylight exposures and associated risks as well as the exposures from specific large banks. Finally, an intraday funds market would keep payments system efficiency intact.

Figure 1
Effects of the intraday funds market as caps are reduced



Full-day fed funds

Another approach to lowering DODs by better aligning banks' daytime positions with their overnight positions is 24-hour or full-day fed funds. Since many aspects of full-day funds are similar to those already discussed for intraday funds, the discussion here will be brief.

Full-day funds could eliminate most or all of the DODs currently caused by repaying overnight funds, even if banks found it too costly to guarantee that the actual duration exactly met the contractual 24-hour maturity. If the return of full-day funds coincided exactly with the receipt of new funds for the next full day, the fed-funds-caused DODs would be completely eliminated. If the seller was late in providing funds, the actual duration of the loan would be slightly under 24 hours. Even so, such funds could be used effectively to eliminate most of these DODs, as long as any window between receiving and repaying such funds occurred outside peak DOD hours. The exact time could vary for each transaction and each pair of banks could decide how to handle late receipts of funds. Full-day funds could be especially useful for banks that would otherwise buy similar amounts of intraday and overnight fed funds from the same sellers.

If large banks switched their borrowing from overnight funds to 24-hour funds, they would effectively eliminate the DODs they now incur from repaying overnight funds. Conversely, if lenders of overnight funds switched to lending 24-hour funds, they would no longer have these funds during the day. This would lower lenders' daytime balances to their (still positive) overnight levels, all else constant.

Full-day funds would provide a more stable funding source and investment opportunity than would an artificial 24-hour instrument formed by combining overnight and intraday funds. In addition, full-day funds would require only half as many transfers, which would reduce transaction costs and the frequency of arrival uncertainty. As explained in the box, arrival uncertainty is the uncertainty regarding exactly what time funds will arrive. Full-day fed funds would also decrease the frequency of funding/investment decisions and reallocate the distribution of daytime funds throughout the banking system. This would reduce risk to the Federal Reserve because intraday exposures from large banks and throughout the system would be significantly reduced.

Once these markets became operational, full-day funds could be used for one day or they could be rolled over. If used for one day, they would be a new financial instrument. If used for more than one day, they would be equivalent to rollover or continuing contract fed funds, except that the first and last days would

now be 24-hour days. In either case, full-day funds would fit easily with current instruments from operational and trading viewpoints. In addition, banks would use the same methods to reduce their uncertainty regarding when full-day funds would be received as they would for intraday funds (See Box).

Since intraday and 24-hour funds are tailored to slightly different needs, banks would have the most funding and investment opportunities, and daytime funds would be allocated most efficiently, if both intraday and full-day fed funds markets developed. Full-day funds would be an appropriate substitute for banks that buy overnight fed funds as a regular source of total funding. Intraday funds would be best used to fulfill remaining daytime needs, after shifts from overnight to full-day funds stabilize.

How much could intraday and full-day funds help?

Based on a 1981 survey of net fed funds purchased by banks with deposits in excess of $1 billion, if an additional 24 percent of the dollar value of overnight fed funds purchased by all of these banks would shift from overnight to term fed funds, 81 percent of the dollar value of DODs at these banks would have been eliminated.[13] Similar results would have occurred if 24 percent of overnight total fed funds had been supplemented by intraday funds or had been converted from overnight to full-day funds. Since only 25 percent of the dollar value of fed funds in 1984 were estimated to be continuing contract or term, rearranging another 24 percent would still allow about 50 percent of overnight fed funds to remain unsupplemented.[14]

DODs could become a larger concern for small banks if overnight fed funds shifted to full-day funds, or were supplemented by intraday funds. Since such shifting would allow the buyer rather than the seller to hold the funds during the day, some sellers might incur DODs and find their caps becoming restrictive. A seller could alleviate this problem by rearranging a smaller portion of its overnight fed funds sold.

Impact on corporations

With an explicit intraday interest charge, banks and corporations would probably develop real time posting and monitoring capabilities (at least for large transactions) to gain needed information on daytime positions.[15] Recently, the Board approved a proposal to require a standard format for third-party payment information over Fedwire.[16] This would allow banks automatically to credit corporate accounts and to better monitor corporate intraday balances.

If large banks and corporations improve their posting and monitoring capabilities, and if an intraday fed funds market develops, then many banks will likely pass some of their explicit intraday revenues (or costs) to corporations having positive (or negative) daytime balances. This would cause three changes for corporations, as follows.

Change #1: Many banks currently sweep funds from a corporation's demand deposit account into an overnight repurchase agreement (repo) automatically at the end of each day and back again each morning—since banks are prohibited from paying interest on demand deposits. However, if caps become restrictive enough to cause an intraday funds market to develop, the intraday rate (i) will become positive. Assuming the full-day rate (f) remains unchanged, which would be necessary if term rates (e.g., 7-day, 3-month, 1-year, etc.) were to remain unchanged,[17] then the overnight rate (o), which is the rate a corporation receives as interest on its repo, would fall according to the equation: $(1+f)=(1+i)(1+o)$.[18] Currently, the intraday rate equals zero ($i=0$), so the full-day rate equals the overnight rate ($f=o$).

Since overnight repos would no longer earn explicit interest at rate (f), banks might give corporations free services or other indirect credits for holding daytime compensating balances in the form of demand deposits. These indirect credits would accrue at a rate below (i) due to the variance of demand deposit balances and thus the lower usefulness of these funds to banks. Therefore, corporations' explicit interest revenues from repos should fall, but their indirect credits should rise to partially offset this fall. A corporation could invest in full-day repos instead of overnight repos to keep explicit interest revenues on its repos the same, but these funds would then not be held in the corporation's demand deposit account.

Change #2: Charging and crediting corporations for daytime balances would motivate corporations to reallocate their intraday funds

among their banks and to consider through which banks they wish to send and receive wired funds. Since the exact rates banks would use to charge or indirectly credit corporations for daytime balances would vary across banks, corporations would have larger daytime overdrafts at banks that pass on relatively small intraday charges, and higher positive balances at banks that give relatively high indirect credits. Subject to receiving adequate service, corporations would reallocate their intraday funds and intraday overdrafts in order to maximize profits (or minimize costs). These changes would re-distribute intraday funds to banks that have a greater need for them, and would decrease DODs systemwide, but would not affect the overall level of intraday funds in the banking system.

Change #3: If an intraday market develops, corporations may choose to delay certain of their wire transfers. In general, corporations would send funds from banks where they have positive daytime balances, so the choice of a sending bank would change. This decision would be part of deciding what level of daytime funds to hold at each of a corporation's banks. Corporate transfers would be delayed only when it was convenient and cost effective to do so, and when the corporation did not have sufficient daytime balances at any of its banks to cover these transfers. Money managers would compare the intraday interest expense, or lower interest revenue, with the urgency for sending a particular wire transfer. Urgent transfers would be sent when needed. Other transfers could be sent later in the day, and arrangements would be made to alter the timing of future transfers to be most efficient.

Conclusion

If daylight overdraft caps are lowered enough, bankers would have strong incentives to develop means to reduce the uncertainty about when sizable wire transfers will arrive. These means could include timing standardization, priority Fedwire messages, prior agreements on when funds will move, two-tiered pricing, or other market innovations. When such means are developed, markets for intraday and full-day fed funds would develop.

Full-day funds would be most useful for banks that regularly buy overnight fed funds to balance their own books and incur daylight overdrafts by repaying these overnight fed funds early the next morning. Intraday funds would be most useful for reallocating the remaining intraday balances in Fed accounts from banks with excess intraday funds to banks with restrictive caps.

It is possible that some minimum level of systemwide DODs is necessary and would remain even after corporations and banks rearrange as many funds transfers as is economically beneficial. This remaining level of DODs can be thought of as the lubricant needed for the payments machine to operate smoothly. If caps are tightened enough, a market for daytime funds would develop, corporate daytime balances would be priced, and the necessary lubricant and associated risks would be minimized. Systemwide intraday funds would be distributed in a more efficient sense with regard to lowering DODs and related risks at individual banks and throughout the system, while minimizing disruptions to the payments system.

---

[1] This number excludes book entry transfers. Banks transfer money through Fedwire electronically, via debits and credits to banks' accounts at the Federal Reserve.

[2] In this paper, "bank" refers to any entity which has direct access to a large dollar wire transfer system such as Fedwire or CHIPS.

[3] For the interested reader, several papers present more detailed overviews of daylight overdrafts and their associated risks. See for example E. J. Stevens (1984), Richard L. Smoot (1985), and David L. Mengle (1985).

[4] In this paper, "DODs" refer to Fedwire funds daylight overdrafts. DODs equate to a negative daytime balance in a bank's account at the Fed, after certain technical adjustments and ignoring U.S. Government securities transactions.

[5] This paper addresses what could happen if caps are tightened enough. The paper is not meant to address the likely impact of current proposals which the Board of Governors has published for public comment.

[6] Policy Statement Regarding Risks on Large-Dollar Wire Transfer Systems, Federal Register, Vol. 50, No. 99, Docket No. R-0515, May 22, 1985.

[7] For an overview of the Board of Governors' DOD policy and many ways in which banks might reduce their DODs, see Stevens (1986).

[8] Board of Governors, "Reduction of Payments System Risk: A Manual for Depository Institutions." (undated) p. c-3.

[9] On average, nationwide, banks with assets over $1 billion obtained 6.9% of their total funding from net overnight fed funds purchased (including repurchase agreements). Banks under $300 million were net sellers on average (Sheshunoff, 1986). In this paper, fed fund sales or purchases refer to net sales or net purchases.

[10] Continuing contract fed funds are overnight funds rolled over day to day until either party seeks a change. The borrowed amount can vary each day, and the net change in amount, plus interest, is sent daily. Rollover fed funds are for one amount over an unspecified number of days. Funds are only sent at the initial borrowing and final repayment. Term funds are rollover funds with a specified maturity. Repayment for these three instruments is early in the morning on the final day.

[11] The author benefited on these points by discussions with Allen Berger at the Federal Reserve Board.

[12] For simplicity, this paragraph assumes DOD buffers are zero, which means DOD caps = DOD targets.

[13] Humphrey (1984), pp. 86-89. The survey included fed funds and repos. These DODs include overdrafts caused by purchasing U.S. government securities, although this type of overdraft is not currently included in the calculation of Fedwire funds DODs.

[14] op. cit. (Humphrey, 1984).

[15] Although this section focuses on corporations, the same ideas also apply to other large customers of banks.

[16] "Format for Wire Transfer of Funds," (Federal Reserve Docket No. R-0575), published for comment on June 6, 1986, approved on November 24, 1986, and effective as of April 3, 1989.

[17] This assumes a flat term structure of interest rates and that all else is constant in order to isolate and identify the effects of i becoming positive.

[18] For simplicity, I assume zero transaction costs here.

References

Board of Governors of the Federal Reserve System. *Reduction of Payments System Risk: A Manual for Depository Institutions.* Washington: (Undated) p. C-3.

_____ "Format for Wire Transfer of Funds," *Federal Register*, vol. 51, no. 112 (June 11, 1986), pp. 21246-21247.

_____ "Policy Statement Regarding Risks on Large-Dollar Wire Transfer Systems," *Federal Register*, vol. 50, no. 99 (May 22, 1985), pp. 21120-21130.

Humphrey, David B. *The U.S. Payments System: Costs, Pricing, Competition and Risk.* Monograph Series in Finance and Economics, No. 1984-1/2. New York: Salomon Brothers Center for the Study of Financial Institutions, Graduate School of Business Administration, New York University, 1984.

Mengle, David L. "Daylight Overdrafts and Payments System Risks." Federal Reserve Bank of Richmond, *Economic Review* vol. 71, (May/June 1985), pp. 14-27.

Reichert, Alan K., William Strauss, and Randall C. Merris. "An Economic Analysis of Short-Run Fluctuations in Federal Reserve Wire Transfer Volume." *Journal of Bank Research*, vol. 15, (Winter 1985), pp. 222-228.

Sheshunoff 1986, vol. 2, Nationwide Balance Sheet, p. VI.1.

Smoot, Richard L. "Billion-Dollar Overdrafts: A Payments Risk Challenge," Federal Reserve Bank of Philadelphia, *Business Review* (January/February 1985), pp. 3-13.

Stevens, E. J. "Reducing Risk in Wire Transfer Systems," Federal Reserve Bank of Cleveland, *Economic Review* (Spring 1986), pp. 17-22.

Stevens, E. J. "Risk in Large-Dollar Transfer Systems," Federal Reserve Bank of Cleveland, *Economic Review* (Fall 1984), pp. 2-16.

FRB CHICAGO ECONOMIC
PERSPECTIVES

Public Information Center
Federal Reserve Bank
of Chicago
P.O. Box 834
Chicago, Illinois 60690

Do Not Forward
Address Correction Requested
Return Postage Guaranteed

BULK RATE
U.S. POSTAGE
PAID
CHICAGO, ILLINOIS
PERMIT NO. 1942