Why commercial banks sell loans: An empirical analysis

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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

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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

Regulatory taxes	Expected sign
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)

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*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 proba-

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

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

**Variable not statistically significant in the model.

bility of selling loans would rise by more than 7 percentage points.

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

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.

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-

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

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.

and 7 percent would sell loans equal to 6.1 percent of its assets.

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 non-interest 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.

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