

# Economic Review

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Ramon Moreno

Saving, Investment, and the  
U.S. External Balance

Carl E. Walsh and  
Peter R. Hartley

Financial Intermediation, Monetary Policy,  
and Equilibrium Business Cycles

Randall Johnston Pozdena

Banks Affiliated with Bank Holding Companies:  
A New Look at their Performance

Ronald H. Schmidt

Hotelling's Rule Repealed?  
An Examination of Exhaustible Resource Pricing

# Banks Affiliated with Bank Holding Companies: A New Look at their Performance

Randall Johnston Pozdena

*The bank holding company (BHC) form of organization has a number of advantages for banking firms. It also is the form that many are recommending be used to enforce corporate separation of traditional banking from expanded banking activities. This paper examines the influence of BHC affiliation on bank behavior. The literature on this subject is large, but has ignored an important potential source of bias. The measured effects of BHC affiliation generally are larger when this bias is treated statistically using a technique described in the paper. BHC-affiliated banks do appear to behave differently than their non-affiliated counterparts, a finding that does not augur well for using this organizational form to isolate a bank from the effects of nonbank activities.*

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The bank holding company (BHC) form of organization has a number of advantages for banking firms, but analysts have argued that such an organizational form also may lead to changes in the behavior of banks affiliated with BHCs. In the 1960s and 1970s, the rate of formation of BHCs was very rapid, leading to increased concern that this organizational form would have adverse effects on bank performance.

This interest in the effects of BHC affiliation on bank performance has been revived recently as part of the debate over the expansion of bank powers. Many are recommending that expanded powers be placed in nonbank subsidiaries of bank holding companies as a means of insulating the bank from any risks arising from those new activities. The assumption is that if the new, nonbanking activities are "corporately" separate from banking activities, the behavior and financial soundness of the bank will be unaffected. An examination of the effect of BHC affiliation on the performance of banks may shed some light on this debate. To the extent that affiliation with a bank holding company affects bank behavior, expectations about the effectiveness of the BHC structure in insulating banks from other activities in the BHC may be too sanguine.

The methodology for examining the influence of BHC affiliation has been quite straightforward. Analysts have compared the income and portfolio characteristics of affiliated banks with those of banks that are not affiliated with a BHC. To ensure that other characteristics of the banking organizations do not bias the comparisons, various statistical control methods have been used. Most commonly, each affiliated bank is "matched" with an unaffiliated bank in size, location, or other attributes. Any differences in performance are then attributed to the affiliation status of the banks. Alternatively, econometric techniques have been employed to control for the diverse characteristics of affiliated and non-affiliated banks. Both types of studies have found important differences in the behavior of BHC-affiliated and non-affiliated banks.

These analyses implicitly assume that, except for their organizational form, affiliated and non-affiliated banks are identical. If they really are identical, however, why are some banks part of BHCs and others not? It seems likely that there is some tendency for self-selection processes to bias simple comparisons of the behavior of affiliated and

non-affiliated banks. Banks that choose to become part of holding companies may have more aggressive management, for example. This may influence observed performance, and simple comparisons with non-affiliated banks will detect the differences. In this case, it may be incorrect to attribute the cause of these differences to the affiliation status. With the renewed importance of understanding how banks behave in different organizational contexts, it would be useful to reexamine the behavior of affiliated banks and to correct, if possible, for the effects of self-selection processes.

The purpose of this paper is to explore the possible influence of self-selection bias on the typical findings regarding the behavior of BHC-affiliated banks. By using simple techniques to control for self-selection in the affiliation decision, I obtain results that differ from many tradi-

tional findings. Some of my findings are more consistent with the theory of why banks affiliate with BHCs in the first place.

In the first section, the reasons why banks choose to affiliate with a BHC and the theoretical implications for bank behavior are reviewed briefly. In Section II, the conventional techniques for evaluating the effect of BHC affiliation are examined, along with the findings that such studies have produced. This section also presents the concept of self-selection bias and discusses the various methods to control for such a bias. In Section III, a statistical control technique is applied to data from a sample of western banking organizations. The paper concludes with a summary and discussion of the policy implications of this research.

## **I. Bank Holding Company Affiliation: The Economic Implications**

To understand why affiliation of a bank with a BHC might affect the bank's behavior, it is important to discuss the motivations for BHC affiliation. These motivations involve both operational and tax advantages of the BHC form of organization and explain formations of both one-bank and multi-bank holding companies.

### **Motives for BHC Formation**

The numerous operational advantages of BHC affiliation derive largely from distortions introduced by regulation and law. First, the activities of non-affiliated banks traditionally have been restricted by regulation to endeavors related to conventional banking business. One way a banking organization may expand its range of activities is to affiliate with a bank holding company.<sup>1</sup> A bank holding company may engage in a variety of activities through the nonbank affiliates of the bank; the affiliated bank thus may gain advantages from joint marketing or production of services with these subsidiaries.

Second, banking organizations structured as holding companies also can avoid some of the laws that restrict branching in certain states. By acquiring individual banks and maintaining them as separate subsidiaries of a BHC, such a banking organization and its bank subsidiaries may be able to enjoy geographical portfolio diversification, economies of scale, and other benefits that accrue to branch bank structures. In fact, the multi-bank holding company structure is common in states with laws that restrict branching by individual banks.

Third, bank holding company affiliation affords a banking organization greater flexibility in financing its activ-

ities. For example, shares of equity in holding companies are more liquid than shares in individual banks. Banks generally may not repurchase their own stock, though a BHC may. By forming a one-bank holding company, therefore, the shareholders of an existing bank effectively obtain increased marketability of their assets. The debt securities of the BHC also enjoy favorable reserves treatment compared to the same securities of a bank. Specifically, BHC non-deposit debt is not subject to reserve requirements, whereas similar obligations of a bank are.

Affiliation with a BHC, particularly prior to 1982, also was used as a mechanism to avoid capital regulation at the bank level. Specifically, the minimum proportion of equity (vs. debt) used to finance a bank's assets is regulated as a means of limiting bankruptcy risk in the banking system. Through means of a bank holding company structure, the affiliate bank's equity (capital) can be provided partly by the BHC. To the extent that the BHC funds its equity investment in the bank via issuance of debt at the parent level, the organization is able, in effect, to avoid leverage constraints imposed at the bank level. This practice, known as "double leverage," is defined by the Federal Reserve as the ratio of the equity in banks and nonbank subsidiaries to the equity in the parent BHC. The ability to double lever equity investments in a bank thus is a potential advantage of the BHC form of organization.

Since 1982, bank regulators have taken steps to limit this practice by coordinating capital regulation of banks and BHCs. Both the bank and the consolidated BHC (that is, the bank, the parent BHC, and the nonbank subsidiaries, with their interorganization obligations netted out) must

maintain the same ratio of capital to total assets. This does not completely eliminate opportunities for double leverage of the bank's capital, however, since capital in nonbank subsidiaries can be manipulated to create the appearance of more capital in the bank (although regulators try to monitor nonbank capital).<sup>2</sup> In addition, there are differences in the treatment of goodwill and certain types of debt on the books of the BHC versus those of the bank that tend to have the effect of creating double leverage opportunities. Also, for banks under \$150 million in assets, up to 300 percent double leverage is permitted by regulation. Thus, the BHC form of organization still may be perceived as offering opportunities to loosen binding bank capital regulation.

Double leverage also creates a tax-related incentive for using the bank holding company form of organization. It involves the tax treatment of dividends generated by a banking organization. If the bank is owned directly by private shareholders, dividends paid to these shareholders are non-deductible expenses of the bank, taxable to the shareholder at his personal tax rate. If the bank, instead, is owned by a bank holding company, 85 to 100 percent of the dividends are deductible at the bank level (that is, they may be passed essentially tax-free to the parent BHC). To the extent that the parent BHC can use debt to finance its activities, these "upstreamed" dividends can be converted, in effect, to deductible interest expenses. Thus, an investor desiring to finance banking activities with a given proportion of debt and equity enjoys better tax treatment if he does so through a holding company rather than through direct, private ownership of the bank.

There are potential disadvantages to BHC affiliation as well, since the holding company form of organization is more complex in a legal sense, and regulation of BHC-affiliated banks differs from that of non-affiliated banks. Specifically, BHC affiliation brings the banking organization under the regulatory *aegis* of the Federal Reserve System, which is charged with implementing bank holding company law. In general, the range of activities permitted BHCs by federal law and regulation is not as broad as that permitted by some state bank charters. Nonetheless, the advantages appear to have outweighed the disadvantages historically, as the proportion of banks affiliated with BHCs has increased steadily.

### Implications for Behavior

The advantages of BHC affiliation discussed above have fairly straightforward implications for the *consolidated* organization. Since shareholders have an interest in financing and operating the banking organization as a whole in a value-maximizing manner, the influence of affiliation

should be reflected in enhancement of aggregate shareholder wealth and in the superior ability of BHC organizations to compete in providing financial services. There is some evidence for this. For example, the BHC organizational form does seem to be competitively superior because it has come to dominate American banking market structure.<sup>3</sup> Nonetheless, it would be desirable to observe the improved (or degraded) value of the affected entity directly. Most research on the effects of BHC affiliation has not focussed on the consolidated entities, however, but rather on the affiliate banks. There are two reasons.

First, studies of the consolidated enterprises are inherently difficult to conduct. To study directly the effects of affiliation on shareholder wealth, good estimates of the market value of equity must be available. Since most banking organizations are relatively small, closely held companies, estimates of the market value of equity (with or without affiliation) are not easily derived. It is possible to narrow one's focus to the larger banking organizations whose shares are actively traded, but the number of such institutions is small and the effective sample size in such studies compromises these efforts.<sup>4</sup>

The second reason that research has not focussed on the consolidated entity also is a pragmatic one. Policy interest in the bank holding company movement has been focussed on the implications of affiliation on *bank affiliate* behavior. This is natural, since lawmakers and regulators view the subsidiary bank as the entity delivering banking services; a different corporate structure and method of corporate control might well influence such an affiliate's behavior. However, the link between the motives for BHC formation and the likely behavior of bank affiliates generally does not follow in an obvious way from the motives for BHC formation.

Consider, for example, the potential influence of BHC affiliation on the profitability of the subsidiary bank. The underlying motivations for affiliation suggest only that the profitability of the *consolidated enterprise* would be higher with affiliation. The profits of the affiliated bank *may* be higher if the affiliation produces scale or scope economies for the bank affiliate. These may not appear at the bank level, however, if the way in which the bank funds or compensates other units in the holding company is through payment of fees (implicitly or explicitly) rather than through upstreaming of dividends to the parent holding company. Indeed, if inter-affiliate fees are high enough, it would be consistent with theory to find measured net bank income *lower* in affiliated banks (even though consolidated company earnings are improved by affiliation).

Similarly, the effects of affiliation on the capital position

of the bank also are ambiguous. If, for example, the desired use of debt is greater than is permitted at the bank level and the parent funds subsidiary bank equity with debt to relieve the regulatory constraint, then affiliation might result in increased capital at the bank level. If, on the other hand, regulatory capital constraints are not binding, a bank affiliated with a BHC might *reduce* its capital—redeploying it to fund the sister affiliates of the bank. This would be consistent with a view that the benefits of affiliation flow not from the double leverage opportunities afforded the BHC, but rather from the economies offered by the expanded scope of activities.

The influence of affiliation on the portfolio composition of banks also has been a concern of policy makers. One

likely possibility is that bank portfolios become less diversified or otherwise riskier because diversification opportunities exist elsewhere in the holding company. On the other hand, the BHC form of organization avoids branching constraints and thus permits greater geographical diversification of lending activity and reduced portfolio risk.

These theoretical ambiguities, coupled with the focus of policy-makers on banks, rather than on consolidated banking organizations, makes the effect of BHC affiliation on bank behavior an empirical matter of some importance. It is a matter of increasing policy relevance, too, as lawmakers debate the appropriate organizational form in which to vest expanded powers.

## II. Studying the Impact of Affiliation

The effect of BHC affiliation on bank behavior has received considerable attention from banking analysts. Over 50 studies published since the late 1960s have examined the effect of BHC affiliation on the performance of the subsidiary bank.<sup>5</sup>

Both simple means and frequency comparisons, as well as more sophisticated econometric techniques, are employed in this type of BHC research. Both types of studies employ techniques to control at least partially for the wide variation observed in bank characteristics and market conditions. In the simple statistical studies, the variation in bank characteristics is controlled by comparing the behavior of a bank after affiliation with its own behavior before affiliation. To control for changes in overall banking market conditions, the changes in the affected banks' performance are compared with the changes in performance observed in a "paired" sample of unaffiliated banks. The "pairing" involves identification of a non-affiliated bank of approximately the same size as the affiliated bank, located in the same (or a similar) banking market.<sup>6</sup>

In other studies, variation in bank characteristics and market conditions is controlled partially by entering attributes of the bank and the banking market as independent variables in regressions on bank performance measures. An estimate of the effect of BHC affiliation in a cross-section of affiliated and non-affiliated banks can then be observed with a dummy variable indexing the affiliation status of the banks in the sample.

Both types of studies have obtained similar estimates of the effect of BHC affiliation on bank behavior. Specifically, affiliation is found to (1) increase the proportion of loan assets in bank portfolios; (2) increase the proportion of state and local obligations; (3) increase loan fees and

interest charges; (4) reduce holdings of cash and U.S. Treasury securities; and (5) with less regularity, increase deposit rates.<sup>7</sup> There has been variation in all of these findings across studies, as might be expected given the variation in models, samples, and statistical techniques. But the BHC affiliation studies have been striking in their tendency to find significant differences in the behavior of affiliated and non-affiliated banks.

In general, however, the findings have been particularly weak regarding the effects of affiliation on profitability and capital ratios—effects crucial to formulating regulatory implications. By using either paired comparisons or econometric models, little change is found in regulatory capital measures or profitability measures such as return on equity (ROE) or return on assets (ROA).<sup>8</sup>

### Problems with BHC Studies

Bank holding company research has been subject to a variety of criticisms. One is that available statistical controls are insufficient to correct for the great variation in circumstances that contribute to differences in bank behavior observed in the real world. In theory, there should not be much, if any, variation in the performance of affiliated and non-affiliated banks in a competitive market. If sufficient statistical control for variation in market conditions peculiar to individual banks were possible, the observed variation in behavior would vanish. Research on BHC affiliation, therefore, like most bank research, implicitly relies on the existence of disequilibrium, adjustment lags, or imperfections in the extent of competition to introduce durable variations in observed performance and the decision to affiliate.

In addition to this general criticism, specific criticisms of BHC studies concern the particular methods of control. Univariate studies, for example, have been criticized for the bias they introduce in limiting the comparisons to banks of a size that permits “pairing” of observations. Most independent banks tend to be small; using pairing as a control technique thus tends to bias sampling toward smaller institutions.<sup>9</sup> If scale economies or other size-related considerations are determinants of bank behavior, as seems likely, such a sampling bias may be important. The univariate studies also have tended to use pre- and post-affiliation comparisons of bank behavior. This technique has been criticized for failing to control for the time that elapses between independence and affiliation.<sup>10</sup>

Econometric studies have received less fundamental criticism. Most criticisms have been directed at alleged errors of omission or commission in selection of control variables and in the stress placed on simple cross-sectional comparison, rather than the pre- and post-affiliation comparison technique used in the univariate studies.

### Self-Selection Bias

A more important criticism of traditional bank holding company research—both in its univariate and econometric manifestations—is that it has ignored the potential problem of self-selection bias.<sup>11</sup> Self-selection bias arises because the decision to affiliate with a BHC is not random; rather, it is an outcome of the same organizational forces that determine other aspects of bank behavior.

To see how self-selection processes may bias the estimation of the influence of BHC affiliation, consider the typical cross-section regression employed in econometric studies:

$$Y_1 = a + bX_1 + cH + e_1 \quad (1)$$

where  $Y_1$  is a performance measure, such as bank ROE, or a portfolio measure,  $H$  is a dummy variable indicating the bank’s affiliation status ( $H = 1$ , if affiliated, and  $= 0$  otherwise),  $X_1$  is a vector of other bank or market characteristics suspected of influencing performance, and  $a$ ,  $b$ , and  $c$  are coefficients.

The influence of BHC affiliation is measured by the coefficient,  $c$ , on the affiliation variable. For the estimate of  $c$  to be unbiased, however, it must be uncorrelated with the error term,  $e_1$ , in the performance equation. This will be the case if holding company affiliation is assigned independently of the  $X$  variables, but not otherwise.

For example, suppose that a bank chooses to become affiliated with a BHC on the basis of another (unobserved)

factor (such as expectations of future profits) not included in  $X_1$ , which we might call  $Y_2$ . Specifically, if

$$Y_2 > 0, \text{ then } H = 1 \quad (2a)$$

and if

$$Y_2 < 0, \text{ then } H = 0. \quad (2b)$$

That is, if expected profits exceed a certain level, then the bank chooses affiliation; if they are equal to or below that level, then it does not choose affiliation. The value that  $Y_2$  takes depends upon other conditions that prevail in the market or at the bank,  $X_2$ , and a random disturbance term,  $e_2$ . That is,

$$Y_2 = d + fX_2 + e_2. \quad (3)$$

The relationships (1), (2), and (3) make up a simple, simultaneous equations system. Thus, if the covariance of  $e_1$  and  $e_2$  is not zero, ordinary regression analysis of equation (1) will not produce unbiased estimates of its coefficients. This is because any disturbance to  $e_2$  will translate into a disturbance in  $H$ , which would then be correlated with the covarying  $e_1$ . Thus,  $H$  is a stochastic variable correlated with  $e_1$ .

As a practical matter, self-selection bias seems likely. That is, it seems likely that factors that disturb the bank’s perception of its expected profits, for example, are likely also to disturb its performance. Therefore, it is likely that the disturbance terms of equations (1) and (3) do have non-zero covariance, and that simple regression analyses of BHC impact will produce biased estimates of the effects of BHC affiliation.

### Treating Self-Selection Bias

The statistical solutions to the problems of self-selection bias belong to a class of econometric methods known as simultaneous equations techniques.<sup>12</sup> The general approach of these techniques is to “purge” the stochastic explanatory variable ( $H$ , in this case) of the influence of  $e_2$ . This is achieved by *estimating*  $H$  using only non-stochastic variables in a separate, “first-stage” regression. The predicted values of  $H$  are then mathematical combinations of non-stochastic variables and would be uncorrelated with  $e_1$ . If these predicted values are used instead of the actual values of  $H$  in regression (1) (the second stage), then the estimates of  $c$  would be unbiased.

Two problems arise in applying this technique to the model described by equations (1), (2), and (3). First, if all



of the non-stochastic variables in the first stage also logically belong in the second stage regression, then the predicted values of H are simply a linear combination of the  $X_1$ , and the second stage regression will not be estimable. (Of course, it need not be the case that all of the X variables in equation (1) belong in equation (3) and vice versa. In such a case, the exclusion of certain X variables will permit identification of the influence of BHC affiliation on the performance measure,  $Y_1$ .)

Second, H (the stochastic variable that introduces the simultaneous equations bias) is a dichotomous variable; it takes on values only of 0 or 1. Estimation of a linear regression equation with a dichotomous dependent variable (such as the first stage regression above) poses difficulties.

Both the identification problem and the dichotomous dependent variable can be addressed by estimating the first stage using a model known as a probit model. Specifically, a *probit* relationship can be used to estimate the first stage,

producing predicted values of H. The probit model is nonlinear, and permits identification of the coefficient on H *even if exclusion is not possible*. The probit model also is intended specifically for use with dichotomous dependent variables.

Equation (1) would then be estimated in the form

$$Y_1 = a + bX_1 + c\hat{H} + e_1 \quad (4)$$

where  $\hat{H}$  is the *predicted probability* of being affiliated with a BHC derived from probit estimation of the affiliation decision characterized by (2) and (3). It can be shown that the coefficients of (4) will be unbiased, though the standard error estimates will not be precisely correct unless a joint maximum-likelihood estimation technique is used. As a practical matter, the standard error estimates tend to change little with maximum likelihood estimation.<sup>13</sup>

### III. Application to a BHC Performance Study

In this section, the probit technique for controlling sample selection bias is applied to an econometric study of the performance of affiliated and non-affiliated banks. Results from conventional econometric techniques for identifying the effects of affiliation are compared to those obtained from a two-stage estimation procedure using a probit model to explain the BHC affiliation selection process.

#### The Sample

The study examines the performance of a cross-section of commercial banks in the Twelfth Federal Reserve District in 1985.<sup>14</sup> Because the circumstances of the banks in the sample in previous years were expected to be relevant to both the affiliation status of the banks and their performance, data were collected for these banks for the years

**Table 1**  
**Descriptive Statistics for a Sample of Banks in the Twelfth Federal Reserve District in 1985**  
 (All Statistics are in percent, unless otherwise noted.)

Variable	Affiliated	Non-affiliated	Total
Total Assets (\$000)	328,442	103,139	202,673
Total Deposits (\$000)	279,250	88,557	172,802
Composition of Assets			
Cash	8.92	8.58	8.73
Treasury Securities	15.91	22.41	19.57
Loans and Other Assets	75.17	69.01	71.70
Loan Income/Loan Assets	4.11	3.78	3.92
Deposit Interest/Deposits	2.98	3.02	3.00
Return on Equity	1.56	4.25	2.89
Return on Assets	0.32	0.51	0.42
Capital/Risk Assets	12.97	12.51	12.71
Capital/Total Assets	8.29	8.76	8.56
Age of Banking Org. (years)	41.30	38.90	39.90
Sample Size (number)	163	161	324

1976, 1979, 1982, and 1985. The only selection criterion used in constructing the sample was that the banks have reported data on Reports of Condition and Income Statements continuously during the sample period. There were 324 such banks. Not all banks, however, report all variables. Thus, some of the analyses presented below using certain performance measures or other variables result in correspondingly smaller samples.

Bank holding company affiliation grew steadily in the sample period. In 1976, only 20 percent of the banks in the sample were affiliated with BHCs. By 1985, the proportion had risen to over 49 percent. Of the 324 banks in the sample, 110 changed their affiliation status at some point during the sample period. The growth in affiliation was primarily a small-bank phenomenon, however. The proportion of bank assets in affiliated institutions was already 87 percent in 1976, and grew to 95 percent in 1985.

The sample means are presented in Table 1. From a simple comparison of sample means, affiliated banks tend to be larger, with more loans and higher loan rates, fewer Treasury securities, and lower returns than non-affiliated banks. The degree of leverage appears to be approximately the same in both types of organizations.

### Simple Econometric Tests

Using the simple econometric model described by equation (1), the effect of affiliation with a BHC can be estimated using ordinary least squares regression techniques. The effects of affiliation in the current period are estimated in this manner for current measures of leverage, profitability, portfolio composition, and pricing.

In addition to the dummy variable representing current BHC affiliation, several variables to control for cross-sectional variation in bank and market attributes were included in the regressions. Lagged bank size is used to control for the potential influence of size on the behavior of affiliated banks. The age of the institution is included, on the presumption that mature financial institutions may behave differently than start-up organizations. The length of time the bank has been affiliated with the BHC also is included—interacted with affiliation status—to capture potential vintage effects of affiliation on bank performance. State dummy variables are included to control for effects of variation in market conditions, variations in bank branching, state charter powers, or other regulations that might be expected to vary by state.<sup>15</sup>

The estimated impacts of affiliation using this simple regression technique are summarized in the first column of Table 2. Not all of the coefficients on the affiliation variable reported in this column are statistically significant. Their signs suggest, however, that affiliation with a

**Table 2**  
**Estimated Effects of BHC Affiliation**  
**on Various Performance Measures in**  
**1985**

(T-statistics are in parentheses.)

Performance Measure	Correction for Self-Selection?			
	No		Yes	
	Exclusion	Non-Exclusion	Exclusion	Non-Exclusion
Return on Equity	-0.078 (-1.497)	-0.147 (-0.961)	-0.086 (-1.641)	-0.573 (-0.964)
Return on Assets	-0.003* (-2.433)	-0.003 (-1.356)	-0.004* (-3.527)	-0.003 (-1.253)
Capital/Risk Assets	0.049 (0.809)	0.584* (3.329)	-0.025 (-0.581)	0.166* (2.340)
Capital/Total Assets	-0.010 (-0.693)	0.150* (3.607)	-0.030* (-2.633)	0.068* (3.521)
Deposit Rate	-0.000 (-0.750)	0.000 (0.233)	0.000 (0.254)	-0.004* (-2.275)
Loan Rate	0.002 (1.278)	0.012* (4.017)	0.001 (1.633)	0.007* (2.635)
Muni Bonds/Assets	-0.034* (-2.146)	-0.089* (-3.213)	-0.034* (-2.043)	-0.105* (-3.363)
Cash/Assets	0.000 (0.094)	0.019 (1.237)	0.002 (0.329)	0.052* (2.670)
Treas. Sec. /Assets	-0.050* (-2.362)	-0.211* (-5.121)	-0.052* (-2.642)	-0.134* (-2.707)
Loans/Assets	0.125* (3.241)	0.246* (3.654)	0.124* (3.302)	0.201* (2.765)

\*Coefficient is different from zero at the 95 percent confidence level or better.

Note: The regressors in the exclusion model are: 1985 affiliation status; age of the banking organization; total assets in 1982; state dummies; the affiliation status interacted with BHC age; a constant term. The regressors in the non-exclusion model include these plus the capital/asset ratio in 1976; return on equity in 1976; the average loan rate in 1976; the average deposit rate in 1976; and total assets in 1976. In the regressions employing a self-selection correction, the actual affiliation status is replaced with an affiliation status predicted from the probit relationship presented in Table 3.



BHC appears to (1) increase the proportion of loans in total bank assets, (2) increase municipal bond holdings by the affiliated bank, (3) increase average loan income and deposit rates, (4) reduce holdings of cash and Treasury securities, and (5) reduce return on equity or assets. The effects on leverage are mixed; the use of equity is lower relative to total assets, but higher relative to risk-assets. These findings generally are consistent with the findings of other studies that have used other samples at other points in time.

### Correcting for Self-Selection

As discussed above, the process for statistical correction of self-selection bias involves a two-stage estimation procedure. The first stage involves estimation of the "Affiliation Choice" relationship. The current affiliation status of the banks in the sample is modelled using probit representations. The selection of variables for inclusion in the probit regression is constrained somewhat by the availability of historical data on the study sample. The variables selected are intended to capture the influence of prior performance, prior affiliation status, and state location on the affiliation choice. The estimated parameters of the probit model of the affiliation choice relationship are presented in Table 3.

It appears from this regression that, in addition to prior affiliation status, prior performance of the banking organization bears importantly on whether it was affiliated in 1985. The probability of being affiliated with a BHC in 1985 appears to be positively related to the capital/asset ratio and the loan rate, and negatively related to the return on equity, the deposit rate, and total assets. The latter effect is consistent with the availability of more favorable double-leverage opportunities to smaller (less than \$150 million in assets) banks. The state dummies are consistently insignificant, an observation in keeping with the notion that variations in state branching or charter powers are not important in determining BHC affiliation status—at least in the states that comprise the Twelfth District.

The probit estimates of affiliation choice are then included in two alternative representations of the performance relationships. The first, called the "Exclusion Model," excludes from the performance relationship some of the explanatory variables that were included in the affiliation choice relationship. The excluded variables are various bank performance measures from the year 1976.<sup>16</sup> This may help to identify the effects of the affiliation decision by excluding these variables from the performance relationships. In the second representation, called the "Non-Exclusion Model," these variables for 1976 are

included in the performance regressions as well. Identification of the influence of BHC affiliation on performance is achieved exclusively by virtue of the nonlinearity of the probit relationship.

Identification by exclusion may or may not be justified. One must be willing to assume that some variables that influenced holding company affiliation can be excluded as influences on current bank performance. There is no *a priori* way of telling, however, whether that assumption is more reasonable than the alternative approach, which relies exclusively on the nonlinearity of the affiliation choice relationship.<sup>17</sup>

In the first column of Table 2, the estimated effects of affiliation are reported for an exclusion model with no correction for self-selection bias. In the second and fourth columns, the impact of affiliation is presented for the two-stage model that corrects for self-selection bias. The second column presents the results from the exclusion model and the fourth column presents the non-exclusion results. For comparison, the third column reports the results of a simple regression which does not exclude any performance variables and does not correct for self-selection bias.

**Table 3**  
**Estimated Coefficients of**  
**Probit Model**  
**of Affiliation Choice**

**Dependent Variable: Affiliation Status,**  
**1985**

Variable	Coefficient	T-Statistic
Constant	-1.632	-2.712
Age of Bank	0.005E-06	0.290
BHC Affiliation, 1982	2.880	6.990
Capital/Assets, 1976	2.663	2.116
ROE, 1976	-1.345	0.703
Loan Rate, 1976	41.801	3.260
Deposit Rate, 1976	-10.935	-2.577
Total Assets, 1976	-2.344E-06	-1.946
Alaska Dummy	-0.191	-0.453
Arizona Dummy	0.024	0.054
Hawaii Dummy	-0.179	-0.713
Idaho Dummy	0.045	0.132
Nevada Dummy	-0.302	-0.556
Oregon Dummy	0.067	0.252
Utah Dummy	0.171	0.670
Washington Dummy	0.012	0.060
Log Likelihood	-191.58258	
Cases with BHC in 1985 = 1	160	
Cases with BHC in 1985 = 0	164	

## Findings

The results of these simple tests of the effects of bank holding company affiliation differ qualitatively between the models that treat self-selection bias and those that do not. The low levels of significance of some of the estimated coefficients permit few strong statistical statements. However, qualitatively at least, treatment of self-selection bias appears to reverse the estimated direction of the effect of BHC affiliation or change the point estimate of its magnitude in virtually all cases.

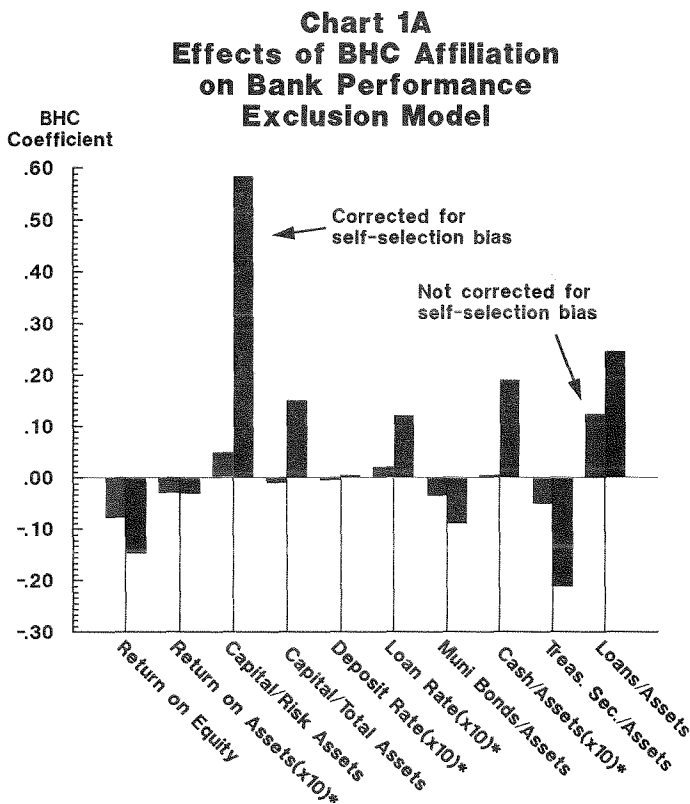
The effects are most easily seen in the two panels of Chart 1. The conventional finding that equity is lower in an affiliated bank is reversed in both of the models that treat self-selection bias. After correcting for self-selection, equity relative to risk assets and equity to total assets both appear to be higher at affiliated banks, although the finding for the equity/risk asset ratio is statistically significant only for the self-selection model that employs the exclusion assumption to identify BHC impact.

The models with self-selection corrections find that measured capital ratios are *higher* at BHC-affiliated banks. This is consistent with the view that affiliation is

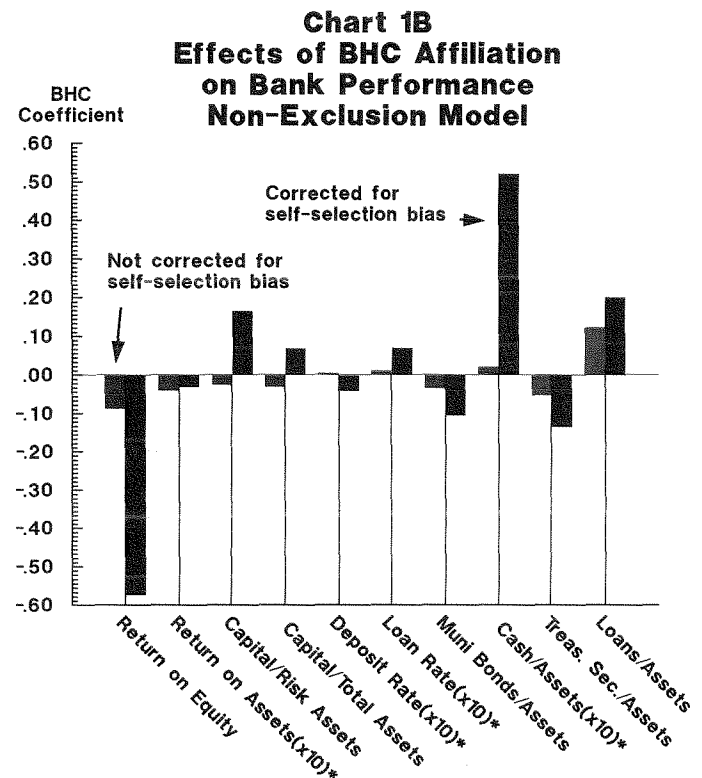
attractive because it allows BHCs to downstream debt as equity to the subsidiary bank. Indeed, the failure of earlier studies to find this impact consistently has been puzzling.

As the table and charts indicate, the self-selection correction models also change the findings regarding the impact of BHC affiliation on portfolio composition. The measured impact of affiliation on the share of loans in total assets is two times larger after correction for self-selection than before. Failing to correct for self-selection bias may underestimate the impact because banks choosing to affiliate with BHCs may tend to be those that, for other reasons, may wish to take on more risky assets and see the BHC vehicle as a convenient means of financing such a portfolio.

A larger impact on the average loan rate (measured as the ratio of average loan income and fees to total loans) also is found with the models using a self-selection correction. The impact of BHC affiliation on the measured loan rate is six to seven times higher in the corrected versus the uncorrected models. This finding is consistent with the argument that those seeking BHC affiliation may be seeking more risk if the higher rates reflect a risk-compensated return.



\*These effects have been multiplied by a factor of ten to make them more visible on the chart.



\*These effects have been multiplied by a factor of ten to make them more visible on the chart.

Other impacts of BHC affiliation are less notably altered by employing the two-stage model for self-selection bias. The holding of Treasury securities appears to be reduced by BHC affiliation in the corrected models. The influence of affiliation on the holding of cash assets remains of low statistical significance. The measured negative impact on the return on equity is larger, but of low statistical significance. The measured impact on the return on assets is about the same, but of lower statistical significance. Difficulty in measuring impacts on earnings and returns is typical in banking research, due to the problems in using accounting measures of the components of these statistics.

Traditional models have tended to find a significant, positive effect of BHC affiliation on a bank's willingness to hold municipal bonds. This is not the case in my sample, perhaps because of the relatively recent data used. The tax treatment of municipal bonds held by banks changed with tax legislation in the 1980s and may have changed the direction of the effect of BHC affiliation. Both corrected models appear to amplify this effect.

#### IV. Conclusion and Policy Implications

The measured effects of BHC affiliation on subsidiary banks are sensitive to attempts to correct for self-selection bias. This suggests that the behavior of a bank and its decision to affiliate with a BHC are statistically related. This, in turn, implies that the findings of the large number of earlier BHC impact studies should be reconsidered in light of their failure to recognize and address this statistical problem directly.

In the specific population of banks examined here, several important measured effects of BHC affiliation are changed when self-selection correction procedures are employed. As important as the direction and magnitude of the changes, however, is the fact that BHC affiliation

Most of the other coefficients of the regression are not of policy interest and, for brevity, are not discussed here. However, it is interesting to note that the variable designed to capture the effect of the time elapsed since BHC formation—the age of the BHC interacted with affiliation status—is insignificant in all performance regressions. Hence, all of the effects of BHC affiliation appear to be captured by the affiliation status variable alone. (This is the measure reported in Table 2.) This suggests that, whatever the influence of BHC affiliation, the effects do not grow or fade with time. It also is interesting to note that the dummy variables for the various states in the region generally are not significant in the affiliation choice probit regression. There is considerable variation in the powers afforded banking organizations in the various states of the region. If state chartering was a viable alternative to obtaining some of the flexibility of BHC affiliation, presumably the affiliation choice regression would have been influenced accordingly by the state dummies.

continues to be associated with significant differences in bank behavior *even when* self-selection bias is treated. This suggests that the behavior of a bank is not independent of the nonbank and holding company affiliations it forms, and contradicts the notion that banks can be “corporately” separated from the activities of their sister or parent organizations. Such separation often forms the basis of proposals that would give banking organizations additional nonbanking powers. My findings suggest that corporate separation cannot fully insulate the bank from the expanded risk-taking opportunities that such an expansion might imply.

## ENDNOTES

1. In some states, a banking organization is allowed to engage in a wide variety of activities under a state charter. Thus, obtaining a state charter is one way to obtain broad banking powers. The fact that the BHC movement has dominated state chartering may suggest that other aspects of the BHC form of organization may be more important than the powers issue.

2. Specifically, if a BHC has substantial nonbank subsidiaries, its consolidated capital/asset ratio may appear high (and compatible with the subsidiary bank standard), but be lower than it would be if the bank truly had to be financed with equity. In addition, Regulation Y permits banks smaller than \$150 million in assets to form a BHC and use as much as three times the debt in the parent as would be permitted in the bank affiliate.

3. In the population employed in this study, for example, fully 92 percent of bank assets are represented by BHC affiliated banks.

4. A good example of a market valuation approach that suffers from sample size problems is Varvel (1975). Frieder and Apilado use share price evidence in the 1982 study, and a synthetic valuation scheme in their 1983 study.

5. The paper by Frieder and Apilado (1982) provides a useful summary and synthesis of bank holding company research.

6. Frequently cited "matched pair" studies include Smith (1971), Talley (1972), and Hobson, Masten and Severiens (1978). The econometric studies cited are those by Johnson and Meinster (1975), Rose (1975), Mingo (1976), Mayne (1977), and Rhoades and Rutz (1982).

7. See Frieder and Apilado (1982).

8. See the study by Fraas (1974) summarizing the ambiguous findings of earlier studies.

9. This criticism is mentioned by Jessup (1974) and Frieder and Apilado (1982).

10. The Hobson, Masten and Severiens (1978) study was one of the first to emphasize the effects of the time elapsed since acquisition.

11. The author is not aware of any direct reference to the

problems of self-selection bias in previous bank holding company research.

12. The literature on self-selection bias in economics arose out of studies of government program impact. See, for example, Barnow (1975) and Barnow and Cain (1977). The statistical properties of estimators of program impact in an environment of self-selection bias were studied by a number of authors, including Heckman (1976 and 1979) and Olsen (1979).

13. See Hausman and Wise (1977).

14. The cross-sectional design has been employed in most earlier studies of the effects of BHC affiliation. Other designs, such as a pooled time-series cross section, pose a number of difficulties for the analyst. Banking regulation and law changed significantly in the early 1980s, first with deposit deregulation in 1980, and then with changes in capital regulation in 1982. Also, the format of the Reports of Condition and Income changed several times during this period, making comparisons of certain financial measures suspect over time.

15. The use of variables lagged prior to change to BHC status also was examined. This modification turns out not to have significant effects on the regression analyses. More importantly, however, since any bank could conceivably change its status at any time—albeit with some implementation lag—a fixed lag in the explanatory variables across all observations is more appropriate.

16. For the regressions reported in the paper, the excluded independent variable set includes leverage, ROE, loan rate, deposit rate, affiliation status, and total asset size measures from the year 1976.

17. In the results presented here, the probit formulation of the choice regression is used to correct for self-selection bias in both the exclusion and non-exclusion models. This is not strictly necessary to achieve identification with an exclusion assumption. The choice regression used to produce predictions of affiliation status can be linear and identification still achieved. A linear formulation of the choice regression, however, has a number of undesirable properties, including the propensity to predict choice probabilities outside the range of zero to one.

## REFERENCES

Barnow, B.S. "The Effect of Head Start and Socioeconomic Status on Cognitive Development of Disadvantaged Children," Ph.D. Dissertation, University of Wisconsin, 1975.

Barnow, B.S. and G.G. Cain. "A Reanalysis of the Effect of Head Start on Cognitive Development Methodology and Empirical Findings," *Journal of Human Resources*, 1977.

Bedingfield, J.P., P.M. Reckers, and A.J. Stagliano. "Distributions of Financial Ratios in the Commercial Banking Industry," *Journal of Financial Research*, Volume 8, Spring 1985.

Boyd, J.H., G.A. Hanweck and P. Pithyachariyakul. "Bank Holding Company Diversification," *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, 1984.

- Brewer, Virgil and William Dukes. "Empirical Evidence on the Risk Return Relationships Between Banks and Related Bank Holding Companies," *Review of Business and Economic Research*, Volume II, Spring 1986.
- Curry, Timothy J. and John T. Rose. "Bank Holding Company Presence and Banking Market Performance," *Journal of Bank Research*, Winter 1984.
- Fraas, Arthur G. "The Performance of Individual Bank Holding Companies," *Staff Economic Study*, #84, Board of Governors of the Federal Reserve System, 1984.
- Frieder, Larry A. and Vincent P. Apilado. "Bank Holding Company Expansion: A Refocus on its Financial Rationale," *The Journal of Financial Research*, Volume VI, Spring 1983.
- Heckman, James J. "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models," *Annals of Economic and Social Measurement*, 1976.
- \_\_\_\_\_. "Sample Selection Bias as a Specification Error," *Econometrica*, Volume 47, January 1979.
- Hobson, Hugh A., John T. Masten, and Jacobus T. Severiens. "Holding Company Acquisitions and Bank Performance: A Comparative Study," *Journal of Bank Research*, Summer 1978.
- Jessup, Paul and Roger Upson. "Return from Bank Holding Companies," *The Bankers Magazine*, Volume 155, Spring 1972.
- Johnson, Rodney D. and David R. Meinster. "An Analysis of Bank Holding Company Acquisition: Some Methodological Issues," *Journal of Bank Research*, Volume 4, Spring 1973.
- Lawrence, Robert J. "The Performance of Bank Holding Companies," *Staff Economic Study*, #55, Board of Governors of the Federal Reserve System, June 1967.
- Lawrence, Robert J. and Samuel H. Talley. "An Assessment of Bank Holding Companies," *Federal Reserve Bulletin*, Board of Governors of the Federal Reserve System, January 1976.
- Lee, Warren F. and Alan K. Reichert. "Effects of Multibank Holding Company Acquisitions on Rural Community Banks," *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, May 1975.
- Light, Jack S. "Effects of Holding Company Affiliation on De Novo Banks," *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, 1976.
- Maddala, G.S. and Lung-Fei Lee. "Recursive Models with Qualitative Endogenous Variables," *Annals of Economic and Social Measurement*, 1976.
- Mayne, Lucille S. "A Comparative Study of Bank Holding Company Affiliates and Independent Banks, 1969-1972," *Journal of Finance*, Volume 32, March 1977.
- Meinster, D.R. and R.D. Johnson. "Bank Holding Company Diversification and the Risk of Capital Impairment," *The Bell Journal of Economics*, Volume 10, Autumn 1979.
- Mingo, John J. "Capital Management and Profitability of Prospective Holding Company Banks," *Journal of Financial and Quantitative Analysis*, Volume 10, June 1975.
- \_\_\_\_\_. "Capital Management by Holding Company Banks," *Journal of Business*, Volume 48, October 1975.
- \_\_\_\_\_. "Managerial Motives, Market Structures and the Performance of Holding Company Banks," *Economic Inquiry*, Volume 14, September 1976.
- \_\_\_\_\_. "More on the Performance Characteristics of Holding Company Acquisitions," *Proceedings of a Conference on Bank Structure and Competition*, Federal Reserve Bank of Chicago, June 1973.
- Olsen, R.J. "A Least Squares Correction for Selectivity Bias," *Econometrica*, Forthcoming.
- \_\_\_\_\_. "Tests for the Presence of Selectivity Bias and their Relation to Specification of Functional Form and Error Distribution," Working Paper 812, Yale University, Institution for Social and Policy Studies, 1979.
- Piper, Thomas R. "The Economics of Bank Acquisitions by Registered Bank Holding Companies," Research Report No. 48, Federal Reserve Bank of Boston, March 1971.
- Piper, Thomas R. and Steven J. Weiss. "The Profitability of Bank Acquisitions by Multibank Holding Companies," *New England Economic Review*, Federal Reserve Bank of Boston, September-October 1971.
- Rhoades, Stephen A. and Roger D. Rutz. "The Impact of Bank Holding Companies on Local Market Rivalry and Performance," *Journal of Economics and Business*, 1982.
- Rose, John T. and Donald T. Savage. "Bank Holding Company De Novo Entry, Bank Performance, and Holding Company Size," *Quarterly Review of Economics and Business*, Volume 23, Winter 1983.
- Rose, Peter S. and Donald R. Fraser. "The Impact of Holding Company Acquisitions on Individual Banks," *The Bankers Magazine*, Volume 156, Spring 1973.
- Smith, David. "The Performance of Merging Banks," *Journal of Business*, Volume 44, April 1971.
- Talley, Samuel H. "The Effect of Holding Company Acquisitions on Bank Performance," *Staff Economic Study*, #69, Board of Governors of the Federal Reserve System, 1972.
- Varvel, Walter A. "A Valuation Approach to Bank Holding Company Acquisitions," *Economic Review*, Federal Reserve Bank of Richmond, July-August 1975.
- Wall, Larry D. "Has Bank Holding Companies' Diversification Affected Their Risk of Failure?" *Journal of Economics and Business*, Volume 39, 1987.