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William K. Templeton
Butler University, wtemplet@butler.edu

Jacobus T. Severiens

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William K. Templeton
Butler University

Jacobus T. Severiens
Kent State University

Abstract

This study examines the effect of activity diversification on bank holding company risk. Banks increasingly are branching into financial services such as security underwriting and insurance. Critics of policies that extend bank powers argue that banks increase their risk through activity diversification. Modern portfolio theory predicts that increased diversification results in lower overall risk if nonbank activities are uncorrelated with banking. This study uses market-based data and several risk measures to address this question. The results of this study support the predictions of portfolio theory. Increases in diversification result in diminishing marginal decreases in risk. Diversification does not appear to have an important effect on measures of systematic risk.

Over the past decade bank holding companies (BHCs) increasingly have resorted to activity diversification in order to offset declining bank subsidiary profits. They have expanded, *inter alia*, into such areas as discount brokerage and equipment leasing. Recent U.S. Treasury Department proposals would permit BHC expansion into life insurance and investment banking, provided the BHC is well capitalized (Keeton, 1991).

Proponents of such diversification often argue that nonbank profits can strengthen bank subsidiaries. Even in the event of losses, the associated banks are protected by virtue of legal and operational separation in the corporate structure. More important, expansion into nonbank activities diversifies BHC assets. Diversification can reduce risk sensitivity.

Critics, however, question whether bank subsidiaries are perceived as entities apart from other BHC-owned companies. In addition, they note that BHCs may be entering fields in which they have little competence or that can create conflicts of interest with bank operations. Such nonbank activities may increase risk and thereby compromise the safety and soundness of the banking system.

Some studies have sought to determine the impact of nonbank diversification upon BHC risk, others the potential effect of diversification into new activities. In either case, the conclusions have been mixed. The methodologies applied and the type of data employed affect the results. Only recently have

researchers incorporated some market-based data rather than accounting-based data. Even their findings necessarily remain limited in scope due to use of a single measure of risk and continued reliance upon accounting-based asset valuations in specifying most variables.

The present study seeks to extend and refine the research on the historic impact of BHC diversification on risk. It differs from previous studies in that it employs three measures of risk and relies mainly upon market-based data. It also considers the related and important question: How much diversification is needed in order to obtain adequate risk reduction benefits?

The current findings suggest that nonbank activities can reduce the risk to BHCs, at least as measured by the variance of returns. Moreover, a small amount of diversification can achieve substantial risk reduction benefits, and many BHCs apparently have attained this goal.

Background

Modern portfolio theory suggests that the variability of shareholder returns can be reduced through appropriate diversification, in the sense that due consideration is given to the variance of the new activity, its covariance with existing activities, and its weight in the overall portfolio. Keeton (1991) notes that studies have found that returns to new financial services neither are correlated highly with returns to banking, nor exceptionally risky by themselves. Therefore, BHC expansion into nonbank activities probably should decrease risk.

But does it? Some observers suggest that poorly managed nonbank operations can create problems for bank subsidiaries. Affiliates tend to rely upon one another for support. Regulations require that intersubsidiary transactions be conducted on an arm's-length basis. Even if this rule is followed in principle, the public perception may remain that the subsidiaries are all part of one corporation.

Many studies have addressed the issue of BHC diversification and risk. Several of these earlier studies used accounting data to examine the riskiness of various activities by themselves and in combination with banking activities. For instance, Heggestad (1975) focuses on the riskiness of activities as reflected in the variance of industry accounting profit measures. He finds that banking is more risky than some of the activities currently denied BHCs such as insurance and real estate development. Moreover, the profitability of some of these activities is uncorrelated with banking. The implication is that diversification may serve to decrease the variability of accounting earnings for BHCs.

On the other hand, Jessee and Seelig (1977) suggest that modern portfolio theory may not apply in the case of BHC diversification. They state that portfolio theory is developed from the point of view of the passive investor. It

contains an implicit assumption that the risks of the individual parts of the portfolio are independent of each other, and that they do not change upon acquisition. Yet the BHC may assume management of nonbank activities. The risk may change, perhaps increase. Potential benefits may not be realized.

Some of the early studies deal with potential rather than actual effects. They employ models or assume that combining uncorrelated activities will result in lower risk. What should matter is not what may occur, however, but the empirical findings. Wall (1987) conducted an extensive study to determine the effects of BHC diversification on individual firm risk. He uses a risk measure that reflects the probability of technical insolvency. He finds that nonbank subsidiaries have higher risks and higher returns than do bank subsidiaries. The correlation between the two types of subsidiaries, however, is nearly zero. Wall, therefore, notes that subsidiaries may tend to reduce the riskiness of BHCs on average.

Boyd and Graham (1986) conduct a similar study, but they arrive at different results and conclusions. Their empirical tests show a significant positive relationship between diversification and two accounting-based risk measures for the period 1971 to 1977. They suggest that strict regulation may be needed if the FDIC is to avoid paying for aggressive BHC behavior. The study provides strong evidence against permitting increased diversification.

The use of accounting data in research studies reflects ready availability. But such figures show historical costs rather than market values. Moreover, banking organizations intentionally use accounting procedures to smooth reported earnings.

Market-based data, therefore, may be more meaningful in determining how BHC risk is affected by activity diversification. Market returns as reflected in stock prices are not smoothed intentionally. Rather, they serve as indicators of investor perceptions about BHC conditions and prospects.

Rose (1989) incorporates market-based return measures in his analysis of BHC diversification and risk. He concludes, based upon a correlation of returns between industries, that potentially beneficial diversification opportunities would exist for BHCs if only public policy were less restrictive. Nonfinancial industries such as business forms and office computing appear particularly attractive.

In addition, Rose suggests that activity diversification may affect BHC sensitivity to economic cycles and financial market conditions such as changes in interest rates. He regresses return measures on fluctuations in Gross National Product, money stock growth, and long-term U.S. Treasury bond yields. As expected, he finds that banks and other financial service organization are more sensitive to these factors than are other industries. Therefore, broader diversification may help insulate BHCs from such factors. His observation points to a need to explore the effect of activity diversification on beta and interest rate coefficients. BHCs having relatively low betas may be ideal from a regulator's

viewpoint. Such firms would be less affected by broad economic swings. They would be less likely to fail during a recession or depression. Interest rate sensitivity has been a major concern since rates began their wide fluctuation in the late 1970s. The standard approaches to dealing with this problem have focused on the composition of bank assets and liabilities as well as the use of artificial hedges in the futures and options markets. Diversification may be an additional way to reduce interest rate risk.

More recently, Brewer (1989) focuses specifically on the effect of diversification on a market-based risk measure. He regresses the standard deviation of stock returns for BHCs on the proportion of holding company assets devoted to nonbank activities. The resulting coefficient for the diversification variable is significantly negative, indicating that nonbank activity decreases BHC risk.

Brewer, however, uses only accounting data to construct his independent variables, even the nonbank diversification measures. Moreover, he considers only total risk and does not examine the effect of the diversification of systematic risk measures. Finally, he does not explore the nature of the relationship between nonbank activities and risk over different levels of diversification.

Research Design and Test Results

The present study extends the research on the BHC diversification and risk topic by considering three measures of risk and examining the linearity with respect to the risk diversification relationship.

A BHC engaging in various activities may be thought of as a portfolio of assets. The variance of returns for such a portfolio is given by the following equation:

$$(1)\ \sigma_p^2 = \sum_{i=1}^{n} \sum_{j=1}^{n} X_i\, X_j\, \rho_{ij}\, \sigma_i\, \sigma_j$$

where:

σ_p^2 = Variance of returns on portfolio p;
X = Proportion of portfolio in asset i or j;
ρ = Correlation coefficient; and
σ = Standard deviation of asset i or j.

The correlation of returns among assets is important in determining the variance for the portfolio. New activities should decrease overall risk if their returns are uncorrelated with banking returns.

The variance of returns risk measure has been employed in several prior studies. In most cases, however, fluctuations are considered in terms of accounting or book returns. The beta and interest rate coefficient have not yet been used in examining BHC risk and diversification.

Stone's (1974) two factor model provides the basis for measuring the systematic risk of BHCs:

$$(2)\ R_{jt} = \alpha_0 + \beta_{jm}R_{mt} + \beta_{jI}R_{It} + e_{jt},$$

where:

R_{jt} = Return on equity of financial institution j at time t;
α_0 = A constant;
β_{jm} = Sensitivity to market movements;
β_{jI} = Sensitivity to interest rate changes;
R_{mt} = A market index;
R_{It} = An interest rate index; and
e_{jt} = An error term.

The sensitivity of returns to the equity market is known as beta in the single factor models. The second source of systematic risk is the sensitivity of shareholder returns to changes in interest rates.

The two factor model suggests a linear relationship between beta and the return on an asset. The beta of a portfolio is a weighted average of the betas of the assets in the portfolio. If BHCs initiate activities with higher systematic market risks than their current operations, the betas of the BHCs should increase.

The situation is identical for the interest rate coefficient. To the extent that additional activities are less sensitive to interest rate changes, this risk is reduced.

Three OLS regression equations can test the relationship between the three measures of risk and nonbank diversification. All three dependent variables— variance of shareholder returns, beta, and the interest rate coefficient—are annual measures based on daily data. The stock market data come from the Center for Research on Security Prices (CRSP) database. Stone's (1974) two factor model is used to calculate the beta and interest rate coefficients. The market factor is the CRSP value-weighted index. The daily interest rate factor is a two year constant maturity yield on U.S. government securities.[1]

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[1] The choice of term is somewhat arbitrary. Nevertheless, Flannery and James (1984, pp. 1146-1147) have tried various maturities in their test of the effect of interest rate changes on the returns of banking stocks. Their "... results indicate commercial bank stock returns are very sensitive to interest rate changes regardless of the interest rate index employed." Some preliminary tests show that bank stocks are more sensitive to the two year maturity than to some of the alternatives.

The independent variable of primary interest is BHC diversification. In this study, BHC diversification is the extent of nonbank activities. The appropriate measure would be the market value of the nonbank subsidiaries divided by the market value of the entire holding company. The market value data for subsidiaries are not available, however. Therefore, a proxy, a variation of one suggested by Boyd and Graham (1986), must be used, namely:

$$(3) \quad g = 1 - \frac{\text{Estimated Bank Assets}}{\text{Market Value of Total Assets}}.$$

The estimated bank assets value is the sum of all bank-related liabilities as listed on consolidated financial statements. Such liabilities include total deposits, fed funds purchased, and repurchase agreements. Market value of total assets is the sum of the book value of total liabilities and preferred stock plus the market value of the common equity. The market value of the equity is found by multiplying the average number of shares outstanding for a year by an average market price of a share of stock for a year.[2]

It is appropriate to control for two other broad influences on risk, namely size and leverage. Larger BHCs are able better to diversify their loan portfolios across geographic regions, industries, and types of loans. If a size variable is not included, the g variable merely may act as a proxy for these influences. The size measure is the natural log of the market value of total assets.

Leverage magnifies changes in performance and thus can influence market-based risk measures (Hamada, 1972). To distinguish between the influence of leverage and diversification, leverage must be controlled. The leverage measure is total liabilities as a percent of total assets. Such liabilities include all deposits, short-term borrowing, and long-term debt.

Data used to construct the g variable, the size variable, and the leverage variable are year-end data and come from annual reports and *Moody's Banking and Finance Manual.* Table 1 contains a summary of all the variables.

A pooled cross-sectional time-series approach is used to construct the sample.[3] The sample period is 1979 through 1986. The first several years represent a

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[2]The weakness of this proxy is that it ignores the role of equity and any other nonbank liabilities used to support bank activities. Thus, the bias is to overstate diversification. Both Brewer (1989) and Boyd and Graham (1986) have used this type of proxy with some alternatives. The use of alternatives has not caused any important differences in results.

[3]Brewer (1989) points out that pooled cross-sectional time-series data imply the introduction of a time-varying error in addition to the usual error term. The Fuller-Batesse regression method allows for such an error term structure. Unfortunately, the method does not tolerate missing data which renders it inappropriate for this sample. As an alternative, the current study has sought to remove time-series dependence by restructuring each of the four models using annual intercept dummy variables. The t-tests reveal that, with only one possible exception—the control leverage variable in the third or beta model—the results are not affected materially by the time constraints.

time of severe interest rate fluctuation and economic recession. The later years reflect more stable rates and economic expansion. The beginning of the period also coincides with the initiation of significant deregulation legislation. During this time, the Federal Reserve phased out interest rate regulations and expanded BHC powers.

The sample BHCs are among the largest 100 domestic BHCs for each of the sample years. An additional requirement is that complete daily market data for the BHC must be available on the CRSP tapes. A total of 54 different BHCs appear in the sample.[4]

Figure 1 shows the distribution of values for the nonbank diversification variable for the pooled sample. On average, 17 percent of BHC holdings are nonbank assets. The distribution is skewed to the right. The frequency is based upon the number of observations over the period, not just the number of banks. Nevertheless, the small mean value suggests that many BHCs may not be highly diversified.

The regression results, shown in Table 2, support the predictions of portfolio theory regarding the variance of shareholder returns. Increased diversification into nonbank activities reduces the total risk of the BHC. This finding confirms the conclusions reached by Wall (1987), Brewer (1989), and Rose (1989). It contradicts results of the Boyd and Graham (1986) and Jessee and Seelig (1977) studies.

As with any test of this type, a question of causality arises: Does increased diversification reduce risk, or do less risky BHCs choose to increase diversification? Following Brewer (1989), the sample has been divided in half, with the higher risk BHCs in one group and the lower risk BHCs in the other. The regression equations for total risk are estimated for both groups. The results are shown in Table 3. Diversification is significant for the higher risk group. Had the findings been otherwise, the implication would be that less risky BHCs simply choose to diversify. As it is, the results are consistent with the view that high risk BHCs decrease their risk via diversification.

To check for a nonlinear relationship, a squared term of the independent variable, g^2, has been added to that regression equation. Regression equation (2) of Table 2 shows that the squared term has a significant positive coefficient. Figure 2 contains a graph in which the predicted values of the variance from regression

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[4]Dimson (1979) has shown that infrequent trading biases market measures of risk when daily data are used. The use of daily data effectively limits the researcher to the larger BHCs. Even so, complete data frequently are not available on the CRSP tapes. Also, mergers can cause a BHC to be deleted or added to the sample during the sample period. Thus, the composition of the sample changes somewhat from year to year in the sample period. The total of 54 represents the number of BHCs that appear in the sample for at least one of the sample years. The number of BHCs in the sample was 38, 40, 45, 44, 41, 40, and 41 for the years 1979 through 1986, respectively.

equation (2) have been plotted against the actual values of the nonbank diversification variable, g.

Fisher and Lorie (1970) show that most of the diversification benefits in a stock portfolio can be achieved with a relatively small amount of diversification (ten to 14 different stocks). BHC experience appears to parallel their results. The nonlinear relationship between diversification and total risk suggests that a small amount of nonbank diversification achieves most of the risk reduction benefits. The mean value for the diversification variable was .17. Apparently this mean level of diversification is sufficient to achieve substantial risk reduction benefits.

Nonbank diversification does not explain levels of systematic risk. The size variable is the only one significant in explaining beta. Perhaps the largest BHCs comprise an essentially different industry than the regional institutions that focus primarily on domestic lending. Large money center institutions are more likely to engage in international lending, currency trading, foreign investment banking operations, interest rate speculation, and futures trading. These factors could result in higher betas for larger BHCs.

The nonsignificant and negative relationship between leverage and beta in these results runs contrary to expectations. Previous research predicts a positive and significant relationship between these two variables (Hamada, 1972). A separate simple correlation test using these data reveals a significantly positive relationship between these variables.[5] Yet the relationship fails to hold in the multiple regression equation. Jahankhani and Lynge (1980) likewise fail to find a significant positive relationship between leverage and beta for a sample of BHCs.

The empirical test fails to show a significant statistical relationship between diversification and interest rate sensitivity. As BHCs expand away from banking, one may expect that BHCs will become less sensitive to interest rate risk (Rose, 1989). Perhaps BHCs have become adept at controlling interest rate sensitivity through gap management and interest rate hedging in the futures market. Also, Chen and Chan (1989) suggest that models employed to test interest rate sensitivity may be subject to a time aggregation bias—that the rate sensitivity of returns may be highly sample period dependent. The present paper does not delineate interest rate cycles during the period under study. A final explanation is suggested by the correlation between the factors in the two factor model. Because the market factor and the interest rate factor are correlated, the interest rate coefficients may reflect only a portion of the effect of interest rate changes on bank stocks. This fact may account for our failure to detect a significant inverse relationship between diversification and interest rate sensitivity. No ready

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[5]The correlation between leverage and beta for these data was .094. This relationship was significant for an alpha equal to .05.

explanation exists for why leverage is significantly negative in relation to variation in the interest rate coefficient.

Implications

The results of this study have implications for both bank holding companies and for regulatory agencies. BHCs that diversify into nonbank activities probably will be in a less risky position than will firms engaged primarily, if not exclusively, in banking. Moreover, such expansion does not need to be extensive in order to produce dramatic reductions in risk. Many BHCs already may have achieved significant risk reduction with but a small amount of diversification.

Still, regulators and legislators may be correct in their continued relaxation of restrictions on nonbank diversification. Permitting insurance and investment banking services expands the definition of activities deemed "closely related to the field of banking." The present study did not investigate the effects of specific types of nonbank diversification. Yet these additional operations may produce even less correlation with traditional banking than do activities currently allowed. Ironically, the inclusion of such activities may enhance the safety and soundness of the banking system.

Furthermore, as regulators contemplate various plans for introducing risk-based deposit insurance or risk-based capital standards, it should be helpful to consider the effect of nonbank diversification. Basing such insurance or capital standards strictly on the bank operations of a BHC ignores the important role that nonbank diversification plays. BHCs that have taken significant steps to reduce their overall risk should not be penalized by such rules.

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Table 1
Variables Used in the Study

Property	Variable Type	Symbol	Definition
Diversification	Independent	g	$1 - \dfrac{\text{estimated bank assets}}{\text{market value of total assets}}$
Size	Control	S	natural log of market value of total assets
Leverage	Control	L	$\dfrac{\text{total liabilities}}{\text{market value of total assets}}$
Total Risk	Dependent	σ^2	variance of daily shareholder returns over a period of one year
Market Risk	Dependent	β_m	regression coefficient for the market factor in the two factor model. The regression uses one year of daily data
Interest Rate Risk	Dependent	β_i	Regression coefficient for the interest rate factor in the two factor model. The regression uses one year of daily data

Table 2
Bank Diversification into Nonbank Activities
Results for 1979 to 1986

Regression Model: Risk = f(g, S, L)

Dependent Variable	Constant Term	g	g^2	Coefficient of S	L	df	R^2
1 Variance	-0.001176	-0.000561 (-2.912)***	—	0.000003 (0.263)	0.001576 (3.132)***	325	.071
2 Variance	-0.000866	-0.003152 (-3.969)***	0.006354 (3.360)***	0.000013 (0.946)	0.001333 (2.662)***	324	.103
3 Beta	-2.23241	0.05767 (0.263)	—	0.23619 (15.624)***	-1.08915 (-1.900)	325	.544
4 Interest Rate Coefficient	0.70831	-0.13068 (-1.164)	—	-0.00458 (-0.592)	-0.69885 (-2.383)**	325	.032

Number in parentheses are t-scores for the regression coefficients
Assuming a two tail test:
  ** significant at .05
  *** significant at .01

Table 3
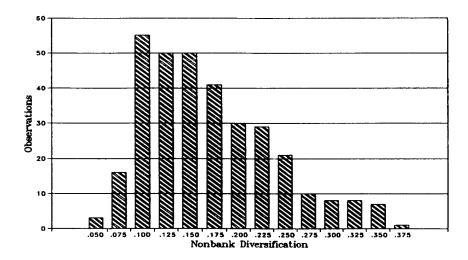**The Relationship Between Diversification and Total Risk for High Risk and Low Risk BHCs**

Regression Model: $\sigma^2 = \alpha_{0v} + \alpha_{1v}g + \alpha_{2v}S + \alpha_{3v}L + \varepsilon_v$

	Constant Term	g	g^2	Coefficient of S	L	df	R^2
High Risk BHCs	-0.001431	-0.000807 (-2.603)***	—	-0.000090 (-0.941)	0.002380 (2.791)***	161	.127
Low Risk BHCs	0.000005	-0.000002 (-0.038)	—	0.000003 (0.682)	0.000138 (0.938)	160	.012

Assuming a two tail test:
*** significant at .01

Figure 1
Frequency Distribution for the Nonbank Diversification Variable, g

Figure 2
The Nonlinear Relationship
Between Nonbank Diversification and Bank Risk