Revenue Shifts and Performance of U.S. Bank Holding Companies
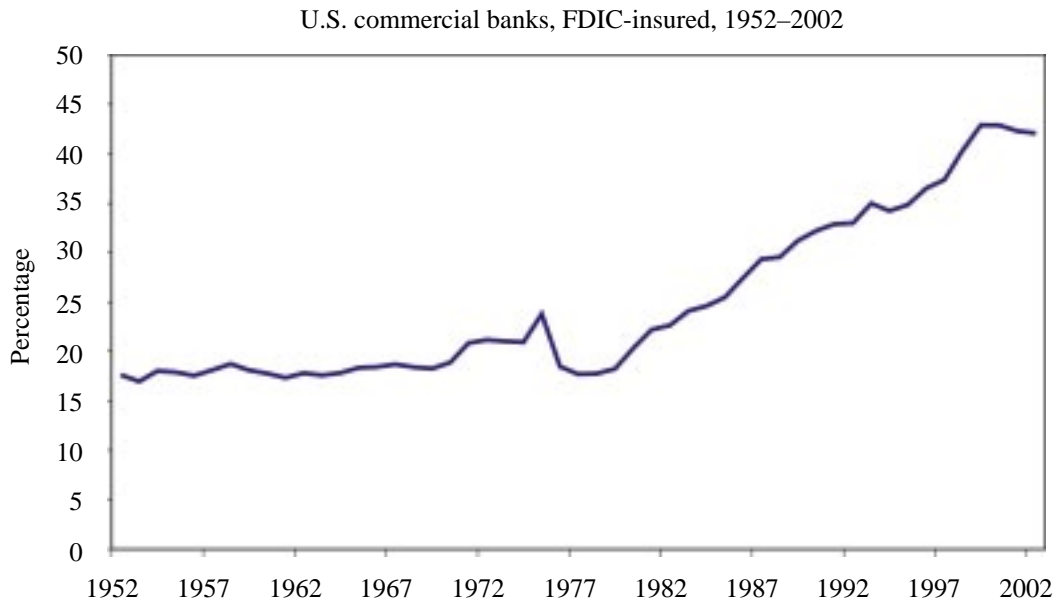
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Introduction

A pervasive trend in the U.S. banking industry over the past two decades has been the steady shift towards activities that generate fees, service charges, trading revenue, and other types of non-interest income. For the period from 1952 to 1977, non-interest income was a readily stable source of revenue for U.S. commercial banks and accounted for about 20 per cent of net operating revenue (see Figure 1).[1] Since the late 1970s, however, non-interest income has grown much more rapidly than net interest income and has accounted for over 40 per cent of net operating revenue.

Why have U.S. commercial banks shifted so steadily towards these activities and revenue streams? Most obviously, the highly regulated banking environment in earlier years may have prevented commercial banks from entering profitable business lines, and the recent expansion simply reflects normal competitive forces. The Gramm-Leach-Bliley Act (GLBA) of 1999,

Figure 1
Non-interest income share of net operating revenue

U.S. commercial banks, FDIC-insured, 1952–2002

Note: Net operating revenue is defined as non-interest income plus net interest income.
Source: FDIC, *Historical Statistics on Banking*, <www.fdic.gov>.

for example, capped a decade of major deregulation for the U.S. banking industry by removing many restrictions on financial service providers.[2] Alternatively, technological and financial innovation may have created the opportunity to grow and exploit synergies between complementary financial activities that make a broad-based financial firm more attractive than in the past. A related explanation is the search for diversification benefits. By offering many products that are imperfectly correlated, managers may improve the risk-return frontier. Finally, there may be little economic rationale for this shift, and bank managers may be pursuing alternative objectives like empire building or protecting the interests of insiders.

To better understand the consequences of the shift towards non-interest income, this paper examines the performance of U.S. bank holding companies (BHCs) to see whether firms that shifted activities and diversified their revenue stream outperform their peers.[3] Measures of performance include average profits (measured as the return on equity (ROE) and return

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2. See Furlong (2000) and Fay (2000) for overviews of GLBA.

3. GLBA required that financial firms must become "financial holding companies" in order to take advantage of the expanded powers. While some of the firms in this sample are financial holding companies and others remain bank holding companies, the term bank holding company is used throughout to simplify exposition.

on assets (ROA)), the volatility of profits (measured as the standard deviation of ROE and ROA), and risk-adjusted returns (measured as average profits relative to the standard deviation of profits). The share of net operating revenue derived from non-interest sources (the non-interest share) is the primary measure of activity and focus, while diversification reflects the concentration of the income statement through a Herfindahl-type index of major revenue streams. The sample includes over 1,800 U.S. BHCs from 1997Q1 to 2002Q4.

The most straightforward way to see the results is to compare average ROE, volatility of ROE, and risk-adjusted ROE with non-interest income shares. Figure 2, which plots the predicted values from simple regressions, shows very different relationships for each variable and raises important questions about the rationale behind the shift towards non-interest activities.[4] For average ROE, there is some increase with the non-interest share, but it is not particularly large. In sharp contrast, there is a large and significant increase in the volatility of ROE with the non-interest share. This reflects the inherently volatile nature of these activities.[5] Finally, risk-adjusted ROE falls steadily with the non-interest share and shows significant declines in risk-adjusted returns for BHCs that are relatively concentrated in these activities.

These results suggest a negative link between performance and non-interest income shares, and it is useful to decompose this into two different channels. First, a shift towards non-interest income by a BHC directly increases the exposure to the risk and return characteristics of those activities, and this is referred to as the "direct exposure effect." Second, a shift towards non-interest income changes the degree of revenue diversification. If a BHC originally earned little non-interest income, this shift diversifies its revenue stream. In contrast, if the BHC originally earned most of its revenue from non-interest income, a further increase concentrates revenues. The impact of changes in revenue diversification is called the "indirect diversification effect." The net impact of a shift towards non-interest activities will depend on the relative magnitude of these effects.

Consider the median BHC, which earned about 18 per cent of its net operating revenue from non-interest sources. For this BHC, a shift towards non-interest income diversifies the revenue stream, and the empirical

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4. Predicted values are from regressions of performance on a constant, initial non-interest income share, and the initial diversification measure for 1,816 BHCs. Details on the data and sample construction are found in section 2.
5. See Stiroh (forthcoming) for evidence on the relatively volatile nature of non-interest income, particularly trading revenue, and DeYoung and Roland (2001) for possible explanations.

Figure 2
Predicted values of BHC performance measures
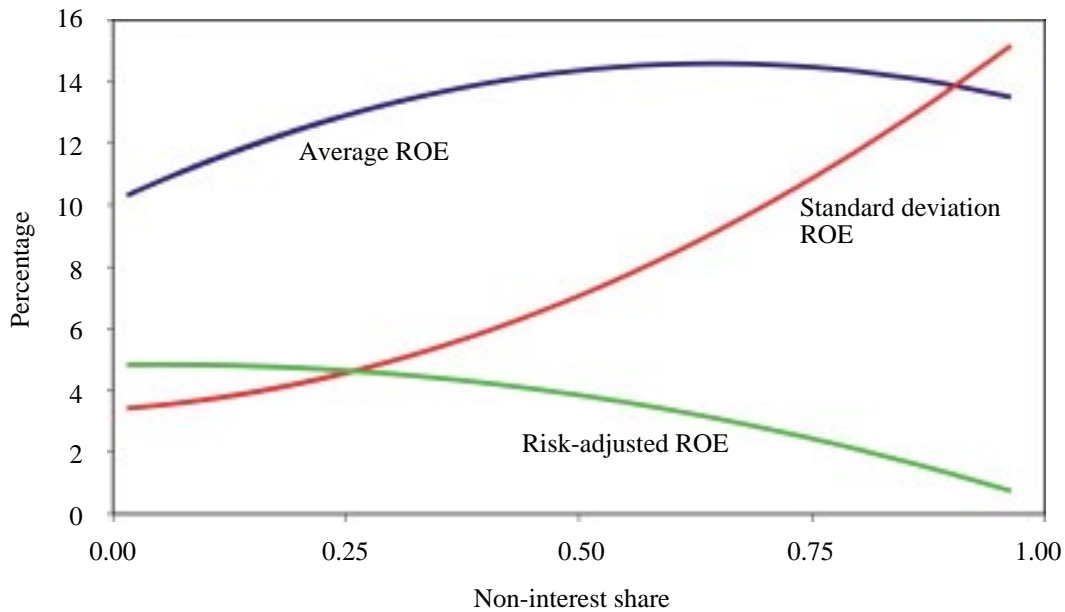
Notes: Predicted value from ordinary least squares regression of performance on initial
non-interest share and diversification. All variables are average for each of 1,816 BHCs.

estimates show improved risk-adjusted performance via the indirect
diversification effect. The direct effect of greater exposure to volatile non-
interest activities, however, is associated with a decline in risk-adjusted
returns that offsets gains for the typical BHC. This BHC is on the flat part of
the risk-adjusted ROE line in Figure 2, where there is no significant gain in
risk-adjusted performance from marginal increases in the non-interest share.

For a BHC that is more concentrated in non-interest income (90th percentile
non-interest share around 30 per cent), however, further increases in non-
interest income are associated with declines in risk-adjusted performance as
the direct exposure effect outweighs the indirect diversification effect. This
BHC is already diversified, and further increases in non-interest income just
increase the exposure to the volatile activities without any offsetting
diversification gains. The data clearly show that risk-adjusted performance
declines with non-interest income for BHCs that are already concentrated in
these activities. In terms of Figure 2, this BHC is on the negatively sloped
part of the risk-adjusted ROE line where marginal increases in the non-
interest share are associated with declines in performance.

These results raise the question of why U.S. banks have moved so
significantly into these activities. One explanation is that managers
overestimated the gains from diversification. In the financial and industry

press, for example, it is common to hear about the potential of "cross selling," where a BHC sells multiple products to the same core customer base to reap economies of scope and gain diversification benefits. This may expand the revenue base, but the different streams are likely to be exposed to the same types of shocks, e.g., an industry slowdown or changing consumer preferences, so traditional diversification benefits would likely be small. Second, managers may focus primarily on expected returns and place relatively little weight on volatility. This might be reasonable if managers reap the gains of higher returns but don't bear all of the costs from increased risk; e.g., if managers are equity-holders, they have an incentive to take risks beyond what debt-holders and supervisors would prefer. Third, non-profit maximizing motives may be driving the shift. Berger, Demsetz, and Strahan (1999); Milbourn, Boot, and Thakor (1999); Bliss and Rosen (2001); Houston, James, and Ryngaert (2001); and Aggarwal and Samwick (2003), for example, discuss how empire building, over-diversification to protect firm-specific human capital, corporate control problems, or managerial hubris and self-interest all influence decisions.

Whatever the motivation, recent activity suggests that U.S. financial firms may recognize these poor outcomes and are pulling back from non-interest income activities. The recent merger between Bank of America and FleetBoston, for example, was touted as a return to the more predictable consumer banking roots (C. Mollenkamp and J. Hechinger 2003). In addition, U.S. financial firms have been involved in a series of large divestitures of subsidiaries that generate non-interest income, e.g., U.S. Bancorp's spinoff of Piper Jaffray, FleetBoston's closing of Robertson Stephens, and Citigroup's spinoff of Travelers Property Casualty (Mandaro 2003). One speculative conclusion is that U.S. bankers are now aware of the risk of certain types of product-line expansion and are retrenching towards more traditional and safer activities.

1 Previous Literature on Performance and Diversification

There is a large literature on the link between performance and diversification, and this section provides a short review of several of the most relevant papers. Saunders and Walter (1994), Reichert and Wall (2000), DeYoung and Roland (2001), Stiroh and Rumble (2003), and Stiroh (forthcoming) provide a more thorough review.

The literature on banking has provided mixed evidence about whether and how diversification affects performance. Saunders and Walter (1994) review 18 studies that examine whether non-bank activities reduce BHC risk and

indicate that no consensus exists: nine answer yes, six answer no, and three provide mixed results. These, and more recent studies, approach the risk question from three perspectives: creation of synthetic or counterfactual mergers of banks with non-banks, analysis of actual operating results, and analysis of market reactions to diversification.

The first set of studies uses the counterfactual merger approach and generally reports diversification benefits for specific types of combinations. Merger simulations between BHCs and non-bank financial institutions like life insurance companies show the potential to reduce risk (Boyd and Graham 1988; Boyd, Graham, and Hewitt 1993; Lown et al. 2000; Reichert and Wall 2000). Estrella (2001) expands on this research and finds that most combinations of banking and insurance companies are likely to produce diversification benefits, but also concludes that mergers between banking and securities firms are less likely to produce such gains because of the securities firms' highly volatile returns.

The second set uses accounting data to measure diversification effects and is generally negative with a stylized result that bank expansion into less traditional financial activities is associated with increased risk and lower returns. DeYoung and Roland (2001) find that a shift towards fee-based activities is associated with increased revenue volatility and a higher degree of total leverage, both of which imply greater earnings volatility. Stiroh (forthcoming) concludes that a greater reliance on non-interest income, particularly trading revenue, is associated with higher risk and lower risk-adjusted profits, while Stiroh and Rumble (2003) show that most of these gains are across institutions (between estimates) with little gain from marginal diversification of specific institutions (within estimates). A study of loan portfolio diversity by Acharya, Hasan, and Saunders (2002) reports that diversification of loans does not typically improve performance or reduce risk. Finally, Morgan and Samolyk (2003) examine geographic diversification and find similarly negative results: diversification is not associated with greater returns (ROE or ROA) or reduced risk.

A few studies do report some potential for diversification gains. Templeton and Severiens (1992) examine 54 BHCs from 1979 to 1986 and find that diversification (as measured by the share of market value not attributed to bank assets) is associated with lower variance of shareholder returns. Kwan (1998) examines the returns of banks' Section 20 subsidiaries and their commercial bank affiliates and finds that Section 20 subsidiaries are typically more risky and not necessarily more profitable than their commercial bank affiliates. Nonetheless, Kwan concludes that some diversification benefits do exist because of the low return correlation between securities and bank subsidiaries.

The third set of studies uses market data to evaluate potential diversification benefits and also reports mixed results. Santomero and Chung (1992) and Saunders and Walter (1994) find reduced risk in the form of less volatile market returns. Conversely, DeLong (2001) finds that diversifying mergers—by activity and/or geography—does not create market value at the time of the merger announcement. Finally, Demsetz and Strahan (1997) arrive at a more nuanced conclusion: large BHCs are typically more diversified than smaller ones, but they offset risk-reducing diversification benefits by engaging in riskier activities, namely, maintaining riskier lending lines (e.g., commercial and industrial loans (C&I)) and lower capital ratios. Thus, large BHCs are not necessarily safer.

2 Definitions and Data

The empirical analysis uses data on revenue and risk-adjusted performance for U.S. BHCs. This section first defines the key variables in the analysis and then describes the construction of the data set from the U.S. Y–9C reports. Data cover the period from 1997Q1 to 2002Q4 and are on a quarterly basis. See Stiroh and Rumble (2003) for further details.

2.1 Variable definitions

The net operating revenue of a BHC can be broken down into two broad categories: net interest income (*NET*) and non-interest income (*NON*), which includes fees, trading income, service charges, and other sources of non-interest income. The share of net operating revenue from net interest sources (SH_{NET}) and the share of net operating revenue from non-interest sources (SH_{NON}) quantify where revenue is originating and are defined as:

$$SH_{NET} = \frac{NET}{NET + NON}$$

$$SH_{NON} = \frac{NON}{NET + NON}, \tag{1}$$

where these variables are averaged over all quarterly observations for each institution to obtain a measure of average net interest income shares ($\overline{SH_{NET}}$) and average non-interest income shares ($\overline{SH_{NON}}$).

Revenue diversification is measured using a Herfindahl-style construct as in Morgan and Samolyk (2003), Stiroh and Rumble (2003), and Thomas (2002) that is based on the breakdown of net operating revenue into these two categories. Using these shares, revenue diversification is:

$$DIV = 1 - (SH_{NET}^2 + SH_{NON}^2), \tag{2}$$

where *DIV* measures the degree of revenue diversification, and a larger value indicates a more diversified mix. A value of 0.0, for example, means that all revenue comes from a single source (complete concentration), while 0.5 is an even split between net interest income and non-interest income (complete diversification).[6] This variable is averaged over all quarterly observations for each institution to obtain a measure of average revenue diversification ($\overline{DIV}$).

The primary measures of performance are based on standard profit ratios: the return on equity (*ROE*) and the return on assets (*ROA*), defined as annualized net income divided by equity and by total assets, respectively. The mean and standard deviation of ROE ($\overline{ROE}$ and σ_{ROE}) and ROA ($\overline{ROA}$ and σ_{ROA}) are calculated over the observed quarters for each BHC. The risk-adjusted return on equity (RAR_{ROE}) and assets (RAR_{ROA}) are defined as:

$$RAR_{ROE} = \frac{\overline{ROE}}{\sigma_{ROE}}, RAR_{ROA} = \frac{\overline{ROA}}{\sigma_{ROA}}, \tag{3}$$

where these ratios can be thought of as accounting returns per unit of risk.[7]

Finally, the *Z-score* measures the number of standard deviations that profits must fall to drive a firm into insolvency. The *Z-score* is essentially a measure of the distance to default for a given institution and is calculated as:

$$Z\text{-}score = \frac{\overline{ROA} + \overline{E/A}}{\sigma_{ROA}}, \tag{4}$$

where $\overline{E/A}$ is the average equity to assets ratio over the same period.

2.2 Data

Table 1 presents summary statistics for the sample, i.e., one observation per firm where all variables are averaged over all quarters the BHC is observed from 1997Q1 to 2002Q4. All data are deflated with the GDP deflator. To be included, institutions must meet the following criteria: at least eight quarters

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6. This measure is analogous to a Herfindahl-Hirschman Index of concentration, except that the interpretation is reversed. Here, a larger number indicates a more diversified and less concentrated set of activities.

7. These estimates are similar to a market-derived Sharpe Ratio, which defines risk-adjusted returns as market returns less the risk-free rate divided by the standard deviation of returns.

of data; all performance measures between the 1st and 99th percentile; and $0 \leq \overline{SH}_{NON} \leq 1$ (i.e., average non-interest income and average net interest income both positive). The regulatory code identifies each institution, and changes in the code are treated as the creation of a new organization because this change typically reflects a major structural reorganization. This procedure left 1,816 observations, which accounted for 78 per cent of the total assets and 74 per cent of the firms in the original sample.

These BHCs ranged in size from \$38M to \$930B, with a mean of \$4.0B. The variables that describe activity exposure also showed wide variation: average diversification, $\overline{DIV}$, had a mean of 0.29 with a range from 0.03 (nearly perfect concentration) to 0.50 (equal shares) and the average non-interest share, $\overline{SH}_{NON}$, had a mean of 20 per cent with a range from 1 per cent to 87 per cent. On the performance side, the sample includes both low- and high-performing firms. The mean $\overline{ROE}$ was 12.3 per cent, with a range from –4.0 per cent to 26.9 per cent, while the mean $\overline{ROA}$ was 1.1 per cent, with a range from –0.2 per cent to 2.6 per cent.

3 Empirical Framework and Results

The primary goal is to examine whether the shift towards non-interest income has improved the performance of the typical BHC. To do this, various performance indicators are compared with measures of the non-interest income share of operating revenue, diversification, and other control variables such as size and leverage. By explicitly controlling for both the non-interest share and revenue diversification, the direct and indirect effects of increased non-interest income can each be quantified.

The basic empirical specification is:

$$Y_i = \alpha + \beta_1 \overline{SH}_{NON,\,i} + \beta_2 \overline{DIV}_i + \gamma \overline{X}_i + \varepsilon_i, \qquad (5)$$

where Y is a measure of performance, $\overline{SH}_{NON}$ is the average non-interest share, $\overline{DIV}$ is average revenue diversification, and $\overline{X}$ is a set of control variables, all for BHC i. All variables are calculated over the BHC's lifetime so that there is one observation per firm.

A complication for the interpretation of the results is the fundamental link between $\overline{SH}_{NON}$ and $\overline{DIV}$, as shown in equation (2), so it is useful to be clear about how they relate.[8] For a BHC shifting from net interest income to

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8. While these variables are obviously correlated, this is not a debilitating econometric concern because of the non-linear relationship, i.e., econometricians routinely include a variable linearly and quadratically.

Table 1
Summary statistics for BHCs

	Mean	Standard deviation	Minimum	Maximum
RAR_{ROE}	4.67	3.20	–0.19	18.43
RAR_{ROA}	4.64	3.19	–0.18	18.29
Z-score	42.59	27.02	2.93	149.50
Assets ($m)	3,896	33,000	38	930,000
Equity/Assets (%)	9.04	2.68	1.89	28.99
Loans/Assets (%)	64.07	11.60	3.97	93.69
ROA (%)	1.08	0.41	–0.20	2.64
ROE (%)	12.28	4.39	–3.97	26.88
SH_{NON} (%)	19.89	10.31	1.43	87.33
DIV	0.29	0.09	0.03	0.50
$SH_{fiduciary}$ (%)	7.50	12.94	–40.34	98.71
$SH_{service}$ (%)	46.75	23.34	–57.13	418.25
$SH_{trading}$ (%)	0.40	5.75	–68.69	193.29
SH_{other} (%)	45.35	22.35	–318.25	195.80

Notes: Results are means from 1,816 BHCs with at least eight quarters of data from 1997Q1 to 2002Q4. All variables are averages over the BHCs' quarterly observations.

non-interest income there are two effects—the BHC is more exposed to non-interest activities (direct exposure effect) and the degree of diversification changes (indirect diversification effect). The direct exposure effect captures differences in ex post returns associated with the different activities, and a positive estimate $\hat{\beta}_1$ indicates that non-interest income activities are associated with improved performance.[9] The indirect diversification effect will depend on both the estimated coefficient $\hat{\beta}_2$ and whether the shift diversifies or concentrates revenue. Recall that an increase in the non-interest share diversifies the revenue of a BHC that has relatively little non-interest income, but further concentrates the revenue of a BHC that has relatively much non-interest income. A positive estimate $\hat{\beta}_2$ indicates that diversification is associated with improved performance. The sum of the indirect and direct effects is the net effect and shows how changes with non-interest shares affect performance through both channels.

A more formal way to think about these effects is to consider the estimated impact of a marginal increase in the non-interest share on Y:

$$\frac{\partial Y}{\partial \overline{SH}_{NON}} = \hat{\beta}_1 + \hat{\beta}_2 \frac{\partial \overline{DIV}}{\partial \overline{SH}_{NON}}, \tag{6}$$

9. Note that because the shares sum to one, one of the shares must be arbitrarily dropped. The coefficient on the included shares shows the impact of a 1 per cent change from the omitted share to the included share.

where the first term is the direct exposure effect and the second term is the indirect diversification effect, which depends on both the estimated coefficient and the change in the diversification measure from an increased non-interest income share.

The $\overline{X}$ vector includes a number of control variables. Total assets (in logs) control for systematic differences in performance across size classes, e.g., scale economies, geographic diversification, or different risk-management techniques. The equity ratio, loan ratio, and asset growth rates control for other factors that are likely to affect performance, e.g., risk-loving banks may hold less equity, make more loans, and grow more rapidly, while loans may be more or less profitable than other earning assets. The number of quarter dummy (how many quarters the BHC is observed over this period) controls for any survivor effect. Quarter and state dummy variables control for differences in the operating environment.[10]

Table 2 presents estimates of equation (5), using basic profitability ratios and variability measures ($\overline{ROE}$, $\overline{ROA}$, σ_{ROE}, and σ_{ROA}) as the dependent variables. The estimates with the profitability ratios (columns 1 and 3) show no significant relationship between profits and either the non-interest share or diversification. In sharp contrast, both variables are highly significant in the regressions that use the variability of profits as dependent variables (columns 2 and 4). For both average *ROE* and *ROA*, the coefficient on $\overline{DIV}$ is negative, which means that diversified revenue portfolios are associated with less volatile profits. This supports the traditional view that diversification can lower volatility. The coefficient on $\overline{SH_{NON}}$, however, is large and positive. This indicates that the increased reliance on non-interest income is associated with more volatile profits, which would offset any diversification benefits.

Table 3 presents estimates using the broader risk-adjusted measures of financial performance (RAR_{ROE}, RAR_{ROA}, *Z-score*) as the dependent variables. In all three cases, the same patterns emerge that indicate offsetting effects from increased non-interest income. First, there is strong evidence

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10. One concern is a potential bias in the variable construction. Net income is defined roughly as net interest income plus non-interest income less non-interest expense, while both the diversification measure and the non-interest share are functions of non-interest income and net interest income. This may cause bias, although the direction is ambiguous. *Ceteris paribus*, positive shocks to net interest income would lower the non-interest share and raise profits (a negative bias on $\hat{\beta}_1$), while positive shocks to non-interest income would raise the non-interest share and raise profits (a positive bias on $\hat{\beta}_1$). Stiroh (forthcoming) documents that non-interest income is the more volatile component, and DeYoung and Roland (2001) present reasons for the higher volatility of non-interest income, e.g., switching costs and higher operating and financial leverage associated with these activities, so one might expect the positive bias to dominate.

that revenue diversification and risk-adjusted performance are correlated (the positive and significant coefficient on $\overline{DIV}$). Because most BHCs have relatively low exposure to non-interest income, an increase in non-interest income diversifies the revenue stream and is linked with improved performance. At the same time, however, the estimates indicate that increased reliance on non-interest income is directly associated with reduced performance (the negative and significant coefficient on $\overline{SH_{NON}}$).

The net effect of increased non-interest income on performance depends on both of these coefficients and, as discussed above, the initial non-interest share. To show the difference in net effects, equation (6) can be evaluated at a different value of the non-interest share. Table 4 reports estimates of the direct, indirect, and the net effects from the RAR_{ROE} regression in column 1 of Table 3, evaluated at non-interest shares of 11 per cent, 14 per cent, 18 per cent, 23 per cent, and 30 per cent, which are the 10th, 25th, 50th, 75th, and 90th percentiles of the sample, respectively.

The first row shows the direct effect: a 1 per cent increase in non-interest income is associated with a significant decline of 0.06 in RAR_{ROE}. This does not vary across non-interest shares, because the estimated direct relationship is linear. The second row shows the indirect effect, which varies monotonically from 0.06 (significant) for a BHC with a non-interest share at the 10th percentile to 0.03 (significant) for a BHC at the 90th percentile of the non-interest shares. These results highlight the sensible conclusion that the largest diversification gains from an increase in the non-interest income share are available to the BHCs that are least exposed to this revenue stream.

The net effect, in the final line, shows the same declining pattern. BHCs with relatively little exposure to non-interest income enjoy diversification benefits from increased non-interest income, but these are offset by the costs of increased exposure to the more volatile non-interest activities. For BHCs with a large initial exposure, however, there are few diversification gains available, and further shifts towards non-interest income are associated with declining performance from the increased exposure.

These results show the double-edged nature of the trend towards non-interest income: increased revenue diversity brings benefits, but they are offset by a greater reliance on the more volatile activities. DeYoung and Roland (2001) and Stiroh (forthcoming) report similar results. DeYoung and Roland attribute the increased volatility to switching costs, operating leverage, and financial leverage, all of which make non-interest income more volatile, while Stiroh shows that trading revenue, which is the most volatile part of non-interest income, is an important source of the lower risk-adjusted returns.

Table 2
Mean and volatility of profitability regressions

	Return on equity (ROE)		Return on assets (ROA)	
	Mean	Std. dev.	Mean	Std. dev.
SH_{NON}	0.038	0.150***	0.002	0.012***
	(0.032)	(0.027)	(0.002)	(0.002)
DIV_{REV}	–0.021	–0.093***	0.001	–0.007***
	(0.034)	(0.027)	(0.003)	(0.002)
ln(Assets)	0.003***	–0.001	0.000***	0.000
	(0.001)	(0.001)	(0.000)	(0.000)
Equity/Assets	–0.337***	–0.361***	0.075***	0.009**
	(0.039)	(0.046)	(0.004)	(0.004)
Loans/Assets	0.017*	0.040***	0.002**	0.003***
	(0.010)	(0.010)	(0.001)	(0.001)
Asset growth	0.120	–0.244**	0.022***	–0.019***
	(0.094)	(0.098)	(0.006)	(0.007)
Asset growth^2	–1.401*	2.047**	–0.302***	0.169***
	(0.829)	(0.891)	(0.050)	(0.059)
No. obs.	1,816	1,816	1,816	1,816
Adjusted R^2	0.170	0.171	0.318	0.117

Notes: Regressions include state fixed effects, quarter fixed effects, and dummy variables for the number of quarters the BHC is observed. All variables are averages for all quarterly observations for each BHC. Robust standard errors are in parentheses.

***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Table 5 presents robustness checks of the RAR_{ROE} regression that use alternative data definitions or subsamples of the data. The goal here is to eliminate alternative explanations for the strong negative correlation between risk-adjusted performance and non-interest shares by excluding the BHCs for which the alternative explanations are most likely. One concern, for example, is that this relationship could reflect a reverse causality story as poor-performing BHCs increase risk to try and recover profitability. This concern can be addressed by using the non-interest shares from the beginning of the observation period, by looking only at the subsample of profitable BHCs, or by looking only at the subsample of long-lived BHCs.[11]

A second concern is that acquisitions or fast internal growth may be associated with poorer and more volatile performance. If these institutions also focus on non-interest income, then the same conditional correlation would be observed. Large BHCs, for example, were active acquirers in the late 1990s, have relatively high non-interest shares, and merger-related

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11. Another solution is to employ panel-data methods, which is addressed by Stiroh and Rumble (2003).

Table 3
Risk-adjusted performance regressions

	RAR_{ROE}	RAR_{ROA}	Z-Score
SH_{NON}	–6.156***	–6.600***	–61.181***
	(1.305)	(1.311)	(9.134)
DIV_{REV}	3.927**	3.887**	29.543**
	(1.557)	(1.571)	(11.779)
ln(Assets)	0.165**	0.210**	0.749
	(0.084)	(0.085)	(0.625)
Equity/Assets	16.119***	17.388***	307.974***
	(2.952)	(2.960)	(28.216)
Loans/Assets	–0.586	–1.004	–15.701**
	(0.753)	(0.773)	(6.344)
Asset growth	10.348	11.713*	97.926***
	(6.390)	(6.159)	(37.734)
Asset growth^2	–193.613***	–186.595***	–1433.838***
	(55.789)	(53.983)	(282.656)
No. obs.	1,816	1,816	1,816
Adjusted R^2	0.102	0.103	0.189

Notes: Regressions include state fixed effects, quarter fixed effects, and dummy variables for the number of quarters the BHC is observed. All variables are averages for all quarterly observations for each BHC. Robust standard errors are in parentheses.

***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

adjustment costs could lead to both lower returns and increased volatility. To address this concern, one can look only at "non-jumping" BHCs (asset changes of less than 20 per cent in every quarter) over the sample period.[12] Similarly, BHCs may be shifting their loan portfolios towards more risky loans at the same time that non-interest shares are rising, which would increase overall BHC risk. As a check, the subset of BHCs that showed relatively stable shares over the period for the four major loan categories (consumer, C&I, real estate, and other) are examined.

Table 5 presents the robustness results. Column 1 repeats the estimates for the full sample for comparison and shows the negative impact of greater exposure to non-interest income, but the positive effect of revenue diversification. Column 2 uses the first-period values of all explanatory variables, column 3 includes only profitable BHCs with $\overline{ROE} > 0$, and column 4 includes only the BHCs with 24 quarters of data (the complete sample). In all cases, the estimated coefficients change very little, which makes it less likely that the observed relationships primarily reflect an

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12. Note that there should not be any mechanical level effects from mergers, because all variables are ratios.

Table 4
Estimated impact of a change in the non-interest share on RAR$_{ROE}$

	Non-interest share percentiles				
	10th	**25th**	**50th**	**75th**	**90th**
Direct effect	–0.062***	–0.062***	–0.062***	–0.062***	–0.062***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Indirect effect	0.062**	0.057**	0.051**	0.042**	0.031**
	(0.025)	(0.023)	(0.020)	(0.017)	(0.012)
Net effect	0.000	–0.005	–0.011	–0.020*	–0.031***
	(0.016)	(0.015)	(0.012)	(0.010)	(0.008)

Notes: Estimates are based on regression results reported in Table 3, column 1, and evaluated at different values of the average non-interest share based on percentile ranks. Robust standard errors are in parentheses.

***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

Table 5
Robustness tests for RAR$_{ROE}$ regressions

	Full sample	**First-period values**	Subsamples			
			Profitable	**Full-period**	**Non-jumping**	**Stable loans**
DIV$_{REV}$	3.927**	3.400**	3.784**	4.233*	4.441**	5.643***
	(1.557)	(1.338)	(1.558)	(2.333)	(2.017)	(1.929)
SH$_{NON}$	–6.156***	–5.391***	–5.885***	–5.543***	–6.433***	–8.480***
	(1.305)	(1.074)	(1.304)	(1.828)	(1.917)	(1.746)
ln(Assets)	0.165**	0.124	0.152*	0.172	0.307**	0.228**
	(0.084)	(0.086)	(0.083)	(0.113)	(0.125)	(0.110)
Equity/Assets	16.119***	8.098***	15.430***	17.713***	23.048***	15.044***
	(2.952)	(2.685)	(2.958)	(4.755)	(3.488)	(3.882)
Loans/Assets	–0.586	–1.165*	–0.379	0.121	–0.681	–0.774
	(0.753)	(0.708)	(0.752)	(1.194)	(0.845)	(0.934)
Asset growth	10.348	7.056	9.145	57.909***	89.435***	30.497***
	(6.390)	(5.934)	(6.168)	(15.622)	(12.117)	(10.274)
Asset growth^2	–193.613***	–171.646***	–188.856***	–888.075***	–1213.412***	–411.077***
	(55.789)	(52.742)	(53.067)	(220.245)	(173.086)	(93.695)
No. obs.	1,816	1,814	1,805	882	1,425	1,181
Adjusted R^2	0.102	0.090	0.101	0.071	0.128	0.109

Notes: Regressions include state fixed effects, quarter fixed effects, and dummy variables for the number of quarters the BHC is observed. All variables are averages for all quarterly observations for each BHC, except column 2, which uses the first-period values of the explanatory variables. Profitable BHCs have average ROE greater than 0. Full-period BHCs have 24 quarters of data. Non-jumping BHCs have no observed growth rates greater than 20 per cent or less than –20 per cent. Stable loan BHCs have changes in loan shares over the period below 10 percentage points. Robust standard errors are in parentheses.

***, **, and * indicate statistical significance at the 1 per cent, 5 per cent, and 10 per cent levels, respectively.

increase in risk taking by poor-performing BHCs. Column 5 includes only the non-jumping BHCs and the results remain robust; it does not appear that adjustment costs or acquisition-related effects are driving the results. Column 6 includes only BHCs with relatively stable loan shares and shows similar results, so changes in the portfolio do not seem to account for this relationship.

Conclusions

These results indicate that the shift towards non-interest income by U.S. BHCs have not been associated with improved financial performance. While there is evidence of diversification benefits for BHCs that earn most of their revenue from net interest income, these gains are typically offset by the increased exposure to volatile non-interest activities. For BHCs that are already heavily exposed to non-interest activities, further increases bring few diversification gains, and performance declines, on average.

Why, then, are U.S. banks moving so steadily into activities that do not improve performance? One potential explanation is that managers may have simply overestimated potential diversification gains. Many firms, for example, have pointed to "cross selling" as a key strategy to lower costs, increase income, and diversify revenue. If BHCs are really just selling many products to the same set of customers, then this may expose multiple businesses to the same shocks, increase the correlation across revenue streams, and limit potential diversification benefits. Moreover, BHCs are shifting into precisely those activities that are the most volatile and this direct effect offsets any diversification benefits.

An alternative explanation is that managers focus on expected returns rather than on the volatility of returns. If BHC managers are large equity-holders, for example, they might take risks beyond what debt-holders and supervisors would prefer. This could be exacerbated by any implicit government guarantee (e.g., a firm considered "too big to fail"), that reduces the incentives for debt-holders to monitor and discipline risk-loving managers. This is especially plausible for the largest firms, which have, in fact, shifted the most into the highly volatile activities. A related reason for excessive risk taking is the standard principal-agent explanation: traders, brokers, and underwriters (agents) may like volatility more than share-holders (principals) do.

Short-run phenomena may also have contributed to the unprofitable shift towards non-interest income. For example, BHC managers may have over-reacted to the lending problems of the late 1980s and early 1990s by shifting too far towards other activities. This desire to avoid earlier problem areas

such as real estate lending, coupled with financial innovation and deregulation that opened new markets and products, may have led the BHCs to push too far into these activities. Other motives like empire building and managerial misconduct would also contribute as managers increase their operations and expand beyond profit-maximizing levels.

A final, more optimistic conclusion is that these activities may ultimately be profitable, but adjustment costs and temporary shocks held down the short-run returns over the period. For example, BHCs may need time to build the business practices, scale, technology, and expertise to successfully combine these activities and products, and achieve higher risk-adjusted returns. Moreover, the late 1990s included a period of extreme financial market volatility linked to financial crises in Russia and Asia. In this view, improved performance for the diversified BHC will eventually emerge.

While it is difficult to sort out the explanations, anecdotal evidence suggests that BHC managers may be realizing that a diversified firm will not guarantee success. Some BHCs, for example, have recently indicated a strategy to shift away from acquiring additional business lines, which was a major focus in the late 1990s, and towards focusing on how to derive greater profits from business lines they already own and operate. Moreover, several large BHCs have recently retrenched and exited from businesses that they had recently entered, e.g., U.S. Bancorp and FleetBoston each shed an investment bank subsidiary, and Citigroup spun off an insurance arm. Whether these examples are part of a larger trend or simply reflect changing economic conditions and opportunities is an interesting question for future work.

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