Diversification in Banking
Is Noninterest Income the Answer?

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Abstract

The U.S. banking industry is steadily increasing its reliance on nontraditional business activities that generate fee income, trading revenue, and other types of noninterest income. This paper assesses potential diversification benefits from this shift. At the aggregate level, declining volatility of net operating revenue reflects reduced volatility of net interest income, rather than diversification benefits from noninterest income, which is quite volatile and has become more correlated with net interest income. At the bank level, growth rates of net interest income and noninterest income have also become more correlated in recent years. Finally, greater reliance on noninterest income, particularly trading revenue, is associated with higher risk and lower risk-adjusted profits. These results suggest little obvious diversification benefit from the ongoing shift toward noninterest income.

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I. Introduction

The U.S. banking industry is steadily shifting away from traditional sources of revenue like loan-making and toward nontraditional activities that generate fee income, service charges, trading revenue, and other types of noninterest income. While noninterest income has always played an important role in banking revenue, Figure 1 clearly shows its growing importance.[1] By 2001, noninterest income accounted for 43% of net operating revenue (net interest income plus noninterest income), up from only 25% in 1984.

This shift toward noninterest income has contributed to higher levels of bank revenue in recent years, but there is also a sense that it can lower the volatility of bank profit and revenue, and reduce risk.[2] One potential channel is that noninterest income may be less dependent on overall business conditions than traditional interest income, so that an increased reliance on noninterest income reduces the cyclical variation in bank profits and revenue. Alternatively, expanded product lines and cross-selling opportunities associated with growing noninterest income may offer traditional diversification benefits for a bank's revenue portfolio. If noninterest income and net interest income are negatively or only weakly correlated, for example, noninterest income may diversify bank revenue and improve the risk/return trade-off.

The ability to reduce risk is obviously a topic of considerable importance for individual banks, as well as their regulators and supervisors. If noninterest income lowers the volatility of bank profits and reduces risk, for example, it might be reasonable to reduce capital requirements for banks with a diversified revenue portfolio and for supervisors to reallocate their scarce resources. Similarly, the costs of bank supervision are tied to the perceived riskiness of the institution, so banks have additional incentives to reduce risk. Managers with large equity interests in banks with franchise values have further incentives to reduce risk and maintain that value. Finally, there is evidence that large banks act as if they are risk-adverse. All of these factors contribute to the keen interest in risk-reduction among bank managers.

This paper uses aggregate and individual bank data from the late 1970s to 2001 to examine how noninterest income affects the mean and variation of bank profits and revenues, and to determine empirically whether concentration in nontraditional activities is correlated with risk indicators. The academic literature is mixed on the risk and return effects of nontraditional activity expansion by

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[1]See Radecki (1999) for details on the sources of noninterest income, with a focus on payment services, for large bank holding companies in 1996.

[2]See, for example, discussions in the *American Banker*, March 12, 2001 and June 27, 2001, as well as annual reports from several large bank holding companies in the late 1990s. This shift could also lower costs if

banks, so this issue deserves further study. By looking at the historical link between revenue diversification and performance of U.S. banks, this paper helps to fill the gap.

At the aggregate level, volatility of bank revenue growth has indeed declined in the 1990s, but this reflects lower volatility within net interest income growth rather than diversification benefits from increased noninterest income. Noninterest income growth is much more volatile than net interest income growth, largely due to very volatile trading revenue, and the covariance between the two has risen as the line between interest and noninterest activities becomes increasingly blurred. More cross-selling and a greater reliance on loan substitutes like commitments are two examples as both strategies expose multiple business segments to the same economic or financial shocks and naturally reduce the potential for diversification benefits. Moreover, neither aggregate bank profits (net income) nor the primary components of bank revenue (net interest income and noninterest income) are very highly correlated with GDP growth; in fact, noninterest income appears somewhat more cyclical than net interest income. This suggests that the banking industry should not necessarily be counting on noninterest income to smooth revenue flows or reduce aggregate cyclicality.

Bank-level data paint the same picture. The cross-sectional correlation between net interest income growth and noninterest income growth across banks in each year has steadily increased from 0.32 in 1979 to 0.66 in 2000. As banks become more heavily involved in nontraditional activities, potential diversification benefits seem to be receding. Looking at individual banks over time, the median bank-specific correlation between net interest income growth and noninterest income growth for over 14,000 banks is 0.16 and only one-third of the banks show the negative correlation needed for strong diversification benefits. Moreover, marginal increases in noninterest income shares for the typical bank is associated with a higher correlation, again limiting diversification benefits from increased noninterest income.

Finally, a novel set of results focuses on overall profitability and risk, and shows that risk-adjusted returns are strongly, negatively associated with the share of income derived from noninterest sources. Trading income, in particular, is associated with a decline in profit per unit of risk, while increased fiduciary income is associated with a gain. Noninterest income shares are also positively linked with insolvency risk, measured by the "Z-score."[3] Taken together, these results imply that the move toward noninterest income is actually worsening the risk/return trade-off for the typical bank as volatility increases while average returns do not.

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economies of scope allow elimination of redundant operations or leveraging of a fixed cost investment like computer infrastructure.

These results suggest caution for those believing that the shift toward noninterest income offers large diversification benefits, guarantees more stable bank earnings, and lowers the risk of the U.S. banking industry. Noninterest income, particularly trading, is quite volatile and the correlation between net interest income and noninterest income is rising as product lines blur and banks increasingly substitute nontraditional sources of income for interest income. This means that the banking industry may not realize the reduction in volatility and risk that some are expecting.

II. Existing Literature

Earlier work on bank diversification benefits has taken several distinct approaches: counterfactual exercises of bank combinations with non-banks, examination of actual operations of banks involved in many activities, and analysis of market reactions to bank diversification. These approaches do not give a uniform picture of the diversification possibilities for banks, so this remains an open research question. Saunders and Walters (1994), for example, review 18 studies that examine whether nonbank activities reduce bank holding company risk, and conclude that 9 answer yes, 6 answer no, and 3 provide mixed results. This section quickly summarizes the existing literature and contrasts the approach used in the current study.[4]

Beginning with the counterfactual exercises, Boyd and Graham (1988) and Boyd, Graham, and Hewitt (1993) simulate mergers between bank holding companies and nonbank financial firms and conclude that mergers between bank holding companies and life insurance firms would likely reduce the risk of bankruptcy. Rose (1989) compares financial and nonfinancial firms from 1966 to 1985 and finds the observed cash-flow correlation between banking and financial-service lines were small and positive, implying some diversification benefits. Saunders and Walter (1994) perform a simulation exercise and conclude that there are potential gains in the reduction of risk from bank expansion into new activities. They find that property and casualty insurance is a particularly attractive area for money center bank expansion. More recently, Lown et al. (2000) conclude that life insurance companies are the merger candidates with the biggest potential to reduce risk.

The second approach examines actual return and volatility data related to a wide-range of banking activities. Rosen et al. (1989) focus on 319 banks involved in real estate activities from 1980-1985 and conclude that shifts toward high-levels of real estate investment will likely increase risk. Templeton and Severiens (1992) examine market data for 54 bank holding companies from 1979 to 1986 and conclude that diversification (measured as the share of market value not attributed to bank

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[3]The Z-score is the number of standard deviations that profits must fall to drive a firm into bankruptcy. See Lown et al. (2000) for details.

[4]Saunders and Walter (1994) and DeYoung and Roland (2001) provide detailed literature reviews.

assets) is associated with lower variance of shareholder returns. This suggests some diversification benefits, although their measure of diversification is a rough proxy at best. Kwast (1989) finds limited diversification benefits from expanded bank securities powers from 1976 to 1985. Similarly, Kwan (1998) reports that bank Section 20 subsidiaries typically posted more volatile accounting returns, although not necessarily higher returns. DeYoung and Roland (2001) examine the link between bank profitability, volatility, and different revenue shares for 472 large commercial banks from 1988 to 1995. They conclude that increased fee-based activities (revenue from all sources except loans, investment, deposit, and trading activities) increases the volatility of bank revenue and bank earnings. Taken together, there is little evidence of large diversification benefits from these papers. Finally, Acharya et al. (2002) use bank-level data for Italian banks from 1993-1999 and conclude that diversification of bank assets (within the loan portfolio) does not typically improve performance or reduce risk.

The final set of papers uses market data to evaluate potential diversification benefits; some examine actual returns and other use simulation methods to estimate the implied volatility of potential bank expansion. Santomero and Chung (1992) use option pricing techniques to simulate the volatility of asset returns from combinations of 123 bank holding companies and 62 non-bank financial firms and conclude that bank expansion into nonbanking businesses reduces risk in general. In particular, bank holding company mergers with securities and/or life insurance firms generally reduces the volatility of bank returns, while mergers with property/casualty insurance increases risk but increases returns even more so that the risk of failure is not increased significantly. Similarly, Saunders and Walter (1994) compare the market returns of banks and other financial firms and build portfolio returns from various combinations. They conclude that life and property insurance combinations offer the biggest potential to reduce systematic risk for money center banks.

Houston and Ryngaert (1994) examine the market returns for a set of 153 bank mergers from 1985 to 1991 and find little evidence of excess returns as negative gains to bidders cancel out positive gains to targets. While this is not a test of diversification directly, it does provide some indirect evidence as the institutions are unlikely to operate in the same product or geographic markets. In fact, they find that in-market mergers are better received by the market as this offers the highest cost-saving potential. Finally, DeLong (2001) uses a similar approach to examine the diversification question more directly. Bank mergers are decomposed into those that either diversify or focus along either geographic or activity dimensions and the results show the largest gains for those mergers that increase focus both in terms of geographic location and activity. In particular, the primary conclusion is that "diversifying mergers do not create value (pg. 222)." Again, this is not a direct test of the

market's reaction to increases in nontraditional activities, but it does suggest that diversification gains are not expected for typical bank expansions via mergers.

This paper builds upon the second approach and examines the sources of volatility and average returns over the last two decades, although several important features differentiate it from the earlier work. First, this study uses actual data for diversified banking institutions rather than simulations of the implied volatility of accounting or market returns between possible combinations of bank and non-bank financial institutions. In particular, this is the first study to examine the historical link between a diversified revenue portfolio and risk-adjusted profitability for all banks, which provides *prima facie* evidence on the actual effects of a diversified earnings stream.[5] Second, this study examines the diversification benefits across types of bank revenue in two complementary ways – a cross-sectional and a bank-specific correlation – which provides a fuller understanding of the risk/return effects of growing noninterest income. For example, the cross-sectional correlation shows how the correlation between noninterest income and net interest income is changing over time, while bank-specific correlation shows how the correlation differs across banks. Third, this is the first comprehensive study that examines the factors that are associated with the correlation between different types of bank revenue. Fourth, previous work only looked at bank-level data, often with a relatively small sample. In contrast, this paper presents both aggregate and bank-level results based on complete data for the U.S. banking industry with over 15,000 observations. By examining the entire industry, one can gain a better idea of the pervasiveness of this activity and its macroeconomic importance. Finally, data are through 2001, which provides a more current perspective on the issue that is most relevant for bank supervisors and regulators.

III. Data, Summary Statistics, and Trends

Two types of data are used in this paper. Aggregate U.S. banking industry data were provided by the Federal Deposit Insurance Corporation (FDIC). These data are on a quarterly frequency from 1984:Q1 to 2001:Q3, and were deflated with the GDP deflator and seasonally adjusted. Bank-level data are from the *Consolidated Report of Condition and Income* ("Call Reports"). These data are on an annual basis from 1978 to 2000 and deflated with the GDP deflator. In cases of mergers and acquisitions, the acquiring bank's code is maintained and the target drops from the sample. The effect of mergers on the bank-level results is addressed below. See the Data Appendix for details.

Table 1 shows the breakdown of major sources of bank revenue for 1980, 1990, and 2000 for three sets of banks – all banks, banks with assets greater than $10 billion (in 1996 dollars), and banks

[5]Saunders and Walter (1994) use a portfolio approach to examine potential returns through various simulation exercises using market data.

with assets below $10 billion – as aggregated from the Call Reports. Net income, net operating revenue (defined as net interest income plus noninterest income), total assets, and the number of banks for each sample are reported.

Noninterest income is a heterogeneous category that comprises many different activities, so it is broken down into four primary components – fiduciary income, service charges, trading revenue, and fees and other income. Fiduciary income is revenue related to the bank's fiduciary operations, e.g., administering investments for others. Service charges include revenue directly related to deposit accounts like ATM or check usage fees. Trading revenue is primarily income from trading cash instruments, off-balance contracts, and mark-to-market changes in the carrying value of assets and liabilities. Fees and other income include all other fees, e.g., loan commitment fees, safe deposit boxes, commissions, and land rental fees. Of course, there is also considerable heterogeneity within these broad categories, but this is the best one can do with the available data.

Details on these components are provided in the Data Appendix. Kwast (1989) provides accounting details on trading revenue in the Call Reports, although one aspect deserves special note here. Trading revenue includes the effect of marking to market certain on-balance sheet assets and liabilities and off-balance sheet items. This is the only component of noninterest income that is based on mark to market accounting, and accounting differences may affect measured volatility as the income items responds more quickly to changing market conditions. It is not possible, however, to precisely quantify how much of trading revenue is due to these adjustments.

As shown in Table 1, noninterest income for all U.S. banks increased as a share of net operating revenue from 20.4% in 1980 to 32.5% in 1990 to 43.4% in 2000. The biggest increase was in fees and other income, but all four components of noninterest income showed sizable increases as a share of net operating revenue. The same pattern is true for the sub-samples of very large and smaller banks. Large banks, for example, saw noninterest income rise from 26.5% of net operating income in 1980 to 47.8% in 2000, while small banks saw an even faster rise from 17.4% to 33.1%. Trading income is highly concentrated in the largest banks with substantial nontraditional operations. A key point, however, is that the shift toward nontraditional sources of income seems to be pervasive across banks of all sizes, and not just limited to a few mega-banks that perform many diverse activities.

IV. Aggregate Fluctuations of Bank Revenue

This section examines the aggregate fluctuations of bank profits and revenue over the last two decades. I explore whether net income and net operating revenue are becoming more cyclical as banks' reliance on noninterest income grows, whether the primary revenue streams are becoming more

volatile, and which components are driving changes in aggregate cyclicality and volatility. All data in this section are the quarterly income figures for the U.S. banking industry provided by FDIC.

All shown in Table 1, both major revenue sources are growing over the sample, so a natural first step in examining whether net interest and noninterest income move together is simply to plot the quarterly growth rates of these series over time. Figure 2 shows the growth of each type of revenue from 1984:Q1 to 2001:Q3 with NBER recession periods as shaded areas. Casual examination does not suggest a strong correlation with the aggregate business cycle for either series.

Noninterest income appears much more volatile than net interest income, particularly in the 1990s.[6] Noninterest income also has a higher mean growth rate, however, and the coefficient of variation (the ratio of the standard deviation to the mean) for noninterest income growth is only slightly higher than for net interest income growth (2.0 vs. 1.9). The volatility of net interest income growth is largely driven by the dramatic swings in the late 1980s when the banking industry experienced substantial problems related to real estate and lending to lesser-developed countries. If this period is excluded and one examines the data after 1989, then noninterest income growth is much more volatile than net interest income growth: the coefficient of variation for noninterest income growth is 2.3 compared to 1.1 for net interest income growth.[7] Thus, noninterest income appears to be becoming more volatile, while net interest income is becoming less so.

Figure 3 shows the growth rates of the four components of noninterest income – fiduciary income, service charges, trading revenue, and fees and other noninterest income. Due to the extreme volatility of these series, Figure 3 plots four-quarter growth rates and even these smoothed series show enormous volatility for trading revenue. For the period 1984:Q1-2001:Q3, the standard deviation of the four-quarter growth rate of trading income was 39.8, compared to 7.2 for fees and other noninterest income, 6.6 for fiduciary income, and 2.9 for service charges.[8] Clearly, trading income is the most volatile component of bank income.

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[6]F-tests are used to compare the volatility of net interest income to noninterest income and reject the null hypothesis of equal standard deviations for the full period (p-value=0.00), the period 1990:Q1 to 2001:Q3 (p-value=0.00), and the period 1984:Q1-1989:Q3 (p-value=0.06).

[7]For the period 1990:Q1 to 2001:Q3, net interest income growth averaged 3.3% with a standard deviation of 3.7, while noninterest income growth averaged 7.0% with a standard deviation of 16.0. The null of equal standard deviations is strongly rejected (p-value=0.00).

[8]F-tests decisively reject the null hypothesis of equal standard deviations for all pairwise combinations of the quarterly growth rates for the four components of noninterest income except for fiduciary and other noninterest income (p=0.12).

a) Aggregate Volatility

To gauge how net interest income and noninterest income contribute to the volatility of bank revenue, it is useful to think of net operating revenue as a simple portfolio of two types of assets: those that generate net interest income and those that generate noninterest income.[9] It is difficult to identify the specific assets associated with each income class to calculate a rate of return, however, so I modify the standard decomposition of portfolio return volatility into a decomposition of portfolio growth volatility. That is, if net operating revenue (*OPREV*) is defined as the sum of net interest income (*NET*) and noninterest income (*NON*), then the volatility of net operating revenue growth is:

$$(1)\quad \sigma^2_{d\ln OPREV} = \alpha^2 \cdot \sigma^2_{d\ln NON} + (1-\alpha)^2 \cdot \sigma^2_{d\ln NET} + 2 \cdot \alpha \cdot (1-\alpha) \cdot Cov(d\ln NON, d\ln NET)$$

where $\alpha = NON/(NET + NON)$ is the noninterest share of bank operating revenue growth, $d\ln X$ is the growth rate of X, and the "contribution" of each component to overall revenue volatility is the share-weighted variance, e.g., $\alpha^2 \cdot \sigma^2_{d\ln NON}$ is the contribution of noninterest income.

Standard portfolio theory implies that the overall variance of net operating revenue rises as the noninterest income share grows if noninterest income is more volatile than net interest income. A negative covariance between noninterest income growth and net interest income growth will directly lower the overall variance. Even if the covariance term is positive, however, the trade-off between growth of net operating revenue and volatility can improve. That is, average growth is the weighted average of the growth rates of the components, but the standard deviations will be less than the weighted average as long as the covariance is not exactly one.

Table 2 shows estimates for the components of Equation (1) for two time periods – 1984:Q1 to 1989:Q4 and 1990:Q1 to 2001:Q3. The first column gives the average shares of noninterest income (α) and net interest income ($1-\alpha$), the second column gives the sample variance or covariance of the variables $\left(\sigma^2_{d\ln OPREV}, \sigma^2_{d\ln NON}, \sigma^2_{d\ln NET}, and\ Cov(d\ln NON, d\ln NET)\right)$, and the third column gives the contributions (share-weighted variances) as on the right-hand side of Equation (1).[10]

These estimates show that bank revenue has become slightly less volatile, e.g., the variance of net operating revenue growth fell from 50.4 for 1984:Q1-1989:Q4 to 46.2 for 1990:Q1-2001:Q3, although the difference in volatility is not statistically significant. More important, however, is the

[9]This approach is similar to the bank-level work of Kwast (1989), Rose (1989), and Saunders and Walter (1994), although they focus on returns across different operations.

[10]The sum of the contributions will not exactly match the variance of net operating revenue because the share is changing throughout the sample.

observation that the decline in volatility does not seem to reflect any diversification benefits between net interest income and noninterest income growth because the covariance between the two became larger across the two periods (–29.0 in the first period vs. 5.6 in the second). In addition, noninterest income is becoming more volatile (variance increased from 228.9 to 259.1, not significantly different) and growing in relative size (share increased from 28% to 37%). This led to an increase in the contribution to the volatility of net operating revenue growth from 18.2 in the first period to 35.8 in the second. The entire decline in overall revenue volatility, therefore, is due to net interest income, which became much less volatile (variance fell from 100.2 to 14.2, significantly different) and relatively less important (share fell from 72% to 63%).[11]

The increased correlation between net interest income growth and noninterest income growth deserves some discussion. One plausible explanation is that the increased focus on "cross-selling" different products to a core customer base may expose different lines of a bank's business to the same shock, e.g., firm, industry, or lending market troubles. That is, simply selling more products to the same customers does not imply diversification benefits if a given customer's demands for all products are highly correlated. Similarly, the increased use of loan commitments exposes both net interest income and fee and other noninterest income (where loan commitment fees are booked) to the same fluctuations in loan demand and market conditions.[12] In both cases, if a bank provides both traditional lending and nontraditional fee-based activities to a particular firm or industry, then several lines of business may suffer simultaneously if that firm or industry faces financial troubles. This would increase the correlation between the two revenue streams and reduce diversification benefits.

This decomposition shows that bank operating revenue has become less volatile simply because net interest income has become less volatile. This could reflect diversification benefits within traditional bank activities as banks become less geographically concentrated. The late 1980s, for example, were a period of regional shocks and regional banking problems. An alternative explanation is that the early sample was particularly volatile due to the severe banking problems of the late 1980s as can be seen in the spikes of net interest income growth. In addition to a more stable banking environment, the U.S. economy in general has become more stable in the 1990s, which likely helped to smooth bank revenue.[13] Diversification benefits associated with the shift toward noninterest income do not seem to have played an important role.

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[11]The p-values associated with the null hypothesis of equal standard deviations across the two periods are: 0.81 for net operating revenue, 0.00 for net interest income, and 0.74 for noninterest income. The same pattern holds if trading income is excluded from the analysis.

[12]Aggregate unused loan commitments increased from 33% of total loans in 1984 to over 120% in 2001.

[13]Perez-Quiros and McConnell (2000) document a decline in GDP volatility that began in the mid-1980s.

b) Aggregate Cyclicality

This section describes the cyclical properties of the different types of bank revenue. Rather than simply looking at recession periods as in Figures 2 and 3, I calculate correlations between income growth and lags of GDP growth by estimating the following regression:

$$(2)\quad d\ln X_t = \alpha + \sum_{\tau=1}^{4} \beta_{t-\tau} d\ln X_{t-\tau} + \sum_{\tau=0}^{4} \delta_{t-\tau} d\ln GDP_{t-\tau} + \varepsilon_t$$

where X_t is some measure of bank income and GDP is real GDP.[14]

Table 3 reports estimates of Equation (1) for six measures of bank income – net income, net income plus provisions, net interest income, net interest income less provisions, noninterest income, and noninterest income less trading revenue. The first two are measures of bank profits; I begin with the bottom line measure of net income and then add back loan loss provisions. Net income plus provisions is included because there is some evidence that banks use loan loss provisions to smooth earnings over the cycle and adding back provisions may help to better understand the cyclicality of bank earnings.[15] The second two columns are indicators of traditional banking activities, measured as net interest income. Again, I begin with the standard measure and then adjust for provisions, here subtracting provisions, because it may provide a more accurate measure of the return to traditional lending activities because it accounts for expected defaults. The final two columns measure nontraditional activities in the form of noninterest income. Noninterest income less trading revenue is included to isolate the portion of noninterest income not associated with the very volatile trading book.

Beginning with the regressions with bank profits as the dependent variable in column 1, there appears to be only a weak correlation between net income growth and GDP growth, e.g., the contemporaneous and lagged GDP coefficients are jointly significant at the 10% level (p-value of 0.08). Adding back provisions in column 2 weakens the significance of the GDP variables slightly (p-value=0.19), so income smoothing does not appear to the story. An alternative explanation is that GDP growth is too broad of a measure, i.e., banks were geographically constrained for much of the sample. Meyer and Yeager (2001), however, find only a weak correlation between local economic activity and the performance of small rural banks so this is unlikely to be the whole answer.

Moving to the two broad components of net operating revenue, both net interest income in column 3 and noninterest income growth in column 5 show little evidence of a link with current and

[14]Rose (1989) ran a simpler regression for banking cash flows using only contemporaneous GNP growth and other controls, but no lagged dependent variables. He finds that banking cash flow is negatively correlated with real GNP growth, but uncorrelated with nominal GNP growth.

[15]See Greenwalt and Sinkey (1988), although Ahmed et al. (1999) conclude that banks do not use provisions to smooth earnings.

lagged GDP growth rates (p-value=0.27 and 0.12, respectively). Subtracting provisions from net interest income in column 4 weakens the relationship dramatically. The large and significant negative coefficients on the lagged dependent variable indicate the negative autocorrelation of the series, i.e., rapid growth in provisions in one quarter is typically followed by negative growth next quarter as provisions return to normal levels. Removing trading revenue from noninterest income in column 6 substantially strengthens the link with lagged GDP, which implies that aggregate fiduciary income, service charges, and fees are more highly correlated with GDP than trading income. While these regressions are quite simple, they appear to refute the belief that the shift toward nontraditional banking activities can smooth the effect of business cycle fluctuations.

A second way to address this issue is with a simple vector autoregression (VAR) framework, i.e., a stacked set of regressions of GDP growth, net interest income, and noninterest income on lagged values of the same. *A priori*, one would expect GDP to affect bank revenue, but it is less obvious that bank revenue should affect GDP; this suggests a natural ordering of the VAR with GDP first.

Figures 4a and 4b show the impulse response function from a VAR with GDP, net interest income, and noninterest income from 1984:Q1 to 2001:Q3. The VAR is estimated in log-levels for real GDP, real net interest income, and real noninterest income with a trend. The impulse response function shows how a shock to GDP propagates through the system and affects net interest income and noninterest income. The results indicate a weak, positive response of net interest income to shocks to GDP for a few quarters, and a significant response for noninterest income in only the first quarter. The timing is also quite different with net interest income showing a short-run impact that fades, while noninterest income shows a modest, although statistically insignificant, increase over the longer run.[16]

These results indicate that net interest income and noninterest income respond only weakly to changes in real output. When trading income is removed from noninterest income, however, there is stronger link with GDP growth, which provides little support for the belief that nontraditional income sources will remove the cyclicality of bank revenue. Moreover, any gains that do exist must be weighed against the larger unconditional volatility of noninterest income growth.

V. Bank-Level Variability

This section moves beneath the aggregate data to examine the role of noninterest income in determining the profitability and riskiness of individual banks. This is done in two ways. First, a "cross-sectional correlation" measures the correlation between net interest income growth and

[16]Augmented Dickey-Fuller tests for GDP, net interest income, and noninterest income with four lagged differences fail to reject the null hypothesis of a unit root in levels, but reject the same null in first differences.

noninterest income growth across banks at a point in time.[17] Second, a "bank-specific correlation" measures the correlation between net interest income growth and noninterest income growth across time for each bank.[18]

The initial focus is on bank revenue, rather than bank profits, because the perception seems to be that diversification leads to smoother revenue flows and because expenses cannot be allocated across business lines to generate returns on each segment. Bank profitability, safety, and soundness, however, may be the areas of ultimate interest, so the last sub-section focuses on the link between noninterest income and the level and variability of bank profits. In particular, I look at the historical relationship between noninterest income shares and measures of bank profitability (net income growth and mean ROE) and risk (Sharpe ratio and Z-scores).

a) Cross-Sectional Correlation

The cross-sectional correlation, ρ_t gives the correlation across banks in each year t and is defined as:

$$\rho_t = Corr(d\ln NET_{i,t}, d\ln NON_{i,t}) \quad \forall\, t$$

$$= \frac{\sum_{i=1}^{I}\left[\left(d\ln NET_{i,t} - \overline{d\ln NET_t}\right)\left(d\ln NON_{i,t} - \overline{d\ln NON_t}\right)\right]}{\left(\sum_{i=1}^{I}\left(d\ln NET_{i,t} - \overline{d\ln NET_t}\right)^2\right)^{1/2}\left(\sum_{i=1}^{I}\left(d\ln NON_{i,t} - \overline{d\ln NON_t}\right)^2\right)^{1/2}} \tag{3}$$

where ρ_t is estimated for each year from 1979 to 2000. $NET_{i,t}$ is net interest income and $NON_{i,t}$ is noninterest income for bank i in year t, and $\overline{d\ln NET_t}$ and $\overline{d\ln NON_t}$ are the average growth rates across all I banks in year t .

The cross-sectional correlation is estimated separately for each year and describes how much net interest income and noninterest income move together across banks in a particular year. That is, it shows whether a bank with above average noninterest income growth typically has above average growth in net interest income. If noninterest income plays a diversifying role for bank revenue, then one would expect them to be negatively correlated, i.e., positive shocks to one revenue source are

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This implies that all series are integrated of order 1. When the VAR is run in log first differences, there is no significant response of either net interest income or noninterest income to GDP shocks.

[17]This analysis is done in growth rates because correlations of revenue levels would be largely determined by the scale of the institutions.

[18]The cross-sectional correlation has one observation for each year, while the bank-specific correlation has one observation for each bank.

offset by negative shocks to the other one. A strong positive correlation, on the other hand, would suggest little diversification from the broadening of bank revenue.

One potentially confounding factor is the impact of rapidly growing or rapidly shrinking banks. For example, if a bank acquires another bank in a given year its entire income statement and balance sheet would likely jump, which would raise the cross-sectional correlation. Similarly, a contracting bank that is shrinking due to competitive pressures or a declining market would likely see negative growth in both net interest income and noninterest income. This is not the type of diversification effect that people seem to have in mind, so I estimate the cross-sectional correlation both with and without these types of rapidly changing banks.

In practice, I begin with all banks with complete data in two consecutive years and then estimate ρ_t for three sets of banks: all banks, large banks (assets greater than $1 billion in 1996 dollars), and a group of "non-jumping banks" (asset growth above the 10th percentile and below the 90th percentile in that year) to remove the effect of rapid growers and shrinkers.[19] In all cases, included banks have data on net interest income, noninterest income, and assets in year *t* and in year *t-1* to be included in the estimation of ρ_t.

Figure 5 plots the time series of cross-sectional correlations, ρ_t, for the three sets of banks. When all banks are included, ρ_t rises steadily from 0.32 in 1979 to 0.66 in 2000; the average across all years is 0.53 with a mean of 0.45 before 1990 and 0.61 after 1989.[20] As expected, when non-jumping banks are excluded, the estimated correlation falls, particularly for the early years, but becomes quite strong (near 0.50) and statistically different from zero during the late 1990s. For large banks, there is less of an upward drift, but the level is quite high with an average of 0.62 across all years. The estimate for large banks is much more volatile because of the decreased number of observations.[21] It is also interesting to note that the correlation for large banks falls during recessions, but it is difficult to draw firm conclusions from only two observations. Overall, the correlation has trended up, which means that bank-specific shocks to net interest income and noninterest income are

[19]The non-jumping sub-sample excludes banks that have extraordinary increases or decreases in their assets and thus should remove banks involved in mergers or large divestitures that might cloud the interpretation. Results are robust to changing the cut-off.

[20]The difference between the two sub-samples is significant at the 99 percent level and null that 1979 and 2000 have the same value is rejected (p-value=0.03).

[21]The sample of all banks drops from 14,117 in 1979 to 8,110 in 2000 and the sample of non-jumping banks falls from 11,319 in 1979 to 6,515 in 2000, while the sample of big banks rises from 308 to 358. The difference between the two time periods is significant at the 95 percent level for the large bank subsample and at the 99 percent level for the non-jumping banks.

becoming more highly correlated precisely when banks are increasing their focus on noninterest income.

One can also calculate the cross-sectional correlation between the components of noninterest income – fiduciary income, service charges, trading revenue, and fees and other – and net interest income for all banks. Figure 6 shows that service charges are the component most highly correlated with net interest income. This is not surprising as service charges are closely aligned with traditional banking operations linked to deposit-taking activities, e.g., maintenance, minimum balance, number of check fees, etc. If all traditional activities respond to the same economic shocks like regional economic activity, then one would expect to see a high correlation between these revenue streams.

The correlation of net interest income with fees and other interest income has increased by a factor of three over two decades, which is consistent with the earlier discussion that increased use of loan commitments is blurring the line between lending and fee income. As banks substitute credit commitments for actual loans, the correlation will rise if both respond in a similar fashion to changes in loan demand. Finally, trading income growth shows the lowest correlation with net interest income growth. This is reasonable as trading income is more dependent on market fluctuations than traditional banking activities and therefore responds to different shocks.

These results show a relatively high degree of correlation between noninterest income and net interest income across banks, which suggests little obvious diversification benefits as growth in one type of income is typically associated with similar growth in the other type. Moreover, the correlation has been trending up, implying less diversification benefits as the banking industry steadily shifts its revenue focus to noninterest income sources. Trading income and fiduciary income show the weakest correlation, which implies the best diversification opportunities for a bank with traditional, interest-generating activities, although any potential gains must be weighed against the higher overall volatility of trading income.

b) Bank-Specific Correlation

The bank-specific correlation, ρ_i gives the correlation <u>across time</u> for each bank and is defined as:

$$\rho_i = Corr(d\ln NET_{i,t}, d\ln NON_{i,t}) \quad \forall\, i$$

$$= \frac{\sum_{t=1}^{T}\left[\left(d\ln NET_{i,t} - \overline{d\ln NET_i}\right)\left(d\ln NON_{i,t} - \overline{d\ln NON_i}\right)\right]}{\left(\sum_{t=1}^{T}\left(d\ln NET_{i,t} - \overline{d\ln NET_i}\right)^2\right)^{1/2}\left(\sum_{t=1}^{T}\left(d\ln NON_{i,t} - \overline{d\ln NON_i}\right)^2\right)^{1/2}} \tag{4}$$

where ρ_i is estimated for each bank with at least six years of data for both net interest income growth and noninterest income growth. $\overline{d \ln NET_i}$ and $\overline{d \ln NON_i}$ are the average growth rates for bank *i* across all *T* years of its years of operations.

The bank-specific correlation is estimated for each bank and describes how a bank's two primary sources of income move together over time. This is a more traditional measure of correlation and has direct implications for the diversification question because it measures whether a given bank's shocks to one type of income are typically accompanied by similar shocks to the second. A negative correlation would suggest strong potential diversification benefits.

Differences in bank behavior can also play a confounding role in interpreting these estimates. Consider a bank that is rapidly growing throughout the sample period due to a stream of acquisitions. This bank would likely have rapid growth of *both* net interest income and noninterest income, on average, but this would not be a problem here because ρ_i calculates whether periods of above average net interest income growth are typically accompanied by above average noninterest income growth. Very rapid or very slow growth rates for only a few years, however, will affect ρ_i, so the empirical work controls for average growth rates.

ρ_i is estimated with annual data for all banks with growth rates of both net interest income and noninterest income for more than five years during the sample period.[22] This left a sample of 14,503 observations for distinct banks with anywhere from six years (the minimum cut-off for inclusion) to 22 years (the complete sample). The mean ρ_i was 0.20, with a median of 0.16 and a standard deviation of 0.42. For large banks (average assets greater than $1 billion in 1996 dollars), the mean ρ_i was 0.33, supporting the earlier result that large banks typically show a stronger correlation between types of income growth. For non-jumping banks (average asset growth between the 10th percentile and 90th percentile), the mean was 0.15, which is close to the full sample and supports the contention that rapidly growing or shrinking banks are not driving these results. Taken together, these results show a modest, positive correlation between net interest income growth and noninterest income growth for the typical bank.

This procedure yields over 14,500 estimates of ρ_i, so it is useful to look at the distribution. Figure 7 shows a wide range of ρ_i for all banks that is centered at 0.2, but ranges from -0.96 to nearly

1.0. An asset-weighted distribution, which provides a better picture of the diversification potential for the industry as a whole, shows a similar pattern as the unweighted distribution in Figure 7. The mass in the right-hand tail with very high correlations primarily reflects banks with a relatively small number of years of data; if the graph is limited to banks with the full 22 years of data, this mass disappears and the distribution appears more normal.

The tails of the distribution are also of particular interest because large negative correlations imply the biggest potential diversification benefits and large positive correlations the least. For the complete sample, about one-third of the banks show a negative correlation between net interest income growth and noninterest income growth. Banks with a negative correlation tend to be smaller on average than banks with a positive correlation (mean average assets of $230 million vs $370 million) and show slower growth over their life (2.8% mean average growth vs. 6.4%). One can also focus on the extreme ends of the distribution and compare banks in the 10th percentile (mean ρ_i of –0.48) to those in the 90th percentile (mean ρ_i of 0.92). Here, there is little difference in average size, although the banks with a high correlation did grow substantially faster (13.9% on average for banks above the 90th percentile vs. 2.8% for those below the 10th percentile).

One can look at the factors associated with the correlation between growth in the two types of bank revenue by using the estimate of ρ_i as the dependent variable in the following regression:

$$\rho_i = \alpha + \beta_1 \ln(\overline{A_i}) + \beta_2 \overline{\left(\frac{E}{A}\right)}_i + \beta_3 \overline{d\ln(A_i)} + \beta_4 \overline{NONSH}_i + \beta_5 \overline{NONSH}_i^2 + \beta_4 \overline{FIDSHR}_i + \beta_5 \overline{TRDSHR}_i + \beta_6 \overline{FEESHR}_i + \beta_7 BANYRS_i + \beta_8 MULTI_i + \varepsilon_i \quad (5)$$

where A is assets, $\left(\frac{E}{A}\right)$ is the leverage ratio, $d\ln(A)$ is annual asset growth, *NONSH* is noninterest income's share of net operating revenue, *FIDSHR* is fiduciary income's share of noninterest income, *TRDSHR* is trading income's share of noninterest income, *FEESHR* is fees and other noninterest income's share of noninterest income, *BANKYRS* is the number of observations used in the bank-specific correlation, and *MULTI* is a dummy variable indicating if the bank belongs to a multi-bank

[22]The five-year cut-off was chosen to drop banks with only a few years worth of data for which the bank-specific correlations are less meaningful. Some banks were also dropped due to missing data on the breakdown of net operating revenue.

holding company.[23] Bars over variables indicate averages for the number of periods bank *i* is observed.[24]

Noninterest income share is one measure of the focus on nontraditional banking activities. While this is surely not an exogenous variable and reflects banks' strategic choices and business opportunities, one can use it to examine the historical relationship between revenue correlations and nontraditional activity. The noninterest income share is included directly and as a quadratic term to account for the natural non-linear relationship. That is, a bank with all of its net operating revenue as either net interest income (*NONSH=0*) or as noninterest income (*NONSH=1*) would show little correlation between the growth rates of the two variables.

Average assets are included to control for any systematic differences in the correlation that are related to size, e.g., large banks may have more developed risk management techniques or may be involved in fundamentally different types of activities with different distributions. The leverage ratio and asset growth are included to proxy for bank risk as high-risk and low-risk banks may have different operating strategies that lead them to focus on revenue generation in different ways. The number of observations of each bank, which ranges from six to 22, is included because banks that are observed for many periods may have a lower correlation, on average, simply because the income streams are longer and subject to more noise. Finally, an indicator of the bank's affiliation is included because banks owned by a multi-bank holding company may have more ability to shift income and affect observed volatility.

Table 4 reports results for the three sets of banks – all banks with an estimate of ρ_i, non-jumping banks, and large banks. For each set of banks, I report estimates of Equation (5) both with and without the detailed shares of noninterest income. Of course, these are all reduced form regressions and one cannot draw causal inferences; rather, they are just conditional correlations.

For all banks and non-jumping banks (columns 1 and 3), the linear and quadratic noninterest income shares are jointly significant and show the expected inverted-U shape, i.e., a positive coefficient on the linear noninterest income share term and a negative coefficient on the squared term. This means that the correlation is largest for banks in the middle range. For banks with low noninterest shares, there appears to be little diversification benefit from marginal increases in noninterest income as this increases the correlation. For large banks (column 5), however, the

[23]A bank is identified as belonging to a multi-bank holding company (*MULTI*=1) if another commercial bank shares the same direct holding company (RSSD9379 in the Call Reports) or high holding company (RSSD9348 in the Call Reports).

[24]One must arbitrarily drop one of the four components of noninterest income to avoid perfect collinearity. Service charges is chosen because it has the largest mean share of noninterest income.

relationship is negative, which likely reflects the relatively high shares of noninterest income for large banks, i.e., they are on the downward part of the inverted-U.

The other controls show that larger banks, banks with high equity ratios, and rapidly growing banks tend to show higher correlations between net interest income growth and noninterest income growth, although the significance varies across samples. In addition, banks that belong to multi-bank holding companies always show a higher correlation.

Moving to the link with different shares of noninterest income (columns 2, 4, and 6), the estimated coefficients on the noninterest income shares do not change much, while the coefficients on the detailed component shares are uniformly negative and often statistically different from zero. As banks shift their noninterest income away from service charges (the omitted component of noninterest income) and toward fiduciary, trading, or fees and other noninterest income, the correlation drops, which suggests that there may be some diversification benefits from these activities. Higher concentrations of service charges, on the other hand, are associated with higher correlations between net interest income growth and noninterest income growth. This supports the cross-sectional estimates in Figure 6 that showed service charges were the component of noninterest income most highly correlated with net interest income in each year. Again, this is reasonable as service charges are the component of noninterest income most closely aligned with traditional banking activities.[25]

c) Noninterest Incomes Shares, Bank Risk, and Return

The final step is to examine how noninterest shares are correlated with other variables in which we are ultimately interested. For example, do banks with a diversified revenue stream show less volatile profits? Higher average profits? Lower insolvency risk? Examining the historical link between noninterest income shares and fundamental measures of bank profitability and risk provides a better understanding of the impact of the shift toward noninterest income on the strength and stability of the banking industry. Bankers and regulators, for example, may be most interested in how noninterest income affects banks' profitability and insolvency risk.

As a first pass, I graph the historical relationship between noninterest income shares and two standard measures of performance and risk – the "Sharpe Ratio" and the "Z-score." The Sharpe Ratio (average return on equity (ROE) divided by the standard deviation of ROE) is a measure of risk-adjusted profits.[26] The Z-score (average return on assets (ROA) plus average equity to assets, divided by the standard deviation of ROA) measures how many standard deviations profits must fall below its

[25]These results are robust to the exclusion of trading income from the noninterest income variable and the shares.

mean to bankrupt the firm and is related to the probability of failure. In both cases, lower values indicate increased risk. Figure 8 plots the Sharpe Ratio and Z-score against noninterest income shares and shows a strong negative slope: banks with high noninterest income shares earn lower risk-adjusted profits and are relatively risky. While there are no controls and noninterest shares are obviously an endogenous variables so one cannot draw causal inferences from this, banks with high noninterest income shares seem to have higher risk.[27]

One can be more formal about this by utilizing regressions similar to Equation (5) with different dependent variables. Columns 1 and 2 of Table 5 use the mean and standard deviation of net income growth, respectively, as the dependent variables. These regressions show how the mean and volatility of bank profit growth vary with the composition of the revenue stream. Columns 3 through 5 of Table 5 shift to the mean and volatility of return on equity (ROE). Column 3 uses mean ROE as the dependent variable, column 4 uses the standard deviation of ROE, and column 5 uses the average Sharpe Ratio (defined above). Column 6 uses the Z-score (defined above) to examine the link between noninterest income shares and insolvency risk.

Column 1 shows the same inverted-U when the mean growth rate of net income is the dependent variable as banks with a balanced revenue portfolio show higher average net income growth, even after controlling for average growth in total assets. The coefficients on the components of noninterest income suggest that trading income shares are most highly associated with higher growth, although it is not statistically different from zero. Fiduciary income shows the most negative correlation, which is consistent with the idea that it is a slow growth business.

With the volatility of net income growth as the dependent variable (column 2), the coefficients again show an inverted-U. The peak of the U, however, is far beyond the typical noninterest income share so an increase in the noninterest income share is associated with increased volatility of net income for the typical bank.[28] Average size is strongly negatively correlated with income volatility, perhaps because large banks are inherently more diversified across and within business lines and geographic markets. The negative coefficient on the average capital ratio likely signals the risk-preference of banks; relatively risky banks have both low capital ratios and high volatility of income.

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[26]More accurately, a Sharpe Ratio subtracts out the risk-free rate of return. If this is constant across all banks, it would not affect the results.

[27]To create this figure, I sorted the nearly 15,000 banks by their average noninterest income shares and created 50 bins with an equal number of banks (about 300) in each. I then plotted the average Sharpe Ratio and Z-score for all banks in each bin to effectively smooth the relationship. A simple regression of the average Sharpe Ratio or Z-score on the average noninterest income share shows a strongly negative and statistically significant relationship.

As expected, trading income is the noninterest income component most highly correlated with income growth volatility; this is similar to DeYoung and Roland (2001). Columns 1 and 2 suggest that trading income raises the volatility of net income growth, but not the mean growth rate, while fiduciary income is a low risk/low return that lowers both the mean and the volatility of net income growth.[29]

The ROE regressions show a similar story.[30] Beginning with mean ROE as the dependent variable in column 3, the noninterest income shares are not statistically different from zero (either independently or jointly) and the regression has essentially no explanatory power. In fact, the only variable that enters significantly is the count variable (*Bank Years*), which is a survivor effect as more profitable banks tend to operate for longer periods of time. Column 4 provides weak evidence that the noninterest income share is positively correlated with the volatility of ROE, although there is again essentially no explanatory power. The quadratic term is negative but quantitatively small and statistically insignificant, which implies a positive relationship between noninterest income shares and volatility of bank ROE. The only other financial variable that is significant is the negative coefficient on the average leverage ratio, which again signals risk preferences.

With the Sharpe Ratio as the dependent variable (column 5), the negative and significant coefficient on the noninterest income share effectively summarizes the main finding – banks with higher noninterest income shares have lower profitability per unit of risk. The coefficients on the components of noninterest income again show that fiduciary income is associated with the most profit per risk, while trading income offers the least. This supports some earlier work that pointed out the downside of trading activities. Kwast (1989), Kwan (1998), and DeYoung and Roland (2001), for example, find that securities or trading activities were associated with higher volatility of returns, but not necessarily higher average returns, while Morgan and Stiroh (2001) report indirect evidence as banks with large trading positions pay higher spreads in the debt market.

Finally, the results with the Z-score as the dependent variable (column 6) are quite similar. The Z-score falls as the noninterest income shares rises, which indicates that banks with a large reliance on noninterest income have higher relative insolvency risk. Increased fiduciary income again lowers risk, while increased fees and other income raises it. Trading income enters with a negative sign, but it is not statistically significant. Again, bank years is strongly positive, indicating an important survivor effect.

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[28]The mean of the average noninterest income share for all banks is about 15%. Maximizing the fitted value, $y=72.6+129.3x-96.4x^2$, gives a peak at about 67%.

[29]Results are similar using net income before provisions in columns 1 and 2.

[30]Results are similar with return on average assets (ROA), with trading income excluded, or with the sub-sample of non-jumping banks.

The results in Table 5 and Figure 8 show that greater reliance on noninterest income has been associated with higher volatility of bank income and higher risk, but not with higher returns. This suggests that the move toward noninterest income may actually be worsening the risk/return trade-off for the typical bank and not generating large diversification benefits. Two caveats deserve mention, however. First, as mentioned above, there is a potential simultaneity issue here because a bank's focus on nontraditional activities is chosen by bank managers and is not exogenous. Second, these results do not mean that no banks are able to successfully manage the nontraditional income and improve profits or lower risk, but rather that this is not the case for the typical bank.

VI. Conclusions

This paper explores the link between the growing reliance on noninterest income and the volatility of bank revenue and profits. Results from both aggregate and bank data provide little evidence that this shift offers large diversification benefits in the form of more stable profits or revenue.

At the aggregate level, noninterest income is much more volatile than more traditional net interest income. Although net operating revenue has in fact become less volatile in the 1990s as noninterest income grew in importance, this can be directly traced to the declining volatility of net interest income that more than offset the increased contribution from the growing share of the relatively volatile noninterest income. Trading income, in particular, shows enormous volatility. Moreover, net interest income and noninterest income growth rates have become more highly correlated in the 1990s.

At the bank level, noninterest income growth also shows an increased correlation with net interest income over the last decade. Service charges and fees in particular are highly correlated with net interest income, while trading and fiduciary income are less so. In terms of bank risk and return, there is a clear negative association between noninterest income shares and profits per unit of risk. Trading activities appear to be the biggest drag on profit per unit of risk and suggest that continued expansion may ultimately lower risk-adjusted returns, while fiduciary income is associated with higher profit per risk and more stable net income growth.

These results raise fundamental doubts about the belief that noninterest income will stabilize revenue and profitability and thereby reduce risk. Net interest income and noninterest income growth are positively correlated for the typical bank, and the correlation seems to be rising for both individual banks and in the aggregate. Potential explanations include the increased focus on cross-selling strategies and increased loan commitments, both of which could expose different business lines to the same shock and raise the correlation of revenue streams.

As a final point, it is worth mentioning that these results do not mean that no institution has benefited from a more diversified revenue stream. Recall that about a third of the banks examined had a negative correlation between net interest income and noninterest income growth. Rather, the historical data simply show this has not been the case for the typical bank and that it appears that potential diversification benefits are receding as bank revenue streams become more closely linked. Moreover, the data analyzed here cover a transition period, and it is possible that banks are still in the early stages of learning how to reap the benefits from broader and more diverse activities. Understanding how banks maximize the gains from a diversified revenue portfolio is a critical piece of information for successful risk management decisions and future empirical work will try to sort out these alternative explanations and divergent outcomes.

Data Appendix

Aggregate Data

The Federal Deposit Insurance Corporation (FDIC) publishes annual data on the U.S. banking industry in its *Historical Statistics on Banking* data, www.fdic.gov. These data include balance sheet and income statement items, and are aggregates of all commercial banks. FDIC also provides quarterly data for most variables from 1983:Q1 to 2001:Q3. Due to reporting issues, quarterly data prior to 1983 is not appropriate for this type of analysis. For example, some small banks only filed regulatory reports in the 2nd and 4th quarter, which makes quarterly analysis impossible. The detailed components of noninterest income, however, are only available on a consistent basis beginning in 1984:Q1.

All series were deflated using the GDP price deflator and transformed into constant 1996 dollars. All variables were seasonally adjusted using the Census Bureau's X11 procedure.

Bank-level Data

Annual bank-level data are taken from the *Consolidated Report of Condition and Income* ("Call Reports") for all commercial banks in operation in any year from 1978 to 2000. These annual data were deflated using the GDP price deflator and transformed into constant 1996 dollars.

For each bank, the Call Reports have a unique code that identifies the bank over time and allows calculation of bank-specific growth rates. In cases of mergers and acquisitions, the acquiring bank's code is maintained and the target drops from the sample.

The availability of data for some of the income statement items changes throughout the history of the Call Reports. In particular, the four components of noninterest income – fiduciary income, service charges, trading revenue, and fees and other – were not always consistently defined over this period. These variables were defined and constructed from the Call Report variable codes as follows:

- Fiduciary income includes gross income from services rendered by the bank's trust department or by any of its consolidated subsidiaries acting in any fiduciary capacity, i.e., administering investments for others. Fiduciary income was consistently defined for 1978-2000 as Call Report item RIAD4070.
- Service charges on deposit accounts include charges for maintenance of deposit accounts, failure to meet minimum balances, excess check writing, withdrawals from nontransaction accounts, early withdraw or closure fees, dormant accounts, extensive activity, ATM usage, bounced check charges, and other fees. Service charges was consistently defined for 1978-2000 as Call Report item RIAD4080.

- Trading revenue includes the net gain or loss from trading cash instruments, off-balance sheet derivative contracts, and sales of assets and other financial instruments. Also included are revaluation to carrying value of assets and liabilities due to marking to market, revaluation of interest rate, foreign exchange, equity derivative, commodity and other contracts due to marking to market, and incidental income and expense related to the purchase and sale of assets and liabilities. Trading income was defined as RIADA220 for 1996-2000, and as RIAD4075 plus RIAD4077 for 1984-1995.
- Fees and other income includes all other noninterest income items, such as service charges, commissions, and fees not reported elsewhere. This includes fees for safe deposit boxes, insurance sales, bank drafts, money orders, etc., bill collection, savings bond redemption, execution of acceptances and letters of credit, mortgage servicing fees, and notary, consulting or advisory services), periodic credit card fees, merchant credit card charges, rental fees, and loan commitment fees. Also included here are net gains on sales of real estate, loans, or premises, data processing services, and sales of other assets, as well as noninterest income on other foreign transactions. Fees and other income was defined as RIAD5407 plus RIAD5408 for 1997-2000, RIAD5407 plus RIAD5408 plus RIAD4076 for 1991-1996, RIAD4076 plus RIAD4078 for 1984-1990. For 1978-1983, only trading income is included in noninterest income for many banks, so the detailed breakdown is not possible.

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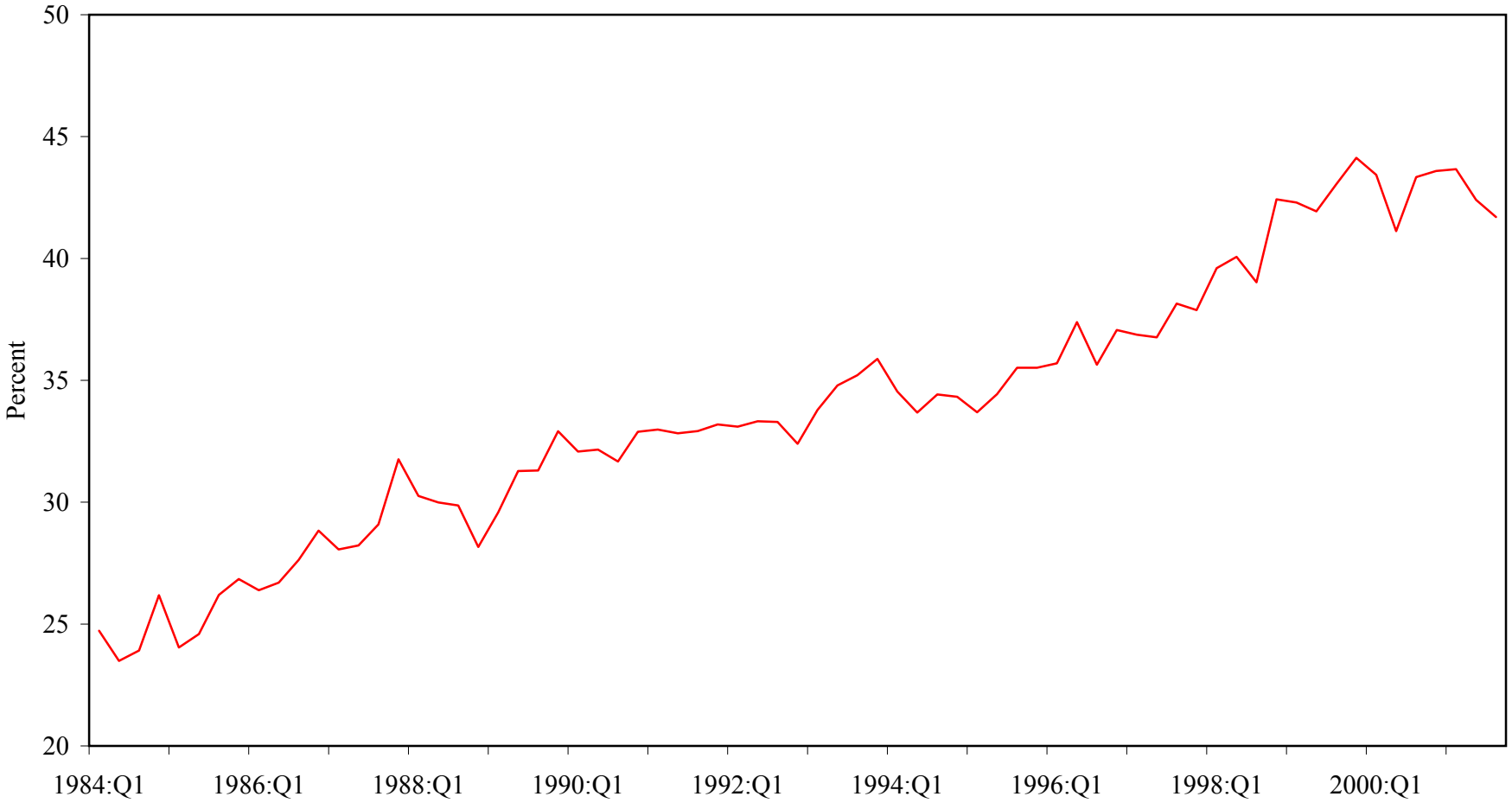
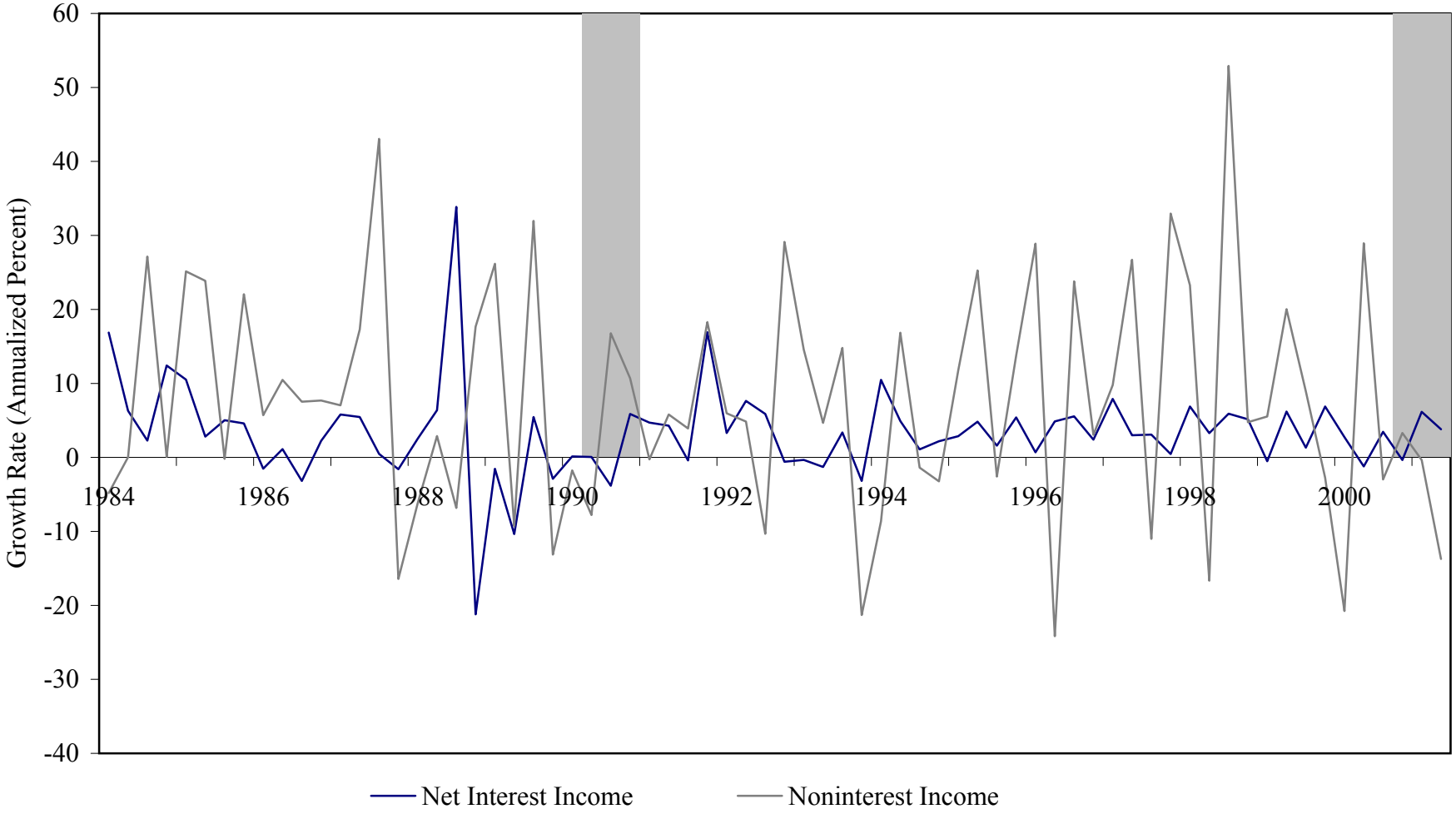
Figure 1: Rising Share of Noninterest Income in Net Operating Revenue



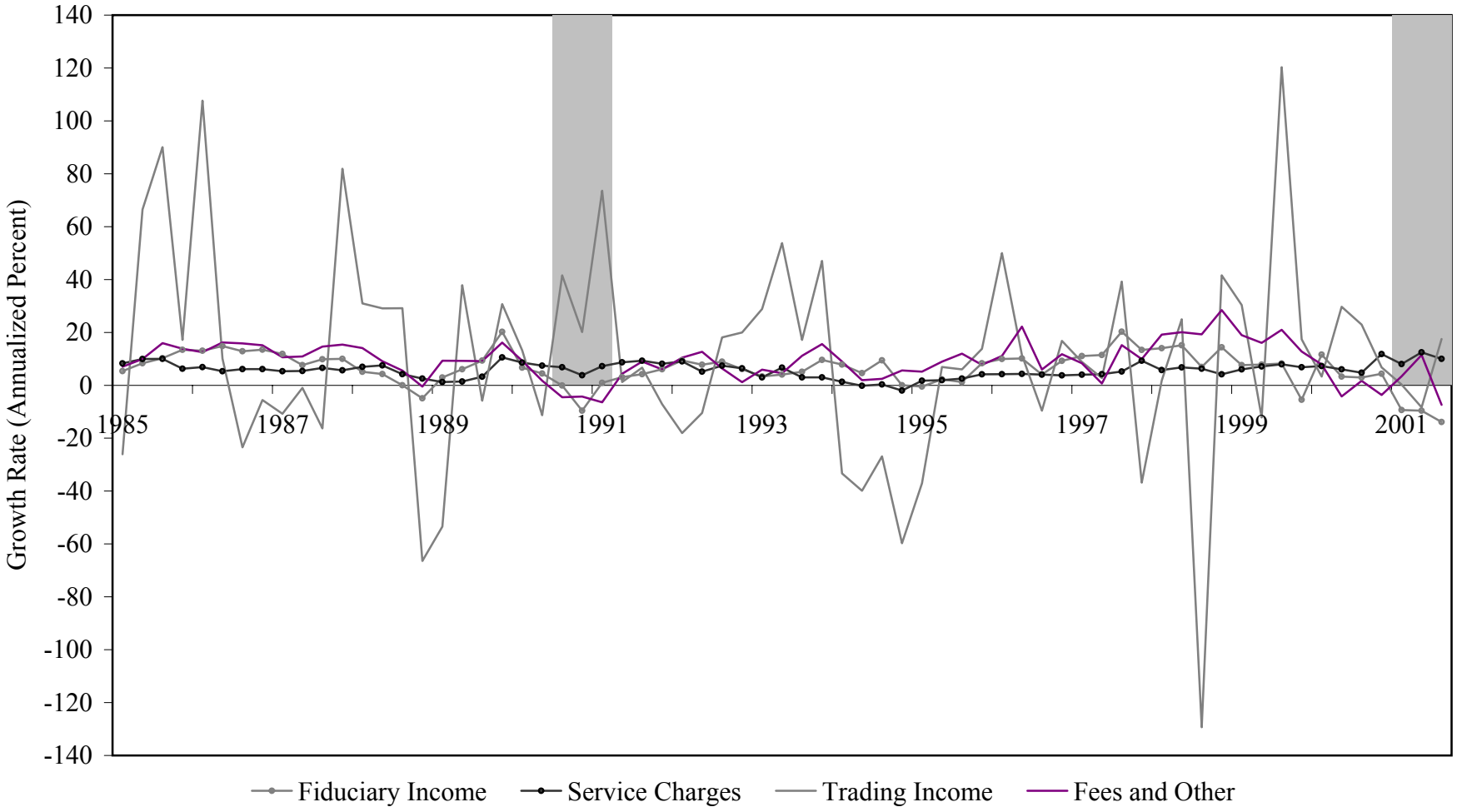
Note: Noninterest income as a share of net operating revenue (noninterest income plus net interest income).
Source: Aggregate data from FDIC.

Figure 2: Noninterest Income is More Volatile than Net Interest Income



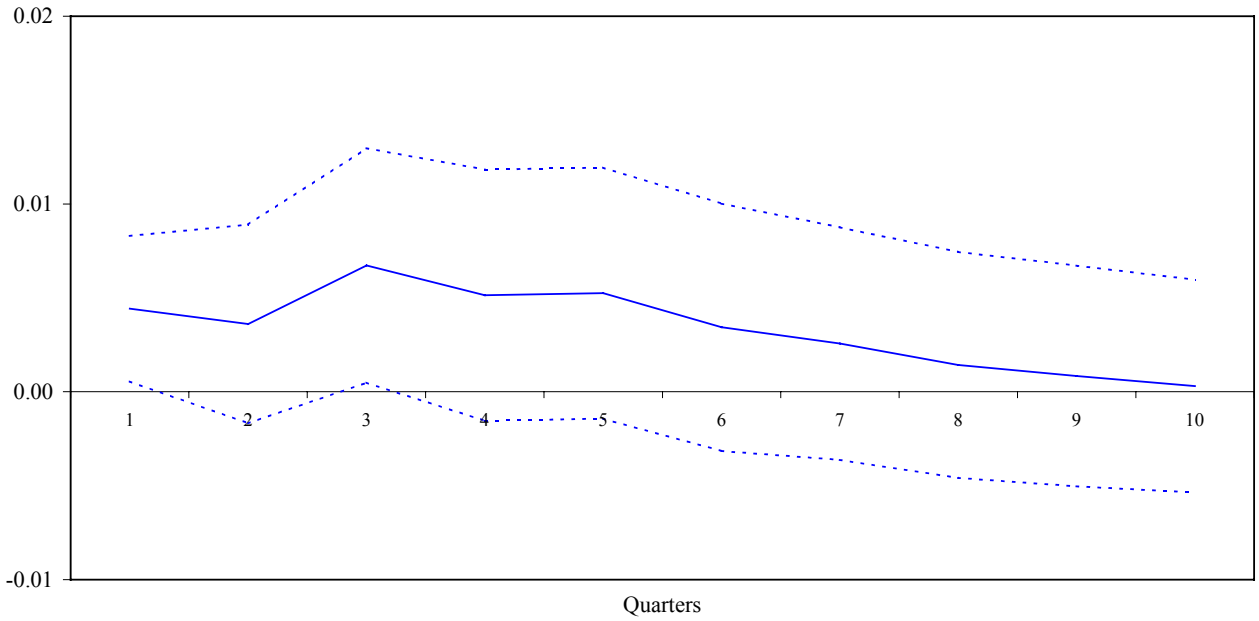
Note: All estimates are annualized quarterly growth rates. Shaded areas are NBER recessions.
Source: Aggregate data from FDIC.

Figure 3: Trading is the Most Volatile Type of Noninterest Income



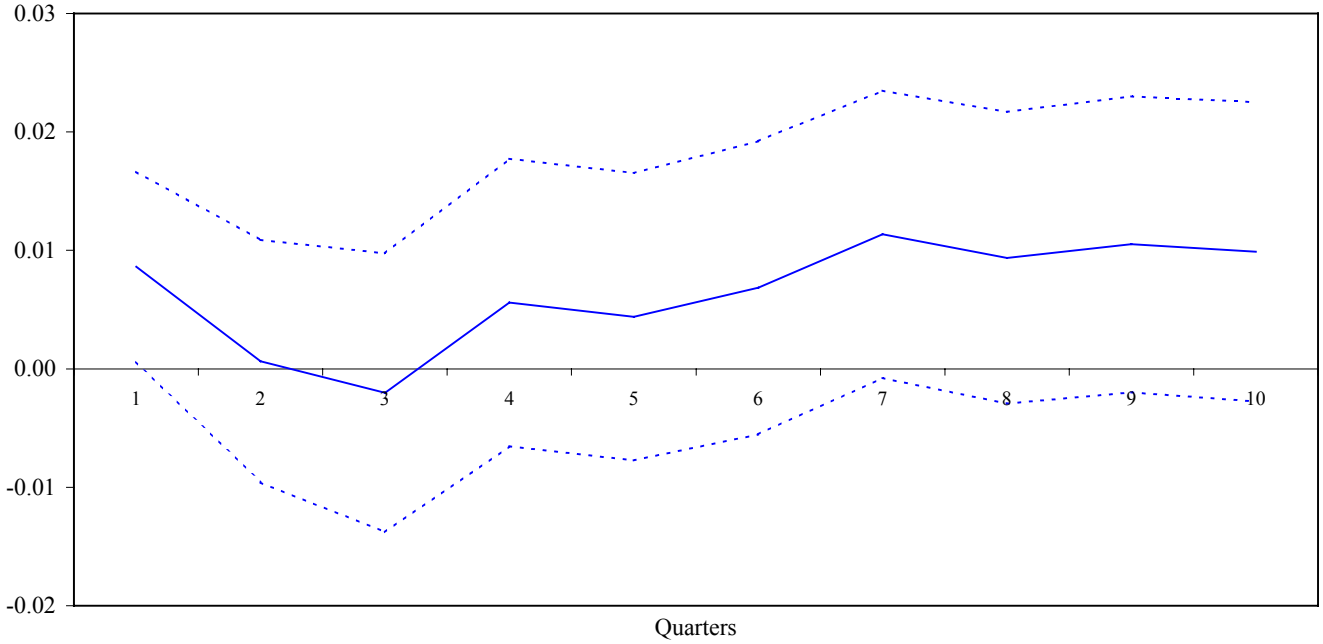
Note: All estimates are four-quarter growth rates. Shaded areas are NBER recessions.
Source: Aggregate data from FDIC.

Figure 4a: Impulse Response Function of Net Interest Income to an Innovation in Real GDP



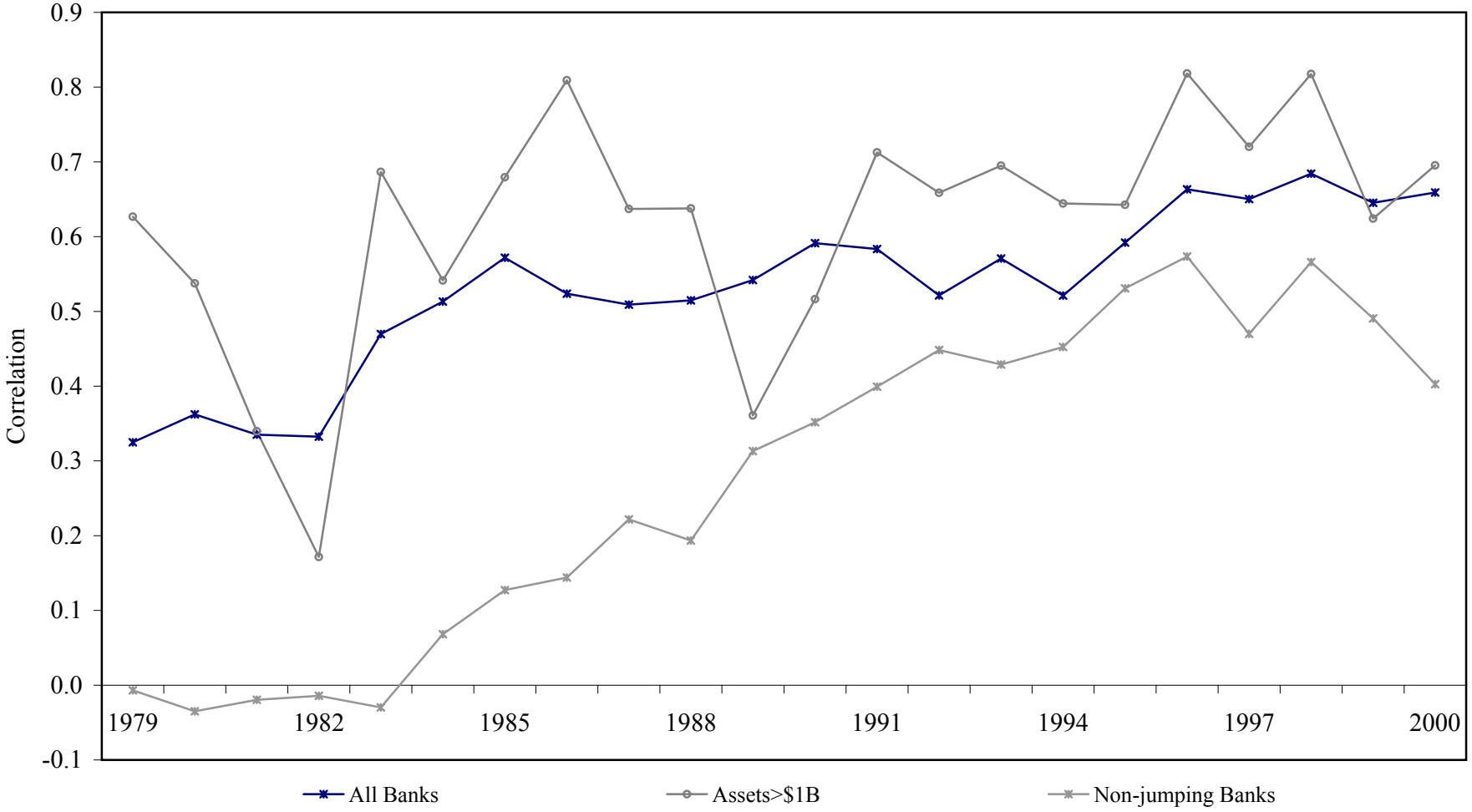
Note: Response of net interest income growth to a Cholesky one standard deviation innovation in real GDP, estimated from a VAR including four lags of real GDP, net interest income, and noninterest income. The VAR is estimated in log-levels with a trend for 1984:Q1 to 2001:Q3.

Figure 4b: Impulse Response Function of Noninterest Income to an Innovation in Real GDP



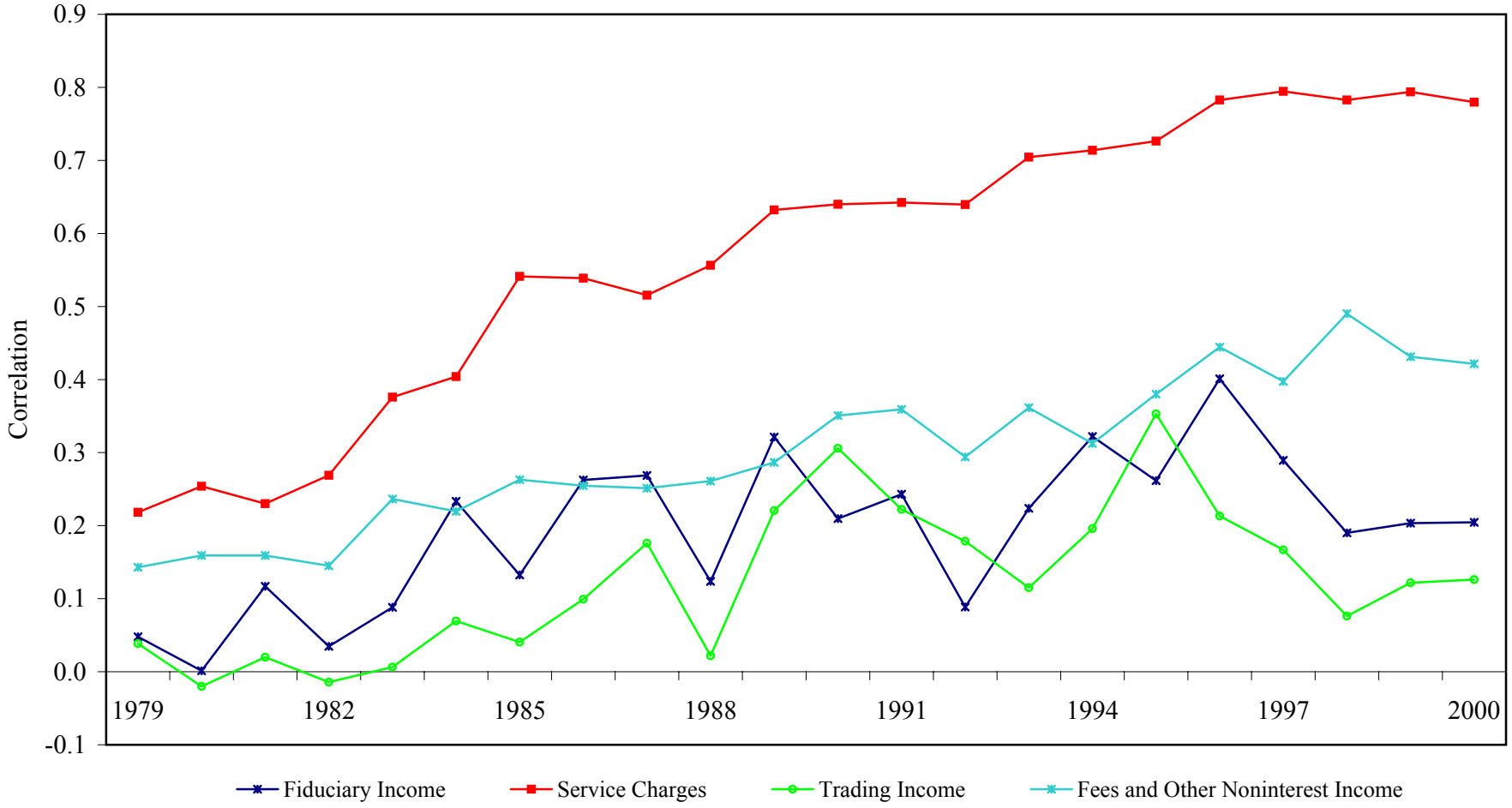
Note: Response of noninterest income growth to a Cholesky one standard deviation innovation in real GDP, estimated from a VAR including four lags of real GDP, net interest income, and noninterest income. The VAR is estimated in log-levels with a trend for 1984:Q1 to 2001:Q3.

Figure 5: Cross-Sectional Correlation between Noninterest Income Growth and Net Interest Income Growth



Notes: Plot of the cross-sectional correlation, ρ_t, between net interest income and noninterest income for banks operating in each pair of consecutive years.

Figure 6: Cross-Sectional Correlation between Net Income Growth and Growth in Components of Noninterest Income



Notes: Plot of the cross-sectional correlation, ρ_t, between net interest income and each component of noninterest income for all banks operating in each pair of consecutive years.

Chart 7: Bank-Specific Correlations, All Banks

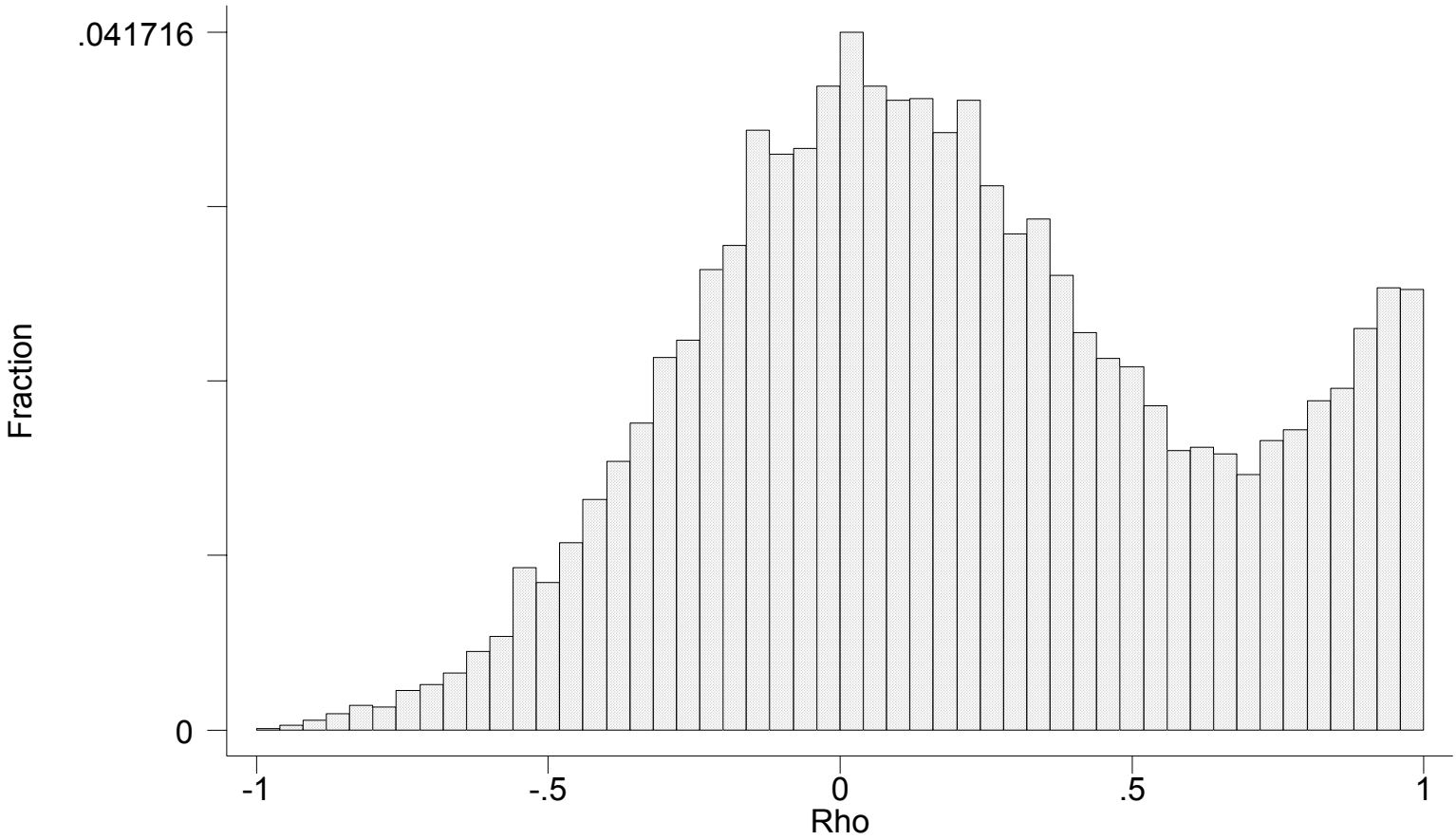
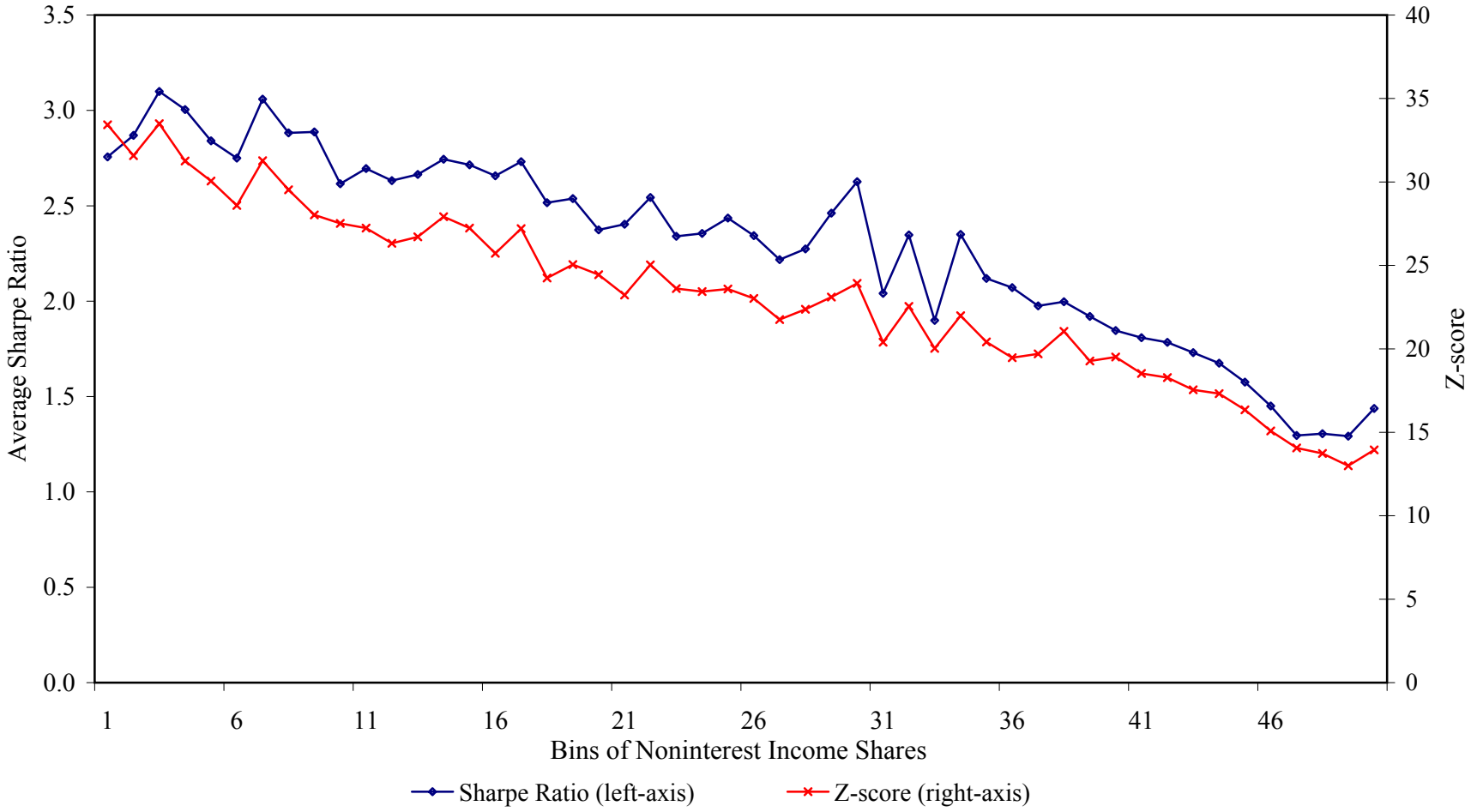


Figure 8: Relation between Risk Measures and Noninterest Income Share



Note: Sharpe Ratio is average return on equity (ROE) divided by the standard deviation of ROE. Z-score is the average return on assets (ROA) plus average Equity/Assets, divided by the standard deviation of ROA. Both measures are averaged for all banks in each bin, where bins are created by sorting banks by their average noninterest income share and making 50 equal sized groups.

Table 1: Commercial Bank Net Operating Revenue, by Source, Year, and Bank Size

	All Banks			Assets >$10B			Assets<=$10B		
	1980	**1990**	**2000**	**1980**	**1990**	**2000**	**1980**	**1990**	**2000**
				Percent of Net Operating Revenue					
Net Operating Revenue	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Net Interest Income	79.6	67.5	56.6	73.5	58.6	52.2	82.6	74.3	66.9
Noninterest Income	20.4	32.5	43.4	26.5	41.4	47.8	17.4	25.7	33.1
Fiduciary Income	3.9	5.0	6.2	4.9	6.7	6.5	3.4	3.7	5.4
Service charges	4.5	6.7	6.6	2.1	5.7	6.7	5.7	7.4	6.4
Trading Revenue	1.5	2.8	3.5	3.1	6.0	4.9	0.7	0.4	0.2
Fees and Other	10.5	18.0	27.1	16.3	23.1	29.7	7.6	14.1	21.1
				Billions of 1996 Dollars					
Net Income	24.4	18.4	66.0	7.6	6.3	44.9	16.8	12.2	21.1
Net Operating Revenue	123.4	196.9	333.7	41.0	86.0	233.1	82.4	110.8	100.6
Total Assets	3,243.0	3,898.6	5,789.2	1,375.1	1,719.9	4,026.8	1,867.9	2,178.7	1,762.4
Number of Banks	14,523	12,370	8,388	31	66	79	14,492	12,304	8,309

Notes: Net operating revenue is net interest income plus noninterest income.

Source: Consolidated Reports of Condition and Income for a Bank with Domestic and Foreign Offices - FFIEC 031.

Table 2: Decomposition of Variance of Net Operating Revenue

	Share	Variance/ Covariance	Contribution to Variance
		1984:Q1 to 1989:Q4	
Net Operating Revenue		50.38	
Net Interest Income	72.0	100.18	51.9
Noninterest Income	28.0	228.89	18.2
Net Interest / Noninterest		-28.95	-11.7
		1990:Q1 to 2001:Q3	
Net Operating Revenue		46.16	
Net Interest Income	63.1	14.24	5.7
Noninterest Income	36.9	259.14	35.8
Net Interest / Noninterest		5.61	2.6

Notes: Share is the percent of net operating revenue. Contribution to variance of net operating revenue is measured in squared units and defined in the text in Equation (1). Contributions do not exactly add up because shares are changing through the sub-periods. All data are aggregates for the U.S. banking industry from FDIC.

Table 3: Link Between Aggregate Bank Income Growth and GDP Growth

	Dependent Variables (X_t)					
	Bank Profits		Traditional Revenue		Non-traditional Revenue	
	Net Income	Net Income plus Provisions	Net Interest Income	Net Int Inc less Provisions	Noninterest Income	Noninterest Income less Trading
X_{t-1}	-0.366***	-0.526***	-0.178	-0.813***	-0.309**	-0.176
	(0.118)	(0.130)	(0.133)	(0.132)	(0.131)	(0.141)
X_{t-2}	-0.031	-0.003	-0.011	-0.495***	-0.084	-0.051
	(0.119)	(0.142)	(0.136)	(0.169)	(0.136)	(0.142)
X_{t-3}	0.038	0.184	-0.174	-0.313*	0.076	0.023
	(0.110)	(0.137)	(0.134)	(0.169)	(0.138)	(0.143)
X_{t-4}	0.137	0.110	0.095	-0.114	-0.228*	-0.096
	(0.094)	(0.129)	(0.128)	(0.137)	(0.127)	(0.133)
GDP_t	0.034	-0.079	0.660	1.570	1.863*	1.616*
	(3.706)	(1.276)	(0.407)	(6.902)	(0.933)	(0.813)
GDP_{t-1}	-7.014*	-1.788	-0.173	6.094	-0.113	-0.409
	(3.604)	(1.329)	(0.430)	(7.223)	(0.971)	(0.844)
GDP_{t-2}	-6.836*	-1.204	0.162	2.388	-1.751*	-1.568*
	(3.637)	(1.370)	(0.446)	(7.477)	(0.983)	(0.851)
GDP_{t-3}	-0.536	1.238	-0.602	-6.516	1.481	2.300***
	(3.519)	(1.316)	(0.431)	(7.265)	(0.971)	(0.827)
GDP_{t-4}	3.525	2.750**	0.327	3.811	1.013	-0.039
	(3.227)	(1.274)	(0.403)	(6.778)	(0.948)	(0.845)
Constant	49.547***	2.899	2.677	-14.763	4.462	4.042
	(17.633)	(6.945)	(2.119)	(36.254)	(5.152)	(4.284)
Jt. Sig. of Lagged X	0.005	0.001	0.271	0.000	0.015	0.659
Jt. Sig. of GDP and Lagged GDP	0.080	0.192	0.272	0.853	0.117	0.026
No. Obs	54	66	66	66	66	66
Adjusted-R^2	0.287	0.195	0.039	0.344	0.183	0.111

Notes: All variables are quarterly growth rates. X_t, the dependent variable, is defined in the column headings. Independent variables include four lags of the dependent variable (X_{t-1} to X_{t-4}), contemporaneous GDP (GDP_t), and four lags of GDP (GDP_{t-1} to GDP_{t-4}). Data are from 1984:Q1 to 2001:Q3. Jt. Sig. reports p-values associated with the null hypothesis that the set of independent variables are jointly insignificant. The net income observation has fewer observations due to the quarters with negative income that prevented calculation of growth rates.

***,**,* indicate statistical significance at the 99%, 95%, and 90% level, respectively.

Table 4: Determinants of Correlation between Net Interest Income Growth and Noninterest Income Growth

	All Banks		Non-Jumping Banks		Large Banks	
Log Assets	0.166	1.186***	-0.351	0.353	1.882	3.128*
	(0.346)	(0.428)	(0.326)	(0.396)	(1.825)	(1.876)
Equity/Assets	0.451**	0.540**	0.227	0.284	1.250	1.703**
	(0.230)	(0.214)	(0.235)	(0.218)	(0.819)	(0.836)
Growth in Assets	2.258***	2.196***	3.440***	3.378***	1.889***	1.813***
	(0.075)	(0.076)	(0.112)	(0.113)	(0.296)	(0.306)
Noninterest Income Share	89.143**	86.335**	59.972*	57.504**	-54.839***	-32.709**
	(36.381)	(33.952)	(31.103)	(28.969)	(9.778)	(13.000)
Noninterest Income Share^2	-124.069**	-112.092**	-68.329	-59.506	5.586	11.945
	(57.552)	(54.053)	(54.326)	(50.637)	(11.444)	(11.807)
Fiduciary Income Share		-18.524***		-11.161**		-27.371
		(4.607)		(4.749)		(16.979)
Trading Income Share		-12.577		-25.727***		-34.951
		(11.514)		(7.406)		(22.834)
Fees & Other Noninterest Income Share		-18.058***		-14.013***		-44.863***
		(4.673)		(4.363)		(15.452)
Bank Years	-0.487***	-0.513***	-0.274***	-0.283***	1.823***	1.650***
	(0.064)	(0.065)	(0.072)	(0.072)	(0.419)	(0.422)
Multi	1.753**	1.584*	3.063***	2.970***	27.710***	23.455**
	(0.873)	(0.871)	(0.959)	(0.956)	(10.000)	(9.744)
Constant	0.033	3.942	-4.485	-1.249	-50.620**	-34.621*
	(5.527)	(5.740)	(5.020)	(5.253)	(19.675)	(20.692)
Adjusted-R^2	0.19	0.19	0.11	0.12	0.25	0.26
No. Obs.	14,503	14,503	11,601	11,601	463	463
Jt. Sig.: Noninterest Income Shares	0.006	0.000	0.000	0.000	0.000	0.000
Jt. Sig.: Component Shares		0.000		0.000		0.030

Notes: Dependent variable is correlation between net interest income growth and noninterest income growth for each bank, multiplied by 100. Robust standard errors are in parentheses. Sample includes all banks with a growth rate for both net interest income and noninterest income for at least six years. Non-jumping banks have average asset growth rates above the 10th percentile or below the 90th percentile. Large banks have average assets greater than $1 billion. All independent variables are averaged for the number of periods the bank operates, except Multi which is a dummy variable set equal to 1 if the bank is part of a multi-bank organization; equal to 0 otherwise. Noninterest income share is noninterest income divided by net operating revenue (net interest income plus noninterest income). Fiduciary income share, trading income share, and fees and other noninterest income shares are all as a share of total noninterest income. Jt. Sig. reports p-values from the F-test of the joint significance of the following sets of variables: noninterest income share and noninterest income share-squared; the three components shares of noninterest income.

***, **, * indicates statistical significance at the 99%, 95%, and 90% level, respectively.

Table 5: Noninterest Income Shares as Determinants of Bank Risk and Return

	Dependent Variables					
	Net Income Growth		Return on Equity (ROE)			
	Mean	Std. Dev.	Mean	Std. Dev.	Sharpe Ratio	Z-score
Log Assets	0.162	-4.255***	0.217	-2.809	0.440***	2.786***
	(0.120)	(0.401)	(2.252)	(6.270)	(0.023)	(0.168)
Equity/Assets	0.126**	-0.307*	0.386	-3.124***	0.059***	0.940***
	(0.054)	(0.163)	(0.279)	(0.814)	(0.012)	(0.083)
Growth in Assets	1.053***	0.316***	-0.104	-0.067	-0.023***	-0.169***
	(0.034)	(0.086)	(0.104)	(0.306)	(0.002)	(0.022)
Noninterest Income Share	19.140***	129.273***	-21.508	117.236**	-8.402***	-74.588***
	(3.831)	(16.782)	(20.109)	(57.311)	(2.120)	(12.244)
Noninterest Income Share^2	-17.057**	-96.423***	36.743	-8.158	3.453	2.276
	(6.925)	(29.590)	(33.937)	(90.564)	(3.375)	(19.677)
Fiduciary Income Share	-2.489**	-19.602***	17.598	-71.679	1.851***	17.402***
	(1.163)	(4.333)	(16.297)	(45.705)	(0.285)	(2.069)
Trading Income Share	3.523	19.674*	4.793	11.717	-2.084*	-6.401
	(2.616)	(11.539)	(14.637)	(36.957)	(1.089)	(5.171)
Fees & Other Noninterest Income Share	-0.856	8.974***	-22.079	72.205	-0.466***	-3.197***
	(0.595)	(3.371)	(19.176)	(52.396)	(0.122)	(0.865)
Bank Years	-0.161***	-1.283***	1.535**	-5.243***	0.050***	0.456***
	(0.023)	(0.071)	(0.642)	(1.708)	(0.004)	(0.028)
Multi	-0.003	-1.768*	3.293	-11.239	0.394***	0.554
	(0.308)	(1.009)	(3.728)	(11.049)	(0.043)	(0.389)
Constant	0.190	72.626***	-18.450*	131.152***	0.114	7.153***
	(1.034)	(3.626)	(10.727)	(32.476)	(0.339)	(2.066)
Adjusted-R^2	0.34	0.10	0.00	0.00	0.15	0.18
No. Obs.	11,697	11,697	14,500	14,500	14,500	14,500
Jt. Sig.: Noninterest Income Shares	0.000	0.000	0.489	0.044	0.000	0.000
Jt. Sig.: Component Shares	0.033	0.000	0.686	0.100	0.000	0.000

Notes: Dependent variable are mean net income growth, standard deviation of net income growth, mean return on equity (ROE), standard deviation ROE, ROE-based Sharpe Ratio (mean ROE / standard deviation of ROE), and Z-score ((mean ROA+mean Equity/Assets) / standard deviation of ROA). Robust standard errors are in parentheses. Sample includes banks with a growth rates for at least six years. All independent variables are averaged for the number of periods the bank operates, except Multi which is a dummy variable set equal to 1 if the bank is part of a multi-bank organization; equal to 0 otherwise. Noninterest income share is noninterest income divided by net operating revenue (net interest income plus noninterest income). Fiduciary income share, trading income share, and fees and other noninterest income shares are all as a share of total noninterest income. Jt. Sig. reports p-values from the F-test of the joint significance of the following sets of variables: noninterest income share and noninterest income share-squared; the three component shares of noninterest income.

***, **, * indicates statistical significance at the 99%, 95%, and 90% level, respectively.