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Public Disclosure, Risk, and Performance  
at Bank Holding Companies

Beverly Hirtle

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## **Public Disclosure, Risk, and Performance at Bank Holding Companies**

Beverly Hirtle

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### **Abstract**

This paper examines the relationship between the amount of information disclosed by bank holding companies (BHCs) and their subsequent risk profile and performance. Using data from the annual reports of BHCs with large trading operations, we construct an index of publicly disclosed information about the BHCs' forward-looking estimates of market risk exposure in their trading and market-making activities. The paper then examines the relationship between this index and the subsequent risk and return in both the BHCs' trading activities and the firm overall, as proxied by equity market returns. The key findings are that more disclosure is associated with lower risk, especially idiosyncratic risk, and in turn with higher risk-adjusted returns. These findings suggest that greater disclosure is associated with more efficient risk taking and thus improved risk-return trade-offs, although the direction of causation is unclear.

Key words: disclosure, value at risk, market discipline, banking

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## **Public Disclosure, Risk, and Performance At Bank Holding Companies**

### **I. Introduction**

Market discipline has occupied an increasingly prominent place in discussions of the banking industry in recent years. Market discipline is the idea that the actions of shareholders, creditors, and counterparties of banking companies can influence the investment, operational, and risk-taking decisions of bank managers (Flannery 2001, Bliss and Flannery 2002). Bank supervisors have embraced market discipline as a complement to supervisory and regulatory tools for monitoring risk at individual banks and for limiting systemic risk in the banking system.<sup>1</sup>

For market discipline to be effective, market participants must have sufficient information to assess the current condition and future prospects of banking companies. This realization has prompted a range of proposals for enhanced public disclosure by banks. Many of these proposals have focused on disclosure of forward-looking risk information, such as value-at-risk (VaR) for trading portfolios or model-based estimates of credit risk exposure. In the words of a major international supervisory group, disclosure of VaR and other forward-looking risk measures is a means of providing “a more meaningful picture of the extent and nature of the financial risks a firm incurs, and of the efficacy of the firm’s risk management practices” (Multidisciplinary Working Group on Enhanced Disclosure 2001).

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<sup>1</sup> For instance, the proposed Basel II regulatory capital regime incorporates market discipline as the “third pillar” along with minimum capital standards and supervisory oversight (Basel Committee on Banking Supervision 2004).

But to what extent does such information result in meaningful market discipline? Is risk-taking or performance affected by the amount of information banks provide about their risk exposures and risk management systems? This paper examines these questions by looking at how the amount of information disclosed by a sample of large U.S. bank holding companies (BHCs) affects their future risk and performance. We focus in particular on disclosures made in the banks' annual reports about market risk in their trading activities. Following previous work on disclosure (Baumann and Nier 2004, Nier and Baumann 2006, Pérignon and Smith 2006), we construct a market risk disclosure index and ask how differences in this index affect future risk and return. Using data from the banking companies' regulatory reports, we examine the risk and return from trading and, using equity market data, we also examine risk and return for the firm as a whole.

The main findings of this analysis are that disclosing more information is associated with higher risk-adjusted trading returns and higher risk-adjusted market returns for the bank overall. The higher risk-adjusted market returns are driven both by higher unadjusted returns and lower equity price volatility, which in turn is due to decreases in the idiosyncratic component of overall returns. These results are strongest for BHCs where trading represents a large share of overall firm activity. The results are economically meaningful as well as statistically significant, with a one standard deviation increase in the disclosure index leading to a 0.50 to 0.70 standard deviation increase in risk-adjusted returns. While higher values of the disclosure index are associated with better future performance, being a leader or innovator in disclosure practices seems to be associated with lower risk-adjusted returns. This finding suggests there may be a

learning process in the market, such that disclosure “first movers” who provide new types of information face a market penalty.

Overall, however, the results suggest that increased disclosure is associated with more efficient trading and an enhanced overall risk-return tradeoff. These findings seem consistent with market discipline affecting not just on the amount of risk a BHC takes, but how efficiently it takes that risk. This interpretation highlights the importance of examining returns, as well as risk, when assessing the effectiveness of market discipline.

An important question in interpreting these results is whether greater disclosure leads to enhanced market discipline and thus better performance, or whether some other channel is at work. Specifically, banks with better risk management systems may be able to trade more efficiently and, more generally, be able to generate a better risk-return tradeoff. The same risk management systems that produce better risk-adjusted performance may also generate the information needed to make more detailed risk disclosures, which may be used by the bank as a public signal of their superior risk management abilities. This may not be the traditional view of market discipline, but it is consistent with the idea that the role of public information is to provide incentives for managers to optimize overall performance. This interpretation highlights that there are many potential channels for the exercise of market discipline on firms.

The remainder of this paper is organized as follows. Section II reviews previous work on disclosure and risk in the banking industry, and discusses how this paper fits into that literature. Section III describes the empirical approach and data used in this analysis, with particular emphasis on the market risk disclosure index. Section IV presents the results, while the final section contains summary and conclusions.

## II. Disclosure and Bank Risk-Taking

A number of previous papers have examined the relationship between disclosure and risk in the banking industry. The key idea is that disclosure of information about banks' current condition and future prospects will facilitate market discipline of risk-taking behavior. As argued in Flannery (2001) and Bliss and Flannery (2002), market discipline has two distinct components: investors and creditors' ability to monitor and assess changes in bank condition, and their ability to influence management behavior. Both are affected by the amount and quality of information disclosed. In theory, greater disclosure provides more information on which investors and creditors can make their assessments of firm condition, which in turn makes a significant market reaction to an adverse change in condition – and subsequent management response – more likely and immediate.

Market discipline may influence banks' behavior not only in response to a market reaction, but also in anticipation of one. That is, market discipline may also work by affecting management behavior *ex ante* so as to prevent a negative outcome and consequent market reaction. In this sense, greater disclosure can serve as a kind of commitment device by providing sufficient information to the market about a bank's condition and future prospects that it is constrained from altering its risk profile in a way that disadvantages either investors or creditors (Cumming and Hirtle 2001). Banks' ability to shift assets and risk positions quickly has been cited as one of the key sources of opaqueness in the banking industry (Meyers and Rajan 1998). In fact, several studies

have found evidence of greater opaqueness at banks with higher shares of liquid assets, including especially trading positions (Morgan 2002, Iannotta 2006, Hirtle 2006).<sup>2</sup>

Underlying much of this discussion is the idea that greater disclosure and enhanced market discipline will lead to reductions in bank risk. Enhanced market discipline would mean the costs of increased risk would be more fully borne by the bank and presumably play a larger role in its risk-taking decisions. More risk-sensitive market prices could also provide signals to regulators that might induce or influence supervisory action (Flannery 2001). Offsetting these factors, however, more information reduces the likelihood that the bank would face an excessive (undeserved) risk premium or that market prices will over-react to news about the firm due to uncertainty about its true condition and prospects. This could lower its funding costs and increase the range of viable (positive net present value) investments, some of which could be riskier than its current portfolio. The net impact of these influences is an empirical question.

One stream of previous empirical work on market discipline has focused on market price reaction to changes in bank condition or to differences across banks in risk profiles. Several papers have found that bond spreads increase with bank risk exposure, especially since the early-1990s reforms associated with the Federal Deposit Insurance Corporation Improvement Act. For instance, Morgan and Stiroh (2001) find that banks with riskier assets (e.g., trading assets) pay higher credit spreads on newly issued bonds. Similarly, Covitz et al. (2004a, 2004b) and Jagtiani et al. (2004) find evidence that subordinated debt spreads increase with banking company risk. In related work, Goyal

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<sup>2</sup> In contrast, Flannery et al. (2004) finds no evidence that bank assets are more opaque than the assets of non-financial firms.



(2005) finds that riskier banks are more likely to have restrictive debt covenants in their publicly issued debt.

In a somewhat different vein, several papers have examined the impact of disclosure on risk-taking using equity trading characteristics – such as bid-asked spreads or price volatility – as proxies for risk.<sup>3</sup> Many of these studies focus on non-financial firms (for example, Bushee and Noe 2000, Luez and Verrecchia 2000), but two recent papers examine the link between disclosure and market volatility in the banking industry. Baumann and Nier (2004) and Nier and Baumann (2006) construct a disclosure index based on the number of balance sheet and income statement items reported by a cross-country sample of banks. The data items captured in their index include measures of loan and security portfolio characteristics, loan performance, capital strength, off-balance sheet positions, and revenue composition. They find that stock price volatility decreases and capital buffers increase as the amount of information disclosed increases, consistent with the idea that greater disclosure enhances market discipline.

The analysis in this paper is complementary to that in Baumann and Nier (2004) and Nier and Baumann (2006). Like them, we examine the link between the amount of information disclosed by banks and subsequent equity price volatility. However, rather than constructing a disclosure index based primarily on balance sheet and income statement variables – which are indirect measures of risk – the disclosures we track are forward-looking risk estimates of the kind advocated by bank supervisors. Our index tracks the amount of information a bank discloses about its own internal estimates of risk

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<sup>3</sup> Using a very different approach, Kwan (2004) examines the impact of market discipline on bank risk-taking by comparing the risk profiles of publicly traded and non-publicly traded bank holding companies. He finds that publicly traded banks take more risk than non-publicly traded institutions, which he interprets as being contrary to market discipline.

exposure.<sup>4</sup> This permits a test of the impact of disclosures that have been specifically designed to convey information about risk on subsequent risk-taking, a relatively direct test of market discipline.

We focus specifically on disclosures concerning the market risk in banks' trading and market-making activities. We focus on market risk in trading activities because trading is a well-defined banking business activity with distinct regulatory and financial statement reporting. Bank holding company annual reports have specific sections for reporting about market risk, and regulatory reports contain trading return information that can be linked directly to these activities. Thus, we can examine the impact of disclosure on overall firm risk, and on the specific activities that are the focus of the disclosures. Previous work has also found that trading activities are associated with greater opaqueness and risk, so this is an area of banking for which disclosure might be particularly influential.

Finally, we not only examine the link between disclosure and risk, as previous studies have done, but also examine how *ex post* performance is related to the extent of disclosure. Specifically, we examine the impact of disclosure on absolute and risk-adjusted returns. Examining performance as well as risk provides an additional window into the ways that market discipline may play out at banking companies, since investors and creditors presumably care not only about the level of risk, but also about how efficiently a bank translates its risk exposures into profits and returns.

### **III. Data and Empirical Approach**

This section describes the data and empirical approach used to assess the impact of disclosure on BHC risk and performance. Since we are interested in the impact of

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<sup>4</sup> As discussed below, the index is similar to the one constructed in Pérignon and Smith (2006).

disclosures relating to market risk in trading activities, we begin by constructing a sample of U.S.-owned BHCs that appear to be active traders. We limit the sample to those BHCs with significant trading activities, since these are the firms that are most likely to make some kind of market-risk-related disclosures in their annual reports. BHCs that are relatively active traders are also more likely to be engaged in purposeful risk management of their trading positions, rather than using the trading account simply to book a limited number of mark-to-market positions.

We use information from the Federal Reserve's Y-9C reports of balance sheet and income statement data for bank holding companies to identify BHCs with significant trading account assets.<sup>5</sup> Overall, relatively few BHCs report holding any assets in the trading account: at year-end 2005, only 93 (of more than 2,000) BHCs reported holding any trading account assets, and only 13 of these held trading assets exceeding \$1 billion. Our sample consists of all U.S.-owned BHCs with year-end trading account assets exceeding \$1 billion (in 2005 dollars) at some point between 1994 and 2004.<sup>6</sup> We include a BHC in the sample starting with the first year in which its constant-dollar trading assets exceed \$500 million and every year thereafter.<sup>7</sup> The resulting sample consists of 141 observations from 24 BHCs over the years 1994 to 2004.<sup>8</sup>

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<sup>5</sup> The Y-9C reports are available at [http://www.chicagofed.org/economic\\_research\\_and\\_data/bhc\\_data.cfm](http://www.chicagofed.org/economic_research_and_data/bhc_data.cfm).

<sup>6</sup> We dropped foreign-owned BHCs because the U.S. activities of these institutions represent only a part of the banks' overall activities and because many of them do not make 10-K filings with the SEC, which we need to construct the market risk disclosure index. In addition, two U.S. BHCs whose activities are primarily non-banking in nature – Metlife and Charles Schwab – are dropped from the sample.

<sup>7</sup> The results are not significantly affected if we include all observations for BHCs with trading assets that eventually exceed \$1 billion in 2005 dollars, or if we limit the sample to just those observations for which trading account assets exceed \$1 billion.

<sup>8</sup> The sample is an unbalanced panel, due mainly to the impact of mergers. During the sample period, several of the BHCs were acquired in a merger, generally by other BHCs in the sample. In addition, BHCs in the sample sometimes acquired large BHCs that were not part of the sample. In estimates, we treat the pre- and post-merger acquiring BHC as separate entities. Observations involving a merger year are dropped. Finally, some BHCs enter the sample mid-way through the sample period, as their trading assets crossed the \$500 million threshold.

The estimates consist of a series of regressions of risk and performance measures in year t+1 on BHC characteristics and disclosure during year t:

$$Y_{i,t+1} = \beta_1 \text{Disclosure}_{i,t} + X_{i,t} \Gamma + \varepsilon_{i,t+1}$$

where  $Y_{i,t+1}$  is the risk or performance measure (discussed below),  $\text{Disclosure}_{i,t}$  is the index of market risk disclosure, and  $X_{i,t}$  is a vector of BHC control variables. Both the disclosure index and the control variables are lagged one year to avoid endogeneity with the risk and performance measures.

The control variables include measures of institution size (the log of assets and log of assets squared), risk profile (the ratio of risk-weighted assets to total assets and the total risk-based capital ratio), balance sheet composition (the deposits-to-assets ratio and the shares of assets held as loans, securities, Fed funds and securities lent, and as “other assets” – the omitted assets category is cash), revenue composition (non-interest income as a share of operating income), and loan portfolio and revenue concentration (Herfindahl-Hirschman Indices based on loan types and sources of revenue<sup>9</sup>). The regressions also include the ratio of trading assets to total assets as a measure of the extent of the institution’s trading activities. All BHC data are from the Y-9C reports. The regressions also include BHC fixed effects and year dummies. Table 1 reports the basic statistics of the regression data set.

The key variables in the estimates are the measures of risk and performance and the market risk disclosure index. The risk and performance measures are based on two distinct sets of information. The first are derived from accounting data on BHCs’ trading

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<sup>9</sup> The loan concentration measure is based on the shares of real estate, commercial and industrial, consumer, agricultural, and other loans in the overall loan portfolio, while the revenue concentration index is based on the shares of net interest income, fiduciary income, deposit service charges, trading revenue, and other non-interest income in overall operating income. Stiroh (2006) shows that revenue concentration is a significant determinant of BHC equity price volatility.

activities. Specifically, BHC regulatory reports contain information on quarterly trading revenues, the gains and losses on the firms' trading activities, including commission, fee, and spread income. Using these data, we calculate quarterly trading return as trading revenue in a quarter as a percent of beginning-of-quarter trading assets. Trading Volatility is then calculated as the standard deviation of quarterly trading return within a year, and Trading Return is calculated as the annual average of quarterly trading return. Finally, Risk-adjusted Trading Return equals Trading Return divided by Trading Volatility (essentially, the trading revenue "Sharpe ratio"). Since these measures reflect risk and return on the BHCs' trading activities, they are tied directly to the disclosure information covered in the market risk disclosure index.

The second set of measures is derived from firm-wide equity prices. Specifically, we use stock return data from the University of Chicago's Center for Research in Security Prices (CRSP) for the BHCs in our sample. For each year between 1995 and 2005, we cumulate daily returns from CRSP to form weekly returns, and then calculate annual average weekly returns, expressed at an annual rate ("Market Return"). We also calculate the standard deviation of weekly returns within each year ("Market Volatility"), and generate Risk-Adjusted Market Returns as the ratio of average returns to the standard deviation of returns.<sup>10</sup> We separate overall equity price volatility into its idiosyncratic and systematic components by estimating a basic market model – annual regressions of weekly returns for each BHC on the returns on a value-weighted market index – and capturing the volatility of the residuals ("idiosyncratic risk") and the market beta ("systematic risk").

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<sup>10</sup> Market returns and market volatility are calculated using weekly, rather than daily, returns to limit the impact of any autocorrelation or mean reversion in daily returns. The main results are very similar if daily returns are used.

Basic statistics for all the risk and performance measures are reported in Table 1.

The market risk disclosure index is the other key variable in the analysis. As discussed above, this index captures the amount of information banks disclose about their forward-looking estimates of market risk exposure in their 10-K (annual report) filings with the Securities and Exchange Commission (SEC).<sup>11</sup> The index covers 18 specific types of information that BHCs could provide in their 10-K filings, primarily related to their value-at-risk (VaR) estimates.

Value-at-risk is a very commonly used measure of market risk exposure from trading activities. VaR is an estimate of a particular percentile of the trading return distribution, assuming that trading positions are fixed for a specified holding period. VaR estimates made by banks in our sample are typically based on a one-day holding period, with distribution percentiles generally at the 95<sup>th</sup> and above.<sup>12</sup> VaR estimates form the base of banks' regulatory capital requirements for market risk (Hendricks and Hirtle 1997) and have been the focus of disclosure recommendations made by financial industry supervisors (Multidisciplinary Working Group on Enhanced Disclosure 2001).

The 18 items covered in the market risk disclosure index include information about a BHC's VaR estimates for its entire trading portfolio ("overall VaR"), VaR by risk type (e.g., risk from interest rate or equity price movements), the historical relationship between VaR estimates and subsequent trading returns ("backtesting"), the distribution of actual trading outcomes ("returns distribution"), and stress testing. The specific items included in the index are listed in Table 2. These items were selected based on a review

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<sup>11</sup> We used the SEC's EDGAR database to find the 10-K filings. The EDGAR database is available at: <http://www.sec.gov/edgar.shtml>.

<sup>12</sup> See Jorion (2006) for an extensive discussion of VaR modeling, and Moody's Investors Services (2006) for a description of typical VaR parameter choices at banks and securities firms.

of a sample of BHC disclosures to determine which items were disclosed with enough frequency to be meaningfully included in the index, and also by benchmarking the individual items and the five broader categories against those listed in a rating agency evaluation of banks' disclosure practices (Moody's Investors Service 2006).

The market risk disclosure index measures the amount of information that BHCs disclose about their market risk exposures, not the content of that information. It is a count of the number of data items disclosed, not an indicator of the amount or nature of market risk exposure undertaken by the BHC. In that sense, it is similar to the disclosure index constructed by Nier and Baumann (2006), though based on different types of data. It is also quite similar to a VaR disclosure index developed independently by Pérignon and Smith (2006). The Pérignon and Smith (2006) index covers much of the same information as the index in this paper, though they use their index primarily to make cross-country comparisons of disclosure practices rather than to examine the link between the index and future risk and performance.<sup>13</sup>

Figure 1 shows the average value of the market risk disclosure index between 1994 and 2004. The average value of the index increases from just over 2 in 1994 to about 7 in 2004. Most of this increase occurred during the early part of the sample, between 1994 and 1998.

The growth through this period reflects two significant regulatory developments. First, U.S. risk-based capital guidelines were amended in 1998 to incorporate minimum regulatory capital requirements for market risk in trading activities (Hendricks and Hirtle

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<sup>13</sup> Pérignon and Smith (2006) examine the link between VaR estimates and subsequent trading volatility, a related, though distinct, question. They find that VaR estimates contain little information about future trading volatility. This finding is similar to that in Berkowitz and O'Brien (2002), but stands in contrast to the results in Jorion (2002) and Hirtle (2003).

1997). The market risk capital charge is based on the output of banks' internal VaR models, and the need to comply with the new capital requirements spurred the development of value-at-risk models in the banking industry. On a separate track, SEC Financial Reporting Release (FFR) 48 required all public firms with material market risk exposure to make enhanced quantitative and qualitative disclosures about their exposures, starting in 1997 (U.S. Securities and Exchange Commission 1997). FFR 48 included three options for forward-looking, quantitative market risk disclosures, one of which was value-at-risk.<sup>14</sup> Together, these two regulatory developments spurred disclosure of VaR estimates and related information.

Figure 1 shows the average value of the market risk disclosure index, but the average masks considerable diversity across BHCs in the sample. Figure 2 illustrates the range of disclosure index values by year. Specifically, the chart shows the minimum and maximum values of the index by year, the 25<sup>th</sup> and 75<sup>th</sup> percentiles, along with the averages reported in Figure 1. The maximum value of the index grows from 7 in 1994 to 15 by the end of the sample period, tracking the growth in the average value. At least one BHC in each year reported no market risk information (index value of zero). As the average value of the disclosure index increases, the dispersion within the sample BHCs grows. The inter-quartile (25<sup>th</sup> to 75<sup>th</sup> percentile) range more than doubles over the sample period, due mainly to growing differentiation in the top half of the distribution after 1998. Over this period, the distance between “top reporting” BHCs and those nearer to the average widened considerably.

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<sup>14</sup> The Pérignon and Smith (2006) index also grows through 1998, and they cite the influence of FFR 48 in this finding for the U.S. banks in their sample. See Roulstone (1999) for an assessment of the impact of FFR 48 on non-financial firms.



Figure 3 shows the market risk disclosure index at the individual BHC level. The BHCs shown in the figure are those that are in the sample for at least five years, traced backward from the BHCs' corporate identity at the end of the sample period without adjusting for mergers. Not surprisingly given the average results, the index tends to increase over the sample period at the individual BHC level. The typical pattern is for the index to rise in steps over time, though there are certainly cases in which the index declines.

On a cross-sectional basis, the index tends to be higher at larger BHCs and at BHCs with more trading activity, on both an absolute and relative level. Table 3 reports the correlation between the value of the market risk disclosure index and real (2005 dollar) assets, trading assets, and trading asset share, where values are averaged across the years a BHC is in the sample. Reading down the first column of the table, the correlation coefficients between the disclosure index and the measures of BHC and trading activity scale are large and positive.

Finally, Table 4 reports the frequency with which the individual data items in the market risk disclosure index are reported. The first column reports the frequency across all observations between 1994 and 2004, while the next two columns report the frequency at the beginning and end of the sample period. The most commonly reported data element is the holding period and confidence interval of the VaR estimate, reported for about 80 percent of the BHC-year observations. This data item is a close proxy for whether a BHC disclosed any information about VaR at all. About 40 percent of the observations included some information about VaR by risk type, while information about backtesting and the distribution of returns is reported in 10 to 30 percent of the

observations. Nearly half the observations indicate that the BHC does some kind of stress testing, but only a tiny share – less than 5 percent – report the results of these efforts. As comparison of the columns with data from 1994 and 2004 make clear, the frequency of reporting increased over the span of the sample period for nearly every data item.

In the regressions, we use the overall market risk disclosure index as the baseline measure of disclosure, but we also construct some alternatives to the basic index. The first of these is the first principal component of the cross-sectional variation in reporting of the 18 individual data items in the index. The basic index is a simple linear weighting (sum) of the individual elements. The first principal component provides an alternate linear combination, with weights that reflect the common variation across BHC-year observations. It captures about 50 percent of this variation, suggesting a meaningful common component of reporting across the individual data items. A second alternative is to use separate sub-indices for each of the five categories of information (overall VaR, VaR by risk type, backtesting, returns distribution, and stress testing), to see whether particular types of information have more or less impact on risk and performance. Finally, we create an indicator variable if a BHC is the only one in the sample to disclose a particular data item in a particular year (“Disclosure Leader”), to assess the impact of innovations in disclosure practice.<sup>15</sup>

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<sup>15</sup> The typical pattern is that once one BHC discloses a particular kind of information, others follow in subsequent years. In that sense, BHCs that are the only ones to report an item in a given year are leaders or innovators.

#### **IV. Disclosure, Risk and Performance**

##### *Disclosure and Risk*

Table 5 presents the results of the estimates relating market risk disclosure to subsequent trading risk and overall firm risk, as measured by equity price volatility. The first columns of the table present the results for the quarterly volatility of trading revenue (“trading revenue volatility”), while the second set of columns presents the results for equity price volatility (“market volatility”).

The estimates suggest that increased disclosure is associated with lower future risk. The coefficients on the aggregate market risk disclosure index, the first principal component variable, and on many of the index sub-components are negative, though they are at best only marginally statistically significant in the trading volatility equations (see the last row of the table). The lower statistical significance in the trading volatility equations may reflect the lower frequency of the accounting return data used to calculate this variable (quarterly, as compared to weekly for the market returns), which may smooth the resulting volatility measure.

Of the disclosure sub-components, information about stress testing and VaR by risk type appear to have the strongest association with subsequent risk. Being a “disclosure leader” has no significant impact, however. For the market volatility equations, the estimates suggest a moderate-sized impact: a one-standard deviation increase in the value of the disclosure index would result in about a one-third standard deviation decrease in future volatility.

These results suggest that increased market risk disclosure is associated with lower future risk. If this link is through market discipline on trading activities, then we

might expect that this effect would be stronger for BHCs that are more heavily engaged in trading. To explore this question, Table 6 presents results where the coefficients on the disclosure variables are allowed to differ between BHCs that are “intense traders” and the rest of the sample. “Intense traders” are defined as BHCs with trading assets as a share of total assets above the median for the BHCs in the sample. Note that by construction, all BHCs in the sample have large trading accounts in absolute dollar terms, so this partition identifies BHCs for which trading is a large share of firmwide activity.<sup>16</sup>

As the results in Table 6 illustrate, the negative relationship between disclosure and future risk is strongest for the intense traders. The coefficients on the disclosure index variables are negative for both trading revenue volatility and market volatility for both the intense traders and other BHCs, but are statistically significant only in the equations for market volatility. In these equations, both the magnitude and precision of the coefficient estimates are greater for the intense traders subset than for the BHCs with a less intensive focus on trading. Interestingly, when the sample is split according to the dollar size of the trading account or by overall asset size, the differences across cohorts are much less evident.<sup>17</sup> Thus, the impact of disclosure on future risk appears to be related to the importance of trading activity within the BHC, not merely the scale of the activity or the size of the bank.

One potential criticism of the findings relating disclosure to future risk is that the disclosure variables may be capturing unobserved characteristics of the BHCs’ trading

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<sup>16</sup> “Intense traders” have trading assets that range between 5 and 45 percent of total assets (average 17 percent), as compared to a range of 0.5 to 3.6 percent (average 2 percent) for the other large traders in the sample.

<sup>17</sup>For conciseness, these results are not reported. In the market volatility equations, the coefficients on the disclosure index variables are statistically significant for both the “large” and “small” cohorts, when these are defined by total assets or total trading assets. As with the overall results, the coefficients are negative but not statistically significant at conventional levels in the trading volatility equations.

portfolios. For instance, the “VaR by Risk Type” sub-index is clearly more relevant for BHCs with trading positions spanning multiple risk factors (e.g., interest rates, exchange rates, equity prices) than for those with simple portfolios. Multi-risk-factor portfolios might have lower volatility, all else equal, due to greater diversification. Similarly, BHCs that report more information about stress testing may do so because they hold portfolios with “tail risk” that would not necessarily be captured in a volatility-based risk measure, but for which stress testing is an important risk management tool. It could be, therefore, that the disclosure variables are capturing differences in underlying risk across BHCs rather than the impact of differential disclosure practices.

We performed a series of robustness checks to assess this concern. To begin, the regression specification includes a variable to control for the size of the trading account, which is a first-order measure of the share of trading risk in the BHC’s overall risk profile (Hirtle 2003). The specification also includes BHC fixed effects, so any differences in risk exposure across BHCs that are systematically associated with differences in disclosure should be absorbed by those controls.

As a further check, we repeated the regressions including additional variables to control for the composition of BHCs’ trading activity. In particular, BHC regulatory reports contain information on trading revenues derived from different types of risk factors, such as interest rates, exchange rates, equity prices, and commodity prices. Nearly all the BHCs in the sample (95 percent) report trading revenue from interest rate and foreign exchange positions, but fewer report revenue from equity and commodity based positions (69 percent and 50 percent, respectively). We re-estimated the regression including dummy variables to capture the impact of these less common trading risk

factors. Regulatory reports also include information on the different types of securities held in the trading account, and we estimated a second alternative specification with variables capturing the composition of trading positions based on these data.<sup>18</sup> Since this information is available only beginning in 1995, we drop observations from 1994 from these estimates.

As a final test, we used a relatively direct measure of the trading portfolio risk, the BHC's market risk capital requirement (scaled by trading account assets). As discussed above, minimum regulatory capital requirements for market risk are based on a BHC's internal VaR estimates. Previous work (Hirtle 2003) has shown that these regulatory capital measures are correlated with future trading portfolio risk, both across banks and for a given bank over time. Thus, they represent a relatively direct measure of trading risk exposure. Unfortunately, they are available only beginning in 1998, when the market risk capital requirements were first imposed, and even then, some BHCs in our sample were not subject to the requirements in every sample year.<sup>19</sup> Overall, the sample size is reduced by about one-third when we include the market risk capital requirement as a control variable.

Results of the estimates including these three sets of additional control variables are reported in Tables 7A and 7B. For conciseness, we report only the coefficients on the additional control variables and on the disclosure variables, but the regressions include

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<sup>18</sup> Specifically, the specification included variables reflecting the share of trading account assets composed of U.S. treasury and agency securities, state and local government securities, mortgage-backed securities, other debt securities, trading positions held in foreign offices, revaluation gains on derivatives positions, and other trading account assets.

<sup>19</sup> Only banks and bank holding companies with trading account assets exceeding \$1 billion or 10 percent of total assets are subject to the market risk capital requirement. In addition, supervisors have the option to exempt a bank or BHC that would otherwise be subject to the requirements if its trading risk is shown to be minimal, or to require a bank or BHC to be subject to the requirements if it has significant trading risk even if it is below the numerical thresholds (Hendricks and Hirtle 1997).

the full set of variables reported in Table 5. Including the additional control variables does not change the basic results. We continue to see a negative relationship between disclosure and risk, though as before, this relationship is stronger for market volatility than for accounting-based trading volatility. That said, the disclosure variable coefficients in the accounting-based trading volatility equations are more precisely estimated in these specifications. The statistical significance of the market volatility results also increases when the risk factor dummy variables are included, though it declines somewhat in the other specifications, perhaps reflecting the reduced sample size. With few exceptions, the coefficients on the additional control variables are not statistically significant.

To provide some additional insight into the volatility results, we did a final set of estimates in which market (equity price) volatility is decomposed into its idiosyncratic and systematic components. Specifically, idiosyncratic volatility is calculated as the standard deviation of the residuals of annual regressions of weekly equity returns on a value-weighted market return, and systematic risk is calculated as the market return “beta” from these regressions. These results are reported in Table 8.

These results suggest that the negative relationship between disclosure and future market volatility is driven primarily by the idiosyncratic component. The coefficients on the disclosure variables are negative in both sets of equations, but are statistically significant only for idiosyncratic market risk. The economic impact is significantly larger for idiosyncratic risk as well: a one-standard deviation increase in the aggregate disclosure index would result in a 0.37 standard deviation decrease in idiosyncratic

market risk, as compared to just a 0.13 standard deviation decrease in the market beta.<sup>20</sup>

While these results are based on a simple market model with just a single market return factor, the findings are the same using a more complex model that includes factors capturing the yield curve and credit spreads.

These results suggest that as a BHC increases the amount of information it discloses about its forward-looking estimates of market risk, its risk-taking may become more efficient. In theory, idiosyncratic risk is uncompensated in terms of expected return, since it is possible to diversify this component away. BHCs appear to take less risk overall and less of this uncompensated risk as their disclosures increase. Overall, these findings seem consistent with the role of disclosure in enhancing market discipline.

#### *Disclosure and Performance*

While the finding that increased disclosure is associated with reduced future risk suggests that market discipline has an impact of BHC risk-taking, it leaves open the question of how this risk-reduction is achieved. A reduction in risk could reflect a move to safer positions with the result that returns decline as well, leaving risk-adjusted returns unaffected (a move along the risk-return frontier). Alternatively, if risk-taking becomes more efficient, then risk-adjusted returns could increase (a shift of the risk-return frontier). This section presents results that explore this question.

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<sup>20</sup> It is difficult to do a similar decomposition of trading volatility into its idiosyncratic and systematic components because it is not straightforward to define the relevant “market return” and because the low frequency of the underlying return data make annual regressions impractical. However, as a rough estimate, we used the average trading return for the BHCs in the sample in each quarter as the “market return” and calculated idiosyncratic trading volatility as the annual standard deviation of the difference between each BHC’s quarterly trading return and this average market return. Regression results using this variable suggest that the greater disclosure leads to lower idiosyncratic trading volatility, though the results are not significant at conventional confidence levels. The market beta is assumed to be 1.0 for all BHCs in all years, so it is not possible to estimate the impact of disclosure on systematic risk in this approach.



To begin, Table 9 presents results relating the market risk disclosure index to subsequent trading and market (equity price) returns. The findings suggest that increased disclosure is positively related to future returns. The coefficients on the aggregate disclosure index, the first principal component variable, and on most of the disclosure sub-indices are positive in both sets of equations, though they are statistically significant only for market returns. The estimates suggest a moderate-sized economic impact: a one-standard deviation increase in the value of the disclosure index or of the first principal component variable would result in about a 0.40 standard deviation decrease in future market returns. In contrast, the results suggest no meaningful relationship between market risk disclosure and future trading returns in either statistical or economic terms.<sup>21</sup>

These results do not seem consistent with market discipline causing BHCs to shift to less risky positions along a fixed risk-return frontier, which would imply a decline both risk and expected returns. Instead, they seem more consistent with enhanced disclosure being associated with more efficient risk-taking and an improved risk-return tradeoff.

The results in Table 10 provide further support to this interpretation. This table presents regressions of risk-adjusted trading and overall market returns (“Sharpe ratios”) on the market risk disclosure index and its sub-components. These results strongly suggest that both risk-adjusted trading returns and risk-adjusted market returns increase as BHCs increase the amount of information they disclose about their forward-looking estimates of market risk exposure. Coefficients on the market risk disclosure index, first principal components variable, and nearly all the disclosure index sub-components are positive and statistically significant (jointly statistically significant in the case of the

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<sup>21</sup> A one-standard-deviation increase in the disclosure index would increase future trading returns by less than one-twentieth of a standard deviation.

index sub-components). The impact is economically meaningful as well as statistically significant: a one standard deviation increase in the market risk disclosure index or in the first principal component variable is associated with a 0.70 standard deviation increase in risk-adjusted trading returns and a 0.50 standard deviation increase in risk-adjusted market returns.<sup>22</sup>

Table 11 presents results in which the sample is once again partitioned into “intense traders” and other large traders to see if the impact of disclosure on risk-adjusted returns is more pronounced for BHCs where trading is a more significant share of overall activity. The results confirm this conjecture. The coefficients on the disclosure index variables are positive for both cohorts, but are statistically significant only for the “intense traders”. As with the results linking disclosure to future risk, we get different results when the sample is partitioned by asset size or trading account size (the coefficients for both cohorts are positive and statistically significant), so once again the link between disclosure about market risk and future performance appears to strongest for BHCs that are most intensively engaged in trading activities.

The final set of results worth noting concern the “disclosure leader” variable, which identifies BHCs that are the only ones to disclose a particular type of information about market risk exposure in a given year. These results provide an interesting counterpoint to the findings linking increases in disclosure to enhance future

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<sup>22</sup> These results are robust to the alternative specifications including additional control variables for trading portfolio composition: the dummy variables for risk factors types, variables for trading portfolio shares in different types of securities, and including the market risk capital charge. The only exception is the results for risk-adjusted trading returns when the market risk capital charge is included: the coefficients on the disclosure variables remain positive but are no longer statistically significant. This change appears to reflect the reduced sample size (recall all observations before 1998 are dropped, as well as observations for BHCs not subject to the market risk capital requirements, generally those with smaller trading risk exposures), as the coefficients lose significance in estimates using the smaller sample even when the market risk disclosure variable is not included.

performance. Being a disclosure leader appears to have no significant association with trading risk or return. The coefficients on the disclosure leader variable are positive in both the trading risk and trading return equations, but never statistically significant. In contrast, the coefficient estimates indicate that being a disclosure leader has a negative and statistically significant impact on both unadjusted and risk-adjusted market returns. Thus, disclosing more information is associated with better performance and an improved risk-return tradeoff as long as the information disclosed is within the range of what other BHCs are disclosing. But being a disclosure leader or innovator appears to be associated with worse firmwide performance, perhaps because there are learning costs for investors and creditors in understanding and putting in context new types of information.

## **V. Summary and Conclusions**

Disclosure plays an important role in market discipline since market participants need to have meaningful information on which to base their judgments of risk and performance. Disclosure is particularly important in the banking industry, since banks are generally viewed as being opaque to outsiders. As a result, banking supervisors and other public sector officials have encouraged enhanced disclosure by banking companies, particularly of forward-looking estimates of risk. This paper tries to assess whether these kinds of disclosures provide useful information to market participants that can help foster market discipline.

In particular, the paper examines disclosures related to market risk in trading and market-making activities. The key variable is an index of market risk disclosure that captures the amount of market risk information banking companies disclose in their annual reports. The index is constructed for a sample of BHCs with significant trading

activities over the years 1994 to 2004. The estimates examine how this index affects future risk and return on trading activities and for the BHC overall, as proxied by the firm's equity price behavior.

The main findings are that increases in disclosure are associated with lower risk and high risk-adjusted returns, for both trading and for the firm overall. These results are economically meaningful as well as statistically significant. The findings are robust to alternative specifications that include additional controls for the composition of the BHCs' trading portfolios and the sources of trading revenue, and are stronger for BHCs where trading represents a larger share of firmwide activity. Overall, the results suggest that as disclosure increases, BHCs experience an improved risk-return tradeoff, not merely a risk-reducing shift along the existing risk-return frontier.

One interesting finding concerns bank holding companies that are "first movers" in disclosure, in the sense of being the first to disclose a particular type of information. These firms appear to have lower future returns, both absolute and risk-adjusted. This finding suggests that there may be learning costs for investors in assessing and putting into context new types of information about risk. To the extent this is the case, policymakers advocating new and innovative disclosures should also consider the role that the public sector could play in educating investors and market analysts about these new disclosures. This could reduce any negative market reaction to unfamiliar information and thus better align the incentives of firms and policymakers about enhanced disclosure.

Overall, the findings are consistent with a broad interpretation of market discipline. Much discussion of market discipline has focused on the idea that market

participants are concerned primarily about risk, so that enhanced disclosure serves mainly to discipline bank managers in terms of risk-taking. However, investors, creditors, and other stakeholders might reasonably be assumed to be concerned with efficient risk-taking and the relationship between risk and return. In this broader interpretation, enhanced disclosure facilitates market discipline not merely by affecting risk, but by making risk taking and trading activities more efficient and productive.

A final related point is that the link between greater disclosure and better performance may not necessarily be due to the impact of market discipline as traditionally defined. Specifically, the same risk management systems that produce better risk-adjusted performance may also generate the information needed to make more detailed risk disclosures, which may be used by the bank as a public signal of their superior risk management abilities. In this story, enhanced disclosure is a by-product of better performance, rather than a cause. That said, even in this story, enhanced disclosure provides market participants with important information about the bank that could influence investor actions, which seems consistent with a broad view of market discipline.

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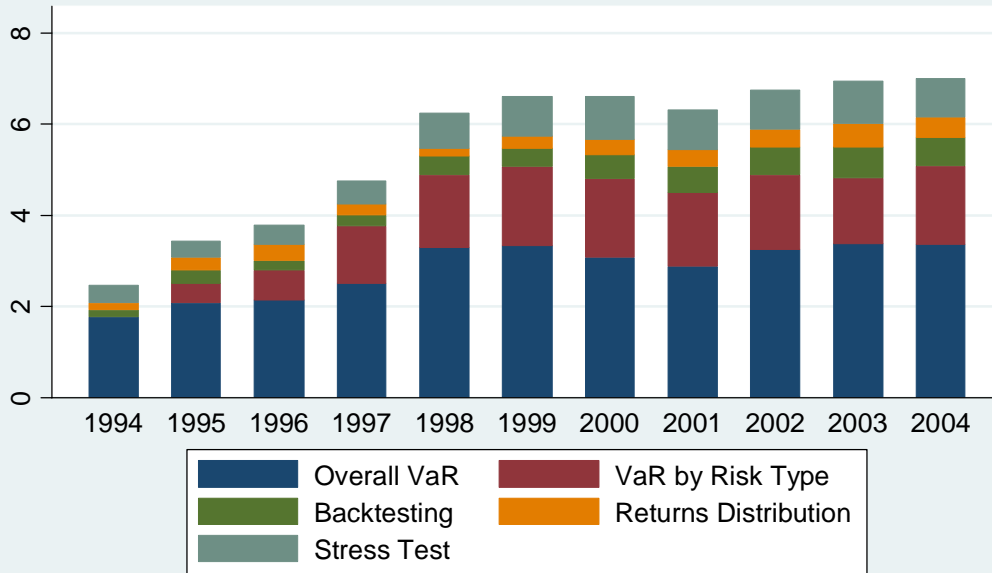
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Figure 1: Average Market Risk Disclosure Index

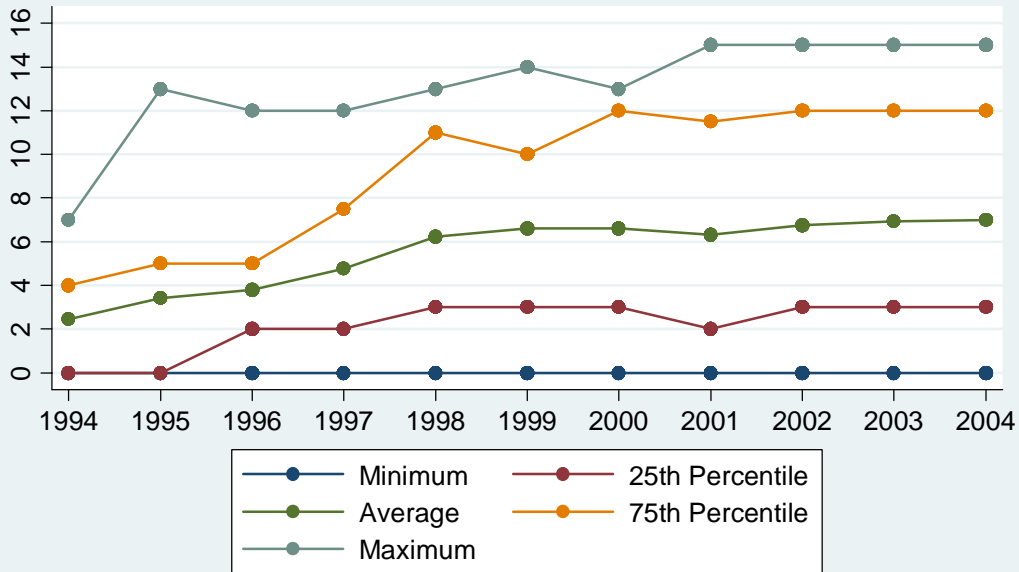
1994 - 2004



Average number of market risk data items reported by BHCs with real trading assets exceeding \$1 billion between 1994 and 2004.

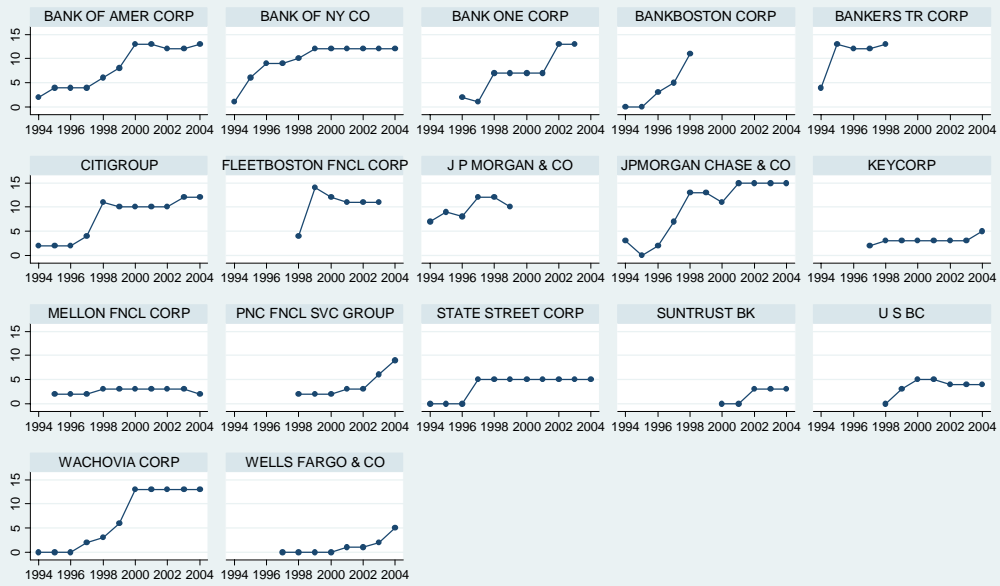
Figure 2: Distribution of Market Risk Disclosure Index

1994 to 2004



Value of market risk disclosure index for BHCs with real trading assets exceeding \$1 billion between 1994 and 2004.

### Figure 3: Disclosure Index for Large BHCs



BHCs with trading assets greater than \$1 billion for at least five years between 1994 and 2004. The data reflect the BHCs' corporate identities in 2004 or the last year they are in the sample, with no adjustments for mergers.

**Table1: Basic Statistics of the Regression Sample**

| <b>Performance Variables</b>         | <b>Mean</b> | <b>Median</b> | <b>Standard Deviation</b> | <b>Minimum</b> | <b>Maximum</b> |
|--------------------------------------|-------------|---------------|---------------------------|----------------|----------------|
| Trading Return                       | 8.504       | 4.689         | 9.598                     | -2.432         | 56.081         |
| Trading Volatility                   | 2.977       | 1.590         | 4.362                     | 0.232          | 40.523         |
| Risk-Adjusted Trading Return         | 3.507       | 2.878         | 2.819                     | -5.428         | 12.614         |
| Market Return                        | 18.764      | 18.914        | 25.471                    | -50.201        | 72.129         |
| Market Volatility                    | 208.01      | 198.17        | 77.67                     | 78.08          | 383.68         |
| Risk-Adjusted Market Return          | 0.107       | 0.102         | 0.125                     | -0.190         | 0.371          |
| Idiosyncratic Market Volatility      | 163.65      | 148.31        | 70.12                     | 66.55          | 358.76         |
| Market Beta                          | 1.098       | 1.089         | 0.406                     | 0.236          | 2.009          |
| <b>Disclosure Variables</b>          |             |               |                           |                |                |
| Disclosure Leader                    | 0.092       | 0             | 0.290                     | 0              | 1              |
| Aggregate Disclosure Index           | 5.553       | 4             | 4.563                     | 0              | 15             |
| First Principal Component            | 0.000       | -1.096        | 2.633                     | -2.937         | 5.712          |
| <i>Index Components:</i>             |             |               |                           |                |                |
| Overall VaR                          | 2.830       | 3             | 1.867                     | 0              | 6              |
| VaR by Risk Type                     | 1.305       | 0             | 1.682                     | 0              | 4              |
| Backtesting                          | 0.433       | 0             | 0.679                     | 0              | 2              |
| Return Distribution                  | 0.305       | 0             | 0.620                     | 0              | 2              |
| Stress Testing                       | 0.681       | 0             | 0.865                     | 0              | 3              |
| <b>BHC Characteristics</b>           |             |               |                           |                |                |
| Asset Size                           | 254.16      | 128.86        | 292.24                    | 22.50          | 1518.02        |
| Risk-weighted Assets/ Total Assets   | 0.798       | 0.831         | 0.173                     | 0.322          | 1.144          |
| Total Risk-Based Capital Ratio       | 12.32       | 12.05         | 1.27                      | 10.36          | 17.99          |
| Trading Assets/ Total Assets         | 0.084       | 0.039         | 0.108                     | 0.001          | 0.490          |
| Deposits/ Total Assets               | 0.576       | 0.614         | 0.138                     | 0.054          | 0.763          |
| Loans/ Total Assets                  | 0.528       | 0.607         | 0.206                     | 0.049          | 0.790          |
| Securities/Total Assets              | 0.153       | 0.140         | 0.073                     | 0.063          | 0.436          |
| Fed Funds/Total Assets               | 0.063       | 0.033         | 0.075                     | 0.001          | 0.300          |
| Other Assets/Total Assets            | 0.098       | 0.093         | 0.037                     | 0.037          | 0.238          |
| Loan Portfolio Concentration         | 0.377       | 0.322         | 0.160                     | 0.256          | 1.000          |
| Non-interest Income/Operating Income | 0.523       | 0.469         | 0.146                     | 0.277          | 0.890          |
| Revenue Source Concentration         | 0.394       | 0.399         | 0.065                     | 0.249          | 0.607          |

The sample consists of 141 annual observations for a sample of 24 bank holding companies with trading assets exceeding \$1 billion (2005 dollars) at some point between 1994 and 2004. BHC characteristics and trading revenue data are from the Federal Reserve Y-9C reports. Disclosure data are from the BHCs' annual reports. Market price data are from CRSP. Trading Return is annual trading revenue divided by trading assets. Trading Volatility is the annual standard deviation of quarterly trading revenue divided by trading assets. Risk-adjusted Trading Return is Trading Return divided by Trading Volatility. Market return is the annual average of weekly equity price returns. Market Volatility is the standard deviation of weekly returns. Risk-adjusted Market Returns is Market Return divided by Market Volatility. Idiosyncratic Market Volatility is the standard deviation of the residuals of an annual market model regression of BHC returns on value-weighted market returns. Market Beta is the beta from annual market model regressions. Disclosure Leader is a dummy variable for whether a BHC is the only one to report a given disclosure item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is the first principal component of the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Return Distribution, and Stress Testing are sub-indices of the aggregate index.

**Table 2: The Market Risk Disclosure Index**

| <b>Category</b>                       | <b>Data Items</b>   |
|---------------------------------------|---|
| <b>I. Overall Value-at-Risk (VaR)</b> | <ol style="list-style-type: none"><li>1. Holding period and confidence interval.</li><li>2. Annual average VaR.</li><li>3. Year-end VaR.</li><li>4. Minimum VaR over the year.</li><li>5. Maximum VaR over the year.</li><li>6. VaR Limit (dollar amount).</li><li>7. Histogram of daily VaR.</li></ol> |
| <b>II. VaR by Risk Type</b>           | <ol style="list-style-type: none"><li>8. Annual average VaR by risk type.</li><li>9. Year-end VaR by risk type.</li><li>10. Minimum VaR by risk type.</li><li>11. Maximum VaR by risk type.</li></ol>   |
| <b>III. Backtesting</b>               | <ol style="list-style-type: none"><li>12. Chart of daily trading P&amp;L versus daily VaR.</li><li>13. Number of days losses exceeded VaR.</li></ol>  |
| <b>IV. Returns Distribution</b>       | <ol style="list-style-type: none"><li>14. Histogram of daily trading P&amp;L.</li><li>15. Largest daily loss.</li></ol>   |
| <b>V. Stress Testing</b>              | <ol style="list-style-type: none"><li>16. Mention that stress tests are done.</li><li>17. Describe the stress tests qualitatively.</li><li>18. Report stress test results.</li></ol>  |

**Table 3: Correlation Between Market Risk Disclosure Index  
and BHC Asset Size and Trading Activity**  
(P-values in parentheses)

|  | Market Risk<br>Disclosure Index | Average Real<br>Assets | Average Real<br>Trading Assets | Average<br>Trading Assets/<br>Total Assets |
|--|---------------------------------|------------------------|--------------------------------|--|
| Market Risk<br>Disclosure Index            | 1.000                           |                        |                                |  |
| Average Real<br>Assets                     | 0.531<br>(0.006)                | 1.000                  |                                |  |
| Average Real<br>Trading Assets             | 0.627<br>(0.001)                | 0.852<br>(0.000)       | 1.000                          |  |
| Average<br>Trading Assets/<br>Total Assets | 0.544<br>(0.005)                | 0.271<br>(0.190)       | 0.659<br>(0.000)               | 1.000                                      |

Figures in the table are based on average values for 24 bank holding companies that have trading assets exceeding \$1 billion at some point between 1994 and 2004. Total assets and trading assets are in 2005 dollars and are averaged across the years a BHC is in the sample.

**Table 4: Frequency of Individual Data Items in the Market Risk Disclosure Index**

| <b>Data Item</b>                       | <b>Share of Observations</b> |             |             |
|--|------------------------------|-------------|-------------|
|  | <b>All Observations</b>      | <b>1994</b> | <b>2004</b> |
| <b><i>Overall Value-at-Risk</i></b>    |                              |             |             |
| Holding Period and Confidence Interval | 0.809                        | 0.583       | 0.857       |
| Annual Average VaR                     | 0.560                        | 0.333       | 0.714       |
| Year-end VaR                           | 0.567                        | 0.167       | 0.429       |
| Minimum VaR Over the Year              | 0.355                        | 0.167       | 0.571       |
| Maximum VaR Over the Year              | 0.390                        | 0.250       | 0.571       |
| VaR Limit (Dollar Amount)              | 0.092                        | 0.000       | 0.214       |
| Histogram of Daily VaR                 | 0.057                        | 0.083       | 0.000       |
| <b><i>VaR by Risk Type</i></b>         |                              |             |             |
| Annual Average VaR by Risk Type        | 0.390                        | 0.000       | 0.500       |
| Year-end VaR by Risk Type              | 0.241                        | 0.000       | 0.214       |
| Minimum VaR by Risk Type               | 0.333                        | 0.000       | 0.500       |
| Maximum VaR by Risk Type               | 0.340                        | 0.000       | 0.500       |
| <b><i>Backtesting</i></b>              |                              |             |             |
| Chart of Daily P&L versus Daily VaR    | 0.106                        | 0.083       | 0.214       |
| Number of Days Losses Exceeded VaR     | 0.326                        | 0.083       | 0.429       |
| <b><i>Returns Distribution</i></b>     |                              |             |             |
| Histogram of Daily P&L                 | 0.206                        | 0.167       | 0.286       |
| Largest Daily Loss                     | 0.099                        | 0.000       | 0.143       |
| <b><i>Stress Testing</i></b>           |                              |             |             |
| Mention that Stress Tests are Done     | 0.447                        | 0.333       | 0.500       |
| Describe Stress Tests                  | 0.206                        | 0.083       | 0.286       |
| Report Stress Test Results             | 0.028                        | 0.000       | 0.071       |

Source: 1994 to 2004 10-K reports of the 24 bank holding companies in the market risk sample. These companies each have trading assets exceeding \$1 billion (2005 dollars) at some point between 1994 and 2004.

**Table 5: Disclosure and Risk**

| <b>Disclosure Variables</b>          | <b>Trading Revenue Volatility</b> |                       |                       | <b>Market Volatility</b> |                          |                         |
|--------------------------------------|-----------------------------------|-----------------------|-----------------------|--------------------------|--------------------------|-------------------------|
| Disclosure Leader                    | 0.5511<br>(1.0619)                | 0.4439<br>(1.0372)    | 0.2811<br>(1.2111)    | -17.9662<br>(18.1864)    | -21.0692<br>(17.8864)    | -24.0615<br>(19.6274)   |
| Aggregate Disclosure Index           | -0.2067<br>(0.1499)               |                       |                       | -5.2876***<br>(2.0049)   |                          |                         |
| First Principal Component            |                                   | -0.3926<br>(0.2542)   |                       |                          | -9.1033***<br>(3.4203)   |                         |
| <i>Index Components</i>              |                                   |                       |                       |                          |                          |                         |
| Overall VaR                          |                                   |                       | -0.0722<br>(0.2747)   |                          |                          | 2.5693<br>(4.1656)      |
| VaR by Risk Type                     |                                   |                       | -0.4793<br>(0.3513)   |                          |                          | -12.3571**<br>(5.9802)  |
| Backtesting                          |                                   |                       | 0.1725<br>(0.6303)    |                          |                          | 2.2028<br>(10.0061)     |
| Returns Distribution                 |                                   |                       | 0.0570<br>(0.6262)    |                          |                          | -16.3232<br>(9.8864)    |
| Stress Testing                       |                                   |                       | -0.7305<br>(1.4926)   |                          |                          | -19.2020*<br>(9.6868)   |
| <b>BHC Characteristics</b>           |                                   |                       |                       |                          |                          |                         |
| Log (Asset Size)                     | -6.3143<br>(7.4626)               | -6.0996<br>(7.5312)   | -5.3596<br>(8.2919)   | 168.8094<br>(119.8606)   | 174.2610<br>(118.8636)   | 195.3135<br>(122.8491)  |
| Log (Asset Size) Squared             | 0.7603<br>(0.8495)                | 0.7318<br>(0.8542)    | 0.7093<br>(0.8900)    | -7.5424<br>(12.1425)     | -8.2857<br>(12.0023)     | -9.1992<br>(12.3462)    |
| Risk-Weighted Assets/ Assets         | -7.2933<br>(9.5531)               | -7.6671<br>(9.5568)   | -7.2232<br>(10.2174)  | 65.6785<br>(115.3084)    | 55.7166<br>(114.5025)    | 31.7537<br>(118.7726)   |
| Total Risk-Based Capital Ratio       | -0.4906<br>(0.3641)               | -0.4805<br>(0.3616)   | -0.5399<br>(0.4039)   | -1.1911<br>(4.3732)      | -0.9675<br>(4.3664)      | -2.1469<br>(4.4698)     |
| Trading Assets/ Assets               | -12.1608<br>(23.4017)             | -12.2277<br>(23.4116) | -11.1142<br>(20.8338) | -21.1540<br>(333.6489)   | -24.1887<br>(330.3911)   | 31.8939<br>(344.9568)   |
| Deposits/ Assets                     | 9.2209<br>(17.1154)               | 9.4076<br>(17.0315)   | 12.5870<br>(20.4780)  | 150.6754<br>(169.8600)   | 149.7204<br>(169.2627)   | 199.5573<br>(161.5082)  |
| Loans/ Assets                        | 9.4097<br>(20.9774)               | 9.3012<br>(20.9745)   | 7.6136<br>(21.4488)   | -245.7839<br>(250.1154)  | -248.3401<br>(247.9748)  | -319.1732<br>(251.7282) |
| Securities/Asset                     | -4.2757<br>(29.5472)              | -4.7549<br>(29.6125)  | -3.9765<br>(28.6789)  | -25.6614<br>(232.4887)   | -35.2014<br>(229.7102)   | -80.1936<br>(239.8353)  |
| Fed Funds/Assets                     | -6.9787<br>(22.2026)              | -7.4482<br>(22.3168)  | -6.9505<br>(21.3824)  | -40.8016<br>(249.2117)   | -52.9536<br>(246.2720)   | -97.5376<br>(251.8612)  |
| Other Assets/Assets                  | 29.9202<br>(37.5125)              | 29.6671<br>(37.3414)  | 30.2351<br>(39.6880)  | 395.3206<br>(375.4566)   | 385.3924<br>(373.5137)   | 318.9373<br>(375.7545)  |
| Loan Portfolio Concentration         | 1.7135<br>(6.0576)                | 1.8378<br>(6.0536)    | 2.2769<br>(7.1405)    | -130.7566<br>(94.3328)   | -127.9617<br>(94.7113)   | -125.4548<br>(100.9179) |
| Non-interest Income/Operating Income | 2.2893<br>(9.4164)                | 2.3858<br>(9.4311)    | 3.0941<br>(10.1118)   | -164.8297**<br>(80.3430) | -163.1132**<br>(79.6865) | -158.2130*<br>(80.2475) |
| Revenue Source Concentration         | -2.7670<br>(9.8090)               | -2.7631<br>(9.8339)   | -3.9644<br>(11.1864)  | -115.9588<br>(145.3124)  | -107.3717<br>(141.2185)  | -112.2317<br>(140.8232) |
| Number of Observations               | 141                               | 141                   | 141                   | 141                      | 141                      | 141                     |
| R-Squared                            | 0.123                             | 0.125                 | 0.129                 | 0.857                    | 0.857                    | 0.867                   |
| P-Value: Disclosure Index = 0?       | 0.171                             | 0.126                 | 0.589                 | 0.010                    | 0.009                    | 0.004                   |

Trading Revenue Volatility is the annual standard deviation of quarterly trading revenue/beginning of quarter trading assets, and Market Volatility is the annual standard deviation of weekly equity market returns. BHC characteristics are from the Federal Reserve Y-9C reports. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the market risk disclosure index. First Principal Component is based on the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all U.S.-owned BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between 1994 and 2004, starting with the first year that trading assets exceed \$500 million. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 6: Disclosure and Risk, by Extent of Trading Activity**

| Disclosure Variables                                   | Trading Revenue Volatility |                    |                         | Market Volatility        |                       |                        |
|--|----------------------------|--------------------|-------------------------|--------------------------|-----------------------|------------------------|
| <i>Impact for Intense Traders</i>                      |                            |                    |                         |                          |                       |                        |
| Disclosure Leader                                      | 0.7733<br>(1.0524)         | 0.7774<br>(1.0558) | 0.0507<br>(1.2660)      | -28.8530<br>(25.7839)    | -28.9930<br>(25.9300) | -43.4583*<br>(24.9336) |
| Aggregate Disclosure Index                             | -0.1392<br>(0.1221)        |                    | -6.3274***<br>(2.3379)  |                          |                       |                        |
| First Principal Component                              | -0.2485<br>(0.2037)        |                    | -10.8608***<br>(3.9363) |                          |                       |                        |
| Index Components                                       |                            |                    |                         |                          |                       |                        |
| Overall VaR  | 0.0056<br>(0.4692)         |                    |                         | 14.2604**<br>(5.8042)    |                       |                        |
| VaR by Risk Type                                       | -0.7902<br>(0.8662)        |                    |                         | -27.8142***<br>(8.6116)  |                       |                        |
| Backtesting  | -0.2309<br>(0.7491)        |                    |                         | 3.7830<br>(14.1304)      |                       |                        |
| Returns Distribution                                   | 0.5892<br>(0.6449)         |                    |                         | -14.4840<br>(10.8055)    |                       |                        |
| Stress Testing   | 0.8647<br>(0.6740)         |                    |                         | -11.7665<br>(12.2274)    |                       |                        |
| <i>Impact for Other Large Traders</i>                  |                            |                    |                         |                          |                       |                        |
| Disclosure Leader                                      | 0.9120<br>(2.2970)         | 0.5745<br>(2.0192) | 4.5338<br>(5.3877)      | -12.4000<br>(28.3010)    | -17.6248<br>(26.8145) | 15.3042<br>(36.5099)   |
| Aggregate Disclosure Index                             | -0.3322<br>(0.3117)        |                    | -3.9004<br>(2.9611)     |                          |                       |                        |
| First Principal Component                              | -0.6445<br>(0.5311)        |                    | -6.3194<br>(4.8846)     |                          |                       |                        |
| Index Components                                       |                            |                    |                         |                          |                       |                        |
| Overall VaR  | 0.4893<br>(0.7044)         |                    |                         | 1.2343<br>(6.7566)       |                       |                        |
| VaR by Risk Type                                       | -2.1685<br>(2.3077)        |                    |                         | 0.7151<br>(11.9511)      |                       |                        |
| Backtesting  | 2.7590<br>(4.0347)         |                    |                         | -11.7702<br>(20.8397)    |                       |                        |
| Returns Distribution                                   | -5.1137<br>(3.9480)        |                    |                         | -98.3117***<br>(34.0707) |                       |                        |
| Stress Testing   | -6.6148<br>(6.7296)        |                    |                         | -20.1356<br>(19.0349)    |                       |                        |
| P-Value: Disclosure Index = 0,<br>Large Trading BHCs   | 0.257                      | 0.226              | 0.496                   | 0.008                    | 0.007                 | 0.005                  |
| P-Value: Disclosure Index = 0,<br>Smaller Trading BHCs | 0.290                      | 0.229              | 0.731                   | 0.192                    | 0.199                 | 0.025                  |
| Number of Observations                                 | 141                        | 141                | 141                     | 141                      | 141                   | 141                    |
| R-Squared  | 0.125                      | 0.128              | 0.189                   | 0.858                    | 0.858                 | 0.881                  |

Trading Revenue Volatility is the annual standard deviation of quarterly trading returns (trading revenue divided by beginning of quarter trading assets), and Market Volatility is the annual standard deviation of weekly equity market returns. BHC characteristics are from the Federal Reserve Y-9C reports. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is the first principal component of the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all U.S.-owned BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between Q4 1994 and Q4 2004, starting with the first year that trading assets exceed \$500 million. Intense/Other Large Traders are BHCs with average trading assets to total assets above/below the median value for the BHCs in the sample. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.



**Table 7A: Robustness Checks on Trading Revenue Volatility Regression Results**

| Disclosure Variables                  | Risk Factor Dummy Variables |                     |                     | Trading Portfolio Asset Shares |                       |                      | Market Risk Capital |                    |                      |
|---------------------------------------|-----------------------------|---------------------|---------------------|--------------------------------|-----------------------|----------------------|---------------------|--------------------|----------------------|
| Disclosure Leader                     | 0.6988<br>(1.0219)          | 0.6003<br>(1.0037)  | 0.4348<br>(1.1337)  | -0.0099<br>(1.0903)            | -0.2140<br>(1.1076)   | -0.1767<br>(1.3818)  | 0.5846<br>(3.8684)  | 0.2523<br>(3.6513) | 3.0045<br>(5.0013)   |
| Aggregate Disclosure Index            | -0.2121<br>(0.1475)         |                     |                     | -0.3754*<br>(0.2200)           |                       |                      | -0.5492<br>(0.4653) |                    |                      |
| First Principal Component             | -0.4059<br>(0.2498)         |                     |                     | -0.7050*<br>(0.3829)           |                       |                      | -0.9788<br>(0.7440) |                    |                      |
| <b>Index Components</b>               |                             |                     |                     |                                |                       |                      |                     |                    |                      |
| Overall VaR                           | -0.0369<br>(0.2893)         |                     |                     | 0.0896<br>(0.4329)             |                       |                      | -0.8557<br>(0.8656) |                    |                      |
| VaR by Risk Type                      | -0.5152<br>(0.3598)         |                     |                     | -0.7469<br>(0.5855)            |                       |                      | -3.0502<br>(2.2992) |                    |                      |
| Backtesting                           | 0.0890<br>(0.6686)          |                     |                     | -0.7282<br>(1.1787)            |                       |                      | 1.0385<br>(2.1801)  |                    |                      |
| Returns Distribution                  | 0.1038<br>(0.6565)          |                     |                     | 0.4089<br>(0.9334)             |                       |                      | 0.0965<br>(1.2793)  |                    |                      |
| Stress Testing                        | -0.7645<br>(1.4903)         |                     |                     | -1.0440<br>(2.4492)            |                       |                      | -1.9654<br>(3.6958) |                    |                      |
| <b>Additional Control Variable</b>    |                             |                     |                     |                                |                       |                      |                     |                    |                      |
| <b>Risk Factor Dummy Variables</b>    |                             |                     |                     |                                |                       |                      |                     |                    |                      |
| Equity-based Revenue                  | -0.4948<br>(1.1879)         | -0.5307<br>(1.1865) | -0.4845<br>(1.3339) |                                |                       |                      |                     |                    |                      |
| Commodity-based Revenue               | 0.3469<br>(0.9473)          | 0.3727<br>(0.9421)  | 0.5104<br>(0.9211)  |                                |                       |                      |                     |                    |                      |
| <b>Trading Portfolio Asset Shares</b> |                             |                     |                     |                                |                       |                      |                     |                    |                      |
| Treasury and Agency Securities        |                             |                     |                     | 3.4264<br>(7.9841)             | 3.3751<br>(7.9184)    | 0.3028<br>(9.8380)   |                     |                    |                      |
| State and Local Gov't Securities      |                             |                     |                     | 34.5569<br>(26.1548)           | 34.9903<br>(25.7240)  | 32.8975<br>(28.3455) |                     |                    |                      |
| Mortgage-backed Security              |                             |                     |                     | 15.1167<br>(12.7157)           | 14.8601<br>(12.6746)  | 12.7777<br>(13.4201) |                     |                    |                      |
| Other Debt Securities                 |                             |                     |                     | 10.1208**<br>(5.0706)          | 10.0267**<br>(4.9260) | 8.1649<br>(5.8032)   |                     |                    |                      |
| Positions in Foreign Offices          |                             |                     |                     | 1.7969<br>(8.0770)             | 1.8886<br>(8.0188)    | -0.1103<br>(7.8871)  |                     |                    |                      |
| Derivatives Revaluation Gains         |                             |                     |                     | 1.5004<br>(2.5670)             | 1.3153<br>(2.4847)    | -1.5335<br>(5.5748)  |                     |                    |                      |
| <b>Market Risk Capital</b>            |                             |                     |                     |                                |                       |                      |                     |                    |                      |
| Market Risk Cap/Trading Assets        |                             |                     |                     |                                |                       |                      | 8.5974<br>(9.4357)  | 8.7444<br>(9.3209) | 10.5400<br>(10.7127) |
| Number of Observations                | 141                         | 141                 | 141                 | 129                            | 129                   | 129                  | 96                  | 96                 | 96                   |
| R-Squared                             | 0.125                       | 0.127               | 0.131               | 0.279                          | 0.282                 | 0.291                | 0.196               | 0.198              | 0.224                |
| P-Value: Disclosure Index = 0?        | 0.154                       | 0.108               | 0.539               | 0.093                          | 0.070                 | 0.656                | 0.243               | 0.194              | 0.755                |

Trading Revenue Volatility is the annual standard deviation of quarterly trading returns (trading revenue divided by beginning of quarter trading assets). BHC characteristics are from the Federal Reserve Y-9C reports for bank holding companies. Disclosure information is from the BHCs' annual reports. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is the first principal component of the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all non-foreign-owned U.S. BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between Q4 1994 and Q4 2004, starting with the first year that trading assets exceed \$500 million. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 7B: Robustness Checks on Market Volatility Regression Results**

| Disclosure Variables                  | Risk Factor Dummy Variables |                       |                       | Trading Portfolio Asset Shares |                       |                       | Market Risk Capital    |                      |                      |
|---------------------------------------|-----------------------------|-----------------------|-----------------------|--------------------------------|-----------------------|-----------------------|------------------------|----------------------|----------------------|
| Disclosure Leader                     | -12.9798<br>(18.5460)       | -16.0770<br>(18.1740) | -18.5766<br>(19.9141) | -19.6470<br>(19.9577)          | -22.2090<br>(19.6321) | -23.4852<br>(20.2532) | 18.8052<br>(46.0753)   | 12.6741<br>(44.6421) | 44.5044<br>(49.4230) |
| Aggregate Disclosure Index            | -5.638***<br>(1.9825)       |                       |                       | -4.4904*<br>(2.6652)           |                       |                       | -7.5359*<br>(4.1431)   |                      |                      |
| First Principal Component             | -9.770***<br>(3.3424)       |                       |                       | -7.9410*<br>(4.5412)           |                       |                       | -12.5675*<br>(6.9925)  |                      |                      |
| <b>Index Components</b>               |                             |                       |                       |                                |                       |                       |                        |                      |                      |
| Overall VaR                           | 3.5796<br>(4.2254)          |                       |                       | 4.7221<br>(5.2696)             |                       |                       | -0.9271<br>(6.8114)    |                      |                      |
| VaR by Risk Type                      | -13.428**<br>(5.8040)       |                       |                       | -15.180**<br>(7.1559)          |                       |                       | -25.1427<br>(15.0027)  |                      |                      |
| Backtesting                           | -1.0590<br>(9.6252)         |                       |                       | 3.8150<br>(13.6767)            |                       |                       | 15.8243<br>(18.1967)   |                      |                      |
| Returns Distribution                  | -13.8166<br>(10.1410)       |                       |                       | -14.2294<br>(12.7196)          |                       |                       | -29.0514*<br>(15.5196) |                      |                      |
| Stress Testing                        | -20.590**<br>(9.7699)       |                       |                       | -19.3521*<br>(10.3721)         |                       |                       | -33.731**<br>(14.5072) |                      |                      |
| <b>Additional Control Variable</b>    |                             |                       |                       |                                |                       |                       |                        |                      |                      |
| <b>Risk Factor Dummy Variables</b>    |                             |                       |                       |                                |                       |                       |                        |                      |                      |
| Equity-based Revenue                  | -4.7580<br>(11.5580)        | -5.6483<br>(11.5087)  | -12.8107<br>(12.4551) |                                |                       |                       |                        |                      |                      |
| Commodity-based Revenue               | 19.8765*<br>(11.0607)       | 20.1542*<br>(11.1223) | 20.1989*<br>(11.3747) |                                |                       |                       |                        |                      |                      |
| <b>Trading Portfolio Asset Shares</b> |                             |                       |                       |                                |                       |                       |                        |                      |                      |
| Treasury and Agency Securities        |                             |                       |                       | -36.6803<br>(63.3155)          | -38.2692<br>(62.6867) | -75.2761<br>(71.4262) |                        |                      |                      |
| State and Local Gov't Securities      |                             |                       |                       | 59.5634<br>(107.592)           | 60.5386<br>(109.334)  | 20.2961<br>(121.717)  |                        |                      |                      |
| Mortgage-backed Security              |                             |                       |                       | 24.3069<br>(82.2676)           | 21.7109<br>(81.8044)  | -14.9592<br>(81.7528) |                        |                      |                      |
| Other Debt Securities                 |                             |                       |                       | -95.2440<br>(79.0637)          | -97.2012<br>(79.2029) | -95.6073<br>(88.6612) |                        |                      |                      |
| Positions in Foreign Offices          |                             |                       |                       | 13.2881<br>(73.3371)           | 13.4164<br>(72.6063)  | -1.0387<br>(76.5471)  |                        |                      |                      |
| Derivatives Revaluation Gains         |                             |                       |                       | 6.3239<br>(54.8511)            | 3.4476<br>(54.2473)   | -31.1812<br>(65.1302) |                        |                      |                      |
| <b>Market Risk Capital</b>            |                             |                       |                       |                                |                       |                       |                        |                      |                      |
| Market Risk Cap/Trading Assets        |                             |                       |                       |                                |                       |                       | 38.7079<br>(32.6835)   | 38.9946<br>(33.1076) | 23.9106<br>(36.7124) |
| Number of Observations                | 141                         | 141                   | 141                   | 129                            | 129                   | 129                   | 96                     | 96                   | 96                   |
| R-Squared                             | 0.862                       | 0.862                 | 0.872                 | 0.863                          | 0.863                 | 0.873                 | 0.874                  | 0.874                | 0.888                |
| P-Value: Disclosure Index = 0?        | 0.006                       | 0.005                 | 0.004                 | 0.097                          | 0.085                 | 0.066                 | 0.075                  | 0.078                | 0.106                |

Market Volatility is the annual standard deviation of weekly equity market returns. BHC characteristics are from the Federal Reserve Y-9C reports for bank holding companies. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is the first principal component of the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all non-foreign-owned U.S. BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between Q4 1994 and Q4 2004, starting with the first year that trading assets exceed \$500 million. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 8: Disclosure and Components of Market Volatility**

| <b>Disclosure Variables</b>          | <b>Idiosyncratic Market Volatility</b> |                           |                           | <b>Market Beta</b>    |                       |                        |
|--------------------------------------|--|---------------------------|---------------------------|-----------------------|-----------------------|------------------------|
| Disclosure Leader                    | -24.7542<br>(15.0421)                  | -28.3187*<br>(15.1170)    | -23.9676<br>(16.1960)     | -0.0271<br>(0.1288)   | -0.0336<br>(0.1268)   | -0.0895<br>(0.1321)    |
| Aggregate Disclosure Index           | -5.7346***<br>(1.6744)                 |                           |                           | -0.0116<br>(0.0139)   |                       |                        |
| First Principal Component            | -9.3540***<br>(2.8687)                 |                           |                           | -0.0208<br>(0.0238)   |                       |                        |
| <b>Index Components</b>              |  |                           |                           |                       |                       |                        |
| Overall VaR                          | -2.2750<br>(3.4670)                    |                           |                           | 0.0470<br>(0.0286)    |                       |                        |
| VaR by Risk Type                     | -5.6172<br>(4.9755)                    |                           |                           | -0.0816**<br>(0.0390) |                       |                        |
| Backtesting                          | -6.9632<br>(9.2097)                    |                           |                           | 0.0987<br>(0.0648)    |                       |                        |
| Returns Distribution                 | -6.4817<br>(8.1217)                    |                           |                           | -0.1061<br>(0.0775)   |                       |                        |
| Stress Testing                       | -16.0553**<br>(7.5447)                 |                           |                           | -0.1399*<br>(0.0719)  |                       |                        |
| <b>BHC Characteristics</b>           |  |                           |                           |                       |                       |                        |
| Log (Asset Size)                     | 91.6935<br>(108.2178)                  | 97.5834<br>(107.8951)     | 112.4350<br>(114.5854)    | 2.2344***<br>(0.8268) | 2.2464***<br>(0.8251) | 2.3809***<br>(0.8204)  |
| Log (Asset Size) Squared             | 0.9185<br>(11.5358)                    | 0.1043<br>(11.4269)       | -0.4036<br>(12.2086)      | -0.1884**<br>(0.0803) | -0.1900**<br>(0.0801) | -0.1938**<br>(0.0760)  |
| Risk-Weighted Assets/ Assets         | 51.4450<br>(105.5427)                  | 40.4194<br>(105.4929)     | 31.8298<br>(111.8739)     | 0.5059<br>(0.7885)    | 0.4844<br>(0.7838)    | 0.2992<br>(0.7478)     |
| Total Risk-Based Capital Ratio       | 4.8204<br>(4.0826)                     | 5.0433<br>(4.1150)        | 4.8279<br>(4.1738)        | -0.0731**<br>(0.0295) | -0.0726**<br>(0.0295) | -0.0849***<br>(0.0290) |
| Trading Assets/ Assets               | 34.8558<br>(295.3115)                  | 30.8341<br>(293.9778)     | 120.5431<br>(317.9761)    | -1.9577<br>(2.0339)   | -1.9632<br>(2.0302)   | -1.6631<br>(1.9959)    |
| Deposits/ Assets                     | 135.8577<br>(124.5075)                 | 131.6579<br>(124.4136)    | 159.2933<br>(121.1287)    | 0.4715<br>(1.1148)    | 0.4747<br>(1.1138)    | 0.9994<br>(1.0321)     |
| Loans/ Assets                        | -68.3519<br>(223.7819)                 | -71.0034<br>(224.8482)    | -59.7929<br>(235.0424)    | -3.6561**<br>(1.6715) | -3.6619**<br>(1.6662) | -4.3770**<br>(1.6662)  |
| Securities/Asset                     | 185.0858<br>(226.1903)                 | 176.2396<br>(227.4711)    | 207.7901<br>(241.5391)    | -3.1526*<br>(1.6442)  | -3.1760*<br>(1.6389)  | -3.6701**<br>(1.6190)  |
| Fed Funds/Assets                     | 180.9305<br>(244.0432)                 | 167.6714<br>(244.7733)    | 202.5151<br>(257.3253)    | -3.0994*<br>(1.6454)  | -3.1259*<br>(1.6389)  | -3.6270**<br>(1.6166)  |
| Other Assets/Assets                  | 483.5158<br>(350.2669)                 | 470.8406<br>(352.3539)    | 505.9403<br>(359.6500)    | -0.9240<br>(2.3604)   | -0.9425<br>(2.3499)   | -1.5388<br>(2.4316)    |
| Loan Portfolio Concentration         | -152.1357<br>(92.8794)                 | -149.3167<br>(94.2918)    | -165.0423*<br>(96.1025)   | -0.6230<br>(0.5513)   | -0.6165<br>(0.5503)   | -0.5473<br>(0.5783)    |
| Non-interest Income/Operating Income | -202.3190***<br>(62.8202)              | -200.8729***<br>(62.8817) | -193.0433***<br>(64.3289) | 0.2585<br>(0.6016)    | 0.2629<br>(0.5993)    | 0.3090<br>(0.6084)     |
| Revenue Source Concentration         | -286.0661**<br>(118.3825)              | -272.0664**<br>(115.8143) | -295.7871**<br>(120.4922) | 1.2457<br>(1.0922)    | 1.2567<br>(1.0812)    | 1.2251<br>(1.0528)     |
| Number of Observations               | 141                                    | 141                       | 141                       | 141                   | 141                   | 141                    |
| R-Squared                            | 0.877                                  | 0.875                     | 0.879                     | 0.693                 | 0.693                 | 0.727                  |
| P-Value: Disclosure Index = 0?       | 0.001                                  | 0.002                     | 0.021                     | 0.405                 | 0.384                 | 0.076                  |

Idiosyncratic Market Volatility is the standard deviation of the residuals of a regression of weekly equity market returns on the value-weighted market return; Market Beta is the coefficient on the market return in those regressions. BHC characteristics are from the Federal Reserve Y-9C reports. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the market risk disclosure index. First Principal Component is based on the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all US-owned BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between 1994 and 2004, starting with the first year that trading assets exceed \$500 million. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 9: Disclosure and Performance**

| <b>Disclosure Variables</b>          | <b>Trading Return</b> |                       |                       | <b>Market Returns</b>    |                          |                          |
|--------------------------------------|-----------------------|-----------------------|-----------------------|--------------------------|--------------------------|--------------------------|
| Disclosure Leader                    | 1.2445<br>(1.8848)    | 1.3179<br>(1.8294)    | 0.7902<br>(2.1893)    | -19.7232**<br>(8.2079)   | -18.4547**<br>(8.1202)   | -19.3106**<br>(9.0110)   |
| Aggregate Disclosure Index           | 0.1038<br>(0.2668)    |                       |                       | 2.3260**<br>(1.0451)     |                          |                          |
| First Principal Component            | 0.1462<br>(0.4793)    |                       |                       | 4.2560**<br>(1.7352)     |                          |                          |
| <b>Index Components</b>              |                       |                       |                       |                          |                          |                          |
| Overall VaR                          | 0.1995<br>(0.4776)    |                       |                       | -1.6432<br>(1.8457)      |                          |                          |
| VaR by Risk Type                     | -0.3017<br>(0.7385)   |                       |                       | 3.0129<br>(2.8839)       |                          |                          |
| Backtesting                          | 0.1230<br>(1.2553)    |                       |                       | 9.9860*<br>(5.2671)      |                          |                          |
| Returns Distribution                 | 0.5069<br>(0.8280)    |                       |                       | 2.7983<br>(5.4956)       |                          |                          |
| Stress Testing                       | 0.4175<br>(1.6493)    |                       |                       | 4.1130<br>(4.5961)       |                          |                          |
| <b>BHC Characteristics</b>           |                       |                       |                       |                          |                          |                          |
| Log (Asset Size)                     | -27.8130<br>(22.2948) | -27.9186<br>(22.2760) | -26.7108<br>(22.3479) | -37.5382<br>(48.6121)    | -39.9472<br>(48.0888)    | -65.2622<br>(48.7938)    |
| Log (Asset Size) Squared             | 2.7751<br>(2.2766)    | 2.7902<br>(2.2778)    | 2.6513<br>(2.3390)    | -1.4008<br>(4.4735)      | -1.0777<br>(4.4131)      | 1.2269<br>(4.4803)       |
| Risk-Weighted Assets/ Assets         | -26.8092<br>(18.5669) | -26.5997<br>(18.7190) | -26.4131<br>(18.9218) | -89.5622<br>(61.3992)    | -85.2873<br>(60.8619)    | -65.5081<br>(61.8573)    |
| Total Risk-Based Capital Ratio       | 0.0951<br>(0.6319)    | 0.0919<br>(0.6336)    | 0.0650<br>(0.6634)    | 0.2061<br>(1.9203)       | 0.0982<br>(1.9222)       | -0.2204<br>(2.0451)      |
| Trading Assets/ Assets               | -11.7739<br>(33.8951) | -11.6685<br>(33.7658) | -16.4412<br>(38.4399) | 85.8255<br>(153.6371)    | 86.8065<br>(152.1624)    | 43.7364<br>(151.5404)    |
| Deposits/ Assets                     | 13.0795<br>(25.0310)  | 13.2966<br>(24.9539)  | 14.7019<br>(28.4030)  | -85.9982<br>(64.2549)    | -87.1113<br>(63.5390)    | -84.2381<br>(63.4947)    |
| Loans/ Assets                        | 53.4865<br>(37.9314)  | 53.5291<br>(37.8278)  | 50.0972<br>(42.2779)  | 250.6245**<br>(112.3378) | 251.8075**<br>(110.9659) | 254.2446**<br>(112.0817) |
| Securities/Asset                     | 43.3817<br>(38.1014)  | 43.4749<br>(38.1085)  | 41.4082<br>(42.1485)  | 160.1370<br>(119.8988)   | 165.0607<br>(118.4967)   | 160.4501<br>(117.1379)   |
| Fed Funds/Assets                     | 11.8491<br>(37.4194)  | 12.0927<br>(37.3491)  | 9.3340<br>(41.9228)   | 86.6395<br>(112.8396)    | 91.9466<br>(111.9960)    | 91.0484<br>(111.7673)    |
| Other Assets/Assets                  | 56.9547<br>(53.4796)  | 57.2693<br>(53.2549)  | 52.9962<br>(60.3300)  | 166.1517<br>(163.7359)   | 169.5948<br>(162.6613)   | 193.4024<br>(163.0746)   |
| Loan Portfolio Concentration         | -1.5997<br>(14.8262)  | -1.6412<br>(14.8534)  | 0.4295<br>(15.4180)   | 19.2088<br>(38.7282)     | 17.8765<br>(38.6413)     | 20.1249<br>(40.8585)     |
| Non-interest Income/Operating Income | 10.1608<br>(16.4389)  | 10.1531<br>(16.4349)  | 10.6638<br>(17.3793)  | -70.8096**<br>(33.8128)  | -71.7660**<br>(33.4265)  | -76.8782**<br>(34.9819)  |
| Revenue Source Concentration         | 5.4136<br>(19.7634)   | 4.9511<br>(19.6869)   | 5.5565<br>(20.4213)   | 87.5454<br>(75.9202)     | 86.0390<br>(74.7319)     | 79.0174<br>(76.6693)     |
| Number of Observations               | 141                   | 141                   | 141                   | 141                      | 141                      | 141                      |
| R-Squared                            | 0.282                 | 0.282                 | 0.285                 | 0.714                    | 0.717                    | 0.736                    |
| P-Value: Disclosure Index = 0?       | 0.698                 | 0.761                 | 0.961                 | 0.029                    | 0.016                    | 0.035                    |

Trading Return is the annual average of quarterly trading revenue divided by beginning of quarter trading assets and Market Returns is the average of weekly equity market returns. BHC characteristics are from the Federal Reserve Y-9C reports. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is the first principal component of the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all non-foreign-owned U.S. BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between 1994 and 2004, starting with the first year that trading assets exceed \$500 million. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 10: Disclosure and Risk-Adjusted Performance**

| Disclosure Variables                 | Risk-Adjusted Trading Return |                       |                      | Risk-Adjusted Market Returns |                       |                       |
|--------------------------------------|------------------------------|-----------------------|----------------------|------------------------------|-----------------------|-----------------------|
| Disclosure Leader                    | -0.2630<br>(1.2239)          | -0.0233<br>(1.2138)   | 0.6572<br>(1.1706)   | -0.0706**<br>(0.0311)        | -0.0631**<br>(0.0307) | -0.0591<br>(0.0366)   |
| Aggregate Disclosure Index           | 0.4289***<br>(0.1421)        |                       |                      | 0.0133***<br>(0.0040)        |                       |                       |
| First Principal Component            |                              | 0.7699***<br>(0.2524) |                      |                              | 0.0238***<br>(0.0066) |                       |
| <b>Index Components</b>              |                              |                       |                      |                              |                       |                       |
| Overall VaR                          |                              |                       | 0.3587<br>(0.3502)   |                              |                       | -0.0006<br>(0.0075)   |
| VaR by Risk Type                     |                              |                       | 1.2974**<br>(0.5215) |                              |                       | 0.0251**<br>(0.0115)  |
| Backtesting                          |                              |                       | -0.9441<br>(0.7858)  |                              |                       | 0.0244<br>(0.0216)    |
| Returns Distribution                 |                              |                       | 0.1702<br>(0.5676)   |                              |                       | 0.0099<br>(0.0233)    |
| Stress Testing                       |                              |                       | 0.6686<br>(0.8554)   |                              |                       | 0.0225<br>(0.0183)    |
| <b>BHC Characteristics</b>           |                              |                       |                      |                              |                       |                       |
| Log (Asset Size)                     | -3.8351<br>(9.3850)          | -4.2787<br>(9.3535)   | -3.7420<br>(9.3832)  | -0.2542<br>(0.1929)          | -0.2680<br>(0.1907)   | -0.3489*<br>(0.1947)  |
| Log (Asset Size) Squared             | 0.4650<br>(0.8474)           | 0.5248<br>(0.8458)    | 0.4254<br>(0.8576)   | 0.0033<br>(0.0181)           | 0.0052<br>(0.0179)    | 0.0119<br>(0.0193)    |
| Risk-Weighted Assets/ Assets         | -1.9192<br>(7.7979)          | -1.1245<br>(7.7306)   | -3.7524<br>(7.7302)  | -0.3430<br>(0.2567)          | -0.3182<br>(0.2537)   | -0.2842<br>(0.2608)   |
| Total Risk-Based Capital Ratio       | 0.5444<br>(0.3813)           | 0.5250<br>(0.3757)    | 0.6942*<br>(0.3798)  | 0.0034<br>(0.0097)           | 0.0028<br>(0.0098)    | 0.0037<br>(0.0102)    |
| Trading Assets/ Assets               | -0.6053<br>(24.1039)         | -0.4033<br>(24.0369)  | 7.2993<br>(23.3091)  | 0.4202<br>(0.6071)           | 0.4266<br>(0.5988)    | 0.3614<br>(0.6415)    |
| Deposits/ Assets                     | 3.6337<br>(13.8206)          | 3.5196<br>(13.8777)   | -2.3660<br>(13.7914) | -0.1305<br>(0.2578)          | -0.1335<br>(0.2549)   | -0.1956<br>(0.2660)   |
| Loans/ Assets                        | 4.1470<br>(17.8291)          | 4.3617<br>(17.5057)   | 11.9630<br>(18.2022) | 1.2327**<br>(0.4727)         | 1.2394***<br>(0.4664) | 1.3262***<br>(0.4858) |
| Securities/Asset                     | 0.6876<br>(17.3905)          | 1.5523<br>(16.9994)   | 5.2059<br>(18.0563)  | 0.7782<br>(0.5134)           | 0.8048<br>(0.5059)    | 0.8194<br>(0.5244)    |
| Fed Funds/Assets                     | -1.4118<br>(18.9989)         | -0.4308<br>(18.5080)  | 3.5741<br>(20.2074)  | 0.7857<br>(0.4922)           | 0.8162*<br>(0.4862)   | 0.8466*<br>(0.5083)   |
| Other Assets/Assets                  | 33.3319<br>(27.3167)         | 34.0218<br>(26.8250)  | 38.2700<br>(27.0117) | 0.7262<br>(0.7227)           | 0.7480<br>(0.7144)    | 0.8614<br>(0.7318)    |
| Loan Portfolio Concentration         | 7.5914<br>(7.1077)           | 7.3518<br>(7.1809)    | 4.3981<br>(7.2246)   | 0.1562<br>(0.1718)           | 0.1488<br>(0.1719)    | 0.1240<br>(0.1780)    |
| Non-interest Income/Operating Income | 7.8268<br>(5.2297)           | 7.6624<br>(5.2452)    | 7.1680<br>(5.5859)   | -0.0910<br>(0.1633)          | -0.0961<br>(0.1611)   | -0.1212<br>(0.1648)   |
| Revenue Source Concentration         | 14.2521<br>(10.7142)         | 13.8392<br>(10.8176)  | 15.4924<br>(10.8937) | 0.5713*<br>(0.3213)          | 0.5576*<br>(0.3163)   | 0.5604*<br>(0.3242)   |
| Number of Observations               | 141                          | 141                   | 141                  | 141                          | 141                   | 141                   |
| R-Squared                            | 0.295                        | 0.302                 | 0.353                | 0.798                        | 0.801                 | 0.806                 |
| P-Value: Disclosure Index = 0?       | 0.003                        | 0.003                 | 0.028                | 0.001                        | 0.001                 | 0.003                 |

Risk-Adjusted Trading Return is the ratio of annual average quarterly trading returns to the annual standard deviation of quarterly trading return, and Risk-Adjusted Market Return is the ratio of annual average weekly stock price returns to the annual standard deviation of weekly returns. BHC characteristics are from the Federal Reserve Y-9C reports. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is based on the 18 individual data items comprising the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all US-owned BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between 1994 and 2004, starting with the first year that trading assets exceed \$500 million. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

**Table 11: Disclosure and Risk-Adjusted Performance, by Extent of Trading Activity**

| Disclosure Variables                                   | Risk-Adjusted Trading Returns |                     |                       | Risk-Adjusted Market Returns |                     |                     |
|--|-------------------------------|---------------------|-----------------------|------------------------------|---------------------|---------------------|
| <i>Impact for Intense Traders</i>                      |                               |                     |                       |                              |                     |                     |
| Disclosure Leader                                      | 0.9074<br>(2.0853)            | 0.8874<br>(2.1043)  | 3.8477***<br>(1.4216) | -0.0599<br>(0.0465)          | -0.0607<br>(0.0464) | -0.0830<br>(0.0657) |
| Aggregate Disclosure Index                             | 0.5982***<br>(0.1651)         |                     | 0.0164***<br>(0.0045) |                              |                     |                     |
| First Principal Component                              | 1.0474***<br>(0.2920)         |                     | 0.0285***<br>(0.0077) |                              |                     |                     |
| <i>Index Components</i>                                |                               |                     |                       |                              |                     |                     |
| Overall VaR  | 0.0895<br>(0.5396)            |                     |                       | 0.0096<br>(0.0130)           |                     |                     |
| VaR by Risk Type                                       | 2.6236***<br>(0.7253)         |                     |                       | 0.0179<br>(0.0228)           |                     |                     |
| Backtesting  | -0.9323<br>(0.8434)           |                     |                       | 0.0557<br>(0.0357)           |                     |                     |
| Returns Distribution                                   | 0.2054<br>(0.6498)            |                     |                       | -0.0090<br>(0.0269)          |                     |                     |
| Stress Testing   | -0.9566<br>(0.8555)           |                     |                       | 0.0087<br>(0.0281)           |                     |                     |
| <i>Impact for Other Larger Traders</i>                 |                               |                     |                       |                              |                     |                     |
| Disclosure Leader                                      | -0.2723<br>(1.3383)           | -0.1227<br>(1.2123) | -1.1061<br>(1.8027)   | -0.0556<br>(0.0459)          | -0.0482<br>(0.0428) | -0.0635<br>(0.0541) |
| Aggregate Disclosure Index                             | 0.1592<br>(0.2148)            |                     | 0.0078<br>(0.0062)    |                              |                     |                     |
| First Principal Component                              | 0.3051<br>(0.3599)            |                     | 0.0152<br>(0.0102)    |                              |                     |                     |
| <i>Index Components</i>                                |                               |                     |                       |                              |                     |                     |
| Overall VaR  | -0.1410<br>(0.5096)           |                     |                       | -0.0059<br>(0.0114)          |                     |                     |
| VaR by Risk Type                                       | -0.4305<br>(0.8805)           |                     |                       | 0.0399*<br>(0.0223)          |                     |                     |
| Backtesting  | 0.5911<br>(1.5416)            |                     |                       | -0.0138<br>(0.0304)          |                     |                     |
| Returns Distribution                                   | 3.3336<br>(2.4044)            |                     |                       | 0.0408<br>(0.0594)           |                     |                     |
| Stress Testing   | 1.3183<br>(1.8136)            |                     |                       | 0.0489<br>(0.0348)           |                     |                     |
| P-Value: Disclosure Index = 0,<br>Large Trading BHCs   | 0.001                         | 0.001               | 0.000                 | 0.000                        | 0.000               | 0.010               |
| P-Value: Disclosure Index = 0,<br>Smaller Trading BHCs | 0.461                         | 0.399               | 0.599                 | 0.211                        | 0.142               | 0.253               |
| Number of Observations                                 | 141                           | 141                 | 141                   | 141                          | 141                 | 141                 |
| R-Squared  | 0.323                         | 0.327               | 0.461                 | 0.802                        | 0.804               | 0.814               |

Risk-Adjusted Trading Return is the ratio of the annual average of quarterly trading return (quarterly trading revenue divided by beginning of quarter trading assets) to the annual standard deviation of quarterly trading return, and Risk-Adjusted Market Return is the ratio of the annual average of weekly stock price returns to the annual standard deviation of weekly returns. BHC characteristics are from the Federal Reserve Y-9C reports. Disclosure information is from the BHCs' annual reports. Stock data are from CRSP. Disclosure Leader is a dummy variable indicating that a BHC is the only BHC to disclose a particular data item in a given year. Aggregate Disclosure Index is the value of the market risk disclosure index. First Principal Component is the first principal component of the 18 individual data items that comprise the aggregate index. Overall VaR, VaR by Risk Type, Backtesting, Returns Distribution, and Stress Testing are sub-indices of the aggregate index. The sample consists of all U.S.-owned BHCs that ever have trading assets greater than \$1 billion (in 2005 dollars) between 1994 and 2004, starting with the first year that trading assets exceed \$500 million. Intense/Other Large Traders are BHCs with average trading assets to total assets above/below the median value for the BHCs in the sample. The regressions include BHC fixed effects and year dummy variables. The symbols \*\*\*, \*\*, and \* indicate statistical significance at the 1%, 5%, and 10% levels, respectively.