Haste Makes Waste: Banking Organization Growth and Operational Risk

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Abstract

This study shows that banking organization growth is associated with higher operational losses per dollar of total assets and incidence of tail risks. Event studies using M&A activity and instrumental variable regressions provide consistent evidence. The relationship between banking organization growth and operational risk varies by loss event types and balance sheet categories. We demonstrate that higher growth predicts worse operational risk realizations during the global financial crisis. These findings have implications for bank performance, risk management, and supervision in a continually growing and consolidating banking industry.

1 Introduction

The U.S. banking industry has experienced tremendous growth over in recent decades. Between 1990 and 2018, industry consolidated assets rose from about \$6.2 trillion to \$19.9 trillion in real terms – an increase of 221 percent, or over 4.1 percent per year. While banking industry growth has been principally driven by value-increasing motives, such as information technology advancements and economies of scale and scope (e.g., Hughes and Mester, 2013; Frame and White, 2014), it may also increase risk at respective institutions. For example, recent empirical evidence suggests that asset growth fuels credit risk – faster growing banks subsequently experience elevated loan losses (Fahlenbrach et al., 2017).[1] Our research identifies operational risk as another important risk externality of banking organization growth. In particular, we show that U.S. bank holding companies (BHCs) that expand faster experience significantly higher operational losses.

Operational risk refers to losses resulting from inadequate or failed internal processes, people, and systems or from external events (Basel Committee on Banking Supervision, 2006). For example, Bank of America paid over \$2.4 billion in 2012 to settle claims it misled investors and hid crucial information from shareholders about the acquisition of brokerage firm Merrill Lynch.[2] More recently, Wells Fargo experienced a number of costly operational failures related to aggressive growth tactics, including opening as many as 2.1 million consumer-banking accounts without customers' knowledge as well as engaging in consumer abuses in the mortgage and auto insurance markets.[3] The bank has paid more than \$3 billion

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[1]Banking regulatory agencies have echoed these findings. The Federal Deposit Insurance Corporation (2018) states that "Competition among financial institutions for growth, profitability, and community influence sometimes results in the compromise of sound credit principles and acquisition of unsound loans. The ultimate cost of unsound loans outweighs temporary gains in growth, income and influence." Similarly, according to the Office of the Comptroller of the Currency (2018), "Excessive growth has been recognized historically as an effective early indicator of potential future problems in banks."

[2]See *The Wall Street Journal*: "BofA Takes New Crisis-Era Hit" (D. Fitzpatrick, C. Berthelsen and R. Sidel, Sep. 29, 2012)

[3]See *The Wall Street Journal*: "How Wells Fargo's High-Pressure Sales Culture Spiraled Out of Control" (E. Glazer, Sep. 16, 2016).

in penalties and settlements as a result of its misconduct and been subject to an asset cap.

Operational risk is a major source of concern for banking organizations. Based on the public reporting of institutions subject to the Advanced Capital Adequacy Framework, operational risk accounted for 28 percent of total regulatory capital on average as of December 2017 (Afonso et al., 2019). This figure is significant when compared to capital held at that time against market and credit risks – 6 and 66 percent of total regulatory capital, respectively. Operational losses are also very significant in a historical loss context. In our sample, BHCs lost staggering $258 billion to operational risk or about 20 percent of their net income. Because operational loss distributions are particularly heavy-tailed, operational risk poses unique challenges to BHC capital management and solvency and may even raise financial stability concerns (e.g., Berger et al., 2020).

A considerable advantage of our research is the use of detailed supervisory data, which is reported to the Federal Reserve System (FRS) by large U.S. BHCs for stress testing purposes. As cautioned by prior research, public sources of data compiled from press accounts can miss many operational loss events, including large ones (de Fontnouvelle et al., 2006; Abdymomunov et al., 2020). By contrast, the confidential supervisory data we study is not afflicted by such setbacks and is very rich and comprehensive. While the data is limited to the 38 largest U.S. BHCs, these institutions account for the majority (more than 85% as of 2018:Q4) of industry assets.

Our core result is a positive and statistically significant association between operational losses (as a share of total assets) and banking organization growth. A one standard deviation increase in asset growth is associated with a $57,120 increase in quarterly operational losses per $1 billion of BHC assets. This is equivalent to $8.3 million per quarter for the median BHC in our sample (with $145 billion in total assets and $18 billion in book equity), a 23.8% increase in relative terms. Event studies using banking mergers and acquisitions and instrumental variables regressions using peer institutions' employee growth confirm this core

result. We also address alternative explanations of our results (e.g., supervisory scrutiny, period-specific shocks) and show the results survive numerous robustness checks (e.g., variable redefinitions, alternative asset growth horizons, additional control variables).

We conduct several exercises aimed at better understanding the positive relationship between operational risk and BHC growth. First, we show that increases (rather than decreases) in assets contribute to the positive relationship. Second, both organic growth and external growth via mergers and acquisitions are associated with higher operational losses. Third, domestic asset growth is positively related to operational losses, while foreign asset growth is not. Fourth, among balance sheet categories, operational risk is mainly related to loan growth and deposit growth. Fifth, "failures in obligations to clients, faulty product design, and business practices" is the specific operational loss type most sensitive to balance sheet growth. Sixth, the frequency of tail operational risk events is positively related to asset growth. Finally, we document that BHCs with higher growth before the onset of the global financial crisis incurred higher operational losses per dollar of assets during the crisis.

The last part of our analysis explores three potential channels linking BHC growth and operational risk. One channel is rapid employee growth that results in problems with managerial oversight and employee integration. We find that employee growth over the prior year is associated with higher operational losses, a result driven by instances when BHC-quarter employee growth is in the top quartile of its distribution. A second channel relates to executive compensation incentives and governance arrangements intended to align shareholder-manager interests. Here we find that the relationship between BHC growth and operational risk occurs at institutions where corporate executives face stronger risk-taking incentives and where boards of directors are constituted with a smaller share of independent directors. A third channel we explore is BHC complexity. We find some evidence that the effect of BHC growth on operational losses is more pronounced at institutions with higher organizational and business complexity, which likely face greater obstacles in monitoring and

managing risks.

Our paper contributes to several research streams. First, our study contributes to the literature on operational risk at financial institutions. Jarrow (2008) describes operational risk with a particular focus on economic capital estimation. Cummins et al. (2006) and Gillet et al. (2010) analyze stock market reactions to operational loss announcements at financial institutions. Cope and Carrivick (2013) and Abdymomunov et al. (2020) analyze financial industry operational losses during the global financial crisis and explicitly link operational risk to the state of the macroeconomic environment. Chernobai et al. (2011) study the determinants of operational risk at financial institutions and show that most operational losses can be traced to a breakdown of internal controls. Chernobai et al. (2021) show that BHC expansions into non-banking activities result in more operational risk. Our study expands this literature by proposing asset growth as an important source of operational risk at large financial institutions. In doing so, we dissect the specific balance sheet categories and types of operational losses driving this nexus.

Second, our paper contributes to the literature linking firm balance sheet growth and financial performance. Faster growth has been universally shown to lead to under-performance at non-financial firms (e.g., Cooper et al., 2008; Polk and Sapienza, 2008; Watanabe et al., 2013; Titman et al., 2013; Hou et al., 2014). Specific to banking, Fahlenbrach et al. (2017) show that institutions with faster loan growth under-perform their peers over time due to an underpricing of credit risk during rapid expansions. More broadly, studies also find that rapid growth is a robust predictor of bank financial distress and failure (e.g., Cole and White, 2012; Berger et al., 2016; Altunbas et al., 2017). Our study suggests operational risk might be a novel channel for the under-performance of quickly growing banking organizations and potentially other firms. The high cost of operational losses, as well as the challenges around operational risk measurement and capital management, highlight the relevance of our findings to this literature. Our findings that operational losses increase subsequent to mergers

and acquisitions also contribute to the literature on long-term returns to these activities (e.g., Roll (1986); Rau and Vermaelen (1998)). In particular, our findings highlight operational losses as a plausible channel for value destruction after M&As.

Third, our study adds to the extensive literature on executive compensation contracts and board composition as mechanisms to incentivize and monitor managers. Managerial compensation design has been shown to impact firm risk-taking, although the timing of pay-outs is important (e.g., Coles et al., 2006; DeYoung et al., 2013). Short-run equity-based goals may be especially problematic in banking owing to implicit and explicit government guarantees (e.g., Rajan, 1994; Peng and Roell, 2008; Acharya et al., 2009). Independent directors are viewed as better monitors that can reduce opportunistic management choices (e.g., Weisbach, 1988; Brickley et al., 1994; Coles et al., 2008; Souther, 2021). However, empirical evidence of the effectiveness of independent directors in banking is mixed (de Andres and Vallelado, 2008; Pathan, 2009; Adams and Mehran, 2012). We find that institutions that provide stronger managerial risk-taking incentives have amplified operational losses associated with balance sheet growth. Conversely, boards with a higher proportion of independent directors significantly mute the positive association between asset growth and operational losses per dollar of assets. We also offer some evidence that complex banks, which are subject to amplified moral hazard and agency problems (e.g., Morgan, 2002; Dam and Koetter, 2012; Bonfim and Félix, 2020; Correa and Goldberg, 2020), experience more operational losses during episodes of faster growth. Overall, our findings highlight compensation design, risk-taking incentives and managerial monitoring as important mechanisms to curtail agency issues at banking organizations that drive up operational risks during organizational expansions.

The results of our analysis are also relevant for supervisory policy given the substantial growth and consolidation of the U.S. banking industry in recent decades (e.g., Adams and Driscoll, 2018). A better understanding of operational risk sources, enhanced governance

frameworks to mitigate operational risks, and ensuring institutions' operational resiliency have all been significant focuses of global banking supervision (e.g., Basel Committee on Banking Supervision, 2001). In this context, our findings suggest that BHC growth is a relevant dimension for institutions operational risk outcomes and should be considered by supervisors when assessing BHC operational risk profiles. Our results also support supervisory actions such as temporary restrictions on asset growth (i.e. asset caps) at institutions experiencing ongoing operational issues.[4] Finally, our findings of significant operational losses around organizational changes such as merger and acquisitions are consistent with the heightened attention such activities receive by supervisors and risk managers.

The rest of this paper is organized as follows. Section 2 describes our data, the construction of variables and descriptive statistics. Section 3 presents our main empirical results. Section 4 checks for robustness. Section 5 discusses the potential channels for our findings. Finally, Section 6 concludes.

2 Data Sample and Variable Definitions

2.1 Operational Loss Data

This study uses supervisory data of operational losses submitted by large U.S. bank holding companies pursuant to the Dodd-Frank Wall Street Reform and Consumer Protection Act. The Federal Reserve System collects such data for stress testing purposes under the Comprehensive Capital Analysis and Review (CCAR) program. The data follows FR Y-14Q reporting requirements (current as of December 2018) and is provided by 35 financial institutions with consolidated assets of $100 billion or more. We supplement this data with

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[4]For example, see *Federal Reserve System*: "Responding to widespread consumer abuses and compliance breakdowns by Wells Fargo, Federal Reserve restricts Wells' growth until firm improves governance and controls. Concurrent with Fed action, Wells to replace three directors by April, one by year end" (Feb. 02, 2018).

data for another three institutions (Comerica, CIT Group and Zions Bancorporation) with consolidated assets in the range of $50-100 billion that participated in the 2017 Dodd-Frank Act Stress Test (DFAST) but no longer do so subsequent to the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018.[5] Although our operational loss data comes from a relatively small number of institutions, they account for the majority of U.S. banking industry assets (85.9% as of 2018:Q4). The data is highly granular and provides information such as loss amounts, loss classifications, and loss descriptions.

Banking organizations subject to the regulation have different thresholds for collecting individual operational losses. To mitigate the impact of firm heterogeneity in collection thresholds on our results, we follow prior research (e.g., Abdymomunov et al., 2020) and discard operational losses below $20,000, the highest threshold across reporting institutions. The final sample contains 376,443 individual loss events from a total of 38 large BHCs over the period [2001:Q1-2018:Q4].[6] Our data is substantially richer than counterparts offered by private vendors. For instance, Chernobai et al. (2011) use a sample with 2,426 loss events from Algo FIRST and Hess (2011) uses around 7,300 loss events from SAS OpRisk Global Data. Furthermore, as discussed in de Fontnouvelle et al. (2006), operational risk data sets based on publicly available information are likely to omit substantial losses otherwise contained in the supervisory data that we use.

To examine the relationship between operational risk and BHC asset growth, our analysis aggregates loss data at the bank-quarter level. We use the quarter of the date when an

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[5]More information about FR Y-14Q reporting requirements, instructions and forms can be found at: http://www.federalreserve.gov/apps/reportforms/. Subsequent to the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018, financial institutions with under $100 billion in total assets are no longer required to file the FR Y-14Q reports effective May 2018. Comerica, CIT Group and Zions Bancorporation drop out from our sample after 2018:Q1.

[6]Per FR Y-14Q reporting instructions, BHCs must report a complete history of operational losses "starting from the point-in-time at which the institution began capturing operational loss event data in a systematic manner." The majority of BHCs in our sample report losses for periods prior to the Dodd-Frank Act. BHCs collected such loss data under the umbrella of supervisory frameworks such as Basel and for internal use. These data are subject to significant data quality checks, including regular data exams conducted by Federal Reserve staff and BHC internal audit functions.

operational loss event occurred or began for aggregation purposes. In particular, we build an unbalanced panel of 1,644 bank-quarter observations over the period [2001:Q1-2018:Q4] in accordance with individual BHC data availability.

2.2 Operational Risk Variables

Table 1 presents variable definitions. Our main measure of operational risk is the total dollar value of operational losses that occur at a BHC in a given quarter. We follow Abdymomunov and Mihov (2019) and other studies in the literature on bank risk and performance (e.g., James, 1991; Ahmed et al., 1999; Ellul and Yerramilli, 2013), and scale losses by BHC asset size. To avoid a potential mechanical relation between operational losses and institution size (e.g., an asset impairment channel of operational risk), we use lagged total assets. However, our results are also robust to using contemporaneous measurements of losses and assets. For presentation purposes, we multiply the loss-to-assets ratio by 10,000 and label it *LtA*. In some of our regression specifications, we also use log-transformed dollar losses, *Ln(Loss)* that occur at an institution in a given quarter.

[Insert Tables 1 and 2 about here]

Table 2 presents descriptive statistics. On average, the BHCs in our sample lose $182 million or the equivalent of 0.024% of their assets per quarter to operational risk. Further, the standard deviations of both dollar losses ($1.4 billion) and asset-scaled operational losses (0.088%) are high relative to the means, indicating substantial time-series and cross-sectional variation of operational losses.

A well-known property of operational losses is the extremely heavy tails of the empirical loss distributions (Chernobai and Rachev, 2006; Jobst, 2007). Indeed, only a few "catastrophic" operational risk events account for a large proportion of the total dollar losses in our sample. Thus, while we focus on quarterly operational losses at BHCs, we also analyze

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tail operational risk. For our analysis, we use three measures of tail risk frequency – *N Tail 90*, *N Tail 95*, and *N Tail 99* – constructed as follows. We start with the 376,443 individual loss events in our sample and scale dollar loss amounts by BHC total assets. We calculate the 90th, 95th and 99th quantiles of the resulting empirical distribution and categorize all loss events with severities above the respective quantiles as "tail losses." We then "collapse" the sample of losses at the BHC-quarter level by counting the number of tail events that occur at a given institution during a given quarter for each tail threshold definition. We label the variables *N Tail 90*, *N Tail 95* and *N Tail 99*, respectively.

2.3   Measure of BHC Growth and Control Variables

We use the year-over-year growth in BHC total consolidated assets, *Asset Growth*, as our main measure of banking organization growth. Specifically, the variable is defined as follows:

$$Asset\ Growth_{i,t} = \frac{Assets_{i,t} - Assets_{i,t-4}}{Assets_{i,t-4}} \tag{1}$$

where i indexes BHCs and t indexes time (calendar quarters). In later sections, we decompose *Asset Growth* into major balance sheet categories and show the robustness of our results to using different time horizons to measure growth.

Our multivariate regression analysis also includes a number of control variables. Curti et al. (2019) demonstrate that among large U.S. bank holding companies, the largest ones are most exposed to operational risk. We thus include the natural log transformation of BHC total consolidated assets (*Ln(Assets)*) to control for size. We include the interest to non-interest income ratio (*II-to-NII*) to account for exposure to business activities. Brunnermeier et al. (2020) document that more traditional banks focused on deposit receiving and lending have different risk profiles from others with relatively higher non-interest income derived from non-core activities such as trading and investment banking. For similar reasons, we

also explicitly control for the proportion of assets funded trough deposits (*Deposits-to-Assets*) and the proportion of lending relative to total assets (*Loans-to-Assets*). We control for BHC profitability as measured by the return on equity (*ROE*), which we define as the ratio of net income to book value of equity. Higher profitability may allow the allocation of more resources to risk management, or alternatively, senior management can turn a blind eye to internal control failures when firms are less financially constrained (Jin and Myers, 2006). Because operational risk is closely related to credit risk as argued by Chernobai et al. (2011), we also control for BHCs' loan charge-off rates (*Loan Losses*). To further control for BHC risk we include tier 1 risk-based capital to total assets (*Tier 1 Capital*) and the log-absolute difference between assets and liabilities that reprice or mature within a year (*Maturity Gap*).

Finally, we also control for the state of the macroeconomic environment. As Abdymomunov et al. (2020) document, BHCs incur more operational losses in adverse conditions. We thus include the year-over-year U.S. real GDP growth rate (*GDP Growth*). The financial crisis period was also specifically associated with significant (government-assisted) merger activity in the banking industry. We additionally include an indicator variable control to account for that episode, *Financial Crisis 2007-09*, defined as 1 over the period [2007:Q4-2009:Q2], and 0 otherwise. This definition reflects the official business cycle contraction period as published by the National Bureau of Economic Research (NBER), although our results are also robust to alternative crisis period definitions.[7]

2.4 Correlations

We start with a simple correlation analysis. Table 2, Panel B reports correlation coefficients between *Asset Growth* and operational risk variables. Most notably, the correlations between *Asset Growth* and *LtA*, and *Asset Growth* and *Ln(Loss)*, are 11% and 12%, respectively.

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[7]More information on U.S. business cycle expansions and contractions can be found at: `http://www.nber.org/cycles.html`.

Faster growing banking organizations not only have more operational losses in dollar terms, but also incur more operational risk per dollar of assets. The correlation coefficients are significant at the 1% level. Figure 1, which presents a bar chart of the average *LtA* for BHCs sorted in quintiles based on total asset growth: "Low", "2", "3", "4" and "High", highlights the same positive relation between *Asset Growth* and *LtA*, visually.

[Insert Figure 1 about here]

Table 2 additionally indicates strong positive correlations between *Asset Growth* and our measures of tail risk (*N Tail 90*, *N Tail 95* and *N Tail 99*). In all cases, the correlation coefficients are again significant at the 1% level.

3 Regression Results

3.1 Operational Losses

To further examine whether faster organizational growth is associated with more operational risk, we estimate the following specification using Ordinary Least Squares (OLS):

$$LtA_{i,t} = \beta_i + \beta_1 Asset\ Growth_{i,t-1} + \beta_2 Controls_{i,t-1} + \epsilon_{i,t} \tag{2}$$

where i indexes BHCs and t indexes time periods (quarters). $LtA_{i,t}$ measures operational losses as a proportion of (lagged) total assets that occur at BHC i during quarter t. $Asset\ Growth_{i,t-1}$ measures BHC total assets growth. $Controls_{i,t-1}$ represents our previously discussed vector of control variables. All explanatory variables are lagged one period. We cluster standard errors at the BHC and quarter levels to account for within-bank and within-quarter correlation of the error terms, and include BHC fixed effects (β_i) to absorb cross-sectional differences in operational losses due to time-invariant and persistent factors

(e.g., risk management quality, business models, corporate cultures, etc.). We use year-over-year GDP growth and an indicator variable for the 2008-09 financial crisis period to eliminate the effects of economic conditions that are common across banks. (We avoid using granular time fixed effects to conserve statistical power given our relatively small sample size. However, Section 4 shows our results are also robust to using quarter fixed effects.) Table 3, Panel A presents the results.

[Insert Table 3 about here]

Columns (1) and (3)-(5) present specifications with and without control variables. Across all specifications, we find that faster growing banking organizations experience more operational losses per dollar of assets. The coefficient estimates on *Asset Growth* are positive and statistically significant in each case at least at the 5% level. Based on Column (4), a one standard deviation increase in *Asset Growth* is associated with a $57,120 increase in quarterly operational losses per $1 billion of BHC assets, which is a 23.8% (=(3.403×0.168)/2.398) increase in *LtA* relative to its mean. In Column (5), using a different operational loss measure as the dependent variable, *Ln(Loss)* or the log-transformed operational dollar losses that occur at BHC i during quarter t, we find consistent evidence. A 1 percentage point increase in asset growth is associated with a 0.34% increase in operational losses.

We note that the positive coefficient on asset growth is often accompanied by a negative coefficient on assets (albeit not robust across all specifications).[8] This suggests that while asset growth at banking organization has adverse implications for operational risk, banking organization size may actually be associated with lower operational losses per dollar of assets (e.g., due to economies of scale in risk management and controls). This is consistent with prior literature suggesting that large U.S. BHCs have improved cost efficiency (Feng and

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[8]This finding is in contrast to Curti et al. (2019) who document a positive relationship between operational losses and BHC size. This difference is driven by the use of BHC fixed effects in our specifications, which can be seen in Column (2).

Serletis, 2010; Wheelock and Wilson, 2012; Hughes and Mester, 2013; Kovner et al., 2014).

We find that the estimated coefficients on other control variables are most often insignificant and not robust across different specifications. An exception to this observation is the coefficient estimate on *Financial Crisis 2007-09*, which is always positive and significant at the 10% level. This result suggests that the BHCs in our sample experienced elevated levels of operational losses during the global financial crisis (Abdymomunov et al., 2020). We do not observe, however, amplified effects of growth on operational risk during the financial crisis. In unreported tests, we find that an interaction term between *Asset Growth* and *Financial Crisis 2007-09* is negative and insignificant. We further discuss the relation between growth *prior to* the financial crisis and operational risk realizations during the financial crisis in Section 3.5.

While we use the year-over-year growth in BHC total consolidated assets as our main measure of banking organization growth, it is important to understand the relation between operational losses and asset growth over alternative time horizons. Figure 2 plots the coefficient estimates and associated *p*-values from re-estimating Equation 2 with growth measures calculated over one quarter (*Asset Growth 1Q*), one year (*Asset Growth 4Q*, which corresponds to our main measure), two years (*Asset Growth 8Q*), three years (*Asset Growth 12Q*), four years (*Asset Growth 16Q*) and five years (*Asset Growth 20Q*). We observe that the coefficients of the growth variables monotonically decline with the length of the horizon and stop being statistically significant beyond the 3-year horizon.

[Insert Figures 2 and 3 about here]

Given these results and the one-year measurement horizon of asset growth in our main specification, it is important to understand if there exists a lagged effect of asset growth beyond the one-year period immediately preceding an operational loss. To that end, we re-estimate Equation 2 by contemporaneously including our main measure as well as its

four non-overlapping lags. Specifically, we include *Asset Growth L0* (which corresponds to our main measure) is the year-over-year growth rate over [t-5, t-1] and *Asset Growth L1*, *Asset Growth L2*, *Asset Growth L3* and *Asset Growth L4* are the year-over-year growth rates over [t-9, t-5], [t-13, t-9], [t-17, t-13], and [t-21, t-17], respectively. Figure 3 presents the regression coefficients and associated p-values of the five growth variables. Notably, all lagged terms are indistinguishable from 0, suggesting no significant effects of asset growth exist beyond one year.

A natural question that arises is whether these results are driven by growing institutions (positive growth) that have higher operational losses or alternatively institutions that are shedding assets (negative growth) that also experience lower operational losses. These two alternative mechanisms have important implications for the interpretation of results. On the one hand, positive growth associated with an increase in operational risk is consistent with channels such as rapid employee growth, compensation incentives for risk-taking and ineffective monitoring arrangements (see Section 5 for details). On the other hand, negative growth associated with a reduction in operational risk might be reflective of strategic organizational motives driven by BHCs downsizing operationally risky assets to curtail losses.

To answer this question, we decompose *Asset Growth* into two variables that account for negative vis-a-́vis positive growth: *Asset Growth (Negative)* and *Asset Growth (Positive)*. Specifically, *Asset Growth (Negative)* equals *Asset Growth* for observations where *Asset Growth* < 0, 0 otherwise. In contrast, *Asset Growth (Positive)* equals *Asset Growth* for observations where *Asset Growth* $>= 0$, 0 otherwise. We then proceed to test the relation of these two variables with our main operational loss measure *LtA*. The results in Column (1) of Table 3, Panel B show that the significantly positive relation between operational losses and asset growth is exclusively driven by expansions in banking organization size.

Banking organizations can grow in size in two primary ways: through mergers and acqui-

sitions or through organic growth. Thus, a natural next question is which "mode" is driving the positive association between BHC growth and operational losses. To operationalize our tests, we build a list of mergers and acquisitions with information from the National Information Center (NIC) on banking organization mergers and entity relationships. The data allow us to construct a mapping of a merged or acquired entity to a final "surviving" parent institution.[9] Each merged entity is required to have a valid RSSD identifier at the time of the merger and file regulatory reports (e.g., FR Y-9C, OTS 1313 Thrift Financial Report, or FFIEC 031/041). The intersection of our main sample and the list of mergers identified from NIC yields a total of 159 mergers.

We then decompose *Asset Growth* into growth via mergers and acquisitions, *Asset Growth (M&A)*, and organic growth, *Asset Growth (Organic)*. The variables are defined as follows:

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\begin{aligned}
Asset\ Growth\ (M\&A)_{i,t} &= \frac{Assets\ (M\&A)_{i,t}}{Assets_{i,t-4}} \\
Asset\ Growth\ (Organic)_{i,t} &= \frac{Assets_{i,t} - Assets\ (M\&A)_{i,t} - Assets_{i,t-4}}{Assets_{i,t-4}}
\end{aligned}
\tag{3}
$$

where $Assets\ (M\&A)_{i,t}$ is the sum of acquired banks' assets by bank i over the period $[t-3,t]$ and $Assets_{i,t}$ is bank i's total assets in quarter t.

Table 3, Panel B, Column (2) presents regression results relating BHC operational losses and M&A vis-à-vis organic asset growth. Both modes appear to contribute to higher operational losses at banking organizations as the coefficients of *Asset Growth (M&A)* and *Asset Growth (Organic)* are each positive and significant at the 5% level. However, the coefficient of *Asset Growth (M&A)* is about 1.5 times larger than that of *Asset Growth (Organic)*,

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[9]To do this, we trace chains of mergers through the NIC data to the final surviving entities in each chain, and then find these surviving entities' most recent high holders using the relationships data. We continue this process until all transactions and relationships have been accounted for and we have a mapping between each RSSD and a final surviving high holder as of the end quarter of the data. In addition, the ultimate parents of several banks in the sample are foreign institutions. This means that a non-US firm is listed as these entities' high holder in the NIC data. In these cases, we replace the ultimate parent with the highest US holding company.

suggesting somewhat more pronounced loss effects associated with growth from mergers and acquisitions.

Finally, motivated by prior research suggesting that foreign assets may be a source of risk for banking organizations (e.g., Berger et al., 2017; Frame et al., 2020), we decompose asset growth into that from foreign versus domestic markets. We measure foreign assets by the sum of foreign loans and leases, foreign debt securities, and foreign interest-bearing balances (i.e., those in foreign offices, Edge-Act or Agreement subsidiaries, and international banking facilities). Domestic assets are defined as the difference between BHC total consolidated assets and foreign assets. We then calculate the growth in foreign assets (*Asset Growth (Foreign)*) and growth in domestic assets (*Asset Growth (Domestic)*) similarly to Equation 1. After calculating these two measures, we test their relation with our main operational loss measure *LtA*. The results in Panel B, Column (3) show that our core result between asset growth and operational losses is exclusively driven by growth in domestic assets. One possible explanation for this finding is that the segmentation of exposures to multiple countries may limit operational risk and deter large-scale risk management failures that operating in a single large (domestic) market allows.

3.2   Balance Sheet Categories

The empirical relation between BHC operational risk and asset growth could be driven by a variety of balance sheet categories. We decompose bank assets in several major categories in accordance with reporting form FR Y-9C: *Cash* (cash and balances due from depository institutions), *Securities* (securities), *Fed Funds Sold Plus* (federal funds sold and securities purchased under agreements to resell), *Loans* (loans and lease financing receivables), *Trading Assets* (trading assets), and *Other Assets* (premises and fixed assets, other real estate owned, investments in unconsolidated subsidiaries and associated companies, direct and indirect investments in real estate ventures, intangible assets, and other assets). Figure 4,

Panel A presents an aggregate asset composition chart for the BHCs in our sample.[10] *Loans* constitutes the largest asset category, accounting for more than 40% of total assets on average. The remaining categories are relatively evenly sized with *Cash*, *Securities*, *Fed Funds Sold Plus*, *Trading Assets* and *Other Assets* accounting for 8.6%, 13.9%, 12.7%, 13.3% and 10.5%, respectively.

Similarly we examine the major categories used to finance assets: *Deposits* (deposits), *Fed Funds Purchased Plus* (federal funds purchased and securities sold under agreements to repurchase), *Trading Liabilities* (trading liabilities), *Other Borrowed Money* (borrowed money including mortgage indebtedness and obligations under capitalized leases), *Other Liabilities* (subordinated notes and debentures, subordinated notes payable to unconsolidated trusts issuing trust preferred securities, and trust preferred securities issued by consolidated special purpose entities, and other liabilities), *Stock & Surplus* (perpetual preferred stock and related surplus, common stock and surplus), and *Retained Earnings Plus* (retained earnings and other residual equity capital components). Figure 4, Panel B shows the liability and equity capital items as share of total assets. *Deposits* constitutes the largest category, accounting for almost one-half of the BHCs' assets. The remaining categories fund the other half: *Fed Funds Purchased Plus* – 9.3%, *Trading Liabilities* – 5.6%, *Other Borrowed Money* – 16.1%, *Other Liabilities* – 10.6%, *Stock & Surplus* – 6.8% and *Retained Earnings Plus* – 3.5%.

We next proceed to examine how operational risk is related to growth in each of these balance sheet categories. Table 4 presents the results.

[Insert Figure 4 and Table 4 about here]

Panel A shows that *Loan Growth* is the single major driver on the assets side, while Panel B shows that *Deposit Growth* is the major driver on the liabilities and equity side. The coef-

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[10]Items in each category, measured as a proportion of total assets, are first averaged within BHCs and then averaged across BHCs.

ficient of *Loan Growth* is similar in magnitude to that of *Asset Growth* in Table 3, while that of *Deposit Growth* is smaller (about 1.5 times). This suggests somewhat weaker operational loss effects stemming from deposit growth relative to loan growth. In unreported results, we examine if these results are driven by specific loan (e.g., construction and development, residential mortgages, commercial and industrial loans and consumer loans) and deposit (e.g., insured, uninsured, brokered) sub-categories. We find no evidence to that effect. Panel B also shows that *Stock & Surplus Growth* is positive and statistically significant, although economically very small (about 1% of that of *Asset Growth*).

3.3 Operational Loss Event Types

Operational risk has many different causes. Losses in our sample are categorized into seven event types (consistent with Basel II Accord classifications): Internal Fraud (IF), External Fraud (EF), Employment Practices and Workplace Safety (EPWS), Clients, Products and Business Practices (CPBP), Damage to Physical Assets (DPA), Business Disruption and System Failures (BDSF), and Execution, Delivery and Process Management (EDPM). Table 1, Panel B includes definitions and Figure 5 presents the allocation of losses across the seven event type categories.[11] The figure suggests that the most significant portion of losses (74.4%) can be traced to the Clients, Products and Business Practices event type. The second most significant event type is Execution, Delivery and Process Management, which accounts for 15.1%. Notably, CPBP and EDPM together accounted for close to 90% of operational losses in our sample. On the other side of the spectrum, Business Disruption and System Failures is the smallest event type, which accounts for only 0.7% of the losses.

We previously documented a significant relation between operational losses and BHC growth after aggregating losses across all seven categories and ignoring the heterogeneity of

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[11]Losses in each event type, measured as a proportion of total losses, are first averaged within BHCs and then averaged across BHCs.

operational risk. Here, we re-estimate Equation 2 for each loss event type separately. We do not have a clear expectation of which particular sub-categories of operational losses are correlated with BHC growth. Table 5 presents the results.

[Insert Figure 5 and Table 5 about here]

The *Asset Growth* coefficients are positive and significantly different from zero in only two specifications — for event type EPWS in Column (3) and event type CPBP in Column (4). As reported in Table 1, Panel A, EPWS captures losses from "[a]cts inconsistent with employment, health or safety laws or agreements, from payment of personal injury claims, or from diversity/discrimination events." CPBP captures losses from "[a]n unintentional or negligent failure to meet a professional obligation to specific clients, or from the nature or design of a product." Importantly, while EPWS accounts for a mere 3.1% of operational losses in our data, CPBP accounts for almost three-quarters of total operational losses. Also important to note is that the coefficient on *Asset Growth* is orders of magnitude larger for CPBP relative to EPWS. This finding thus suggests that the strong positive association between operational risk and BHC growth is largely driven by one type of operational risk: failures in obligations to clients and/or product design.

3.4   Tail Operational Risk

Our prior analysis examined the association between operational risk and banking organization growth by modeling the conditional average (assets-scaled) operational losses. This section focuses on the frequency of tail loss events. The distinction between experiencing a higher level of operational risk vis-à-vis tail operational loss events is important. Higher, but stable, operational losses have adverse implications for BHC profitability but are easier to anticipate and reserve for. Operational tail losses, on the other hand, pose difficulties for loss reserving practices and capital management, and are very relevant for BHC failure risk.

As discussed in Section 2.2, we use three different definitions of BHC tail loss frequency over a given quarter: *N Tail 90*, *N Tail 95* and *N Tail 99*. The pairwise correlations in Table 2, Panel B provide some preliminary evidence that the faster growing banking organizations experience more tail events. We next show that these associations also persist in a multivariate setting. To accommodate the use of count-based dependent variables (i.e. tail loss frequencies), we use Negative Binomial (NB) regressions. Our specifications are otherwise similar to Equation 2. Table 6 presents the results.

[Insert Table 6 about here]

Faster growth at BHCs is notably related to a higher frequency of tail operational loss events. Depending on the tail risk measure used, a one standard deviation increase of *Asset Growth* from its mean would result in 0.05-1.27 more tail risk events experienced by a BHC in a given quarter, or a 6.1-8.7% increase in relative terms. The coefficients of *Asset Growth* are positive and significant at least at the 5% level for each measure of tail operational risk. In unreported results, we test the robustness of our results to using alternative measures of tail risk. Specifically, rather than using frequency-based measures, we calculate the tail operational dollar losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets. Our results remain directionally and statistically robust.

3.5   Global Financial Crisis

Banking organization growth could be related to the build-up of significant operational risks (e.g., due to inadequately scaled processes and controls, strained managerial oversight and poorly integrated employee workforces) that are later realized during periods of economic and financial stress. The U.S. banking sector indeed experienced massive operational losses during the 2007-09 global financial crisis and significant differences existed across institutions (Abdymomunov and Mihov, 2019; Abdymomunov et al., 2020). Here, we investigate whether

BHCs with faster growth prior to the crisis had larger operational losses during the crisis.

To test this, we calculate *Asset Growth 2005-06* as the average of *Asset Growth* over the period [2005:Q1-2006:Q4]. We then interact *Asset Growth 2005-06* with *Financial Crisis 2007-09* (equal to 1 during the period [2007:Q4-2009:Q2], and 0 otherwise) and test the term's significance in a regression framework similar to Equation 2. While our specifications separately include *Asset Growth 2005-06* and *Financial Crisis 2007-09*, the stand-alone coefficient of *Asset Growth 2005-06* cannot be identified due to the inclusion of BHC fixed effects and is thus not reported. Table 7 presents results.

[Insert Table 7 about here]

The coefficient of *Asset Growth 2005-06 * Financial Crisis 2007-09* in Column (1) is positive and significant at the 10% level. This finding suggests that high banking organization growth in the pre-crisis period subsequently contributed to larger operational losses during the crisis. A one standard deviation increase in *Asset Growth 2005-06* is associated with a 86.7% increase in *LtA* during the 2007-09 period relative to its unconditional mean. Column (2) shows that our results are also robust to a broader definition of the crisis period that spans [2007:Q4-2011:Q4].

4   Robustness Checks

This section explores whether our main empirical findings have alternative explanations and whether they are robust to endogeneity checks, alternative estimation methodologies, variable definitions, and additional control variables.

4.1 Alternative Explanations: Supervisory Scrutiny

Our main finding suggests that faster growth at banking organizations is associated with higher operational losses. Rather than a causal interpretation between growth and operational risk, there could be alternative explanations of this relation. One alternative explanation is that fast growth of banking organizations attracts supervisory attention and increases scrutiny over these institutions. In turn, supervisors discover more wrongdoing by the BHCs and consequently impose penalties and fines, which drive up operational losses. It could be thus the higher scrutiny associated with BHC growth increases BHC operational losses, rather growth itself.

To address this possibility, we construct a proxy for supervisory scrutiny similar to Hirtle et al. (2020), defined as the total number of hours spent by Federal Reserve supervisory staff on a quarterly basis at each BHCs (*Supervisory Hours*). The data is sourced from the Federal Reserve Resource Optimizgation Activity Manager - Time Collection (ROAM-T).[12] As a next step, we proceed to re-estimate Equation 2 by controlling in our specifications for log-transformed *Supervisory Hours*. Table 8, Column (1) presents the results.

[Insert Table 8 about here]

The coefficient of *Asset Growth* remains positive and statistically significant at conventional levels. In contrast, *Ln(Supervisory Hours)* is negative, but statistically indistinguishable from zero. The negative coefficient implies that, if anything, supervisory scrutiny is related to lower BHC operational losses – an observation that is intuitive but inconsistent with this alternative explanation. In unreported results, we also test indicator variables for whether a BHC is among the 3 or 5 largest institutions in its Federal Reserve supervisory district. Hirtle et al. (2020) show that the largest institutions in each district receive dispro-

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[12]ROAM-T is the national time-collection and time-keeping tool used by the Federal Reserve Bank Supervision and Regulation staff. All supervision staff are expected to assist in ensuring the reportability of timesheets and integrity of ROAM-T data.

portionatelly higher supervisory attention relative to smaller BHCs. The results from such additional tests are qualitatively similar, *Asset Growth* remains significantly positive, while the indicators are indistinguishable from zero. We thus conclude that supervisory scrutiny (associated with BHC growth) does not explain our findings.

4.2 Evidence from M&A Event Studies

As discussed in Section 3.1, M&As are a primary mechanism through which banking organizations grow. Moreover, they are well-defined events that can plausibly be treated as exogenous growth shocks and otherwise orthogonal to operational risk (other than through growth-related channels). We use the list of previously identified M&A events (from Section 3.1) in an event-study setting to identify whether these events result in higher operational losses. Our event study tests mitigate particular identification concerns that we are not capturing the relation between operational risk and BHC growth, but rather the relation between operational risk and some uncontrolled institution-specific effect. Specifically, the short event windows around M&As and the inclusion of rigorous M&A event fixed effects (as discussed below) preclude endogenous interpretations. (For example, BHCs with high risk appetite not only pursue M&As but also engage in other operationally risky strategies different from M&A that ultimately drive up operational losses.)

We estimate the following regression specifications:

$$LtA_{i,m,t} = \beta_{i,m} + \beta_1 Post\ Merger_{i,m,t} + \beta_2 Controls_{i,m,t} + \epsilon_{i,m,t} \qquad (4)$$

where i indexes BHCs, m indexes M&A events and t indexes quarters before and after. We use several alternative window lengths around events: 1, 2, 3, and 4 quarters. $LtA_{i,m,t}$ measures operational losses as a proportion of total assets that occur at BHC i during quarter t. *Post M&A*$_{i,m,t}$ is an indicator variable equal to 1 for the quarters of and following

the M&A consumption (consolidation of acquired entity m into BHC i), and 0 otherwise. $Controls_{i,m,t}$ represents our previously discussed vector of BHC-level and macroeconomic control variables. We include M&A event fixed effects ($\beta_{i,m}$) and cluster standard errors at the M&A event level. Table 9 present the results.

[Insert Table 9 about here]

Post M&A is positive and significant at the 5% level across specifications in Columns (1)–(4) using varying windows around an event. This result suggests that operational losses (as a proportion of total assets) increase in the four quarters following a combination and is consistent with the idea that merger and acquisition activity increases operational risk at banking organizations. Importantly, as we use the occurrence quarter (rather than discovery or reporting) of operational losses in our analysis, these results do not capture pre-acquisition operational losses that were only discovered by the BHCs after the acquisitions.

We next take a step further and test whether larger M&As are associated with more operational risk. To study this issue, we calculate *M&A Size (%)*, which measures the asset size of the acquired company as a proportion of the acquiror's asset size one quarter prior to the consumption of the merger. We then estimate a model similar to Equation 4 but include interactions between *Post M&A* and *M&A Size (%)*. Due to the inclusion of M&A event fixed effects, we are unable to identify the coefficient on *M&A Size (%)* individually. Column (5) shows that indeed larger acquisitions are associated with more operational risk. The coefficient of the interaction term *Post M&A * M&A Size (%)* is positive and significant at the 10% level.

4.3   Instrumental Variables

In addition to our event study analysis, we also estimate an instrumental variable regression as another approach to address endogeneity concerns. Our instrumental variable, *Peer N*

Employees Growth, is based on employee growth of peer BHCs. Our idea is that while employee growth should be significantly positively correlated with the asset growth of a given firm, it should not be (positively) related to the occurrence of operational losses other than through the organizational growth channel. We take a step further to refine this idea and mitigate the unlikely possibility that the correlation between asset growth and operational losses at a given BHC is driven by a latent *firm-specific* factor that determines both and is also correlated with BHC employee growth. For a BHC in a given quarter, we select the five institutions in our sample with closest asset growth. We then use the median employee growth of this group of peer banks as an instrument for the asset growth of the specific bank in a given quarter. Our explicit assumption for the validity of the instrument is thus that the median employee growth of matched institutions should not reflect the latent *firm-specific* characteristics that drive both operational losses and asset growth at the BHC for which the matched group is created. Table 10 presents the results.

[Insert Table 10 about here]

Table 10, Columns (1) presents first-stage results. Our instrument is strongly positively correlated with BHC growth and is highly statistically significant, suggesting that the IV regression does not suffer from weak instrumental variable problems. Column (2) presents second-stage results. Here, we see that *Asset Growth* retains its positive sign and statistical significance at conventional levels. Our IV analysis, therefore, suggests that our main results are robust to accounting for omitted variable problems.

An additional identification concern could be that there is reverse causality stemming from operational losses to BHC growth (e.g., operational losses might reduce total assets through reputation and asset impairment channels). We note, however, that reverse causality is unlikely to be the driver of our results for two reasons. First, to the extent that such reverse causality implies a negative correlation between operational risk and BHC growth, it should

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only bias our results downwards against finding the positive relation that we do. Second, using lagged asset growth to match operational loss occurrence in our estimations suggests a feedback loop from losses to growth is conceptually impossible to have an impact in our specifications.[13] We thus rule out this second identification concern but note that our M&A event studies and instrumental variable estimations also serve to address any remaining reverse causality concerns.

4.4   Time Fixed Effects and Sub-sample Analysis

Our baseline specification in Section 3.1 employs within-firm estimation (i.e. BHC fixed effects) to control for cross-sectional differences in operational losses and size growth. A natural question arises whether our results are driven by period-specific shocks. While we already control for the financial crisis period through an indicator variable and more generally the macroeconomic environment through GDP growth, potential industry-level shocks might not have been adequately captured by these controls. We next specifically show that our baseline results are robust to economic cycle fixed effects and even granular quarter fixed effects. Table 8, Columns (2) and (3) present results. *Asset Growth* remains positive and statistically significant at least at the 5% level in the presence of both economic cycle and quarter fixed effects. We conclude our results cannot be explained industry-level shocks.

Figure 6 plots the average asset growth for the BHCs in our sample. A notable pattern here is the disparate average asset growth of banking organizations in the first (pre-2010) vis-á-vis the second (post-2010) half of the sample. This pattern may reflect at least partially the different regulatory environments for large banking organizations in the two sub-periods. Specifically, after the global financial crisis, large banking organizations have received consid-

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[13]An additional argument that invalidates reverse causality concerns given our empirical setup is that bank managers or outside investors do not know about operational losses until such losses are discovered (or accounted for). There are usually significant time lags (in the order of several years) between the occurrence and discovery of material operational losses that could plausibly result in feedback loops (Abdymomunov et al., 2020).

erable regulatory scrutiny, including a wave of regulatory reforms focused on reducing these institutions' systemic risks (e.g., Dodd-Frank Act of 2010, Basel III). The average level of operational losses in these two periods are also very different, with operational losses notably higher in the first half of our sample. *LtA* has a mean of 4.37 with a standard deviation of 13.46 over the period [2001:Q1-2010:Q4]. The mean and standard deviation of *LtA* over the period [2011:Q1-2019:Q4] are 1.08 and 2.11, respectively.

As previously discussed, our regression specifications use within-BHC variation in variables to estimate coefficients (due to the use of BHC fixed effects), and consequently, the differences in operational losses and asset growth across the two sub-periods should be very informative for our results, if not driving them. It thus remains interesting to see whether our documented result persists in either of the two sub-samples. To explore this question, we next estimate Equation 2 for each of the two sub-periods individually. Table 8, Columns (4) and (5) present results.

[Insert Figure 6 about here]

While *Asset Growth* remains positive and significant in the earlier sub-period in Column (4) at the 5% level, it is indistinguishable from zero in the later sub-period in Column (5). This is expected given there is much more variation in asset growth and operational losses in the earlier part of the sample.

4.5   Alternative Variable Definitions and Additional Controls

In this section, we check the robustness of our baseline results in Section 3.1 to alternative scaling of our main dependent variable, *LtA*. *LtA* is defined as the operational losses that occur at a BHC over a given calendar quarter scaled by a BHC's total assets (and multiplied by 10,000). Table 8, Columns (6) and (7) show that our results remain robust if we use alternative scaling factors for operational losses, specifically gross income (*LtI*) or total

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liabilities (*LtL*).

We also test the inclusion of additional control variables. Throughout our study, we rely on the ratio of interest to non-interest income (*II-to-NII*), the ratio of deposits to assets (*Deposits-to-Assets*), the ratio of loans to assets (*Loans-to-Assets*) and BHC fixed effects to account for cross-sectional differences in exposure to business activities. Here, we include a more detailed set of variables capturing business area exposures. Specifically, we include the proportion of revenue coming from: interest income on loans and leases (*Loans and Leases*), interest income on investment securities (*Investment Securities*), income from fiduciary activities (*Fiduciary Activities*), trading revenue (*Trading*), income from investment banking, advisory, brokerage and underwriting fees (*Investment Banking*), venture capital revenue (*Venture Capital*), securitization income (*Securitization*) and servicing fees revenue (*Servicing Fees*). Table 8, Column (8) shows our baseline results are robust to the inclusion of these additional controls.

5 Potential Channels

This section explores three potential channels through which banking organization growth may result in greater operational risks.

5.1 Employee Growth

Organizational growth can strain managerial oversight, including risk surveillance (e.g., Brickley et al., 2003; Berger et al., 2005), and non-managerial employee resources. If growth is improperly "staffed," employees might spread their attention too thin over increasing job responsibilities or stretch internal rules to complete their assignments, resulting in costly operational mistakes. Alternatively, if growth is accompanied by workforce expansions, new employees may expose an institution to operational risks while training and gaining "on-the-

job" experience.

We explore the organizational growth channel by correlating the year-over-year growth in the number of BHC employees, *N Employees Growth*, and operational risk in a regression specification similar to Equation 2. Table 11, Column (1) shows that employee growth is associated with higher operational losses – the coefficient of *N Employees Growth* is positive and significant at the 1% level.[14] To differentiate between growth that is insufficiently staffed versus rapid increase in the bank's employee base, we decompose *Asset Growth* into three variables: *Asset Growth (Low Emp Growth)*, *Asset Growth (Med Emp Growth)* and *Asset Growth (High Emp Growth)*. *Asset Growth (Low Emp Growth)* equals *Asset Growth* for observations where *N Employees Growth* is in the lowest quartile of its distribution and 0 otherwise. *Asset Growth (Med Emp Growth)* equals *Asset Growth* for observations where *N Employees Growth* is in the inner two quartiles of its distribution and 0 otherwise. *Asset Growth (High Emp Growth)* equals *Asset Growth* for observations where *N Employees Growth* is in the highest quartile of its distribution and 0 otherwise. We then proceed to test the relation of these three variables with our main operational loss measure *LtA*.

[Insert Table 11 about here]

The results in Column (2) show that the significantly positive relation between operational losses and asset growth is driven by observations where BHCs experience the highest employee growth. This finding supports the idea that rapid expansions of bank employee bases expose banking organizations to operational risks through inadequate oversight and/or employee experience. A particular driver of the relationship between employee growth and operational risk can be organizational changes such as mergers and acquisitions (which often result in large increases in BHC employee bases). To examine this point further, we decom-

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[14]We emphasize that employee growth is not a separate factor that amplifies operational losses associated with BHC (asset) growth, but rather it is inherent and related to BHC growth. Hence, we do not test this channel through interaction terms, nor do we control for *Asset Growth* in our specifications. The operational risk effects of employee growth are implicit in BHC size growth.

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pose *N Employees Growth* into employee growth via M&A (*N Employees Growth (M&A)*) and organic employee growth (*N Employees Growth (Organic)*).[15] Column (3) shows that *N Employees Growth (M&A)* and *N Employees Growth (Organic)* are both positively and statistically significantly related to operational losses per dollar of assets.

5.2 Compensation Incentives and Governance Arrangements

The positive relationship between organizational growth and operational losses could be associated with agency issues. Specifically, growth could be fueled by short-term incentives of BHC managers with high-powered compensation schemes tilted to current profits (e.g., Rajan, 1994). Such compensation schemes specifically induce managers to book business at the expense of potential future operational losses, which oftentimes take years to materialize from when they occur to when they get discovered (Abdymomunov et al., 2020; Chernobai et al., 2021). In their push for growth, bank executives could set incentives that lead employees to engage in risky practices that are not directly observable by them. Alternatively, executives could be fully cognizant of the higher risk of the practices that employees engage in, but overlook that risk for better short-run performance. In either case, risky practices such as aggressive "cross-selling" of products, outright mis-selling (i.e. the deliberate or negligent sale of products or services in circumstances where the contract is either misrepresented, or the product or service is unsuitable for the customer's needs), and abusive deposit growth strategies (e.g., as in the Wells Fargo fake-account scandal) oftentimes result in significant regulatory fines and redress payments.[16]

We explore this channel with widely used measures of executive compensation incentives and board monitoring strength. First, we use a compensation-based measure of risk-taking

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[15]The construction of these two variables is analogical to the construction of *Asset Growth (M&A)* and *Asset Growth (Organic)* in Equation 3.

[16]See *Office of Attorney General*: "Attorney General Shapiro Announces $575 Million 50-State Settlement with Wells Fargo Bank for Opening Unauthorized Accounts and Charging Consumers for Unnecessary Auto Insurance, Mortgage Fees" (December 28, 2018).

incentives (vega) for corporate executives (Core and Guay, 2002), a measure previously used in the banking literature by DeYoung et al. (2013). These data, provided to us by Coles et al. (2006), cover 26 of the BHCs in our sample over the period [2000-2014]. Formally, vega is defined as the dollar change in executive wealth associated with a 0.01 change in the standard deviation of the BHCs's returns (in $000s). We discretize the variable and define *Execu Comp Vega* as an indicator variable equal to 1 if vega for a BHC during a given quarter is greater than the sample median, and 0 otherwise. Second, we follow prior literature that has traditionally used the proportion of independent directors on a firm's board as a measure of board monitoring strength (e.g., Weisbach, 1988; Brickley et al., 1994; Coles et al., 2008). This measure has also been used in prior banking governance studies by de Andres and Vallelado (2008), Pathan (2009), and Adams and Mehran (2012). Our data on board independence come from the U.S. Spencer Stuart Board Index reports, which provide board statistics for 25 of the BHCs in our sample over the period [2004-2018].[17] Using these data, we define *Board Independence* as an indicator variable equal to 1 if the proportion of independent directors on a BHC's board during a given quarter is greater than the sample median and 0 otherwise.[18]

As a next step, we interact *Asset Growth* with *Execu Comp Vega* and *Board Independence*, respectively, and test the terms' significance in a regression framework similar to Equation 2. Table 11, Columns (4) and (5) present the results. Consistent with the existence of this second channel, the coefficient of *Asset Growth * Execu Comp Vega* in Column (4) is positive and the coefficient of *Asset Growth * Board Independence* in Column (5) is negative (both significant at the 10% level). While institutions which provide executives with more risk-taking compensation incentives have amplified operational losses associated with BHC

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[17]The latest U.S. Spencer Stuart Board Index report can be found at: `https://www.spencerstuart.com/research-and-insight/us-board-index`.

[18]Our measures of executive compensation incentives and board independence are available at the annual frequency. To match them to the rest of our data at the quarterly frequency, the annual value of a measure for a given BHC is assigned to all the quarters in that year for that BHC.

growth, enhanced board monitoring by independent directors appears to mitigate the positive effect of BHC growth on operational risk. We additionally point to our results in Section 3.3, which indicate that the principal driver of the relation between operational risk and banking organization growth are breaches and failures in obligations to clients, faulty product design, and business practices. These results put into perspective and highlight credible types of operational losses caused by skewed compensation incentives and weak monitoring.

5.3   Organizational Complexity

Banking organization complexity is often associated with risk-reducing diversification across product lines and geographies (e.g., Bonfim and Félix, 2020; Correa and Goldberg, 2020). However, complexity may intensify agency problems at financial conglomerates (Laeven and Levine, 2007), which could manifest through reduction of managerial effort, inadequate risk controls, or even the outright shareholder expropriation. Increased complexity can additionally render risk controls less effective by hindering information exchanges within the BHC (e.g., Chernobai et al., 2021). It is thus plausible that banking organization complexity could amplify the operational-risk-increasing effects of banking organization growth.

We explore this channel with two different complexity measures. First, we measure organizational complexity with the number of subsidiaries in the BHC's organizational structure (*Org Complexity*). Second, we measure business complexity by the number of business activities the BHC's subsidiaries are engaged in (*Bus Complexity*). Business activities are based on NAICS industry 4-digit code. We discretize both measures and calculate indicator variables equal to 1 if the respective complexity measure for a BHC during a given quarter is greater than the sample median, and 0 otherwise. We then interact *Asset Growth* with the two complexity measures and test the terms' significance in regressions specifications. Table 11, Columns (6) and (7) present the results. While the coefficients of *Asset Growth * Org Complexity* and *Asset Growth * Bus Complexity* are both positive, only the latter

one is significant at conventional statistical levels. We interpret these results as some weak evidence that banking organization complexity amplifies the positive effect of BHC growth on operational risk.

6   Conclusion

Over the last two decades, the operational risks inherent in large financial institutions have become apparent to the public and increasingly in-focus for regulators. However, academic research into the calibration, causes, and consequences of operational risk remains scant. This paper leverages a novel sample of 376,443 individual loss events from the 38 largest U.S. BHCs over the period [2001:Q1-2018:Q4] to explore whether balance sheet growth exposes these institutions to higher operational risk.

The core result is that BHCs whose assets grow faster have higher operational losses per dollar of assets. Several exercises help us to better understanding this positive relationship. We show that increases, and not decreases, in assets are the driver of the positive relationship. Both organic growth and external growth via mergers and acquisitions are associated with higher operational losses. Domestic asset growth is positively related to operational losses, while foreign asset growth is not. Among balance sheet categories, operational risk is mainly related to loan growth and deposit growth. "Failures in obligations to clients, faulty product design, and business practices" is the specific operational loss type most sensitive to balance sheet growth. Asset growth is positively related to the frequency of tail operational risk events. We document that BHCs with higher growth before the onset of the global financial crisis incurred higher operational losses per dollar of assets during the crisis. Lastly, our analysis also explores three potential channels for our core result: rapid employee growth, compensation incentives and governance arrangements, and BHC complexity.

We conclude that organizational growth is an important factor for banking institutions'

operational risk profiles. Our study highlights operational risk as a unique channel through which financial institution growth could lead to subsequent under-performance, thereby counteracting anticipated scale-related efficiencies. This finding complements earlier literature that has singularly pointed to unexpected credit risk of financial institutions as the only organizational growth externality. Our findings are also relevant for corporate risk management and supervisory policy. They suggest that quickly growing BHCs could benefit from tighter operational risk management practices and that such institutions should be subject to greater supervisory scrutiny.

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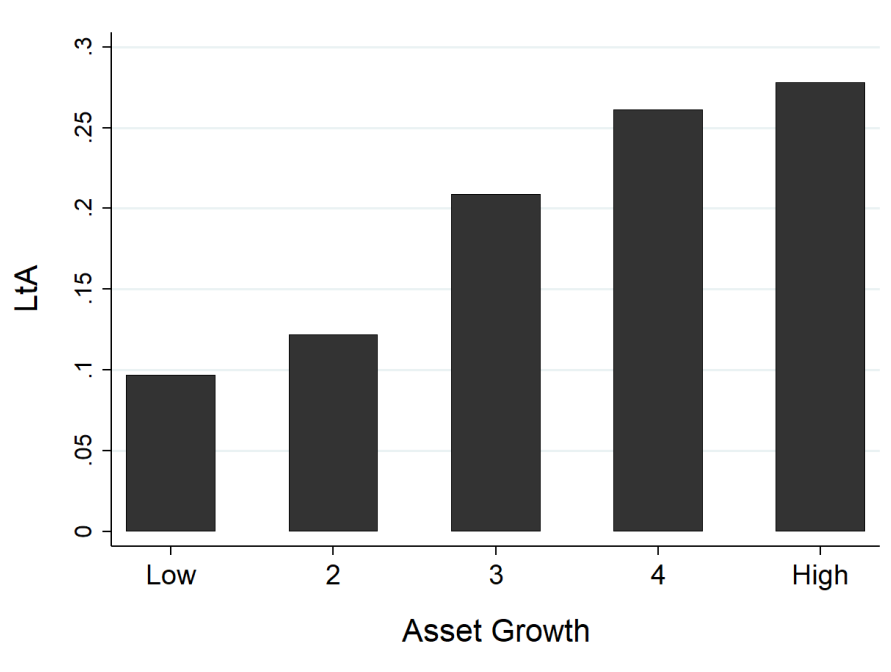
Figure 1: **Operational Losses per Dollar of Assets by Asset Growth Groups**
This figure presents a bar chart of the average ratio of operational losses to total assets (multiplied by 10,000), *LtA*, for BHCs sorted in quintiles based on total asset growth: "Low", "2", "3", "4" and "High". The chart presents the average *LtA* for each of the asset growth groups. The sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4].
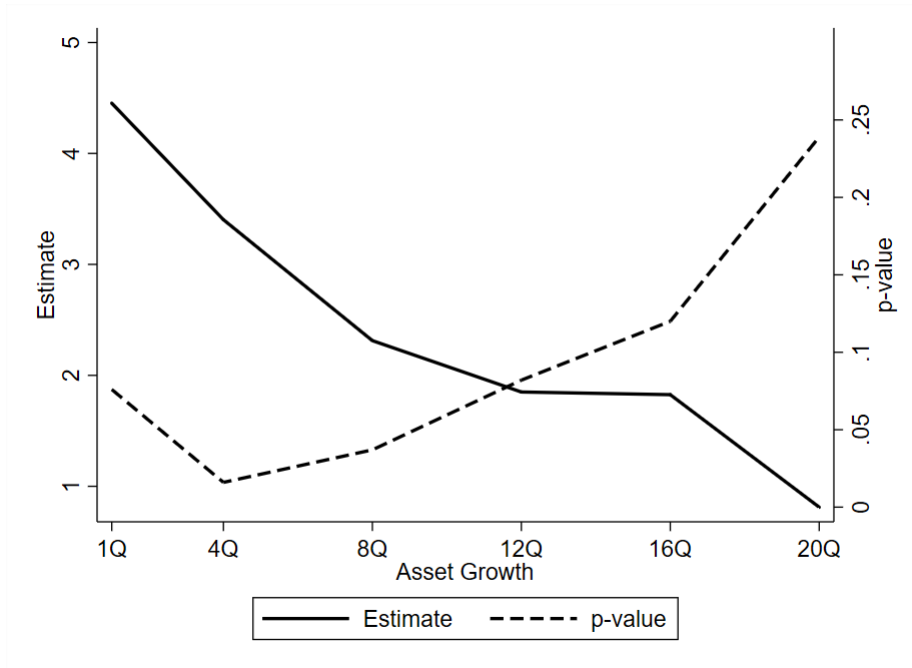
Figure 2: **Asset Growth Horizons**
This figure plots coefficients and p-values from panel regressions of operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Asset Growth 1Q, 4Q, 8Q, 12Q, 16Q and 20Q* are the one-quarter, one-year, two-year, three-year, four-year and five-year growth of BHC total assets over [t-2, t-1], [t-5, t-1], [t-9, t-1], [t-13, t-1], [t-17, t-1] and [t-21, t-1], respectively. *Asset Growth* terms enter the regressions one at a time. Control variables include *Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels.
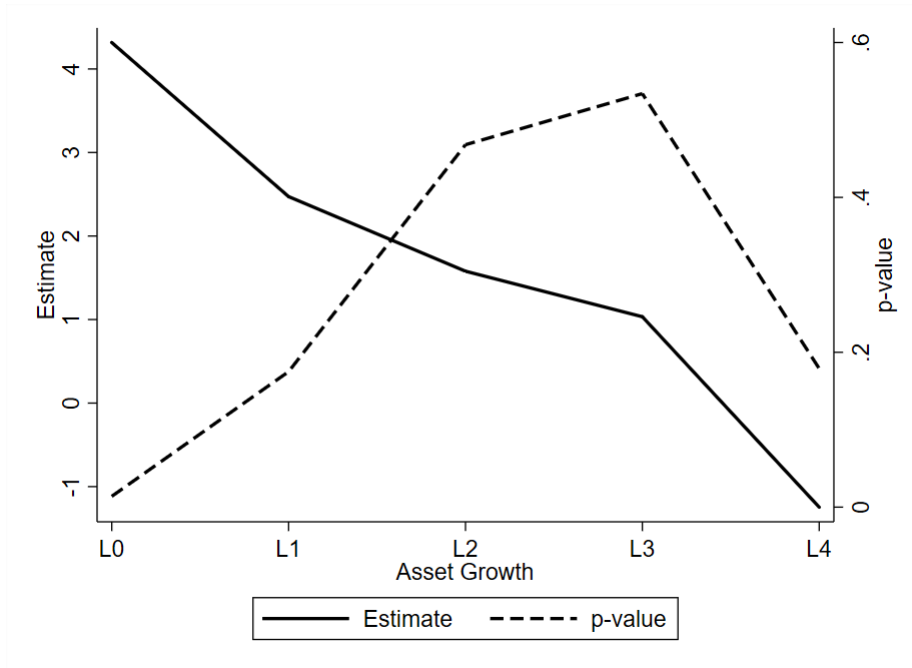
Figure 3: **Lag Structure of Effect**
This figure plots coefficients and p-values from a panel regression of operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Asset Growth L0, L1, L2, L3, L4* are the year-over-year growth of BHC total assets over $[t\text{-}5, t\text{-}1]$, $[t\text{-}9, t\text{-}5]$, $[t\text{-}13, t\text{-}9]$, $[t\text{-}17, t\text{-}13]$, and $[t\text{-}21, t\text{-}17]$, respectively. All *Asset Growth* lags enter the regression contemporaneously. Control variables include *Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels.

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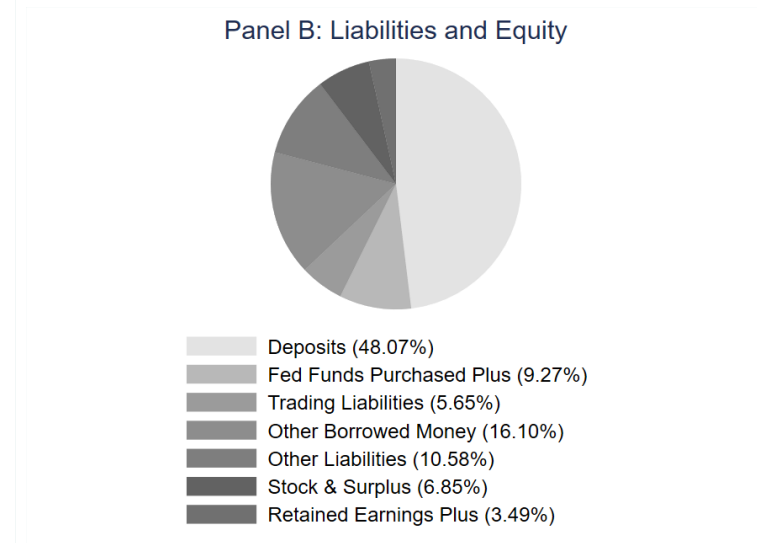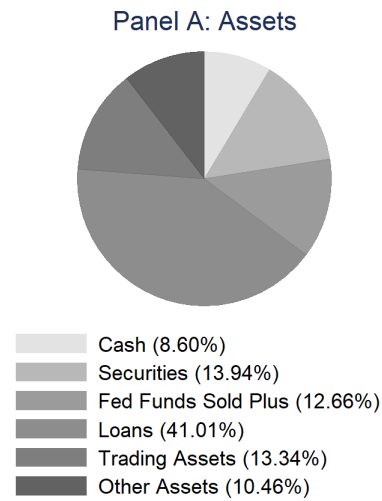
Figure 4: **Major Balance-sheet Categories**
This figure presents the relative composition of assets in Panel A and liabilities and equity in Panel B according to major FR Y-9C balance-sheet categories. Items in each category are first averaged within BHCs and then averaged across BHCs. The sample includes 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4].
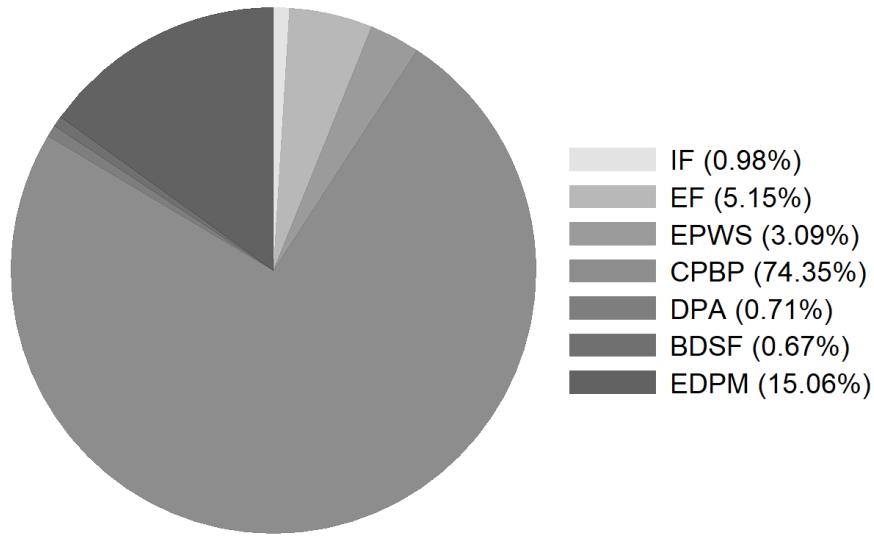
Figure 5: **Operational Losses by Event Type**
This figure presents the percentage allocation of losses according among the 7 operational risk event type categories. Losses in each category are first averaged within BHCs and then averaged across BHCs. The nomenclature for event types is as follows: Internal Fraud (IF), External Fraud (EF), Employment Practices and Workplace Safety (EPWS), Clients, Products and Business Practices (CPBP), Damage to Physical Assets (DPA), Business Disruption and System Failures (BDSF), and Execution, Delivery and Process Management (EDPM). The sample includes 376,443 operational losses incurred by 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4].
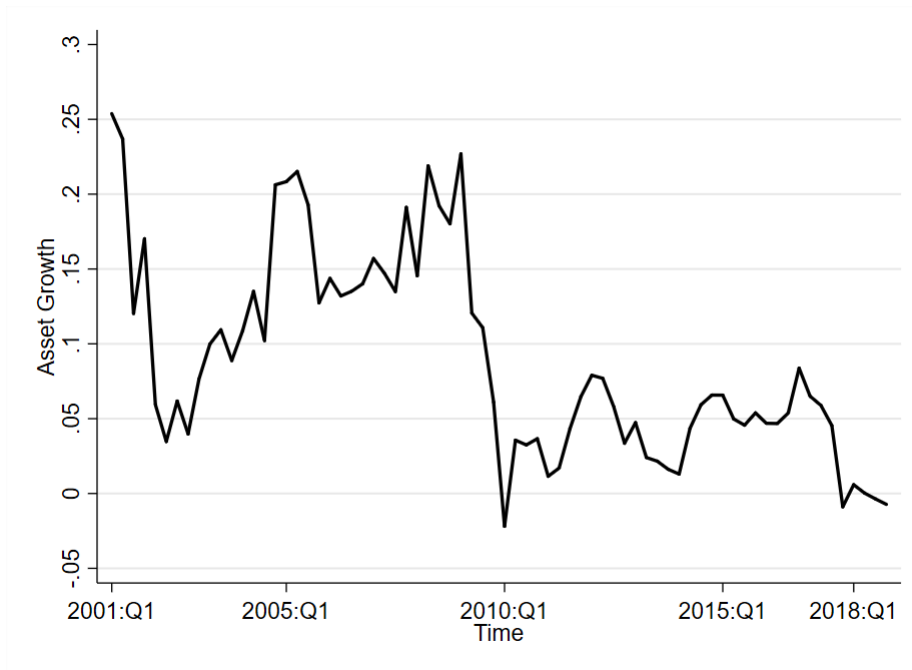
Figure 6: **BHC Growth over Time**
This figure plots BHC asset growth over time. The sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *Asset Growth* is the cross-sectional average year-over-year growth of BHC total assets in a given quarter.

Table 1: **Operational Loss Event Type and Variable Definitions**
This table presents variable definitions in Panel A and operational loss event type definitions according to Basel Committee on Banking Supervision (2006) in Panel B.

Panel A: Variable Definitions	
Variable	Definition
Assets	BHC total assets in billions of U.S. Dollars
Asset Growth 2005-06	A BHC's average *Asset Growth* over [2005:Q1-2006:Q4]
Asset Growth (Domestic, Foreign)	*Asset Growth (Domestic)* is the year-over-year growth of BHC domestic (U.S.) assets. *Asset Growth (Foreign)* is the year-over-year growth of BHC foreign (non-U.S.) assets
Asset Growth (Low Emp Growth, Med Emp Growth, High Emp Growth)	*Asset Growth (Low Emp Growth)*, *Asset Growth (Med Emp Growth)* and *Asset Growth (High Emp Growth)* equal *Asset Growth* if *N Employees Growth* is in the lowest, two inner or the highest quartiles, respectively, of *N Employees Growth*'s distribution, 0 otherwise
Asset Growth (M&A, Organic)	*Asset Growth (M&A)* is the year-over-year growth of BHC assets through M&A activity. *Asset Growth (Organic)* is the year-over-year growth of BHC assets achieved organically
Asset Growth (Positive, Negative)	*Asset Growth (Positive)* equals *Asset Growth* if *Asset Growth* is $>= 0$, 0 otherwise. *Asset Growth (Negative)* equals *Asset Growth* if *Asset Growth* is < 0, 0 otherwise
Board Independence	An indicator variable that equals 1 if the proportion of independent directors on a BHC's board is greater than the sample median, 0 otherwise
Bus Complexity	An indicator variable that equals 1 if the number of business activities a BHC is engaged in is greater than the sample median, 0 otherwise
Cash Growth	Year-over-year growth of BHC cash and balances due from depository institutions
Deposits-to-Assets	The ratio of BHC deposits to total assets
Deposit Growth	Year-over-year growth of BHC deposits
Execu Comp Vega	An indicator variable that equals 1 if vega (a compensation-based measure of BHC executive risk-taking incentives) is greater than the sample median, 0 otherwise

Panel A (Continued)

Variable	Definition
Fed Funds Purchased Plus Growth	Year-over-year growth of BHC federal funds purchased and securities sold under agreements to repurchase
Fed Funds Sold Plus Growth	Year-over-year growth of BHC federal funds sold and securities purchased under agreements to resell
Financial Crisis (2007-09, 2007-11)	*Financial Crisis 2007-09* is an indicator variable that equals 1 during the periods [2007:Q4-2009:Q2], and 0 otherwise. *Financial Crisis 2007-11* is an indicator variable that equals 1 during the periods [2007:Q4-2011:Q4], and 0 otherwise
GDP Growth	Year-over-year U.S. real GDP growth rate
II-to-NII	The ratio of BHC interest income to non-interest income
Loans-to-Assets	The ratio of BHC loans to total assets
Loan Growth	Year-over-year growth of BHC loans and lease financing receivables
Loan Losses	BHC loan charge-off rate
Loss	Operational losses that occur at a BHC over a given calendar quarter in millions of U.S. Dollars
Ln(·)	A natural log transformation operator applied to a variable. For example, *Ln(Assets)* is a natural log transformation of *Assets*
LtA	Operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's lagged total assets, multiplied by 10,000
LtI	Operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's lagged gross income, multiplied by 10,000
LtL	Operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's lagged total liabilities, multiplied by 10,000
Maturity Gap	A natural log transformation of the absolute difference between all assets that either reprice or mature within a year and all the liabilities that reprice or mature within a year
M&A Size (%)	The asset size of an acquired company as a proportion of the BHC's asset size 1 quarter prior to the merger
N Employees	BHC number of employees in thousands
N Employees Growth	Year-over-year growth of the number of BHC employees
N Employees Growth (M&A, Organic)	*N Employees Growth (M&A)* is the year-over-year growth in the number of BHC employees due to M&A activity. *N Employees Growth (Organic)* is the residual year-over-year growth in the number of BHC employees not due to M&A activity

Panel A (Continued)

Variable	Definition
N Tail (90, 95, 99)	The frequency of total assets-scaled tail operational losses at the 90th, 95th or 99th percentiles, respectively, that occur at a BHC over a given calendar quarter
Org Complexity	An indicator variable that equals 1 if the number of subsidiaries in the BHC's organizational structure is greater than the sample median, 0 otherwise
Other Assets Growth	Year-over-year growth of BHC assets other than cash and balances due from depository institutions, securities, federal funds sold and securities purchased under agreements to resell, loans and lease financing receivables and trading assets
Other Borrowed Money Growth	Year-over-year growth of BHC other borrowed money
Other Equity Growth	Year-over-year growth of BHC equity other than stock, surplus and retained earnings
Other Liabilities Growth	Year-over-year growth of BHC liabilities other than deposits, federal funds purchased and securities sold under agreements to repurchase and other borrowed money
Peer N Employees Growth	The median year-over-year growth in the number of BHC employees of the 5 BHCs with closest asset growth to a given BHC
Post M&A	An indicator variable that equals 1 post an M&A event, and 0 otherwise
Retained Earnings Growth	Year-over-year growth of BHC retained earnings
ROE	BHC return on equity, define as the ratio of net income to book value of equity
Securities Growth	Year-over-year growth of BHC securities (held-to-maturity, available-for-sale and equity) held by a BHC
Stock & Surplus Growth	Year-over-year growth of BHC preferred stock, common stock and related surplus
Supervisory Hours	The total number of hours spent by Federal Reserve supervisory staff on a BHC in a given calendar quarter
Tier 1 Capital	BHC tier 1 risk-based capital ratio
Trading Assets Growth	Year-over-year growth of BHC trading assets
Trading Liabilities Growth	Year-over-year growth of BHC trading liabilities

Panel B: Event Types

Event Type Category	Short	Description
Internal Fraud	IF	Acts of a type intended to defraud, misappropriate property or circumvent regulations, which involves at least one internal party
External Fraud	EF	Acts of a type intended to defraud, misappropriate property or circumvent the law, by a third party
Employment Practices and Workplace Safety	EPWS	Acts inconsistent with employment, health or safety laws or agreements, from payment of personal injury claims, or from diversity / discrimination events
Clients, Products and Business Practices	CPBP	An unintentional or negligent failure to meet a professional obligation to specific clients, or from the nature or design of a product
Damage to Physical Assets	DPA	Damage to physical assets from natural disasters or other events
Business Disruption and System Failures	BDSF	Disruption of business or system failures
Execution, Delivery and Process Management	EDPM	Failed transaction processing or process management, from relations with trade counterparties and vendors

Table 2: **Variable Descriptive Statistics and Correlations**

This table presents variable descriptive statistics and correlations. The sample includes 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4] for which requisite data is available. The definitions of all variables are reported in Table 1. Panel A presents descriptive statistics. Panel B presents variable correlations. p-values are presented in parentheses.

Panel A: Descriptive Statistics						
	Mean	SD	P25	P50	P75	N
Operational Risk Variables:						
LtA	2.398	8.820	0.309	0.680	1.593	1644
Loss	181.713	1353.766	4.124	12.094	55.253	1644
N Tail 90	20.109	20.078	8.000	15.000	24.000	1644
N Tail 95	9.783	9.848	4.000	7.000	12.000	1644
N Tail 99	1.836	2.279	0.000	1.000	3.000	1644
Other Variables:						
Asset Growth	0.073	0.168	-0.001	0.042	0.098	1644
Asset Growth (Positive)	0.087	0.155	0.000	0.042	0.098	1644
Asset Growth (Negative)	-0.014	0.040	-0.001	0.000	0.000	1644
Asset Growth (M&A)	0.041	0.144	0.000	0.000	0.000	1644
Asset Growth (Organic)	0.032	0.140	-0.013	0.029	0.074	1644
Asset Growth (Domestic)	0.069	0.161	-0.004	0.039	0.095	1644
Asset Growth (Foreign)	0.005	0.029	-0.001	0.000	0.005	1644
Asset Growth 2005-06	0.167	0.134	0.054	0.137	0.228	1150
Assets	419.869	617.416	85.605	144.648	350.188	1644
II-to-NII	1.960	5.714	1.173	1.802	2.723	1644
Deposits-to-Assets	0.604	0.184	0.521	0.664	0.735	1644
Loans-to-Assets	0.534	0.206	0.393	0.621	0.689	1644
ROE	0.019	0.031	0.011	0.021	0.030	1644
Tier 1 Capital	8.769	2.357	7.185	8.740	10.120	1644
Loan Losses	0.305	0.367	0.081	0.159	0.418	1644
Maturity Gap	17.726	1.326	16.891	17.616	18.443	1644
GDP Growth	0.019	0.016	0.015	0.021	0.027	1644
Financial Crisis 2007-09	0.097	0.296	0.000	0.000	0.000	1644
Financial Crisis 2007-11	0.273	0.445	0.000	0.000	1.000	1644
Supervisory Hours	5247	3743	2565	4356	6638	1433
N Employees Growth	0.031	0.154	-0.027	0.002	0.045	1644
N Employees Growth (M&A)	0.036	0.170	0.000	0.000	0.000	1644
N Employees Growth (Organic)	-0.005	0.162	-0.041	-0.006	0.033	1644

Panel B: Correlations

Variables	LtA	Ln(Loss)	N Tail 90	N Tail 95	N Tail 99	Asset Growth
LtA	1.000					
Ln(Loss)	0.435	1.000				
	(0.000)					
N Tail 90	0.225	0.444	1.000			
	(0.000)	(0.000)				
N Tail 95	0.241	0.459	0.931	1.000		
	(0.000)	(0.000)	(0.000)			
N Tail 99	0.287	0.547	0.615	0.716	1.000	
	(0.000)	(0.000)	(0.000)	(0.000)		
Asset Growth	0.106	0.119	0.068	0.080	0.085	1.000
	(0.000)	(0.000)	(0.006)	(0.001)	(0.001)	

Table 3: **Operational Losses and BHC Growth**

This table reports coefficients from panel regressions of operational losses on BHC asset growth (Panel A) and asset growth decompositions (Panel B), and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Ln(Loss)* is a natural log transformation of operational dollar losses that occur at a BHC over a given calendar quarter. *Asset Growth* is the year-over-year growth of BHC total assets. *Asset Growth (Positive)* equals *Asset Growth* if *Asset Growth*>= 0, 0 otherwise. *Asset Growth (Negative)* equals *Asset Growth* if *Asset Growth*< 0, 0 otherwise. *Asset Growth (M&A)* is the year-over-year growth of BHC assets through M&A activity. *Asset Growth (Organic)* is the year-over-year growth of BHC assets achieved organically. *Asset Growth (Domestic)* is the year-over-year growth of BHC domestic (U.S.) assets. *Asset Growth (Foreign)* is the year-over-year growth of BHC foreign (non-U.S.) assets. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels. *p*-values are presented in parentheses.

Panel A: Asset Growth

	(1) LtA	(2) LtA	(3) LtA	(4) LtA	(5) Ln(Loss)
Asset Growth	5.256***		5.120***	3.403**	0.579**
	(0.003)		(0.004)	(0.016)	(0.043)
Ln(Assets)		−2.358**	−2.296***	−1.438*	0.265
		(0.012)	(0.007)	(0.077)	(0.308)
II-to-NII				0.026***	0.002
				(0.009)	(0.467)
Deposits-to-Assets				0.819	−2.423
				(0.814)	(0.101)
Loans-to-Assets				3.822	0.495
				(0.497)	(0.591)
ROE				6.593	0.401
				(0.292)	(0.753)
Tier 1 Capital				−0.234	−0.074
				(0.102)	(0.187)
Loan Losses				1.989	0.706***
				(0.124)	(0.009)
Maturity Gap				−0.322	−0.051
				(0.379)	(0.592)
GDP Growth				12.697	−0.323
				(0.613)	(0.920)
Financial Crisis 2007-09				3.551*	0.386*
				(0.075)	(0.051)
N Obs	1644	1644	1644	1644	1644
Adj R^2	0.04	0.04	0.05	0.07	0.70

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Asset Growth Decompositions

	(1) LtA	(2) LtA	(3) LtA
Asset Growth (Positive)	3.690**		
	(0.024)		
Asset Growth (Negative)	−0.393		
	(0.934)		
Asset Growth (M&A)		3.340**	
		(0.020)	
Asset Growth (Organic)		2.207*	
		(0.064)	
Asset Growth (Domestic)			3.104**
			(0.013)
Asset Growth (Foreign)			−1.522
			(0.817)
Controls	*Yes*	*Yes*	*Yes*
N Obs	1644	1644	1644
Adj R^2	0.06	0.12	0.12

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: **Major Asset and Other Balance Sheet Categories**

This table reports coefficients from panel regressions of operational losses on the growth of major asset and other balance sheet categories and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Cash Growth*, *Securities Growth*, *Fed Funds Sold Plus Growth*, *Loan Growth*, *Trading Assets Growth* and *Other Assets Growth* measure the growth of major asset categories. *Deposit Growth*, *Fed Funds Purchased Plus Growth*, *Trading Liabilities Growth*, *Other Borrowed Money Growth Other Liabilities Growth*, *Stock & Surplus Growth*, *Retained Earnings Growth*, *Trading Liabilities Growth* and *Other Equity Growth* measure the growth of major liability and equity categories. Panel A presents results for asset growth measures. Panel B presents results for liability and equity growth measures. Control variables (*Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*) are included, but their coefficient estimates are omitted for brevity. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels. *p*-values are presented in parentheses.

Panel A: Assets						
	(1)	(2)	(3)	(4)	(5)	(6)
	LtA	LtA	LtA	LtA	LtA	LtA
Cash Growth	0.401					
	(0.377)					
Securities Growth		−0.033				
		(0.233)				
Fed Funds Sold Plus Growth			−0.000			
			(0.375)			
Loan Growth				3.103**		
				(0.019)		
Trading Assets Growth					−0.028	
					(0.543)	
Other Assets Growth						0.171
						(0.209)
Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N Obs	1638	1635	1362	1644	1546	1591
Adj R^2	0.06	0.06	0.06	0.07	0.06	0.06

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel B: Liabilities and Equity

	(1) LtA	(2) LtA	(3) LtA	(4) LtA	(5) LtA	(6) LtA	(7) LtA	(8) LtA
Deposit Growth	2.274**							
	(0.022)							
Fed Funds Purchased Plus Growth		−0.000						
		(0.999)						
Trading Liabilities Growth			0.007					
			(0.965)					
Other Borrowed Money Growth				0.066				
				(0.312)				
Other Liabilities Growth					1.700			
					(0.157)			
Stock & Surplus Growth						0.038***		
						(0.000)		
Retained Earnings Growth							0.004	
							(0.966)	
Other Equity Growth								0.000
								(0.979)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N Obs	1623	1487	1500	1624	1581	1640	1643	1640
Adj R^2	0.06	0.06	0.07	0.06	0.06	0.08	0.06	0.06

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: **Operational Loss Event Types**

This table reports coefficients from panel regressions of operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. Operational losses are categorized into seven categories: Internal Fraud (IF), External Fraud (EF), Employment Practices and Workplace Safety (EPWS), Clients, Products and Business Practices (CPBP), Damage to Physical Assets (DPA), Business Disruption and System Failures (BDSF), and Execution, Delivery and Process Management (EDPM). *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Asset Growth* is the year-over-year growth of BHC total assets. Control variables (*Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*) are included, but their coefficient estimates are omitted for brevity. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels. *p*-values are presented in parentheses.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	LtA	LtA	LtA	LtA	LtA	LtA	LtA
	IF	EF	EPWS	CPBP	DPA	BDSF	EDPM
Asset Growth	0.018	0.755	0.083*	2.401*	−0.044	−0.002	0.191
	(0.415)	(0.287)	(0.093)	(0.056)	(0.278)	(0.681)	(0.246)
Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N Obs	1644	1644	1644	1644	1644	1644	1644
Adj R^2	0.04	0.05	0.16	0.05	−0.00	0.04	0.01

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: **Tail Operational Risk**
This table reports coefficients from regressions of tail operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *N Tail 95*, *N Tail 99* and *N Tail 99.9* measure the frequency of assets-scaled tail operational losses at the 90th, 95th and 99th quantiles, respectively, that occur at a BHC over a given calendar quarter. *Asset Growth* is the year-over-year growth of BHC total assets. The definitions of all variables are reported in Table 1. All specifications are estimated via Negative Binomial regression with BHC fixed effects. *p*-values are presented in parentheses.

	(1) N Tail 90	(2) N Tail 95	(3) N Tail 99
Asset Growth	0.494***	0.484***	0.353**
	(0.000)	(0.002)	(0.020)
Ln(Assets)	−0.677***	−0.642***	−0.645***
	(0.000)	(0.000)	(0.000)
II-to-NII	0.000	0.001	−0.000
	(0.535)	(0.540)	(0.896)
Deposits-to-Assets	−1.046***	−1.400***	−2.447***
	(0.000)	(0.000)	(0.000)
Loans-to-Assets	1.335***	1.377***	1.000**
	(0.000)	(0.000)	(0.033)
ROE	0.860*	0.633	0.437
	(0.083)	(0.170)	(0.663)
Tier 1 Capital	−0.027**	−0.021	−0.002
	(0.036)	(0.155)	(0.942)
Loan Losses	0.403***	0.281***	0.288***
	(0.000)	(0.000)	(0.001)
Maturity Gap	−0.033	−0.077**	−0.063
	(0.292)	(0.027)	(0.178)
GDP Growth	0.701	−0.106	−0.058
	(0.469)	(0.923)	(0.972)
Financial Crisis 2007-09	0.140**	0.118*	0.287***
	(0.029)	(0.098)	(0.001)
N Obs	1644	1644	1644

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: **Global Financial Crisis**

This table reports coefficients from panel regressions of operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of 1,150 quarterly observations of 19 large U.S. bank holding companies over the period [2001:Q1-2018:Q4] with requisite asset growth data over the period [2005:Q1-2006:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Asset Growth* is the year-over-year growth of BHC total assets. *Asset Growth 2005-06* is a banking holding company's average *Asset Growth* over [2005:Q1-2006:Q4]. *Financial Crisis 2007-09* is an indicator variable that equals 1 during the periods [2007:Q4-2009:Q2], and 0 otherwise. *Financial Crisis 2007-11* is an indicator variable that equals 1 during the periods [2007:Q4-2011:Q4], and 0 otherwise. Control variables (*Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*) are included, but their coefficient estimates are omitted for brevity. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels. *p*-values are presented in parentheses.

	(1) LtA	(2) LtA
Asset Growth	4.588**	5.264**
	(0.026)	(0.023)
Financial Crisis 2007-09	1.395	
	(0.335)	
Asset Growth 2005-06 * Financial Crisis 2007-09	15.522*	
	(0.097)	
Financial Crisis 2007-11		0.555
		(0.663)
Asset Growth 2005-06 * Financial Crisis 2007-11		9.819*
		(0.061)
N Obs	1150	1150
Adj R^2	0.07	0.06

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: **Robustness Checks**

This table reports coefficients from OLS panel regressions of operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. Column (1) has 1,376 observations; Column (4) has 659 observations; Column (5) has 985 observations; Column (8) has 1,636 observations, and the rest columns have 1,644 observations. The specifications in Columns (1)-(3) and (6)-(8) use the entire sample period. Columns (4) and (5) split the sample in two sub-periods, [2001:Q1-2010:Q4] and [2011:Q1-2018:Q4], respectively. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's lagged total assets, multiplied by 10,000. *LtI* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's lagged gross income, multiplied by 10,000. *LtL* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's lagged total liabilities, multiplied by 10,000. *Asset Growth* is the year-over-year growth of BHC total assets. *Ln(Supervisory Hours)* is a log transformation of the total number of hours spent by Federal Reserve supervisory staff on a BHC over a given calendar quarter. Control variables (*Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*) are included, but their coefficient estimates are omitted for brevity. *Additional Controls* is an additional vector of control variables including: *Loans and Leases*, *Investment Securities*, *Fiduciary Activities*, *Trading*, *Investment Banking*, *Venture Capital*, *Securitization* and *Servicing Fees*. The definitions of all variables are reported in Table 1 and Section 4.5. *p*-values are presented in parentheses.

	(1) LtA	(2) LtA	(3) LtA	(4) LtA	(5) LtA	(6) LtI	(7) LtL	(8) LtA
Asset Growth	2.779*	3.020***	2.503**	3.235**	−0.226	416.044**	3.782**	2.818**
	(0.098)	(0.002)	(0.024)	(0.033)	(0.675)	(0.046)	(0.015)	(0.012)
Ln(Supervisory Hours)	−0.999							
	(0.474)							
Controls	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Additional Controls	*No*	*No*	*No*	*No*	*No*	*No*	*No*	*Yes*
BHC FE	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Econ Cycle FE	*No*	*Yes*	*No*	*No*	*No*	*No*	*No*	*No*
Quarter FE	*No*	*No*	*Yes*	*No*	*No*	*No*	*No*	*No*
N Obs	1376	1644	1644	659	985	1644	1644	1636
Adj R^2	0.06	0.06	0.08	0.04	0.18	0.02	0.06	0.08

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9: **Evidence from Mergers and Acquisitions**

This table reports coefficients from panel regressions of operational losses on BHC M&A activity and control variables. The estimation sample includes data for 159 M&A events from 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Post M&A* is an indicator variable that equals 1 after an M&A event, and 0 otherwise. *M&A Size (%)* is the asset size of an acquired company as a proportion of the BHC's asset size 1 quarter prior to the merger. The definitions of all variables are reported in Table 1. We use observation windows of $+/-$ 1, 2, 3, or 4 quarters around each M&A event and report results in Columns (1)-(4), respectively. All specifications include M&A event fixed effects. The error terms are clustered at the M&A event level. *p*-values are presented in parentheses.

	(1) LtA	(2) LtA	(3) LtA	(4) LtA	(5) LtA
Post M&A	2.755**	2.329**	2.097**	2.094**	1.937**
	(0.020)	(0.022)	(0.012)	(0.012)	(0.018)
Post M&A * M&A Size (%)					5.584*
					(0.100)
Ln(Assets)	−14.967*	−8.707	−6.302	−6.409*	−9.514**
	(0.074)	(0.140)	(0.116)	(0.056)	(0.029)
II-to-NII	15.465**	8.901*	9.527**	8.753***	8.807***
	(0.010)	(0.094)	(0.011)	(0.003)	(0.003)
Deposits-to-Assets	11.537	9.564	−9.505	−24.978	−28.548*
	(0.788)	(0.728)	(0.679)	(0.140)	(0.088)
Loans-to-Assets	−12.909	0.035	24.205	47.484**	48.574**
	(0.771)	(0.999)	(0.341)	(0.040)	(0.035)
ROE	38.423	−17.059	−3.710	6.206	6.230
	(0.451)	(0.493)	(0.872)	(0.774)	(0.773)
Tier 1 Capital	0.401	0.162	0.560	0.957**	0.944**
	(0.450)	(0.699)	(0.175)	(0.032)	(0.031)
Loan Losses	−163.090	−118.237	−287.255	−349.341	−349.469
	(0.632)	(0.583)	(0.188)	(0.167)	(0.168)
Maturity Gap	10.205***	4.539*	3.418**	1.881**	2.109**
	(0.004)	(0.075)	(0.022)	(0.037)	(0.028)
GDP Growth	241.359*	97.961	95.056**	90.247*	94.803**
	(0.059)	(0.229)	(0.044)	(0.051)	(0.044)
Financial Crisis 2007-09	7.211	0.749	0.322	0.329	0.550
	(0.112)	(0.866)	(0.907)	(0.883)	(0.806)
N Obs	477	780	1071	1323	1323
N M&As	159	156	153	147	147
Adj R^2	0.37	0.25	0.34	0.31	0.31

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10: **Instrumental Variables**

This table reports coefficients from instrumental variable regressions of operational losses on BHC asset growth and control variables. The estimation sample comprises an unbalanced panel of 1,644 quarterly observations of 38 large U.S. bank holding companies over the period [2001:Q1-2018:Q4]. *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the bank's total assets, multiplied by 10,000. *Asset Growth* is the year-over-year growth of BHC total assets. We use *Peer N Employees Growth*, the median year-over-year growth in the number of BHC employees of peer banks, as an instrumental variable for *Asset Growth*. The definitions of all variables are reported in Table 1. Column (1) presents first-stage results. The F-test for IV strength has a value of 40.39 and Prob$> F$=0.0000. Column (2) presents second-stage results. Both regression stages include BHC fixed effects. Standard errors are clustered at the BHC and quarter levels. p-values are presented in parentheses.

	(1) Asset Growth	(2) LtA
Peer N Employees Growth	2.239***	
	(0.000)	
Asset Growth		6.312**
		(0.035)
Ln(Assets)	0.006	−1.476*
	(0.808)	(0.050)
II-to-NII	0.000	0.025***
	(0.725)	(0.010)
Deposits-to-Assets	−0.022	1.231
	(0.821)	(0.728)
Loans-to-Assets	−0.221	4.402
	(0.180)	(0.433)
ROE	0.205**	5.538
	(0.029)	(0.314)
Tier 1 Capital	−0.015**	−0.164
	(0.028)	(0.177)
Loan Losses	−0.042*	2.204*
	(0.052)	(0.076)
Maturity Gap	−0.007	−0.304
	(0.571)	(0.467)
GDP Growth	−0.921*	14.003
	(0.082)	(0.585)
Financial Crisis 2007-09	0.057**	3.311
	(0.012)	(0.110)
N Obs	1644	1644
Adj R^2	0.50	0.03

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11: **Operational Losses and BHC Growth – Channels**
This table reports coefficients from panel regressions of operational losses on BHC growth measures and control variables. The estimation sample comprises an unbalanced panel of: 1,644 quarterly observations of 38 large U.S. BHCs over the period [2001:Q1-2018:Q4] in Columns (1), (2) and (3); 1,018 quarterly observations of 26 large U.S. BHCs over the period [2001:Q1-2014:Q4] in Column (4); 1,048 quarterly observations of 25 large U.S. BHCs over the period [2004:Q1-2018:Q4] in Column (5); and 1,588 quarterly observations of 37 large U.S. BHCs over the period [2001:Q1-2018:Q4] in Columns (6) and (7). *LtA* measures the operational losses that occur at a BHC over a given calendar quarter as a proportion of the BHC's total assets, multiplied by 10,000. *Asset Growth* is the year-over-year growth of BHC total assets. *N Employees Growth* is the year-over-year growth in the number of BHC employees. *Asset Growth (Low Emp Growth)*, *Asset Growth (Med Emp Growth)* and *Asset Growth (High Emp Growth)* equal *Asset Growth* if *N Employees Growth* is in the lowest, two inner, and highest quartiles, respectively, of *N Employees Growth*'s distribution, 0 otherwise. *N Employees Growth (M&A)* is the year-over-year growth in the number of BHC employees due to M&A activity. *N Employees Growth (Organic)* is the residual year-over-year growth in the number of BHC employees that is not due to M&A activity. *Execu Comp Vega* is an indicator variable that equals 1 if vega (a compensation-based measure of executive risk-taking incentives) is greater than the sample median, 0 otherwise. *Board Independence* is an indicator variable that equals 1 if the proportion of independent directors on a BHC's board is greater than the sample median, 0 otherwise. *Org Complexity* is an indicator variable that equals 1 if the number of subsidiaries in the BHC's organizational structure is greater than the sample median, 0 otherwise. *Bus Complexity* is an indicator variable that equals 1 if the number of business activities a BHC is engaged in is greater than the sample median, 0 otherwise. Control variables (*Ln(Assets)*, *II-to-NII*, *Deposits-to-Assets*, *Loans-to-Assets*, *ROE*, *Tier 1 Capital*, *Loan Losses*, *Maturity Gap*, *GDP Growth* and *Financial Crisis 2007-09*) are included, but their coefficient estimates are omitted for brevity. The definitions of all variables are reported in Table 1. All specifications include BHC fixed effects. The error terms are clustered at the BHC and quarter levels. *p*-values are presented in parentheses.

	(1) LtA	(2) LtA	(3) LtA	(4) LtA	(5) LtA	(6) LtA	(7) LtA
N Employees Growth	3.104** (0.018)						
Asset Growth (Low Emp Growth)		−0.709 (0.855)					
Asset Growth (Med Emp Growth)		1.555 (0.702)					
Asset Growth (High Emp Growth)		3.814** (0.019)					
N Employees Growth (M&A)			2.709** (0.045)				
N Employees Growth (Organic)			2.565* (0.083)				
Asset Growth				−1.148 (0.451)	9.586** (0.047)	0.981 (0.700)	−0.886 (0.583)
Asset Growth * Execu Comp Vega				6.800* (0.059)			
Execu Comp Vega				2.060 (0.269)			
Asset Growth * Board Independence					−8.101* (0.098)		
Board Independence					0.303 (0.698)		
Asset Growth * Org Complexity						3.439 (0.357)	
Org Complexity						−0.617 (0.377)	
Asset Growth * Bus Complexity							5.542* (0.083)
Bus Complexity							0.313 (0.725)
N Obs	1644	1644	1644	1018	1048	1588	1588
Adj R^2	0.06	0.06	0.11	0.06	0.08	0.07	0.07

$^{*}\ p < 0.10,\ ^{**}\ p < 0.05,\ ^{***}\ p < 0.01$