Uncertainty or Misvaluation? New Evidence on Determinants of Merger Activity from the Banking Industry

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Abstract

We use data from the past 30 years of takeover activity in the U.S. banking industry to test competing neoclassical and misvaluation merger theories. Test results are consistent with evidence in the literature that merger activity is significantly related to both structural industry change and stock price misvaluation. Our primary contribution is to show that changes in misvaluation reflect a rise in industry-wide risk taking and that increases in risk originate from changes in industry structure due to deregulation. A measure of bank risk taking subsumes the power of stock price misvaluation to explain subsequent merger activity.

Keywords: Mergers and Acquisitions, Deregulation, Banking, Idiosyncratic Risk

JEL Classification: G21, G34, G38

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1. Introduction

Neoclassical explanations of corporate mergers and acquisitions (M&A) argue that broad fundamental factors such as economic, regulatory, or technological shocks drive industry merger activity, often in waves (Mitchell and Mulherin, 1996; Andrade, Mitchell and Stafford, 2001; Harford, 2005). However, recent studies show that periods of high stock market valuation are often positively correlated with increased merger activity; the bull markets of the 1990s and mid-2000s being prime examples. These papers employ both theory (Shleifer and Vishny, 2003) and empirical analysis (Rhodes-Kropf, Robinson, and Viswanathan, 2005) to support the behavioral and asymmetric information explanations that managers use temporary misvaluation of the firm's stock to acquire assets or growth options. Because M&A are such a large part of corporate capital expenditures, aggregate U.S. M&A deal value totaled over $1.5 trillion in 2014 (Factset, 2015), determining the cause(s) of such a large turnover in corporate control has implications for investors, corporate managers, and public policy makers alike.

The aim of this study is to test the effects of both misvaluation and fundamental shocks on takeover activity in a single industry. We use data from the past 30 years of takeover activity in the U.S. banking industry to determine, empirically, whether shocks to industry fundamentals or stock price misvaluation drive merger activity in the industry. We also examine the specifics of how deregulation creates the forces necessary to spur a merger wave in the industry.

The U.S. banking industry provides an excellent setting to contrast these two broad hypotheses because the industry experienced several structural shocks via deregulation and technological change over the sample period (Mitchell and Mulherin, 1996; Winston, 1998; Harford, 2005), and simultaneously benefited from several bull markets (mid-1980s, 1990s and mid-2000s) that provide fertile ground for possible misvaluation. In addition, past multi-industry

merger studies exclude banking because its historically regulated nature is viewed to have muted natural market responses, such as takeover activity, to industry change. The study of this single industry provides an opportunity to test these theories with new data.

While the two contrasting explanations of M&A activity have generally been a focal point of the literature relating to merger waves, more recent research builds on the notion that industry-level M&A builds into a wave-like concentration of activity only when other conditions are in place. Specifically, Harford (2005) shows that in addition to the economic shocks that initiate the wave, capital liquidity is needed to provide sufficiently low transaction costs to allow for large scale reallocation of assets. Garfinkel and Hankins (2011) provide evidence that cash flow uncertainty, typically created by industry shocks or increased competition, spurs companies to vertically integrate to hedge against future cash flow volatility; actions which help produce merger waves.

Although Rhodes-Kropf, Robinson, and Viswanathan (2005) find significant support for their merger misvaluation theory, when they test their predictions against neoclassical predictions they find support for both misvaluation and neoclassical theory. They conclude that, despite the fact that most acquirers fall in the quintile with the highest misvaluation, economic shocks could be the fundamental driver of merger activity while misvaluation shapes how the shocks propagate through the industry.

The U.S. banking industry is somewhat unusual in that it continues to this day to be subject to significant government regulation, despite having undergone extensive deregulatory change over the last 30 years. Importantly, deregulation did not simply slow the economic decline of the industry as happened in some other industries (Ovtchinnikov, 2013); it helped produce an increasingly profitable and heterogeneous industry characterized by product innovation and

diversification. This resulted in higher levels of growth options and widening product profit margins.

Many studies examine the impact of deregulation and product diversification on the risk / return profile of U.S. banks (Kwan, 1998; DeYoung and Roland, 2001; among others). While some find that a growing reliance on revenue from noninterest income sources (fee-based income, commissions, trading profits) produce a lower *expected* risk-return relation, many such studies also find that the diversification impacts on realized returns are short lived. Furthermore, the literature finds that some noninterest income activities increase risk and lead to higher leverage (due to lower capital requirements), thus producing a significant increase in earnings volatility (DeYoung and Roland, 2001; Stiroh, 2004; Stiroh and Rumble, 2006).

Motivated by this evidence, we argue that deregulation ultimately caused an increase in the level and dispersion of risk throughout the industry, which led to increases in measures of industry stock misvaluation. Recent work demonstrates that increases in firm-level cash flow volatility increase firm-level risk, as proxied by idiosyncratic stock return volatility (Irvine and Pontiff, 2009). We lean on these findings to support our argument that the increasingly heterogeneous and risky nature of the banking industry made it increasingly difficult for investors to forecast future revenues and profitability with certainty. Combined with industry consolidation that suppressed acquirer's market / book multiples, the increased uncertainty led to larger discounts to estimates of long run value over the sample period.

We provide evidence in this paper to show that the Rhodes-Kropf, Robinson, and Viswanathan (2005) industry misvaluation proxy (a measure of aggregate stock misvaluation at the industry level) increases significantly with increases in industry cash flow volatility, a measure of uncertainty/risk. We also find that cash flow volatility increases with increases in both average

industry revenue volatility and revenue from fee-based products. Consistent with the findings in Rhodes-Kropf, Robinson, and Viswanathan, we find that banks with relatively low growth options buy banks with higher growth options using high short-run firm-level valuations. Thus, while structural industry change is responsible for impelling merger waves in the banking industry, the firm-level misvaluation measure of Rhodes-Kropf, Robinson, and Viswanathan is important in capturing who buys whom: overvalued banks use stock to buy relatively undervalued banks with higher growth options. However, test results in this study indicate that changes in industry fundamentals ultimately drive industry merger waves and that the industry-level misvaluation and long-term growth measures of Rhodes-Kropf, Robinson, and Viswanathan reflects these changes in fundamentals at the industry level.

Finally, we show that increases in industry revenue and cash flow volatility are driven by increases in industry competition after two significant deregulatory acts (1994 and 1999) and that merger activity increases significantly around the passage of these two deregulatory acts. These findings support evidence from the literature that merger activity is significantly related to structural industry change. We use this collective evidence to conclude that structural industry change is the primary driver of industry takeover activity; a finding that supports the neoclassical theory of mergers.

The paper proceeds as follows: Section 2 briefly reviews the literature and establishes a framework for testing the hypotheses. Section 3 lays out the recent history of bank deregulation. Section 4 reviews the data sample and construction of variables. Section 5 presents initial unconditional tests and results. Section 6 examines the influence of deregulation on risk and competition. Section 7 presents relative value data and examines the effect of risk and misvaluation on merger activity and Section 8 concludes.

2. Literature review and hypothesis development

Motivating this study is the fact that relatively little work has been done in the banking literature to examine the effects of stock misvaluation on bank merger waves or contrast the effects of misvaluation against that of structural industry change. This section provides a brief overview of the literature most relevant to developing testable hypotheses; more complete reviews of the bank merger literature can be found in the surveys by Berger, Demsetz and Strahan (1999), Jones and Critchfield (2005), and DeYoung, Evanoff and Molyneux (2009).

Given that mergers have received much scholarly interest, there exists a substantial body of work covering many aspects of M&A. As mentioned previously, the corporate finance M&A literature has evolved into two broad and contrasting camps. Behavioral explanations link M&A activity and (relative) stock valuations. Shleifer and Vishny (2003) create a model that explains many of the empirical regularities about the characteristics and returns of merging firms. They argue that an inefficient market allows for periods of high stock market valuations that drive M&A activity as rational managers use their overvalued stock as currency to buy undervalued, or less overvalued, firms. As a bull market trends higher, M&A tend to cluster in time until a market pullback ends the market run.

Rhodes-Kropf, Robinson, and Viswanathan (2005), in a follow up to an earlier theoretical paper, develop several proxies for short and long run misvaluation via a decomposition of the market-to-book ratio; they show that short-term overvaluation is a significant driver of M&A activity. Their study produces an interesting empirical regularity that firms with relatively lower growth options buy firms with higher growth options. Dong, Hirshleifer, Richardson and Teoh (2006) evaluate the misvaluation theory and find that bidders are more highly valued than their targets; the effect is stronger in the 1990s than the 1980s. Ang and Cheng (2006) also examine

firm-level valuation and conclude that stock overvaluation is an important motive for firms to make acquisitions.

To the best of our knowledge, Esty, Narasimhan and Tufano (1999) is one of the few studies to examine the effect of market indices on bank takeover activity. They examine how interest rate levels and exposure affect takeover activity in the banking industry. They find that the level of acquisition activity is positively correlated with equity indices and negatively correlated with interest rates.

A testable prediction for the misvaluation theory of merger activity, as synthesized from the discussions above, is as follows:

Stock Price Misvaluation Hypothesis

H1: Merger activity occurs more intensely during periods of industry stock misvaluation.

H2: Overvalued firms buy relatively less overvalued firms.

H3: Stock acquirers are more overvalued than cash acquirers. Stock targets are more overvalued than cash targets.

Neoclassical theory suggests that corporate M&A are an efficient response to economic shocks. Gort (1969) is one of the earlier researchers to argue that economic shocks drive the reallocation of assets within an industry. Mitchell and Mulherin (1996) examine merger activity at the industry level and find that economic, regulatory, and technological shocks create clusters of merger activity that vary in time and intensity across industries. Andrade, Mitchell, and Stafford (2001) and Mulherin and Boone (2000) confirm the clustering of merger activity by industry during the 1990s. Harford (2005) also finds evidence of merger waves driven by economic, regulatory and technological shocks but contends that sufficient levels of capital liquidity are needed to make merger activity cluster into a wave-like pattern over time. Ovtchinnikov (2013)

shows that merger waves often follow industry deregulation; Holmstrom and Kaplan (2001) confirm this finding and further attribute merger waves to issues in corporate governance.

The banking literature also identifies financial and technological innovation, prompted by deregulation, as the overarching forces most responsible for spurring the wave of consolidation that swept the banking industry over the last three decades (Berger, Demsetz and Strahan, 1999; Group of Ten, 2001; DeYoung, Evanoff and Molyneux, 2009). Berger (2003) finds that technological improvements in bank computer systems led to gains in efficiency and productivity; test results result show these effects helped accelerate industry consolidation. Product and organization innovation changed the industry playing field (Frame and White, 2004), prompting regulatory changes which spurred bank expansion via M&A (DeYoung, Evanoff and Molyneux, 2009).

Testable predictions for the neoclassical theory of structural change, as synthesized from the discussion above, are as follows:

Neoclassical Structural Shock Hypothesis

H4: Merger activity increases following deregulation.

H5: Merger activity increases following economic shocks.

The banking industry has undergone extensive geographic and product diversification. A sizable strand of literature examines the effect of diversification on the risk and return profiles of banks across the industry. Stiroh (2006) notes that 40% of the net operating revenue for the average bank in the industry now comes from noninterest income, a substantial increase from pre-deregulation times. The study finds that activities that generate noninterest income (among others) are systematically linked with higher risk. DeYoung and Roland (2001) find that noninterest income activities increase risk, leverage and earnings volatility. Stiroh (2004) shows that greater

noninterest income leads to higher return volatility and lower risk-adjusted profits. Stiroh and Rumble (2006) conclude that, for the average bank, the benefits of product diversification are more than offset by a greater exposure to more volatility activities; the end result is a decrease in risk-adjusted performance. The literature is not unanimous, however. Kwan (1998) finds that the low return correlation between securities and commercial banking activity does benefit risk-adjusted performance.

The evidence on elevated risk and earnings volatility leads to our most important hypothesis: that the increased uncertainty associated with the banking industry ultimately led to larger discounts to estimates of long run value. We argue that the measure of stock price misvaluation examined in this paper (the measure used by Rhodes-Kropf, Robinson, and Viswanathan, 2005), is likely picking up the increasing discount to a modeled "true" value; rather than measuring an error in real valuation. If that is the case, the evidence that credits stock price misvaluation with forming merger waves is missing the true driver of merger activity – the structural change that drives the increase in industry-wide risk and volatility.

The final testable prediction for the neoclassical theory of structural change, is as follows:

Neoclassical Structural Shock Hypothesis

H6: Industry-level stock misvaluation increases during periods of increased industry uncertainty.

3. Recent bank deregulation

The U.S. banking industry has historically been among the most heavily regulated industries in the country. Following the stock market crash of the late 1920s, increased regulatory oversight produced many new restrictions, including the separation of deposit taking from

securities underwriting. However, beginning in the late 1970s, federal and state governments began to gradually ease restrictions on banking activity. State banks, thrifts, and bank holding companies were permitted bank branch networks that crossed state lines. In 1994, the Riegle-Neal Interstate Banking and Branching Efficiency Act amended the laws governing federally chartered banks to allow them interstate branch networks as well. This deregulatory act essentially marked the end of geographic restrictions on banking activity as it had existed in the United States for the past century. Much work has been done to study the effects of interstate banking; a common empirical finding is that bank deregulation spurred merger activity (Winston, 1998; Mitchell and Mulherin, 1996), the end result of which was a more competitive industry made up of banks with greater profitability (Winston; Stiroh and Strahan, 2003). Because the literature shows that the Riegle-Neal Act had a significant effect on several facets of the banking industry, including merger activity, we include it in this study.

The second major deregulatory event to occur during our sample period concerns the restrictions on permissible banking products. In response to active bank lobbying, the Federal Reserve, beginning in the mid-1980s, gradually relaxed restrictions on securities underwriting and trading imposed by the Banking Act of 1933, also known as the Glass-Steagall act. The Glass-Steagall act severely limited bank securities activity and the affiliation between banks and securities firms. The restrictions on the permissible products, and related revenues, were repealed in a series of regulatory interpretations from the late 1980s to late 1990s. In 1999, the Financial Modernization Act, also known as the Gramm-Leach-Bliley Act, finally eliminated the last remaining restriction around the combination of banking, securities, and insurance operations. Arguably more so than any other deregulatory event, the gradual repeal of the Glass-Steagall restrictions during the 1990s changed the nature of commercial banking and its competitive

position in the financial services industry. Due to the significance of the Gramm-Leach-Bliley Act and its effects on the industry, we include it in this study.

4. Data sample and variable construction

4.1 Sample construction

The sample period used for this study includes the years 1979 to 2009. The period has several characteristics useful for this study: it is long enough to span several decades of change including several significant deregulatory acts, periods of significant technological and financial innovation, and the bull market runs of the mid-1980s, 1990s and mid-2000s. We construct the data sample by first selecting firms belonging to the Fama and French 49 industry classification code 45 (Banks) from the CRSP monthly stock file; the CRSP file is comprised of publicly traded firms on the NYSE, Amex, and Nasdaq stock exchanges. The Fama and French code 45 (Banks) comprises Standard Industry Classification (SIC) codes 6000 to 6199; it includes commercial banks, savings and loans, and other depository institutions. We keep firms with CRSP Share Code 10 and 11 (ordinary common shares), and exclude foreign firms (incorporated outside the United States and ADRs). The remaining sample of target firms consists only of domestic public U.S. bank holding companies and financial companies[1]. Mergers are confirmed against Thomson Financial SDC Platinum merger data or manually confirmed against financial press stories from the LexisNexis database.

[1] For the remainder of the paper we use the term bank to refer to the bank holding companies and financial firms in the sample.

4.2 Construction of fundamental variables

The proxy for economic shocks we use is a modified version of the variable used in Harford (2005). Harford's "economic shock index" is the first principal component of seven economic shock variables. The variable is intended to capture the magnitude of multiple indicators of economic shock; each economic shock variable is measured as the median absolute change in the underlying economic variable, per industry year. The variables are: return on sales (ROS), return on assets (ROA), asset turnover, research and development scaled by assets, capital expenditures scaled by assets, employee growth, and sales growth. Because banks, on average, spend relatively little on research and development and physical capital expenditures, we remove the variables research and development scaled by assets and capital expenditures scaled by assets from the index calculation. Untabulated robustness checks using the complete index of seven variables do not change the qualitative findings in this paper. We compute the variables using data from the CRSP/Compustat Merged Fundamentals Annual file for the firms belonging to the banking industry.

Although our chosen measure of economic shocks does not explicitly consider regional economic shocks or regional variation in economic conditions (e.g., New England and Texas during the S&L crisis in 1990 – 1991), our modified Harford's economic shock index does indirectly capture the effects of regional economic shocks through variation in the financial measures of the banks affected by the regional shocks. We choose to capture the broader effects of these disturbances via the variables in our economic shock index.

Figure 1 displays the time-series of the calculated economic shock index. Index values increase throughout the 1980s and 1990s, spiking during the economic recovery following the 1987 stock market crash and around the passage of both the 1994 Riegle-Neal Act and the 1999

Graham-Leach-Bliley Act. Index values dip during the 2000s, a period notable for the absence of significant change in bank regulation, until increasing sharply in response to the financial crisis.

As noted in Section 3 above, state laws and federal agency restrictions governing bank activities were often relaxed several years in advance of passage of federal deregulatory acts. As a result, prospective changes in the federal laws were often anticipated by the industry and financial markets in advance of the passage of legislation; banks often acted in advance of the actual enactment of federal legislation (Becher, 2009). Due to the quickly shifting competitive landscape, banks many times acted by acquiring new product capabilities or customer markets through M&A rather than organic growth – changes that are reflected in the growth and return measures that make up the index. Hence, the effect of the two deregulatory federal acts could be reflected in changes to index values not only after, but up to several years before, the passage of the act, consistent with the results displayed in Figure 1.

<Insert Figure 1 about here>

This study builds on recent research by Garfinkel and Hankins (2011) who find that merger activity is significantly driven by increases in firm cash flow uncertainty. While Garfinkel and Hankins (2011) use two measures of uncertainty, we use the measure that is most relevant to income uncertainty in an industry like banking that does not produce physical goods. The measure of uncertainty used in this study, Cash Flow Volatility, is the volatility of operating income before depreciation (OIBD). We measure OIBD quarterly by firm and use the last 20 periods to calculate the measure. We scale OIBD by total assets (TA) to remove any skewness attributable to large firms. The variable Cash Flow Volatility_Standard Deviation is the annual cross sectional standard deviation of Cash Flow Volatility across the banking industry; the measure captures the dispersion of industry cash flow volatility. Cash Flow Volatility is calculated as follows:

$$\sigma\left(\frac{OIBD}{TA}\right) = standard\ deviation\ of\ \left(\frac{OIBD}{TA}\right) over\ quarters\ t = 0, \ldots, -19 \qquad \textbf{(1)}$$

4.3 Construction of misvaluation variables

We use valuation variables from Rhodes-Kropf, Robinson, and Viswanathan (2005) to quantify misvaluation at the industry and firm level. Rhodes-Kropf, Robinson, and Viswanathan decompose the market to book (M/B) ratio into three variables. The first variable (firm error) is a measure of the market price of a firm's stock to a value implied by industry-level multiples estimated at year *t*. The second variable (time-series sector error) measures the deviation of industry valuation implied by current, year *t*, multiples from industry valuation implied by long-run multiples; they also argue that valuation implied by long-run multiples is an estimate of a fundamental or "true" firm value. Added together, firm-specific error and time-series sector error make up the aggregate measure called industry market-to-value (M/V), or industry error. The third, and last, variable is a measure of the estimated fundamental value-to-book value (V/B) of the stock.

As in Rhodes-Kropf, Robinson, and Viswanathan (2005), we run cross-sectional regressions of firm market equity on firm accounting data each year to decompose the M/B ratio for the sample of firms in the banking industry as defined by Fama and French code 45 (Banks). To do so, we match each firm's fiscal year accounting data from Compustat with CRSP equity market value at fiscal year-end and run the following regression:

$$m_{it} = \alpha_{0jt} + \alpha_{1jt} b_{it} + \alpha_{2jt}\, ln(NI)^{+}_{it} + \alpha_{3jt} I_{(<0)}\, ln(NI)^{+}_{it} + \alpha_{4jt} LEV_{it} + \varepsilon_{it} \qquad \textbf{(2)}$$

where $\boldsymbol{m}$ is market value of firm equity for firm $\boldsymbol{i}$ at time $\boldsymbol{t}$, $\boldsymbol{b}$ is book value of firm equity, $\boldsymbol{NI}$ is firm net income and $\boldsymbol{LEV}$ is firm financial leverage. Market equity $\boldsymbol{m}$ and book value of equity $\boldsymbol{b}$ are computed in logs (and notated in lowercase) to account for the right skewness in the accounting

data. NI^{+} is the absolute value of net income and $I(<0)\ ln(NI)^{+}_{it}$ is an indicator function for negative net income observations. Estimating this cross-sectional regression for each year allows the multiples (α_k, k = 0,…, 4) to vary over time.

We apply the year multiples to the firm-level, time-varying accounting information to estimate the firm-specific error. Rhodes-Kropf, Robinson, and Viswanathan use this measure as an estimate of firms' temporary deviations from industry-wide valuation; it is a measure of idiosyncratic misvaluation. We next apply the long-run, 30 year average of the multiples (estimated from the regression) to the firm-level, time-varying accounting information to compute the time-series sector error, and long-run value-to-book (V/B) ratios, respectively. We follow Rhodes-Kropf, Robinson, and Viswanathan in using V/B as a measure of market valuation that reflects growth opportunities based on long-run industry average multiples. As such, it is a backward-looking measure of value using information not available to the market during the sample period. Rhodes-Kropf, Robinson, and Viswanathan argue that firm managers likely possess private information that the market does not have access to which allows them to better estimate true value; V/B is an estimation of that value.

Time-series sector error measures the component of market valuation that reflects potential misvaluation as measured by the deviation of short-run industry multiples from their long-run average values. Rhodes-Kropf, Robinson, and Viswanathan (2005) argue that a positive deviation could be interpreted as an "overheated" segment of the market recognized by management of firms within the industry, given the private information that was unknown to the market at the time.

Figure 2 displays the time-series of the calculated Rhodes-Kropf, Robinson, and Viswanathan (2005) industry-level M/B decomposition variables. The figure displays the value of the median annual M/B ratio of the industry, the median annual V/B ratio of the industry, and

the median annual M/V ratio of the industry. The values are displayed in lognormal format. A notable feature of the time series in Figure 2 is the divergence and direction of the two decomposition variables. The estimated value of the industry error variable (M/V) is positive and greater than the estimated value of the long-term growth variable (V/B) from the start of the sample period, 1979, and declines in magnitude until becoming negative in 1991. The estimated value of the long-term growth variable (V/B) is negative and less than the estimated value of the industry error variable (M/V) from the start of the sample period, 1979, and increases until switching signs and becoming positive in 1991. The two variables diverge after 1994, with the long-run growth options variable (V/B) becoming increasingly positive and the industry error variable (M/V) becoming increasingly negative. The variables converge and finish negative in 2009 during the financial crisis.

<Insert Figure 2 about here>

Rhodes-Kropf, Robinson, and Viswanathan (2005) argue that the V/B ratio reflects long-run growth opportunities while the M/V ratio can be interpreted as short-run market price deviations from an estimated "true" value. In this context, the patterns in Figure 2 can be interpreted as reflecting the shift within the banking industry, beginning in the 1980s, to a more profitable, yet risky, product mix. The shift is reflected in the increasing V/B ratio as the market forecasts future profit growth in the industry, incorporating the anticipated expansion of product markets as Glass-Steagall restrictions are gradually repealed, and interstate banking and technology changes force less efficient banks out of the market place (Stiroh and Strahan, 2003). The increasing riskiness of the median bank in the industry is reflected in the divergence of the M/V ratio from the V/B ratio; the divergence can be thought of as representing an increasing discount to "true" value. Thus, the Rhodes-Kropf, Robinson, and Viswanathan model estimates

that the banking industry, as a whole, is "overvalued" in the 1980s but shifts to being "undervalued" at the start of the 1990s when deregulation begins to pick up steam. The industry remains "undervalued" for the remainder of the sample period.

Figure 3 presents the time-series of industry cash flow volatility as compared to the calculated value for the industry error variable (M/V). A notable pattern in the time-series is the negative correlation between the two series from the start of the sample period, 1979, until around the year 2000, when the series begin to switch to a positive correlation. The pattern, when compared against aggregate merger activity presented in Figure 4, shows that the bulk of the merger activity during the sample period takes place while industry cash flow volatility is increasing and the industry error measure is decreasing (1979-2000). As hypothesized, the pattern fits the profile of an increasingly risky industry with larger discounts to the model estimate of fundamental value over the time series of observations.

<Insert Figure 3 about here>

4.4 Construction of industry revenue variables

To test the hypothesis that shifts to more volatile sources of revenue drive the observed increases in revenue and cash flow volatility over time, we construct variables that measure bank product mix and product revenue contribution to total revenue. We follow previous work on bank product mix and risk (notably DeYoung and Roland, 2001) to categorize revenue into buckets that represent traditional vs. newer emerging bank income sources. To do so we disaggregate bank revenue into two broad categories: interest and investment revenue and trading and fee revenue. Interest and investment revenue is defined as the sum of loan revenue and investment revenue. Loan revenue is the sum of the income (both interest and fee) from the bank loan portfolio. Investment revenue is defined as the income (interest, dividend, and capital gains/losses) from the

bank's investments not held in trading portfolios. Trading and fee revenue is essentially all remaining revenue not categorized as interest and investment revenue and is defined as the sum of trading, fee-based, and deposit revenue. Trading revenue is defined as the income (interest, dividend, and capital gains/losses) from the bank's trading portfolios. Deposit revenue is the total of all fees charged to customers for deposit services. Fee-based revenue includes fees from all other products, including trust department income, credit card fees, real estate operations, and all other fees and charges not included in other categories. These categories capture 100% of reported bank revenue.

Revenue data are sourced from Compustat. The variable Fee Revenue Percentage_Median is calculated annually as the median industry ratio of firm trading plus fee revenue as a percentage of total revenue. The variable Revenue Volatility_Median captures industry-wide revenue volatility. We measure total revenue annually by firm and use the last five annual observations to calculate the measure. We scale total revenue by firm total assets to remove any skewness attributable to large firms. Annual data are used to breakdown the revenue into the categories described above; quarterly Compustat reports do not capture these measures as completely. Revenue volatility is calculated as follows:

$$\sigma\left(\frac{TotalRevenue}{TotalAssets}\right) = standard\ deviation\ of\ \left(\frac{TotalRevenue}{TotalAssets}\right) over\ years\ t = 0, \dots, -5 \quad \textbf{(3)}$$

Table 1 reports descriptive statistics for the variables used in regression analysis. The variable Cash Flow Volatility_Standard Deviation is log transformed to make it approximately normally distributed and is used, for that reason, in later regression analysis

<Insert Table 1 about here>

5. Tests of neoclassical and misvaluation theories as drivers of merger activity

5.1 Industry merger activity

To evaluate merger activity within the context of the contemporary structure of the industry, Table 2 tabulates the size of the industry and corresponding merger activity for each year during the sample period 1979 to 2009. Industry count as reported in Table 2 is the count of banks reported on CRSP for the Fama and French bank code 45. The industry count increases during the 1990s as more banks access the capital markets, particularly on the Nasdaq. However, industry consolidation is evidenced by a consistently shrinking count during the 2000s. The industry ends in 2009 with more than double the number of public banks (564) than at the start of the sample period in 1979 (212).

<Insert Table 2 about here>

Merger count increases steadily throughout the 1990s, averaging roughly 40 mergers a year that involve a public target, peaking at 88 mergers in 2000. Merger activity falls during the early 2000s recession but picks up again during the middle of the decade before falling drastically during the financial crisis. Over time, merger activity plays a larger role within the industry. Merger count averages roughly 4% of industry count during the 1980's, 6% during the 1990's and 7.5% during the 2000s. The predominant pattern is one of increasing merger activity throughout the sample period. Overall, Table 2 depicts an industry with a steadily growing number of (public) participants and significant merger activity.

5.2 Influence of structural shocks and misvaluation on industry merger activity

Another noticeable trend in the merger time-series data, as seen in Figure 4, is the increase in merger activity following the two deregulatory acts we study in this paper. Following the Riegle-Neal Act of 1994, average merger activity increases to 48 per year for the five year period

following passage (1994 to 1998). This marks an 83% increase from the 26.2 per year average for the period 1989 to 1993, as reported in Table 3. A t-test of difference in means for the two series produces a *t*-statistic of 3.92, significant at the .001 level. Following the Graham-Leach-Bliley Act of 1999 the average merger activity increases from 48 per year (1994 to 1998) to 64.8 per year (1999 to 2003). The *t*-statistic for a test of a difference in means is 1.90, indicating significance at the .10 level. The finding is consistent with evidence in the literature that industry deregulation spurs merger activity (Mitchell and Mulherin, 1996; Harford, 2005; and Ovtchinnikov, 2013).

<Insert Figure 4 about here>

<Insert Table 3 about here>

When the annual merger count in Figure 4 is compared with the economic shock index time-series presented in Figure 1 it becomes apparent that increases in the economic shock index precede large increases in merger activity. This initial result is consistent with evidence in Winston (1998) and Mitchell and Mulherin (1996).

We next use OLS regression analysis to further examine the influence of structural shocks and industry-level misvaluation on aggregate industry merger activity. We test specifications that allow us to run a horse race between structural shock variables and industry misvaluation variables. Because the variables Industry Valuation Error (M/V) and V/B are highly (negatively) correlated, the variables must be tested in separate but otherwise identical specifications. In addition to the variables constructed in section 4, the indicator variable Dereg is used to measure the impacts of industry deregulation on merger activity; it takes on a value of 1 for each year observation beginning two years before to two years after a deregulatory event, 0 otherwise. We begin to measure an act's impact two years prior to its passage as evidence from the literature shows that

the market efficiently anticipates the passage of deregulatory events and often acts before its passage (Becher, 2009).

The bank merger literature also provides evidence that industry mergers are, in part, motivated by the desire to increase both market power and cost efficiency. The regression specification controls for these effects by including the Herfindahl-Hirschman index as a proxy variable for market power; it is the sum of the squared market share (sales over total industry sales) of firms in an industry in a given year. The dispersion in return on sales (Dispersion in ROS*)* is a gauge of the dispersion of firm cost efficiency across the industry; it is the cross-sectional standard deviation of the return on sales (cash flow/sales).

Table 4 reports the test results of the effect of structural and industry misvaluation variables, lagged one year (time *t=-1*), on annual industry merger count (time *t=0*). We theorize that the relation is not contemporary; that is, it takes time for companies to act on any changes in the series of explanatory variables. A one period lag is utilized to account for this time lag. Models 1 and 2 report that increases in the Economic Shock variable do not have a significant effect on Merger Count in the subsequent year; adding control variables in Models 3 and 4 yields a positive and significant coefficient for the Economic Shock variable in Model 4 (*t*-statistics are computed by means of Newey-West corrected standard errors). Results for the Dereg (1999)[2] indicator variable demonstrate that the passage of deregulatory legislation is positively and significantly associated with increases in subsequent merger activity in model specification 1 only. Together these results provide weak support for the structural shock predictions H4 and H5.

<Insert Table 4 about here>

[2] In untabulated results, the deregulation indicator variable Dereg (1994 and 1999) is shown to have slightly less statistical power to explain subsequent merger activity than Dereg (1999). For this reason, the variable Dereg (1999) is used for testing purposes henceforth.

Results of tests of the misvaluation variables presented in Table 4 are consistent with predictions in H1 that misvaluation significantly drives merger activity. The estimated coefficients for the long-term growth variable, median industry V/B ratio, are positive and statistically significant in Models 1 and 3, consistent with the notion that increases in long-run growth opportunities spur merger activity. The estimated coefficients for the Industry Valuation Error variable (M/V) is negative and statistically significant in Models 2 and 4. The direction of the coefficient can be interpreted as follows: given that M/V decreases over the majority of the sample period while V/B increases, the increasing misvaluation (decreasing M/V ratio) increases merger activity.

Introducing control variables for the effects of market power and industry efficiency increases produce estimated coefficients for the misvaluation variables that are of similar direction and magnitude to that reported in models 1 and 2. Overall, tests results in Table 4 provide only weak support for neoclassical theory and strong support for misvaluation theory; proxy variables for stock price misvaluation appear to have more explanatory power than do structural shock variables to explain industry merger activity.

6. The influence of deregulation on risk and competition

In this section, we examine how deregulation affects product market activity and competition in the banking industry. We build on insights from previous literature which find that shifts toward more volatile revenue sources increases risk and leverage within the industry. We investigate whether these same forces explain the reported increase in industry risk over time.

6.1 Industry competition and risk

Recent literature shows that idiosyncratic stock volatility is negatively and significantly related to firm return on assets (Irvine and Pontiff, 2009). Irvine and Pontiff test the cross section of industries in the Fama French 49 industry classification and find that the return on assets (ROA) time-series declines over the period 1964 – 2003 while idiosyncratic volatility rises over that same period, consistent with the notion that increases in competition increase firm risk. The authors also examine deregulated industries separately and find that the banking industry (among others) experiences increases in idiosyncratic risk after deregulation.

We examine the hypothesis with our sample data. Following Irvine and Pontiff (2009), we use ROA as a proxy for competition. They argue that firms with less competition and more market power will generate higher returns, on average, than those firms with more competition and less market power. We analyze the link between competition and risk by examining the time-series relation between industry revenue volatility and several proxies for competition. Table 5 reports the results of OLS analysis of the effect of industry median ROA and industry Turnover on industry median Revenue Volatility. We again follow Irvine and Pontiff in the use of a second competition variable: turnover. Industry turnover (exit and entry from an industry) can proxy for the market power of the firms that remain within the industry; the stiffer the competition within an industry, the greater the expected industry turnover.

<Insert Table 5 about here>

Model 1 reports that contemporaneous industry median ROA has a significantly negative relation with industry median Revenue Volatility. Adding the competition variable Turnover, as well as controls for structural shocks, Model 2 reports that contemporaneous median ROA maintains a significantly negative relation with industry median Revenue Volatility while

Turnover has an insignificant influence. The Economic Shock Index variable has a significantly positive relation with industry median Revenue Volatility while the Dereg (1999) variable has an insignificant relation. When the efficiency control variable Dispersion in ROS is added to the previous specification, as reported in Model 3, industry median ROA remains as the only variable to have a significant relation with industry median Revenue Volatility. Taken as a whole, results in Table 5 support the notion that increased product market competition significantly increases revenue volatility.

While the previous test provides evidence that greater industry competition leads to increases in risk, we next test the related argument that relaxed product regulation contributed to increases in the dispersion of risk throughout the industry. The literature provides evidence that deregulation of the industry led to greater product innovation; a change which, in turn, led to a greater reliance on revenue from noninterest income sources. These activities had the effect of increasing risk, financial leverage and earnings volatility (DeYoung and Roland, 2001; Stiroh and Rumble, 2006).

To test the hypothesis, we examine the relation between industry cash flow volatility and variables representing the percentage revenue from trading and fee revenue (known alternatively as noninterest income) and revenue volatility. For the median bank in this study, noninterest income as a percent of total revenue grows from roughly 5% at the start of the sample period to greater than 35% at the end of the sample period. Table 6 presents OLS analysis, the results of which support the hypothesis that reliance on more volatile sources of revenue, proxied by trading and fee revenue, are positively and significantly related to cash flow volatility.

<Insert Table 6 about here>

Model 1 reports a positive and highly significant relation between one-period lagged Fee Revenue Percentage (noninterest income percentage) and industry Cash Flow Volatility. Model 2 reports a positive and significant relation between one-period lagged industry median Revenue Volatility and industry Cash Flow Volatility. The control variables added in models 3 and 4 do not affect the significance of the relation from Models 1 and 2; increases in Fee Revenue Percentage and Revenue Volatility remain positively and significantly related to industry cash flow volatility.

6.2 Risk and stock price misvaluation

To this point, test results confirm that a shift to new and more volatile activities, spurred on by financial innovation and deregulation, are associated with an increase in risk throughout the industry. This section examines whether increases in risk within the industry drives the power of the Rhodes-Kropf, Robinson, and Viswanathan (2005) industry misvaluation variable to explain industry merger activity. As noted, the time-series of industry cash flow volatility and the industry misvaluation variable (M/V) display a negative correlation from the start of the sample period, 1979, until around the year 2000, when the series begins to switch to a positive correlation. The pattern is generally consistent with the hypothesis that increasing industry uncertainty results in an increasingly larger discount to a theoretical "true" value. We analyze the validity of the hypothesis by examining the relation between industry misvaluation and industry cash flow volatility.

Cash flow volatility of the median firm in the industry increases over the sample period, with a very rapid increase evident after 1990. Following the Riegle-Neal Act of 1994, the standard deviation of industry cash flow volatility increases to roughly 87% for the five year period following passage (1994 to 1998). Table 7 shows this marks a 10% increase from the 79% average per year for the period 1989 to 1993. A t-test of difference in means for the two series is not

significant. However, following the Graham-Leach-Bliley Act of 1999, the standard deviation of industry cash flow volatility increases from 87% (1994 to 1998) to 180% (1999 to 2003). The *t*-statistic for a test of a difference in means is significant at the .01 level. Thus, while our measure of uncertainty, the standard deviation of industry cash flow volatility, increases throughout the sample period, Table 7 reports that the increase is significant during the latter half of the sample period when the bulk of merger activity occurs.

<Insert Table 7 about here>

Table 8 reports the results of OLS analysis of the effects of industry cash flow volatility on industry misvaluation. Model 1 reports a significant negative relation between industry Cash Flow Volatility and Industry Valuation Error. The effect of the estimated coefficient can be interpreted that as industry cash flow volatility increases, so does misvaluation. The Dereg (1999) indicator variable also has a significant and negative coefficient. After adding controls for competition, models 2 and 3 report that Cash Flow Volatility and Dereg (1999) remain significant drivers of industry valuation error. After adding the control for efficiency, Model 4 reports that Cash Flow Volatility is still a significant driver of industry valuation error, however, Dereg (1999) loses its significance. Thus, results from Table 8 support hypothesis H6.

<Insert Table 8 about here>

7. Relative value and merger activity

Thus far, test results indicate that industry-wide increases in risk are a significant driver of industry-level misvaluation. Earlier test results reveal that changes in industry fundamentals and the level of industry valuation error are significant drivers of industry merger activity. This section examines the role that firm-level misvaluation plays in the level of industry merger activity. We

test the sample of merged firms using the Rhodes-Kropf, Robinson, and Viswanathan (2005) M/B decomposition variables: V/B, Sector Error and Firm Error. First, we test predictions from Section 3 regarding the relative valuation of acquirers vs. targets. Then, we compare the effect of firm and industry-level stock price misvaluation against that of changes in industry fundamentals to determine the primary driver(s) of industry merger activity over time.

To test relative firm valuation predictions we use a subset of merged public firms drawn from the merger sample analyzed in previous sections (and summarized in Table 2). We include in this subset merger deals in which both the acquirer and target are publicly traded, have the relevant financial data reported in the CRSP/Compustat Merged database, and for which the method of payment is reported in financial press reports. After applying these data screens to the original merger sample, we are left with a sample of 426 mergers in which both acquirer and target are public. In addition, we use a second sample to test method of payment predictions; this sample contains 838 mergers of public and private firms. We lose 248 observations from the original sample of 1,086 because of lack of data or uncertainty regarding method of payment or announcement date; we lose 412 observations because one of the merged firms is not public or the requisite data is lacking.

7.1 Relative value components of merged firms

Table 9 reports the difference in risk and valuation characteristics of merged firms by acquirer and target. Panel A shows that acquirers are, on average, riskier than targets: both the average level and standard deviation of firm Cash Flow volatility are twice that of targets; the *t*-statistics of the differences are statistically significant. Panel B reports valuation characteristics for the full merger sample. Results clearly demonstrate that the average M/B ratio of acquirers is significantly higher than that of targets. However, comparing the three components of M/B reveals

interesting deviations from the high buys low story. The level of Acquirer Firm Error is much greater than that of targets, but the Sector Error and V/B of targets is greater than that of acquirers. These findings are largely consistent with the findings of Rhodes-Kropf, Robinson, and Viswanathan (2005) that high M/B firms buy lower M/B firms, acquirers have higher short-term valuations, in the form of Firm Error, than do targets and acquirers have lower long-run growth options, in the form of V/B, than do targets. Although the direction of Sector Error is inconsistent with Rhodes-Kropf, Robinson, and Viswanathan, the relative difference is consistent with their findings – reported results demonstrate that acquirers are less undervalued than targets as compared to industry time-series average.

<Insert Table 9 about here>

The remainder of the table reports the valuation characteristics by method of payment. Panels C, D, and E report on stock-only, cash-only, and mixed payment mergers, respectively. The results by form of payment are consistent, overall, with those for all mergers. That is: acquirers are significantly more overvalued than acquirers, as measured by M/B and Firm Error, are less undervalued as compared to industry time-series average than targets, as measured by Sector Error, and have significantly lower long-run growth options than targets, as measured by V/B ratios.

The valuation components by method of payment in Table 9 are consistent with the findings of Rhodes-Kropf, Robinson, and Viswanathan (2005) and are also consistent with their predictions regarding relative values within an industry. Rhodes-Kropf, Robinson, and Viswanathan predict that overvalued firms buy relatively undervalued firms, targets in stock-only mergers are more overvalued than targets in cash-only mergers, and acquirers in stock-only mergers are more overvalued than acquirers in cash-only mergers. A comparison of results from

panels C, D and E supports the first prediction: acquirers in mergers using all three forms of payment are significantly more overvalued than targets, as measured by M/B and Firm Error. A comparison of results from panels C and D largely support the second and third prediction: both acquirers and targets in cash-only mergers are less overvalued than acquirers and targets in stock-only mergers, as measured by M/B ratios and Firm Error. Thus, these findings collectively support our stock price misvaluation hypotheses H2 and H3.

Table 10 provides a breakdown of the merger sample by method of payment. The first column reports statistics for banking M&A deals involving both public and private firms; the second column reports on the sample of public deals analyzed in Table 9. The results are consistent across samples. In both samples, over half of the mergers are financed by all stock, roughly a third are mixed payment with the balance financed by all cash.

<Insert Table 10 about here>

We also reconfirm the findings in Rhodes-Kropf, Robinson, and Viswanathan (2005) that increasing misvalaution, as measured by M/B and Firm Error, increases the probability that the takeover is financed with all stock. Table 11 reports the results of probit regressions in which the dependent variable is 1 if the deal is all stock, 0 if it is all cash or mixed payment. Column 1 shows that increases in M/B significantly increase the probability that a merger is financed with all stock. Columns 2 and 3 report unconditional results for the decomposition variables specifically related to misvaluation. Increases in the short term valuation component, Firm Error, significantly increase the probability that a merger is financed with all stock, while Sector Error does not significantly influence method of payment. Similarly, column 4 reports that the decomposition variable related to the level of growth options, V/B, does not significantly influence method of payment. Columns 5 and 6 report that, conditional on the level of V/B, increases in both Firm and

Sector Error significantly increase the probability that a merger is financed with all stock. These results support stock price misvaluation hypothesis H3.

<Insert Table 11 about here>

7.2 Cash flow volatility, stock price misvaluation, and merger activity

We test whether changes in industry fundamentals subsume the effect of industry and firm misvaluation as drivers of industry merger activity. We examine the relation between industry merger count, an expanded set of structural change, and misvaluation variables. Given the evidence presented in Table 9 that both risk, and the valuation components Firm Error and V/B, are significantly different for acquirers and targets involved in a merger, perhaps it is the magnitude of the difference in, rather than the level of, the measures that spurs merger activity. We examine that possibility by including both the level of, and differences in, the risk and valuation measures of acquirers and targets in subsequent tests.

Table 12 reports the results of OLS analysis of the effect of both industry and firm-level risk and valuation characteristics on annual industry merger count. The specification in Model 1 examines the effect of the primary industry-level risk and valuation components, Cash Flow Volatility and Industry Error, on subsequent merger activity. Results demonstrate that the level of Industry Error has a significant positive effect on subsequent merger activity, while the level of industry Cash Flow Volatility has an insignificant effect on merger activity (given industry valuation levels). Model 2 substitutes Cash Flow Volatility Difference for the level of Cash Flow Volatility; Cash Flow Volatility Difference is positive and significant, subsuming the ability of the misvaluation variable Industry Error to explain industry merger activity.

<Insert Table 12 about here>

As noted, among the most important firm-level findings in Rhodes-Kropf, Robinson, and Viswanathan (2005) are that acquirers with high firm error buy targets with lower firm error and that acquirers with low long-run growth options buy targets with high long-run growth options. Our breakdown of M/B is consistent with Rhodes-Kropf, Robinson, and Viswanathan on these points. Because of the important implications of these findings we test them in the following model specifications. Model 3 examines the effect of these two valuation components, Firm Error and long-run V/B, on contemporaneous merger activity. The results show that the level of the target's long-run growth options, V/B, has a positive and significant impact on merger activity while the influence of the acquirer's short-term valuation, Acquirer Firm Error, is insignificant[3].

Model 4 adds industry Cash Flow Volatility to the specification from Model 3[4]. Results show that Cash Flow Volatility, Acquirer Firm Error, and Target V/B significantly influence merger activity. However, the reported results indicate that the level of uncertainty in the industry is less important to merger activity than the short-term valuation of the acquiring firms. Surprisingly, the level of Acquirer Firm Error is significant and negatively related to merger activity, the opposite of the predicted direction. However, the direction of the estimated coefficient could be an artifact of valuation levels in the merger sample. As seen in Table 9, Panels C through E, as V/B levels increase from stock to mixed to cash, firm error levels decrease. What stays relatively constant is the direction and significance of the difference in firm error; acquirer firm error is always significantly greater than target firm error.

Model 5 substitutes Cash Flow Volatility Difference for industry Cash Flow Volatility. The estimated coefficient for Difference in Cash Flow Volatility is positive and significant while

[3] The number of annual observations drops to 26 because the merger sample contains several years in the 1980's for which no Compustat data is available for the publicly traded merged banks.
[4] The control variable for market power, HH Index, is again excluded from this particular specification to alleviate collinearity issues.

that for Acquirer Firm Error and Target V/B are insignificant. Thus, the difference in acquirer and target risk, a measure of structural industry change, exhibits more power to explain industry merger activity than does the acquirer's short-term valuation or the level of the target's long-run growth options.

Due to the presence of multicollinearity, testing the three M/B decomposition variables in one specification is problematic. To address this issue, we split the variables into otherwise identical specifications. Models 6 and 7 compare the power of Cash Flow Volatility against that of another misvaluation variable, Acquirer Sector Error, to explain merger activity. The misvaluation variable significantly increases merger activity, while industry Cash Flow Volatility does not. However, when Difference in Cash Flow Volatility is substituted for industry Cash Flow Volatility in the next model, the same pattern emerges: the estimated coefficient for Difference in Cash Flow Volatility is positive and significant while that for Acquirer Sector Error is insignificant.

Next, we next examine whether the magnitude of the differences in the M/B decomposition variables influence industry merger activity. Model 8 reports that Firm Error Difference and V/B Difference have an insignificant effect on contemporaneous merger activity while increases in the structural variable Difference in Cash Flow significantly increase industry merger activity. After adding the Difference in Firm Error to the specification, Model 9 reports largely the same result: the estimated coefficient for Difference in Cash Flow Volatility is positive and significant while the estimated coefficient for Difference in V/B, Firm Error and Sector Error are insignificant.

Finally, Model 10 substitutes the level of Industry Error for the Difference in Sector Error in the previous specification. Results demonstrate that the structural variable Difference in Cash Flow Volatility subsumes the ability of misvaluation variable Industry Error to explain industry

merger activity. The estimated coefficient for Difference in V/B and Difference in Firm Error remain insignificant. The estimated coefficients for the structural shock variables Economic Shock Index and Dereg (1999) are positive and significant in over half of the model specifications, providing support for hypotheses H4 and H5. The high adjusted R^2 value of all the regression specifications, .74 to .82, demonstrates the power of the model specifications to explain industry merger activity.

It is possible that the findings thus far are attributable to the measure of takeover activity employed: annual merger count. To examine the sensitivity of our findings to the takeover activity measure used, we run the same test with a measure commonly used in the literature: merger intensity. We define merger intensity as the annual sum of all M&A deal values from our sample scaled by the sum of total assets of the banking industry in the same year.

<Insert Table 13 about here>

Table 13 reports the same test specifications employed in Table 12, but using annual merger intensity as the dependent variable in place of the annual merger count[5]. Results are largely consistent with those in Table 12; Cash Flow Volatility Difference significantly increases subsequent merger intensity. Target V/B and Industry Error shows some power to drive subsequent merger intensity, but that power is subsumed by the Difference in Cash Flow Volatility when tested jointly in the same specification. No other measure of misvaluation significantly drives merger intensity. Notably, the structural shock variables Economic Shock Index and Dereg (1999) are not significant in any of the model specifications.

[5] To deal with the very large outlying deal values attributable to the mega-mergers of the 1990s and 2000s, deal values are winsorized at the 5% and 95% level, by decade. Decade is chosen as a compromise to mitigate issues with inflation over the entire 30 year sample period and to provide sufficient number of observations to make winsorization effective.

Test results reported in Tables 12 and 13 provide valuable insight into the fundamental question addressed in this paper: do changes to industry fundamentals or stock price misvaluation drive industry-level merger activity? Results demonstrate that industry-level misvaluation and target firm long-run growth options are significant drivers of merger activity. However, the power of these variables to explain industry merger activity is subsumed by the difference in risk between the merged firms.

Combined with prior test results, the findings in this paper support the hypothesis that changes in industry fundamentals brought about by deregulation, particularly an increased reliance on volatile noninterest income revenue activities, produced an increasingly risky, profitable and heterogeneous industry that drove merger activity. This notion is supported by the fact that the difference in acquirer and target risk and level of target long-run growth options are significant drivers of merger activity. At the firm level, however, misvaluation plays an important role in determining who participates in the industry merger activity: acquirers have, on average, high firm-specific valuation and choose to buy targets with high growth options.

8. Summary and Conclusion

We study the U.S. banking industry over the past thirty years to provide new evidence about the determinants of merger activity. We use measures of economic shock, deregulatory legislative acts, stock misvaluation, and cash flow uncertainty to test competing neoclassical and misvaluation merger theories. Initial test results indicate that merger activity is significantly related to both structural industry change and industry-level stock price misvaluation; findings that are consistent with the M&A literature. Merger activity increases significantly following the two deregulatory acts examined (1994 and 1999). Additionally, merger activity is positively and

significantly linked to industry growth options and industry-level stock price misvaluation. However, further test results show that industry-level stock price misvaluation increases significantly with increases in industry-level cash flow volatility and that cash flow volatility increases with increases in fee revenue percentage. We tie the increase in industry revenue and cash flow volatility to increased industry competition after several deregulatory events.

Consistent with the findings in Rhodes-Kropf, Robinson, and Viswanathan (2005), we find that firm-level misvaluation is important in capturing who buys whom. During merger waves in the banking industry, banks with high short-run, firm-level valuations use stock to buy relatively undervalued banks with higher growth options. Thus, while the industry as a whole trades at discounts to average long-run multiples, the choice of which firms become a buyer or seller is determined by short-run, firm-level valuation. Tests that compare structural change with misvaluation theories show that firm-level differences in risk subsumes the power of industry-level misvaluation to explain industry merger activity. The level of target firm long-run growth options significantly drive merger activity.

The fact that the banking industry is undervalued at the industry level, as measured by the Rhodes-Kropf, Robinson, and Viswanathan (2005) Industry Error variable, is, to the best of our knowledge, a new finding and inconsistent with Rhodes-Kropf, Robinson, and Viswanathan's theory and overall findings. However, the relative difference is consistent with Rhodes-Kropf, Robinson, and Viswanathan (the acquirer is less undervalued than the target in all forms of payment). The fact that the whole industry, as well as the target and the acquirer, are undervalued, could cause both parties to misgauge synergies as Rhodes-Kropf, Robinson, and Viswanathan theorize. In this context, future research that examines the effects of deregulation on stock misvaluation in other industries could help solve this puzzle.

Taken together, the findings in this paper support the hypothesis that changes in industry fundamentals brought about by deregulation, particularly an increased reliance on volatile noninterest income revenue activities, produced an increasingly risky, profitable and heterogeneous industry. These volatile revenue streams, embraced by larger regional and national banks, prompted an industry evolution marked by an increase in the level and dispersion of risk throughout the industry over time. In turn, the widening dispersion of risk and profitability within the industry contributed to the increase in industry takeover activity. We use this collective evidence to conclude that structural industry change is the primary driver of industry takeover activity; a finding that supports the neoclassical theory of mergers.

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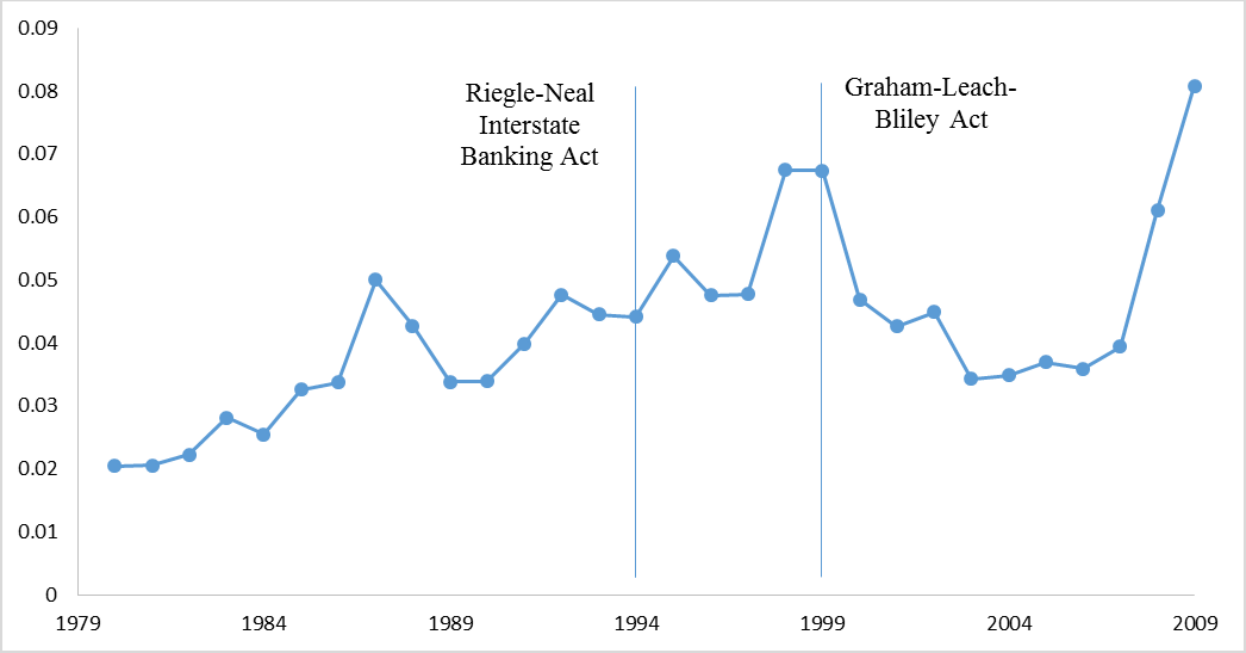

Figure 1:

Annual time-series of economic shock index values

This figure presents a time-series plot of the estimated values of an economic shock index. The index is based on Harford's (2005) measure; it is the first principal component of five economic shock variables. Each economic shock variable is measured as the median absolute change in the underlying economic variable, per industry year. The variables are: return on sales, return on assets, asset turnover, employee growth and sales growth.

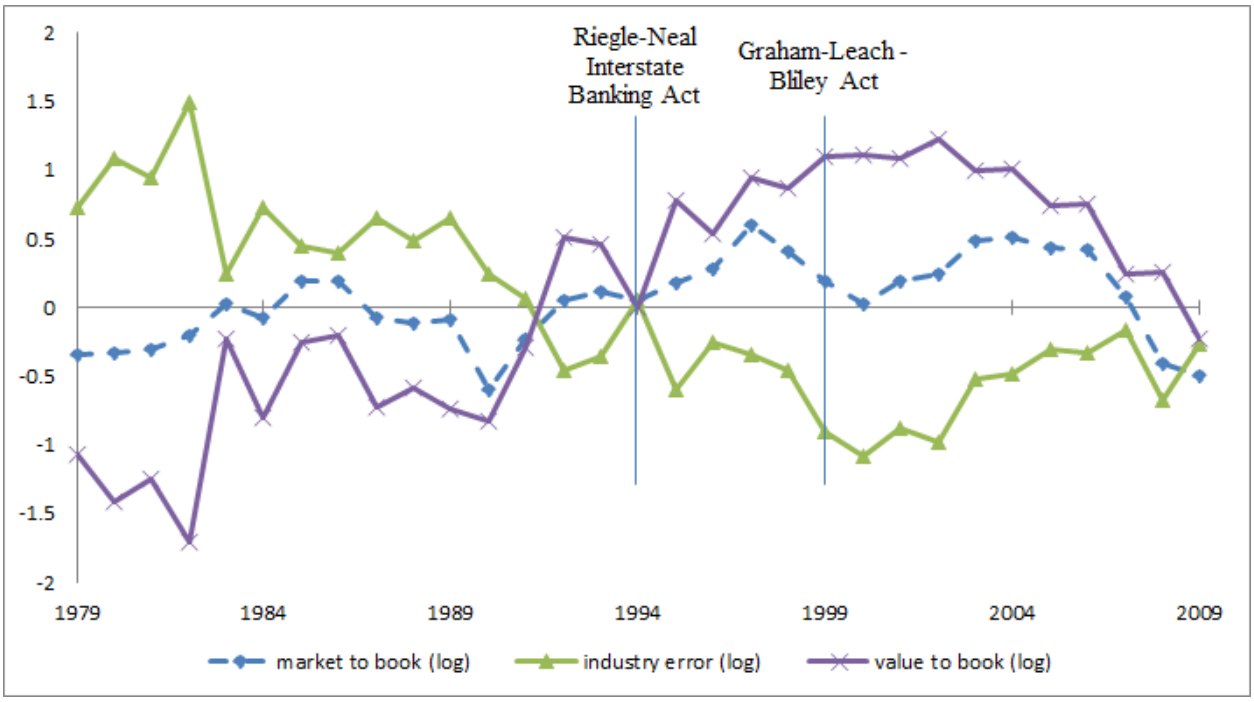

Figure 2:

Annual time-series of market to book decomposition

This figure presents a time-series plot of market to book (M/B) decomposition variables, estimated using the Rhodes-Kropf, Robinson, and Viswanathan (2005) M/B decomposition. The figure displays the value of the median annual M/B ratio of the industry, the median annual value to book (V/B) ratio of the industry and the median annual market to value (M/V) ratio of the industry. The values are displayed in lognormal format. V/B measures the component of market valuation that reflects growth opportunities based on long-run industry average multiples. M/V, or industry error, measures the component of market valuation that reflects potential misvaluation based on the deviation of short-run industry multiples from their long-run average values.

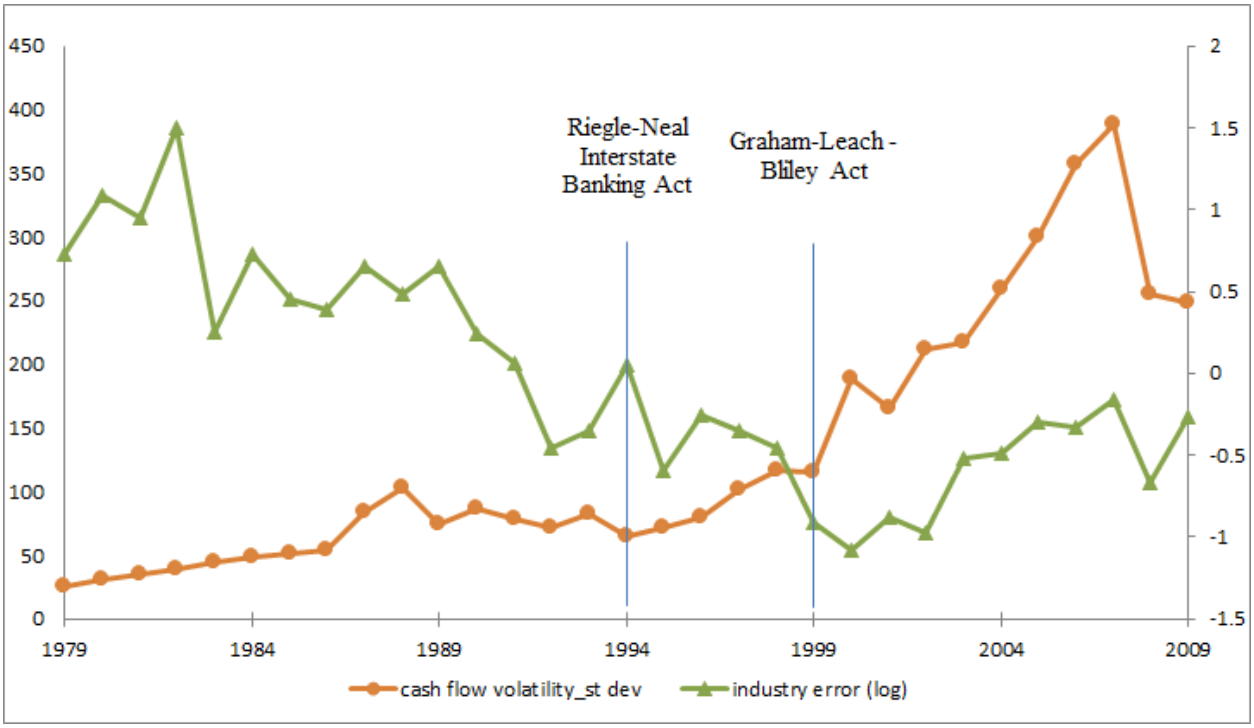

Figure 3:

Annual time-series comparison of industry error and volatility of industry cash flows

This figure presents a time-series plot of industry valuation error for the banking industry as compared to annual cash flow volatility of the banking industry. Industry valuation error is a proxy for industry level stock misvaluation; the measure is calculated using the Rhodes-Kropf, Robinson, and Viswanathan (2005) M/B decomposition. Cash flow volatility, a proxy for cash flow uncertainty, is the standard deviation of firms' past twenty periods of quarterly cash flow, measured as the firm's operating income before depreciation, and scaled by quarter-end firm total assets. Cash flow volatility_st dev is the annual cross sectional standard deviation of cash flow volatility across the banking industry.

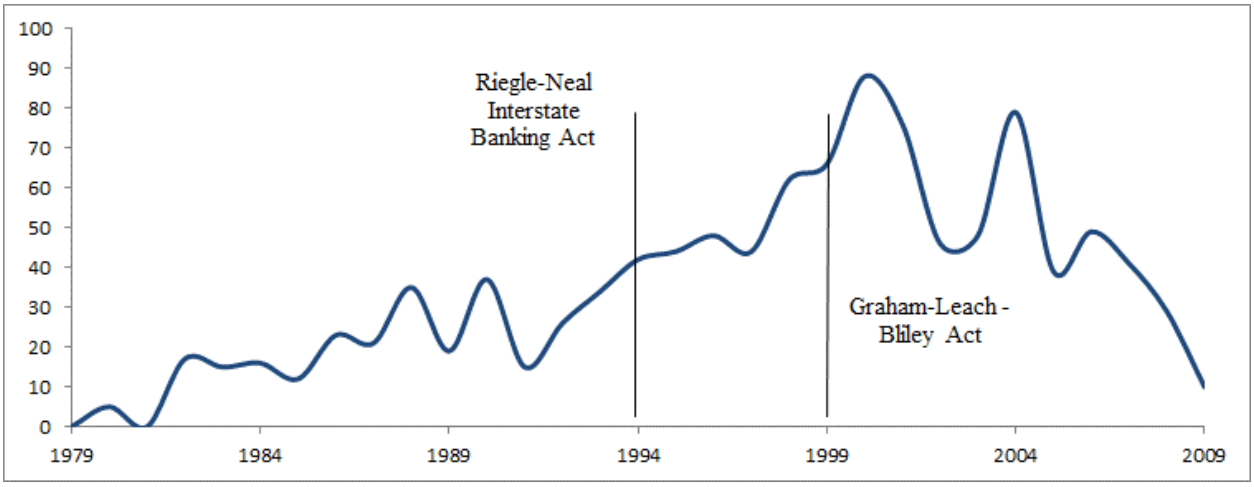

Figure 4:

Annual time-series of merger activity

This figure presents a time-series plot of the number of annual mergers for the sample period 1979 to 2009.

Table 1:

Summary statistics of explanatory variables

This table presents summary statistics for the explanatory variables employed in the regression analysis for the period from 1980 to 2009. Economic shock index is measured each year as the first principal component of the median absolute change in five economic variables: sales/assets, net income/sales, ROA, sales growth, and employee growth. Dereg (1999) is a deregulation indicator variable that identifies a 5-year window from two years before to two years after the 1999 Gramm-Leach-Bliley deregulatory legislation was signed. Cash flow volatility is the standard deviation of firms' past twenty periods of quarterly cash flow, measured as the firm's operating income before depreciation and scaled by quarter-end firm total assets. Cash flow volatility_std. dev. is the natural log transformation of the annual cross sectional standard deviation of cash flow volatility across the banking industry. Cash flow volatility difference is the difference in cash flow volatility between acquirers and targets. Fee revenue percentage_median is calculated annually as the median industry ratio of firm trading plus fee revenue as a percentage of total revenue. The variable revenue volatility_median is the median of annual industry revenue volatility. Revenue volatility is calculated annually as the standard deviation of 5 years of firm total revenue and scaled by year-end firm total assets. Firm error (proxy for firm misvaluation), time-series sector error, industry error (proxy for industry misvaluation) and V/B (proxy for fundamental value-to-book) are computed using the Rhodes-Kropf, Robinson, and Viswanathan (2005) market-to-book equity ratio decomposition. Firm error difference, time-series sector error difference and V/B difference are the difference in the respective measures between acquirers and targets. ROA_median is the annual median industry return on assets; used as a proxy for competition. Turnover is defined as the number of exits and entries from the industry and is a proxy for the market power of the firms within the industry. HH Index is the Herfindahl-Hirschman index of industry concentration, the sum of the squared market shares (sales/total industry sales) of firms in an industry in a given year. ROS_dispersion is the cross-sectional standard deviation of the return on sales (cash flow/sales).

Summary statistics	Mean	Median	Min	Max	Std. dev.	Annual obs.
Econ. shock index	0.04	0.04	0.02	0.07	0.01	29
Dereg (1999)	0.17	0.00	0.00	1.00	0.38	29
Cash flow vol._std. dev.	4.61	4.43	3.42	5.96	0.72	29
Fee revenue %_median	0.14	0.06	0.03	0.36	0.13	29
Revenue vol._median	0.01	0.01	0.01	0.01	0.00	29
Industry error	-0.27	0.06	-4.44	4.06	2.51	29
V/B	0.12	0.26	-1.70	1.23	0.85	29
Acquirer firm error	0.45	0.48	0.04	0.73	0.19	26
Acquirer time-series sector error	-0.14	-0.35	-0.93	1.02	0.58	26
Target V/B	0.18	0.40	-1.39	1.24	0.79	26
Cash flow vol._difference	29.86	24.59	-12.31	68.90	19.06	26
Firm error_difference	0.27	0.29	-0.86	0.79	0.32	26
Industry error_difference	0.04	0.02	-0.14	0.48	0.14	26
V/B_difference	-0.04	-0.04	-0.36	0.36	0.15	26
ROA_median	0.02	0.02	0.01	0.03	0.00	29
Turnover	0.06	0.05	0.02	0.11	0.03	29
HH index	0.04	0.04	0.02	0.09	0.02	29
ROS_dispersion	0.17	0.16	0.12	0.24	0.03	29

Table 2:

Annual time-series of industry merger rate

This table reports the time-series distribution of merger activity for U.S. public banks traded on the NYSE, Amex and Nasdaq stock exchanges, over the 1979 to 2009 sample period. The industry is defined as Fama and French industry code 45 (Banks), comprised of SIC codes 6000 to 6199: commercial banks, savings and loans and other depository institutions. The sample is restricted to domestic public banks; it excludes foreign incorporated firms and ADRs.

Year	Industry	Merger count	% of industry
1979	212	0	0.0
1980	217	5	2.3
1981	226	0	0.0
1982	223	17	7.6
1983	285	15	5.3
1984	317	16	5.0
1985	371	12	3.2
1986	495	23	4.6
1987	595	21	3.5
1988	587	35	6.0
1989	580	19	3.3
1990	544	37	6.8
1991	533	15	2.8
1992	559	26	4.7
1993	633	34	5.4
1994	671	42	6.3
1995	722	44	6.1
1996	800	48	6.0
1997	839	44	5.2
1998	882	62	7.0
1999	861	66	7.7
2000	797	88	11.0
2001	750	76	10.1
2002	727	46	6.3
2003	710	48	6.8
2004	664	79	11.9
2005	654	39	6.0
2006	629	49	7.8
2007	598	41	6.9
2008	564	29	5.1
2009	522	10	1.9
Total		1086	
Annual average	573	35	5.8

Table 3:

Merger activity before and after deregulation

This table presents yearly averages of industry-level merger activity 5 years before and 5 years after banking deregulatory acts passed in 1994 and 1999. The variable M&A count is annual merger count. t(diff) is the *t*-statistic of the difference in the means.

	5 year averages			
Variable	Before	After	% increase	t(diff)
Panel A:	*1989 to 1993*	*1994 to 1998*		
M&A count	26.2	48.0	83%	(3.92) ***
Panel B:	*1994 to 1998*	*1999 to 2003*		
M&A count	48.0	64.8	35%	(1.90)

The symbol *** denotes statistical significance at the 0.001 level.

Table 4:

Regression of annual merger count on lagged explanatory variables

This table presents the results from OLS regression analysis of annual merger count (time *t=0*) on lagged one year (time *t=-1*) explanatory variables for the 1980 to 2009 sample period. Merger activity (count) is the number of annual mergers across the sample period. Economic shock index is measured each year as the first principal component of the median absolute change in five economic variables: sales/assets, net income/sales, ROA, sales growth, and employee growth. Dereg (1999) is a deregulation indicator variable that identifies a 5-year window from two years before to two years after the 1999 Gramm-Leach-Bliley deregulatory legislation was signed. Industry error (proxy for industry misvaluation) and V/B (proxy for fundamental value-to-book) are computed using the Rhodes-Kropf, Robinson, and Viswanathan (2005) market-to-book equity ratio decomposition. HH index is the Herfindahl-Hirschman index of industry concentration, the sum of the squared market shares (sales/total industry sales) of firms in an industry in a given year. ROS_dispersion is the cross-sectional standard deviation of the return on sales (cash flow/sales). Newey-West corrected *t*-statistics are reported in parentheses.

Dependent variable = merger activity (count)				
Explanatory variables	(1)	(2)	(3)	(4)
Econ. shock index	9.0	37.7	38.2	43.0 **
	(0.27)	(1.14)	(1.81)	(2.85)
Dereg (1999)	18.7 *	16.0	12.6	8.4
	(2.56)	(1.72)	(2.46)	(1.69)
Industry error		-4.3 ***		-4.0 **
		(3.94)		(2.96)
V/B	15.2 ***		8.3 *	
	(4.42)		(2.37)	
HH index			-214.3 *	-379.4 **
			(2.73)	(3.39)
ROS_dispersion			-256.5 **	-247.4 ***
			(3.55)	(4.45)
Constant	28.5 *	18.0	71.0 ***	75.2 ***
	(2.34)	(1.62)	(5.75)	(7.66)
Adj. R-Square	0.67	0.63	0.75	0.79
Observations	29	29	29	29

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 5:

Regression of revenue volatility on explanatory variables

This table presents the results from OLS regression analysis of median revenue volatility on contemporary explanatory variables for the 1979 to 2009 sample period. The variable Revenue volatility_median is the median of annual industry revenue volatility. Revenue volatility is calculated annually as the standard deviation of 5 years of firm total revenue. ROA_median is the annual median industry return on assets; used as a proxy for competition. Turnover is defined as the number of exits and entries from the industry and is a proxy for the market power of the firms within the industry. Dereg (1999) is a deregulation indicator variable that identifies a 5-year window from two years before to two years after the 1999 Gramm-Leach-Bliley deregulatory legislation was signed. Economic shock index is measured each year as the first principal component of the median absolute change in five economic variables: sales/assets, net income/sales, ROA, sales growth, and employee growth. ROS_dispersion is the cross-sectional standard deviation of the return on sales (cash flow/sales).

Dependent variable = revenue volatility_median			
Explanatory variables	(1)	(2)	(3)
ROA_median	-808,670 **	-828,605 **	-1,404,735 ***
	(3.06)	(3.27)	(6.44)
Turnover		-22,188	-33,520
		(0.77)	(1.60)
Dereg (1999)		1,244	-3,204
		(0.49)	(1.57)
Econ. shock index		14,801 *	23,795 ***
		(2.24)	(4.65)
ROS_dispersion			-101,141 ***
			(4.88)
Constant	23,034 ***	18,262 *	46,033 ***
	(3.91)	(2.65)	(6.09)
Adj. R-Square	0.22	0.35	0.66
Observations	30	30	30

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 6:

Regression of cash flow volatility on explanatory variables

This table presents the results from OLS regression analysis of the standard deviation of cash flow volatility on explanatory variables for the 1980 to 2009 sample period. Cash flow volatility is the standard deviation of firms' past twenty periods of quarterly cash flow, measured as the firm's operating income before depreciation and scaled by quarter-end firm total assets. Cash flow volatility_std. dev. is the natural log transformation of the annual cross sectional standard deviation of cash flow volatility across the banking industry. Fee revenue percentage_median, lagged one year (time *t=-1),* is calculated annually as the median industry ratio of firm trading plus fee revenue as a percentage of total revenue. The variable Revenue volatility_median, lagged one year (time *t=-1),* is the median of annual industry revenue volatility. Revenue volatility is calculated annually as the standard deviation of 5 years of firm total revenue and scaled by year-end firm total assets. ROA_median is the annual median industry return on assets; used as a proxy for competition. Turnover is defined as the number of exits and entries from the industry and is a proxy for the market power of the firms within the industry. ROS_dispersion is the cross-sectional standard deviation of the return on sales (cash flow/sales). Dereg (1999) is a deregulation indicator variable that identifies a 5-year window from two years before to two years after the 1999 Gramm-Leach-Bliley deregulatory legislation was signed. Economic shock index is measured each year as the first principal component of the median absolute change in five economic variables: sales/assets, net income/sales, ROA, sales growth, and employee growth. Newey-West corrected *t*-statistics are reported in parentheses.

Dependent variable = cash flow volatility_standard deviation				
Explanatory variables	(1)	(2)	(3)	(4)
Fee revenue %_median	4.9 ***		5.4 ***	
	(9.51)		(9.46)	
Revenue vol._median		203.6 ***		141.7 ***
		(5.22)		(4.14)
ROA_median			26.7	-38.0
			(1.90)	(2.03)
Turnover			1.6	-0.8
			(1.13)	(0.31)
ROS_dispersion			2.1	-10.2 **
			(1.09)	(3.59)
Dereg (1999)			-0.1	-0.5
			(0.83)	(1.94)
Econ. shock index			0.9	2.2 *
			(1.74)	(2.17)
Constant	4.0 ***	2.8 ***	2.6 **	5.2 ***
	(31.47)	(7.00)	(3.23)	(4.54)
Adj. R-Square	0.83	0.36	0.83	0.57
Observations	29	29	29	29

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 7:

Cash flow volatility before and after deregulation

This table presents yearly averages of inter-firm dispersion in cash flow volatility 5 years before and 5 years after banking deregulatory acts passed in 1994 and 1999. Cash flow volatility is the standard deviation of firms' past twenty periods of quarterly cash flow, measured as the firm's operating income before depreciation, and scaled by quarter-end firm total assets. The variable Cash flow volatility, st dev is the standard deviation of cash flow volatility across the banking industry. t(diff) is the *t*-statistic of the difference in the means.

	5 year averages			
Variable	Before	After	% increase	t(diff)
Panel A:	*1989 to 1993*	*1994 to 1998*		
Cash flow volatility _standard deviation	79.06	86.88	10%	(0.78)
Panel B:	*1994 to 1998*	*1999 to 2003*		
Cash flow volatility _standard deviation	86.88	179.59	107%	(4.44) ***

The symbol *** denotes statistical significance at the 0.001 level.

Table 8:

Regression of industry valuation error on explanatory variables

This table presents the results from OLS regression analysis of Industry error on contemporary explanatory variables for the 1979 to 2009 sample period. Industry error is a proxy for industry misvaluation; it is computed using the Rhodes-Kropf, Robinson, and Viswanathan (2005) market-to-book equity ratio decomposition. Cash flow volatility is the standard deviation of firms' past twenty periods of quarterly cash flow, measured as the firm's operating income before depreciation and scaled by quarter-end firm total assets. Cash flow volatility_std. dev. is the natural log transformation of the annual cross sectional standard deviation of cash flow volatility across the banking industry. Economic shock index is measured each year as the first principal component of the median absolute change in five economic variables: sales/assets, net income/sales, ROA, sales growth, and employee growth. Dereg (1999) is a deregulation indicator variable that identifies a 5-year window from two years before to two years after the 1999 Gramm-Leach-Bliley deregulatory legislation was signed. ROA_median is the annual median industry return on assets; used as a proxy for competition. Turnover is defined as the number of exits and entries from the industry and is a proxy for the market power of the firms within the industry. ROS_dispersion is the cross-sectional standard deviation of the return on sales (cash flow/sales).

Dependent variable = industry error				
Explanatory variables	(1)	(2)	(3)	(4)
Cash flow vol._std. dev.	-2.4 ***	-2.6 ***	-2.5 ***	-2.0 ***
	(5.63)	(6.44)	(6.12)	(4.12)
Econ. shock index	3.2	2.8	3.1	-0.5
	(1.34)	(1.26)	(1.35)	(0.19)
Dereg (1999)	-3.2 ***	-2.6 **	-3.1 ***	-1.7
	(3.94)	(3.45)	(4.01)	(2.01)
ROA_median		-188.7 *		-53.5
		(2.43)		(0.54)
Turnover			-17.6	
			(1.92)	
ROS_dispersion				21.0
				(2.01)
Constant	10.3 ***	15.2 ***	11.7 ***	7.0
	(5.64)	(5.78)	(6.20)	(1.47)
Adj. R-Square	0.64	0.70	0.67	0.73
Observations	30	30	30	30

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 9:

Risk and valuation components of merged firms

This table presents the risk and valuation components for the firms involved in mergers during the 1980 to 2009 sample period in which both acquirer and target are public. Cash flow volatility_std. dev. is the standard deviation of firm cash flow volatility; average is the mean of firm cash flow volatility. M/B is the market to book ratio of the firm. Firm error (proxy for firm misvaluation), time-series sector error (proxy for industry misvaluation) and V/B (proxy for fundamental value-to-book) are computed using the Rhodes-Kropf, Robinson, and Viswanathan (2005) market-to-book equity ratio decomposition.

Risk and valuation measures	Acquirer	Target	t(diff)
Panel A: all mergers			
Cash flow vol._average	51.6	21.3	3.49 ***
Cash flow vol._st. dev.	189.4	64.8	3.85 ***
Panel B: all mergers			
Firm error	0.457	0.167	15.84 ***
Time-series sector error	-0.507	-0.532	2.36 *
V/B	0.707	0.760	3.77 ***
M/B	0.656	0.396	12.35 ***
N	426	426	
Panel C: stock-only mergers			
Firm error	0.543	0.205	13.29 ***
Time-series sector error	-0.480	-0.515	2.41 *
V/B	0.695	0.748	2.52 *
M/B	0.759	0.438	10.29 ***
N	228	228	
Panel D: cash-only mergers			
Firm error	0.326	0.021	5.29 ***
Time-series sector error	-0.591	-0.599	0.24
V/B	0.666	0.777	3.31 ***
M/B	0.400	0.199	3.77 ***
N	56	56	
Panel E: mixed mergers			
Firm error	0.372	0.163	7.35 ***
Time-series sector error	-0.517	-0.529	0.77
V/B	0.740	0.771	1.37
M/B	0.595	0.405	5.96 ***
N	142	142	

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 10:

Merger and acquisition deals by method of payment

This table presents a breakdown of method of merger payment for the sample of merger observations analyzed in this paper. The column labeled overall sample reports statistics for the mergers of public and private firms. The column labeled data sample reports statistics for the mergers in which both acquirer and target are public. Stock only represents mergers for which the payment is all stock; cash only for which the payment is all cash and mix of stock and cash for which the payment is a mix of stock and cash.

Method of payment	Overall sample	Data sample
Stock only	52%	54%
Cash only	20%	13%
Mix of stock and cash	27%	33%
N	838	426

Table 11:

Method of payment likelihood regression

This table presents the results from probit regression analysis of method of merger payment on explanatory variables for the sample of merger observations. M/B is the market to book ratio of the firm. Firm error (proxy for firm misvaluation), time-series sector error (proxy for industry misvaluation) and V/B (proxy for fundamental value-to-book) are computed using the Rhodes-Kropf, Robinson, and Viswanathan (2005) market-to-book equity ratio decomposition.

Dependent variable: stock = 1, not stock =0						
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)
M/B	0.66 ***					
	(21.48)					
Firm error		0.98 ***			0.98 ***	1.02 ***
		(26.10)			(26.01)	(27.12)
Time-series sector error			0.27			0.67 **
			(2.46)			(5.55)
V/B				-0.05	-0.03	0.33
				(0.17)	(0.07)	(2.80)
Constant	-0.33 ***	-0.35 **	0.23 *	0.13	-0.32 *	-0.26
	(8.81)	(10.51)	(4.69)	(1.55)	(5.46)	(3.33)
Log Likelihood	-280.84	-277.98	-291.42	-292.60	-277.94	-274.98
χ^2	23.68	29.42	2.53	0.17	29.49	35.42
Observations	426	426	426	426	426	426

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 12:

Regression of annual merger count on lagged explanatory variables

This table presents the results from OLS regression analysis of annual merger count on explanatory variables for the 1980 to 2009 sample period. Merger activity (count) is the number of annual mergers across the sample period. Cash flow volatility_std. dev. is the natural log transformation of the annual cross sectional standard deviation of Cash Flow Volatility across the banking industry. Firm error (proxy for firm misvaluation), time-series sector error, industry error (proxies for industry misvaluation) and V/B (proxy for fundamental value-to-book) are computed using the Rhodes-Kropf, Robinson, and Viswanathan (2005) market-to-book equity ratio decomposition. Firm error difference, time-series sector error difference and V/B difference are the difference in the respective measures between acquirers and targets. Cash flow volatility difference is the difference between acquirer and target cash flow volatility. Economic shock index is measured each year as the first principal component of the median absolute change in five economic variables: sales/assets, net income/sales, ROA, sales growth, and employee growth. Dereg (1999) is a deregulation indicator variable that identifies a 5-year window from two years before to two years after the 1999 Gramm-Leach-Bliley deregulatory legislation was signed. HH index is the Herfindahl-Hirschman index of industry concentration, the sum of the squared market shares (sales/total industry sales) of firms in an industry in a given year. ROS_dispersion is the cross-sectional standard deviation of the return on sales (cash flow/sales). Newey-West corrected *t*-statistics are reported in parentheses.

Panel A: Dependent Variable = Merger Activity (Count)										
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cash flow vol._st. dev.	4.7			7.5 *		6.2				
	(1.59)			(2.29)		(1.67)				
Cash flow vol. difference		0.5 ***			0.6 **		0.7 **	0.8 **	0.7 **	0.6 **
		(4.27)			(3.01)		(3.40)	(3.26)	(3.29)	(3.20)
Acquirer firm error			-15.8	-30.8 **	-13.9					
			(2.06)	(3.01)	(1.57)					
Firm error difference								-1.5	-4.3	-0.4
								(0.35)	(0.95)	(0.06)
Acquirer time-series sector error						-10.6 *	-6.1			
						(2.30)	(1.40)			
Time-series sector error difference									-9.9	2.3
									(1.00)	(0.17)
Target V/B			15.8 **	12.9 *	7.3					
			(3.44)	(2.77)	(1.51)					
V/B difference								-6.8	-7.4	-2.7
								(0.92)	(0.97)	(0.30)
Industry error	-3.4 *	-2.3								-2.1
	(2.27)	(1.71)								(1.35)
Econ. shock index	35.1 *	60.4 ***	119.9 *	63.8 *	53.3	28.7	42.1	60.5 *	61.8 *	52.5
	(2.11)	(4.15)	(2.23)	(2.80)	(1.92)	(0.82)	(1.44)	(2.51)	(2.66)	(2.05)
Dereg (1999)	11.0	7.1	9.7	12.0 *	8.8 *	14.0 **	9.6 *	9.3 **	10.5 **	7.5
	(2.03)	(1.80)	(1.96)	(2.53)	(2.50)	(2.89)	(2.73)	(2.98)	(3.59)	(1.80)
HH index	-464.2 ***	-358.4 ***	-62.7		-379.3 *	-414.7	-506.7 *	-439.0	-443.9 *	-464.5
	(3.86)	(4.33)	(0.66)		(2.30)	(1.80)	(2.77)	(2.13) *	(2.12)	(2.08)
ROS_dispersion	-239.5 ***	-117.9	-65.8	40.2	-58.6	-292.3 **	-182.7 *	-152.7	-142.8	-140.4
	(4.86)	(1.87)	(1.03)	(0.55)	(1.07)	(3.14)	(2.46)	(1.95)	(1.76)	(1.92)
Constant	58.7 ***	32.6 *	35.7	-18.8	25.7	60.1	49.4	31.9	31.2	39.7
	(4.15)	(2.14)	(1.84)	(0.77)	(1.45)	(2.06)	(2.05)	(1.44)	(1.41)	(1.64)
Adj. R-Square	0.78	0.82	0.75	0.77	0.80	0.74	0.80	0.78	0.77	0.77
Observations	29	29	26	26	26	26	26	26	26	26

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.

Table 13:

Regression of annual deal value on lagged explanatory variables

This table presents the results from OLS regression analysis of annual aggregate deal value on explanatory variables for the 1980 to 2009 sample period. All explanatory variables are defined in Table 12. Newey-West corrected *t*-statistics are reported in parentheses.

Panel A: Dependent Variable = Merger Intensity (Deal Value)										
Explanatory Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Cash flow vol._st. dev.	0.0001			0.0001		0.0003				
	(0.19)			(0.20)		(0.93)				
Cash flow vol. difference		0.00002			0.00005 *		0.00005 **	0.0001 **	0.0001 ***	0.00005 **
		(1.28)			(2.60)		(3.06)	(3.76)	(4.00)	(2.97)
Acquirer firm error			-0.0010	-0.0014	-0.0008					
			(1.36)	(1.11)	(1.17)					
Firm error difference								0.0002	-0.0004	-0.0002
								(0.78)	(1.15)	(0.59)
Acquirer time-series sector error						-0.0008	-0.0004			
						(1.89)	(0.82)			
Time-series sector error difference									-0.0022	-0.0017
									(1.69)	(1.08)
Target V/B			0.0012 *	0.0011 *	0.0006					
			(2.74)	(2.37)	(1.09)					
V/B difference								0.0010	0.0009	0.0011
								(1.24)	(1.10)	(1.70)
Industry error	-0.0003 *	-0.0002								-0.0001
	(2.18)	(1.75)								(0.75)
Econ. shock index	0.0017	0.0024	-0.0001	0.0014	0.0003	-0.0009	-0.0001	0.0010	0.0013	0.0009
	(1.14)	(1.65)	(0.02)	(0.50)	(0.10)	(0.27)	(0.03)	(0.53)	(0.73)	(0.45)
Dereg (1999)	0.0005	0.0004	0.0007	0.0006	0.0006	0.0009	0.0007	0.0006	0.0008	0.0007
	(0.76)	(0.70)	(0.93)	(0.94)	(0.94)	(1.31)	(1.01)	(1.00)	(1.43)	(1.20)
HH index	-0.0207 *	-0.0187 *	-0.0153 *		-0.0379 *	-0.0353 *	-0.0466 **	-0.0488 **	-0.0499 ***	-0.0508 ***
	(2.71)	(2.36)	(1.60)		(2.78)	(2.14)	(3.73)	(3.78)	(4.06)	(4.26)
ROS_dispersion	-0.0293 ***	-0.0246 ***	-0.0244 **	-0.0180 *	-0.0239 **	-0.0408 ***	-0.0325 ***	-0.0332 ***	-0.0310 ***	-0.0309 ***
	(7.15)	(5.41)	(3.40)	(2.24)	(3.77)	(6.22)	(8.86)	(7.85)	(7.52)	(9.07)
Constant	0.0066 ***	0.0053 **	0.0070 ***	0.0045	0.0062 ***	0.0091 ***	0.0077 ***	0.0073 ***	0.0071 ***	0.0075 ***
	(4.59)	(3.61)	(4.24)	(1.59)	(4.15)	(4.83)	(4.42)	(5.82)	(6.08)	(5.67)
Adj. R-Square	0.79	0.79	0.76	0.75	0.80	0.75	0.80	0.79	0.80	0.79
Observations	29	29	26	26	26	26	26	26	26	26

The symbols ***, **, and * denote statistical significance at the .001, 0.01 and 0.05 levels, respectively.