Historical Patterns and Recent Changes in the Relationship between Bank Holding Company Size and Risk

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The number of banks in the United States fell from about 14,500 in the early 1980s to about 11,000 a decade later, and the average bank asset size rose by about 40 percent in inflation-adjusted terms. This trend toward fewer, larger banks raises an interesting question: How does the size of a banking company affect the amount and type of risk it takes? The answer is important for policymakers concerned with banking system risk.

This article investigates the relationship between asset size and risk at bank holding companies from 1987 to 1993.[1] We find that for most of this period, the *level* of risk at large bank holding companies did not differ significantly from that at small bank holding companies. However, we do find some significant differences in the *nature* of that risk. Although the advantage of size has allowed larger institutions to diversify their risk, differences in activities and leverage have counterbalanced this diversification advantage, leaving large bank holding companies with no less risk than small companies throughout most of the period that we examine.

Since 1991, however, a different pattern has begun to emerge. The lending patterns and off-balance-sheet activities of large and small bank holding companies have evolved and, most important, differences in the leverage of large and small companies have declined significantly. Consequently, the diversification advantage of size has become apparent, and we have begun to observe an inverse relationship between size and risk.

We suggest that the recent reduction in risk at large bank holding companies relative to small companies may stem from the regulatory reforms of the early 1990s. Implementation of risk-based capital requirements has most strongly affected banking companies that have had low capital ratios and have engaged heavily in risky lending and off-balance-sheet activities, characteristics generally associated with large banking companies. Moreover, the largest banking companies may now face additional pressure to reduce risk as a result of the Federal Deposit

Insurance Corporation Improvement Act, which strengthens market discipline by directing regulators to back away from a "too-big-to-fail" policy.

The Relationship between Size and Risk

We use information on the stock returns of publicly traded bank holding companies to measure their risk. In particular, our analysis is based on "equity risk," defined as the degree to which a bank holding company's weekly stock return fluctuates over a one-year period. Equity risk is a summary measure associated with the holding company as a whole—that is, it captures risk stemming from all of the holding company's subsidiaries and reflects diversification across them.

This approach has many advantages, but also some drawbacks—mainly that it limits our analysis to those bank holding companies that have publicly traded equity. The main advantage of our approach is that it provides a forward-looking measure of risk, since stock market valuations reflect the expectations of market participants (such as analysts and investors) regarding the future profitability of banking institutions. A second advantage is that it facilitates measurement of both risk and diversification using a single methodology, described below.

A Risk Decomposition

Our analysis draws upon two underlying principles of portfolio theory: (1) diversification reduces risk and (2) the potential for diversification increases with the size of a portfolio. We apply these principles to the banking institution. In particular, if a large bank holding company is nothing more than a scaled-up version of a small bank holding company, then we should expect large companies to exhibit lower risk because of the benefits of diversification. Both small and large bank holding companies engage in loan origination and loan funding, with large companies generally having access to a broader deposit base and a wider variety of borrowers. Portfolio theory would suggest that this diversification potential works to reduce the risk of large bank holding companies.[2] If, however, there are fundamental differences in the nature of the assets, liabilities, and off-balance-sheet positions of large and small bank holding companies, then large companies might not exhibit lower risk than small companies.

In our analysis, we divide equity risk into two components and calculate the relationship between asset size and each risk component. The first risk component, *systematic risk*, measures equity return variability related to underlying economic conditions affecting the banking industry as a whole. The remaining variability in stock returns, *firm-specific risk*, measures equity return variability unique to each company. Each component is derived by measuring the extent to which a given company's stock return tracks the stock returns of a large sample of bank holding companies (see appendix).[3]

This risk decomposition provides a convenient way to measure the role of diversification in explaining the relationship between size and risk at bank holding companies. Because the poorly diversified banking company is subject to shocks stemming from industrial, regional, or other types of asset or liability concentrations, it is likely to display a large amount of firm-specific risk—risk that a well-diversified company is much more likely to avoid. Diversification cannot help the well-diversified company eliminate systematic risk, however, since this risk is related to broad underlying economic conditions affecting the banking industry as a whole.

Systematic risk measures equity return variability related to underlying economic conditions. . . . Firm-specific risk measures equity return variability unique to each company.

Consider a hypothetical example: Suppose two bank holding companies have similar levels of total equity risk, but the first company's risk is predominately firm-specific.[4] We would conclude that the first company is less diversified than the second. We would also conclude that if

the first company were to increase its diversification (for example, by expanding the scope of its lending to new industries or regions of the country), then its firm-specific risk would decrease. With no concurrent increase in systematic risk, the overall equity risk of the company would decrease by the same amount.

Using the same reasoning, we make the following claim: If large bank holding companies are simply scaled-up, better diversified versions of small bank holding companies, then the greater a company's size, the lower its firm-specific risk. Since diversification reduces only firm-specific risk, however, we should observe no relationship between size and systematic risk. As in our hypothetical example, the end result would be an inverse relationship between size and total equity risk.

Of course, if large bank holding companies are not simply scaled-up versions of small companies, these relationships may not hold. For instance, if large companies pursue riskier activities, we may observe a positive relationship between size and either of the two components of equity risk, even if large bank holding companies are more diversified. The relationship between size and total equity risk would then be ambiguous.

Empirical Evidence

We now turn to empirical evidence to determine which of these two characterizations is more accurate. That is, can large bank holding companies be characterized simply as scaled-up, better diversified versions of small companies, or are there fundamental differences between the assets, liabilities, and off-balance-sheet positions of large and small institutions?

Our answer is based on an analysis of approximately 100 bank holding companies.[5] We measure holding company size using total assets. Since we must restrict our attention to publicly traded companies, our sample asset size distribution is not representative of all bank holding companies, but it does provide ample variation. For instance, the asset sizes in our sample in 1993 ranged from $340 million to $214 billion, with a median of $10 billion. Taken as a group, the companies in our original sample held a little less than half of all commercial banking assets in the United States in 1993.

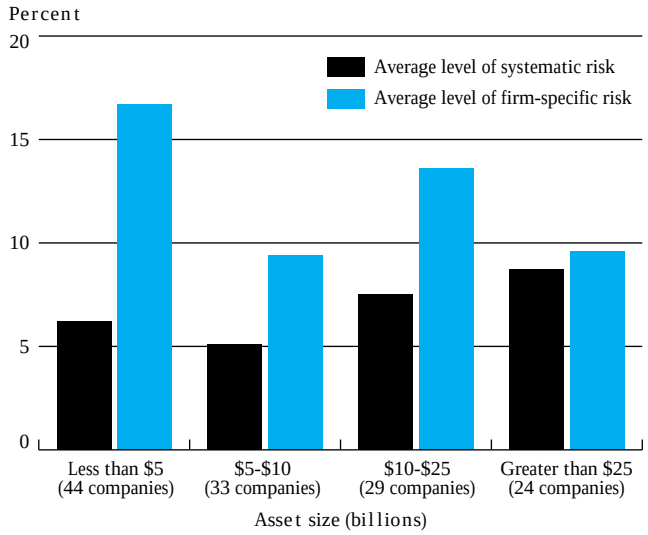
Using data from 1987 to 1993, Chart 1 illustrates the empirical relationships between size and each of the two components of equity risk.[6] Once asset size exceeds $5 billion, we observe a positive relationship between asset size and systematic risk. Firm-specific risk is highest for the smallest size group but otherwise bears little relationship to size. Note that the mix between systematic and firm-specific risk at large bank holding companies (those with assets of more than $25 billion) is very different from the mix at small companies (those with assets of less than $5 billion). In particular, firm-specific risk makes a bigger contribution to total equity risk at small companies than at large ones. (That contribution falls from 73 percent to 53 percent as asset size increases.)

Firm-specific risk makes a bigger contribution to total equity risk at small companies.

By combining the two components of risk, Chart 2 shows how total equity risk varies with holding

Chart 1

Relationship between Bank Holding Company Size and Risk Components, 1987-93



Source: Authors' calculations, based on data from the Center for Research in Security Prices and the consolidated financial statements of a sample of publicly traded bank holding companies.

company size. We see little discernible relationship between asset size and total equity risk.

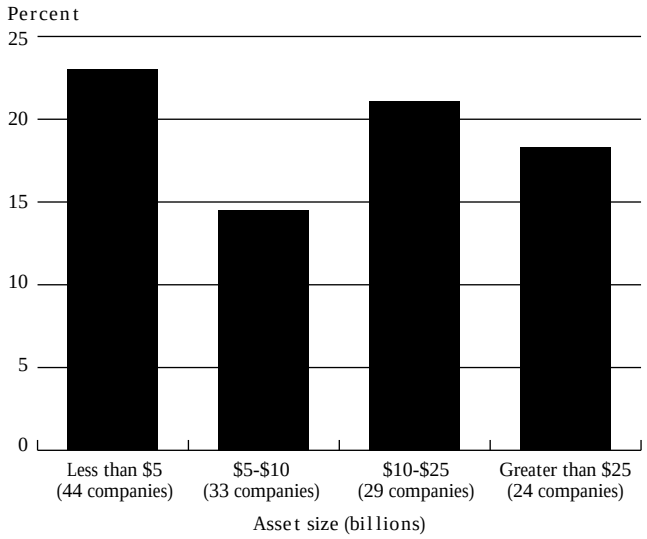
The patterns illustrated in these charts provide empirical support for the idea that size enhances diversification, since firm-specific risk makes a smaller contribution to total equity risk at large bank holding companies. However, size also appears to lead to an increased appetite for certain risky activities: systematic risk (unaffected by diversification) increases by 70 percent as we move from companies with $5 billion to $10 billion in assets to those with more than $25 billion. The different activities of small and large bank holding companies may also affect how firm-specific risk varies with size, masking the negative relationship that we would expect to see if large bank holding companies were simply scaled-up, better diversified versions of small companies.

Risky Business: How Portfolios Differ

Fundamental disparities in the portfolios of small and large bank holding companies are indeed important in understanding the differences in their risk characteristics.

Chart 2

Relationship between Bank Holding Company Size and Total Risk, 1987-93



Source: Authors' calculations, based on data from the Center for Research in Security Prices and the consolidated financial statements of a sample of publicly traded bank holding companies.

Note: Each bar indicates the average level of total risk (systematic risk plus firm-specific risk) for bank holding companies in a given size group.

Throughout most of the period that we examine, large companies were more likely to engage in certain risky activities, such as commercial and industrial lending. At the same time, small companies were more likely to be involved in the relatively safe activities of home mortgage and consumer lending.[7]

These portfolio differences are presented in Table 1. Using data from 1987, we contrast certain key balance-sheet characteristics and off-balance-sheet positions for a typical small and a typical large bank holding company in our sample. (Typical small company characteristics are defined as the median characteristics for the sample of companies with less than $5 billion in assets. Typical large company characteristics are defined as the median

Table 1

How Portfolio Attributes of Large and Small Bank Holding Companies Differ

Portfolio Attribute	Typical Small Bank Holding Company (Percent)	Typical Large Bank Holding Company (Percent)
Commercial and industrial loans/assets	18.74	23.70
Real estate loans/assets	20.57	16.09
Agricultural loans/assets	0.24	0.23
Consumer loans/assets	12.98	10.32
Loan concentration index[a]	29.36	28.89
Trading assets/assets	0.05	2.53
Deposits/assets	78.18	64.28
Noninterest deposits/assets	24.67	24.76
Foreign deposits/assets	0.04	21.21
Equity capital/assets	6.43	5.15
Interest rate swaps/assets[b]	0.00	19.20
Foreign exchange futures/assets[b]	0.00	28.72
Noninterest income/net interest income	54.17	86.24
Multiple census indicator[c]	0	1

Source: Consolidated financial statements of a sample of publicly traded bank holding companies.

Notes: Table presents the median portfolio attributes from 1987 for two subsets of our sample of publicly traded bank holding companies. The first column presents median portfolio attributes for holding companies with less than $5 billion in assets; the median size of the small holding companies is $3.6 billion. The second column presents median portfolio attributes for holding companies with more than $25 billion in assets; the median size of the large holding companies is $50 billion.

[a] The loan concentration index equals the sum of the squared shares of each of the bank holding company's loan types (commercial and industrial, real estate, agricultural, consumer, and other) as a fraction of total loans. Higher values of the index indicate more concentrated lending.

[b] Interest rate swaps and foreign exchange futures are based on notional principal amounts.

[c] This variable equals 1 for holding companies with commercial bank subsidiaries operating in more than one census region and zero otherwise.

characteristics for the sample of companies with more than $25 billion in assets.)

Of particular interest are differences in lending behavior, capital ratios, and geographical diversification. For example, the typical large company was far more likely to diversify geographically by operating commercial banking subsidiaries in more than one census region or by accepting foreign deposits. At the same time, the large bank holding company also engaged in more commercial and industrial lending and less consumer lending and operated with a smaller capital ratio.[8] (Higher leverage—that is, a smaller capital-to-assets ratio—increases equity risk because changes in asset values at highly leveraged firms have a larger impact on equity value.) Finally, large bank holding companies were more likely to hold assets in their trading accounts, were more likely to participate in derivatives markets, and generated a larger percentage of income from noninterest revenues.

Table 2
HOW PORTFOLIO ATTRIBUTES OF LARGE AND SMALL BANK HOLDING COMPANIES AFFECT RISK

	Percent Change in Risk When Moving *from* Small *to* Large Bank Holding Company Portfolio Attribute	
Portfolio Attribute	Systematic Risk	Firm-specific Risk
Commercial and industrial loans/assets	12.60*	11.59*
Real estate loans/assets	-4.67*	-3.39
Agricultural loans/assets	-0.02	-0.21*
Consumer loans/assets	-1.39	0.51
Loan concentration index	-0.65	-0.85*
Trading assets/assets	-0.03	-3.18
Deposits/assets	1.00	5.20
Noninterest deposits/assets	0.04	-0.04
Foreign deposits/assets	-10.80	-7.79
Equity capital/assets	12.40*	20.33*
Interest rate swaps/assets	-0.56	0.83
Foreign exchange futures/assets	4.88*	1.81
Noninterest income/net interest income	0.29	0.51*
Multiple census indicator	-21.20*	-26.00*

Source: Authors' calculations, based on data from the Center for Research in Security Prices and the consolidated financial statements of a sample of publicly traded bank holding companies.

Notes: Table presents the effect on systematic and firm-specific risk of changing from the portfolio attributes of the typical small holding company to those of the typical large holding company. The difference between large-company and small-company values for each portfolio attribute is multiplied by a regression coefficient estimated by relating the log of firm-specific risk or the log of systematic risk to the set of portfolio attributes shown in Table 1. Each regression also includes a measure of each holding company's stock liquidity as an explanatory variable. See Demsetz and Strahan (1995) for a detailed description of the regression model.

* Statistically significant at the 5 percent level.

For our purposes, these portfolio differences are interesting primarily because of their effects on each of the two components of equity risk. The strength of these effects is demonstrated in Table 2, which illustrates how risk changes as we move *from* the portfolio attributes of the typical small bank holding company *to* those of the typical large company.[9] For instance, changing from the capital-to-assets ratio of the small bank holding company to that of the large company leads to a 12 percent increase in systematic risk and a 20 percent increase in firm-specific risk. Changing from the ratio of commercial and industrial loans to assets of the small bank holding company to that of the typical large company leads to a 13 percent increase in systematic risk and a 12 percent increase in firm-specific risk.

Some of the other portfolio characteristics described in Tables 1 and 2 tend to *reduce* the risks of large bank holding companies. For instance, changing from the geographical diversification of commercial bank subsidiaries at the typical small bank holding company to that at the typical large company is associated with a 21 percent decrease in systematic risk and a 26 percent decrease in firm-specific risk.[10]

We gauge the collective importance of the portfolio characteristics in Table 2 by quantifying the relationship between size and risk *while holding portfolio characteristics constant*. By comparing this "conditional" relationship between size and risk with the "unconditional" relationship between the same two variables, we can illustrate just how important fundamental differences in the portfolio attributes of large and small bank holding companies are in explaining differences in their risk profiles. Ideally, we would quantify the conditional relationship by identifying a sample of bank holding companies of different sizes with similar portfolio attributes and observing how their risk characteristics differ. Since this experiment is not possible, we instead use regressions to quantify the conditional relationship between size and risk. We estimate two regressions relating systematic and firm-specific risk to asset size and the portfolio characteristics described in Table 2.[11]

The key results from our regression analysis appear in Table 3. Once we control for portfolio characteristics, the relationship between size and systematic risk becomes statistically indistinguishable from zero. In contrast, the negative relationship between size and firm-specific risk strengthens, implying that a 10 percent increase in total assets would lead to a 2.5 percent reduction in firm-specific risk, provided that this increase in assets was not accompanied by an increase in risk-enhancing activities. The relationships between size and the two components of equity risk are now consistent with the predictions of portfolio theory.

Why do we observe such important differences in the relationship between size and risk before and after controlling for portfolio characteristics? Consider commercial and industrial lending, which is (1) pursued more aggressively by large bank holding companies, as shown in Table 1, and (2) positively related to both systematic and firm-specific risk, as shown in Table 2. If we attempted to measure the relationship between size and systematic or firm-specific risk *without* controlling for this type of lending, we would actually measure a combination of two effects: the effect of size on risk *and* the effect of commercial and industrial lending on risk. We would therefore exaggerate the true effect of size on each risk component because of the strong positive relationships between commercial and industrial lending and holding company size *and* between commercial and industrial lending and holding company risk.

Omitting portfolio characteristics inversely related to size and directly related to risk (or vice versa) from the analysis would lead us to *understate* the true size/risk relationship. Overall, the commercial and industrial lending example typifies the norm. Whether we focus our attention on systematic risk or firm-specific risk, we find that the conditional relationship between size and risk is smaller than the unconditional relationship. According to the conditional relationship, size reduces firm-specific risk but, as expected, has little effect on systematic risk.[12]

According to the conditional relationship, size reduces firm-specific risk but, as expected, has little effect on systematic risk.

Table 3
RELATIONSHIP BETWEEN BANK HOLDING COMPANY SIZE AND RISK: WITH AND WITHOUT CONTROLS FOR PORTFOLIO ATTRIBUTES

	Percent Change in Risk following a 1 Percent Change in Size	
Type of Risk	Without Portfolio Control Variables	With Portfolio Control Variables
Systematic	0.17 (6.1)*	0.07 (1.7)
Firm-specific	-0.14 (-4.3)*	-0.25 (-5.7)*

Source: Authors' calculations, based on data from the Center for Research in Security Prices and the consolidated financial statements of a sample of publicly traded bank holding companies.

Notes: Table presents the coefficient on log of asset size from two regression models relating the log of systematic risk and the log of firm-specific risk to the log of size and a series of portfolio attribute control variables. Tables 1 and 2 describe the portfolio variables in the model. T-statistics are reported in parentheses below each of the coefficient estimates.

* Statistically significant at the 5 percent level.

WHY DO LARGE BANK HOLDING COMPANIES HOLD RISKIER PORTFOLIOS?

Although large bank holding companies have benefited from risk-reducing diversification, on average they have still taken on greater risk than small companies. This raises the question: Why have large bank holding companies chosen to counterbalance their diversification advantage by pursuing certain risk-enhancing activities and operating with less capital? An empirical analysis providing a definitive answer is beyond our present scope, but we can briefly examine a few factors that may have operated in the past.

First, it is important to recognize that risk-enhancing activities (such as commercial and industrial lending and participation in derivatives markets) frequently are also profit-enhancing activities for bank holding companies of all sizes. Large companies may simply be capable of pursuing these activities more aggressively because they are equipped with the diversification advantage of size. Likewise, they may choose to operate with lower capital ratios because of their diversification advantage. If small companies had that same advantage, they might also choose to operate with lower capital ratios.[13]

Second, economies of scale may make it cost-effective for large bank holding companies to specialize in riskier activities. For instance, derivatives dealers must invest in costly resources, such as sophisticated computer systems and skilled financial engineers. These investments may be worthwhile only for large-scale operations. Similarly, large bank holding companies may have cost advantages in terms of originating and holding commercial and industrial loans.[14] To the extent that there are economies of scale in risk-enhancing activities, we would likely observe large bank holding companies pursuing these activities more aggressively than small companies, even if small companies were as well diversified.

A final factor that may explain differences in risk taking by large and small bank holding companies is the moral hazard problem associated with the too-big-to-fail policy. Moral hazard occurs when deposit insurance or some other form of guarantee reduces the incentives for depositors and creditors to monitor and discipline bank risk taking. Although moral hazard is a problem for all depository institutions, the 1984 insolvency of Continental Illinois set a precedent establishing that both insured and uninsured deposits would be protected in the event of insolvencies at very large institutions.[15] If large depositors are de facto insured, the monitoring and discipline of risk taking at large institutions will be further reduced. A too-big-to-fail policy may therefore result in greater risk taking at large bank holding companies than at small ones.[16]

The portfolios of the large companies, characterized by greater leverage and riskier activities, offset the diversification advantage of size.

We have seen that large bank holding companies are better diversified than small ones but are no less risky. The portfolios of the large companies, characterized by greater leverage and riskier activities, offset the diversification advantage of size. However, there have been some very interesting changes in the relationship between size and risk since 1991, which we now explore.

Recent Changes in the Relationship between Size and Risk

A Yearly Analysis

To begin, we look at the evolution of the size/risk relationship from 1987 to 1993. Table 4 reports measurements of the strength of the relationships between size and systematic risk, size and firm-specific risk, and size and total equity risk. Each column reveals some interesting differences between the pre-1992 and post-1992 periods. Changes in the relationship between size and systematic risk are most striking. The size/systematic risk relationship is consistently positive from 1987 to 1991, but becomes statistically indistinguishable from zero in both 1992 and 1993. The relationship between size and firm-specific risk also changes over time. Between 1987 and 1991, this relationship tends to be negative but is generally weak. In 1992 and 1993, the inverse relationship between size and firm-specific risk strengthens and becomes statistically significant.

Post-1992 changes in the size/systematic risk and size/firm-specific risk relationships lead to changes in the size/total equity risk relationship. From 1987 to 1991,

Table 4
Year-by-Year Correlation of Bank Holding Company Size and Risk

Year	Sample Size	Asset Size and Systematic Risk	Asset Size and Firm-specific Risk	Asset Size and Total Equity Risk
1987	129	0.38*	-0.22*	0.10
1988	119	0.26*	-0.19	-0.04
1989	111	0.33*	-0.14	0.01
1990	105	0.42*	-0.07	0.20*
1991	98	0.27*	-0.03	0.12
1992	89	0.12	-0.47*	-0.21*
1993	80	0.17	-0.47*	-0.14

Source: Authors' calculations, based on data from the Center for Research in Security Prices and the consolidated financial statements of a sample of publicly traded bank holding companies.

Note: Table presents the Spearman (rank) correlation coefficient between total holding company assets and systematic risk, firm-specific risk, and total equity risk.

* Statistically significant at the 5 percent level.

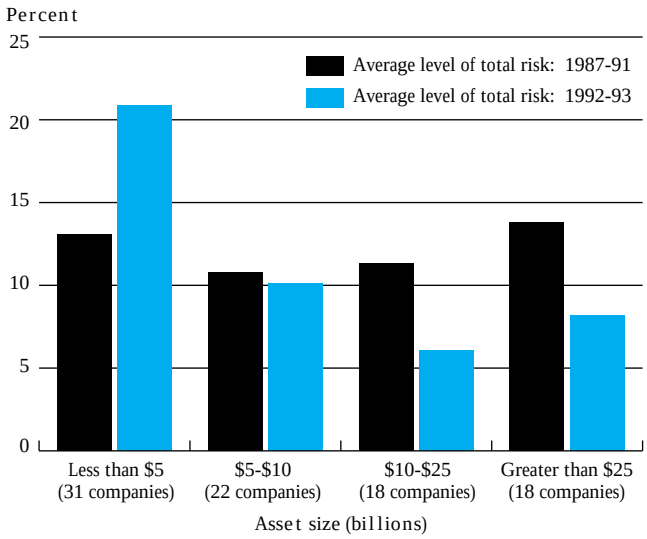
large bank holding companies display significantly greater systematic risk than small companies but display less firm-specific risk (significantly less in 1987). The two relationships tend to balance, such that the relationship between size and total equity risk over this period is either statistically indistinguishable from zero or positive. In 1992 and 1993, however, large bank holding companies display significantly less firm-specific risk than small bank holding companies, and they display similar systematic risk. As a result, the relationship between size and total equity risk is negative and, in 1992, significantly different from zero.

Note that only after 1991 do the unconditional size/risk relationships become consistent with the predictions of portfolio theory: Large bank holding companies display significantly less firm-specific risk than small companies but similar levels of systematic risk. As a result, we observe an inverse relationship between size and total equity risk. This contrasts with the generally insignificant size/risk relationship observed before 1991.

Just how striking has the recent change in the relationship between size and risk been? We answer this question in Chart 3, which shows how total equity risk varies with size for the 1987-91 and 1992-93 periods. For this analysis, we also take account of a potential statistical complication. In particular, if small bank holding companies are more likely to exit our original sample through acquisition or failure, and if the stock returns of acquired or failing companies are highly variable, then the evolution of the size/risk relationship in the sample would be biased. We avoid this potential source of bias by including only those bank holding companies that remain in the sample throughout the 1987-93 period.[17] As in Table 4, we find that the diversification advantage of size becomes apparent after 1991. In contrast to the earlier period, the relationship between size and total equity risk is negative, at least for bank holding companies with assets up to $25 billion.

Chart 3

Relationship between Bank Holding Company Size and Total Risk, 1987-91 and 1992-93



Source: Authors' calculations, based on data from the Center for Research in Security Prices and the consolidated financial statements of a sample of publicly traded bank holding companies.

We find that the diversification advantage of size becomes apparent after 1991.

Changes in the Portfolios of Large and Small Bank Holding Companies

We see for the first time in 1992 and 1993 that the potential risk-reducing benefits of diversification are evident in lower overall risk at large bank holding companies. What has changed? One possibility is the riskiness of banking activities. As we have seen, large and small bank holding companies have traditionally held different portfolios, so a reduction in the riskiness of activities in which large companies dominate (or an increase in the riskiness of activities in which small companies dominate) will reduce the risk of large bank holding companies relative to that of small ones.[18] A second possibility is that banking activities have themselves changed—that is, differences in the portfolio composition of the typical large and the typical small bank holding company may have diminished over time.

We can support this second hypothesis by comparing the 1987 and 1993 portfolio characteristics for a typical small and a typical large bank holding company (Table 5). There are some striking differences between the values of several of these characteristics. For our purposes, we will

focus on changes in those characteristics found to be most important in explaining differences in risk at large and small bank holding companies.

Trends in capital are very important in explaining the decline in equity risk at large companies relative to small ones. Although capital ratios of both small and large bank holding companies increased between 1987 and 1993, the increase associated with the typical large company was much greater, thus closing substantially the gap between the capital ratios of large and small bank holding companies. (In 1987, the typical small bank holding company held 25 percent more capital per dollar of assets than the typical large company. By 1993, the difference in the capital ratios had fallen to only 3.5 percent.)

Changes in lending practices between 1987 and 1993 also contributed to declines in equity risk at large bank holding companies relative to small ones. For instance, the ratio of consumer loans to assets decreased at the typical small company but increased at the typical large company. The commercial and industrial loan ratio at both small and large bank holding companies decreased, slightly reducing the differential between the small company and large company ratios. Because commercial and industrial lending tends to enhance risk and consumer lending tends to decrease it, these patterns are consistent with the observed decline in equity risk at large bank holding companies relative to small ones.[19]

The Role of Regulatory Changes

What accounts for the shifts in holding company portfolios? We certainly could point to the many changes in the banking industry in recent years. From July 1990 to March 1991, the U.S. economy underwent a recession, accompanied by a credit slowdown. But by 1992, improving loan performance and changes in the level and slope of the yield curve led to increased banking profits. Overall, the rate of bank failures in the 1990s has been very low, following a decade in which the failure rate reached record high levels

Table 5
How Portfolio Attributes of Large and Small Bank Holding Companies Differ, 1987 and 1993

Portfolio Attribute	Is Attribute Significant in Explaining Risk?	1987 Portfolio Attributes: Typical Small Bank Holding Company (Percent)	1987 Portfolio Attributes: Typical Large Bank Holding Company (Percent)	1993 Portfolio Attributes: Typical Small Bank Holding Company (Percent)	1993 Portfolio Attributes: Typical Large Bank Holding Company (Percent)
Commercial and industrial loans/assets	Yes	18.74	23.70	12.23	16.80
Real estate loans/assets	Yes	20.57	16.09	25.93	21.84
Agricultural loans/assets	Yes	0.24	0.23	0.02	0.10
Consumer loans/assets		12.98	10.32	7.10	11.40
Loan concentration index[a]	Yes	29.36	28.89	36.91	30.01
Trading assets/assets		0.05	2.53	0.00	0.53
Deposits/assets		78.18	64.28	83.64	74.55
Noninterest deposits/assets		24.67	24.76	22.88	21.49
Foreign deposits/assets		0.04	21.21	0.00	4.40
Equity capital/assets	Yes	6.43	5.15	7.30	7.05
Interest rate swaps/assets[b]		0.00	19.20	0.00	28.51
Foreign exchange futures/assets[b]	Yes	0.00	28.72	0.00	4.30
Noninterest income/net interest income	Yes	54.17	86.24	43.74	66.49
Multiple census indicator[c]	Yes	0	1	0	1

Source: Consolidated financial statements of a sample of publicly traded bank holding companies.

Notes: Table presents median portfolio attributes from 1987 and 1993 for two subsets from a sample of publicly traded bank holding companies. The first column indicates whether or not the portfolio attribute has a significant impact on holding company risk. Columns 2 and 4 present median portfolio attributes for companies with less than $5 billion in assets; the median size of the small bank holding companies is $3.6 billion in 1987 and $3.3 billion in 1993. Columns 3 and 5 present median portfolio attributes for holding companies with more than $25 billion in assets; the median size of the large bank holding companies is $50 billion in 1987 and $51 billion in 1993.

[a] The loan concentration index equals the sum of the squared shares of each of the bank holding company's loan types (commercial and industrial, real estate, agricultural, consumer, and other) as a fraction of total loans. Higher values of the index indicate more concentrated lending.

[b] Interest rate swaps and foreign exchange futures are based on notional principal amounts.

[c] This variable equals 1 for holding companies with commercial bank subsidiaries operating in more than one census region and zero otherwise.

not seen since the Depression (Edwards and Mishkin 1995).

Although these events are important in understanding the evolution of bank holding company risk, widespread economic conditions would likely affect companies of all sizes in a similar manner. Our results suggest that something has changed the risk-taking behavior of large banking companies *relative to that of small banking companies*.

Risk-Based Capital Requirements

Recent changes in the U.S. regulatory climate provide one possible explanation for changes in the behavior of large banking companies relative to that of small ones. In 1988, bank regulators established a set of international standards designed to incorporate credit risk into each country's capital adequacy rules, as well as to provide a "level playing field" for internationally active banking companies. In response to these international standards, each of the U.S. banking regulatory agencies amended its capital adequacy standards to include new risk-based capital requirements.

Recent changes in the U.S. regulatory climate provide one possible explanation for changes in the behavior of large banking companies relative to that of small ones.

The risk-based capital requirements, fully implemented since 1992, permit banks and bank holding companies engaged in relatively safe activities (such as home mortgage lending) to operate with less capital than those engaged in riskier activities. High-risk assets (such as commercial and industrial loans) tend to reduce a company's risk-based capital ratio, while low-risk assets (such as government securities) tend to increase that ratio. Consequently, a banking company can improve its risk-based capital ratio either by increasing capital or by shifting its portfolio from high-risk to low-risk assets. Moreover, risk-based capital requirements take account of the credit risk exposure associated with off-balance-sheet positions, including derivatives. As part of the reform of capital standards, U.S. regulators now also require banking companies to meet a minimum leverage ratio, defined as total regulatory capital divided by average assets.[20]

Several empirical studies indicate that these regulatory requirements led to declines in bank lending in the early 1990s. For instance, Laderman (1994) finds that banks with deficiencies in "tier 1" capital reduced lending sharply, in contrast to banks unconstrained by capital or constrained only by their "tier 2" capital.[21] Moreover, Peek and Rosengren (1993) find that loan growth was smaller at banks facing formal regulatory actions.

If large bank holding companies were more likely to be constrained by the new capital requirements, these requirements may have had their greatest effect on the portfolio choices of large companies. Table 6 uses data from 1991 to show that the tier 1 and total risk-based capital ratios, as well as the leverage ratio, fell with holding company size.[22] For instance, the tier 1 risk-based capital ratio fell from 10.2 percent for the typical small holding company to 6.6 percent for the typical large holding company. This pattern is not surprising given that large bank holding companies were more active in commercial and industrial lending and off-balance-sheet activities and tended to hold less capital as a percentage of assets. It suggests that risk-based capital requirements and leverage ratio requirements may indeed have had a greater effect on the recent behavior of large bank holding companies than on the behavior of small ones.

Table 6
Regulatory Capital Ratios for Bank Holding Companies by Size

Asset Size	Tier 1 Risk-based Capital Ratio	Total Risk-based Capital Ratio	Leverage Ratio
Less than $5 billion	10.2	12.1	6.6
$5 to $10 billion	8.9	10.8	6.5
$10 to $25 billion	8.0	10.5	6.6
Greater than $25 billion	6.6	10.5	5.4

Source: Consolidated financial statements of a sample of publicly traded bank holding companies.

Note: Table reports the median tier 1 and total risk-based capital ratios and the median leverage ratio for bank holding companies in each of four size categories as of the end of 1991.

Further refinements in risk-based capital requirements may emerge in the near future as market risks associated with banks' trading activities are incorporated into capital standards. Regulators from the U.S. banking agencies are developing market risk capital standards with bank regulators from other countries through the Basle Committee on Banking Supervision. Market risks, which encompass risks associated with changes in interest rates, foreign exchange rates, and equity prices, mainly affect large banking companies heavily engaged in trading and dealing in derivatives (such as interest rate and foreign exchange swaps). Any new capital requirements related to market risks will therefore most likely affect these large banking companies more than small ones.

Other Regulatory Changes

Additional changes in bank regulations have followed from passage of the Federal Deposit Insurance Corporation Improvement Act (FDICIA) of 1991, a broad-based attempt to strengthen the deposit insurance funds (the Savings Association Insurance Fund and the Bank Insurance Fund). The Prompt Corrective Action provision of FDICIA attempts to reduce the cost of bank failure by enabling regulators to intervene early when banks face financial difficulties. The act also attempts to reduce bank risk taking by furthering the scope of risk-based capital requirements and attempts to improve market discipline by discouraging a too-big-to-fail policy.

Like risk-based capital requirements, FDICIA's least-cost resolution provision (which mandates that the Federal Deposit Insurance Corporation use the least-cost method of resolving bank insolvencies) has presumably had its greatest effect on large banking companies. If depositors with accounts of more than $100,000 no longer believe that their bank is too big to fail but instead believe that they may face losses in the event of a failure, these depositors may bring additional market discipline to bear on large banks. In particular, large depositors or other creditors can penalize risky banks by requiring higher interest payments for the use of their funds.

By strengthening capital standards, raising the costs of holding a risky portfolio, and reducing the probability that a large banking company will be deemed too big to fail, recent regulatory changes would seem to have bitten hardest at large bank holding companies. Recent changes in large companies' portfolios, in particular increased capital and decreased risky lending, suggest that these regulatory changes have had a greater impact on the risk-taking behavior of large companies than on that of small companies. These new regulatory standards, however, have not been in place long enough to enable us to fully substantiate their role in the evolution of the size/risk relationship.

Conclusions

This article has explored the relationship between bank holding company size and risk. We have shown that in the past, size affected the mix between firm-specific and systematic risk but did not affect the level of total risk. Large banking companies operated with greater leverage and held riskier portfolios, offsetting the risk-reducing benefits normally associated with diversification.

In recent years, however, the relationship between size and risk has changed. The portfolios of large and small holding companies have become increasingly similar. As a result, the negative relationship between size and firm-specific risk has strengthened substantially, while the positive relationship between size and systematic risk has weakened. The diversification advantage of size has become evident in the lower total equity risk at large bank holding companies.

Our analysis suggests that changes in the regulatory climate could explain changes in the relationship between size and risk. New regulatory standards have not been in place long enough to assess their full effect on this relationship. Nevertheless, the evidence to date suggests that these standards have prompted large bank holding companies to reduce their overall risk to a level below that of small bank holding companies.

Appendix: Methodology for Measuring Systematic and Firm-Specific Risk

We define total equity risk as the variance of each bank holding company's weekly stock return over each year. In order to define systematic and firm-specific risk for each company, we estimate a return-generating model of the following form:

$$R_{t,i} = \alpha_i + \sum_{k=1}^{5} (\beta_i^k f_t^k) + \varepsilon_{t,i},$$

where t is an index for time, i is an index for each bank holding company, k is an index for each of five systematic factors (denoted f^k), and $R_{t,i}$ is the return for bank holding company stock i during week t. The return-generating model is estimated by a statistical procedure called factor analysis. Using only information on the stock returns of bank holding companies in our sample, factor analysis solves for the factors ($f^1_t,...,f^5_t$) and the factor loadings ($\beta^1_i,...,\beta^5_i$) that best explain the component of returns common to the -companies in our sample.

Intuitively, the f^k are akin to economic variables that generate changes in bank holding company stock returns, such as changes in the level of the stock market, changes in interest rates, and changes in the slope of the yield curve. The statistical procedure, however, does not require us to associate each factor with a particular source of economic risk. That part of a given company's stock return unexplained by the five factors is captured in $\varepsilon_{t,i}$. This "residual return" is determined by influences unique to each bank holding company.

We use this model to divide total risk (the variance of weekly stock returns) into systematic risk and firm-specific risk. Systematic risk is defined as that part of total variance explained by the systematic factors (f^k). The remainder of total variance is called firm-specific risk. Our procedure permits the following variance decomposition:

Total Risk=Systematic Risk+Firm-Specific Risk

$$\sigma^2(R_i) = \sum_{k=1}^{5} (\beta_i^k)^2 \sigma^2(f^k) + \sigma^2(\varepsilon_i) \ .$$

Notice that each bank holding company has a unique set of βs, where β_i^k measures company i's exposure to factor k. Bank holding companies heavily exposed to systematic factors will have large βs (in absolute value) and high levels of systematic risk. The first term above is the variability of company i's stock generated by its exposure to the five systematic factors. The stock returns of bank holding companies with concentrations in particular industries or regions will tend to be dominated by ε, since the fortunes of such companies will be tied to a particular type of business or area of the country. The second term above represents the variability in company i's stock generated by the residual return.

One advantage of this approach is that because the factors are determined using only data on bank holding company returns, the measure of systematic risk will incorporate sources of risk specific to the banking industry, such as changes in deposit insurance premia or changes in regulations. However, the procedure may assign to systematic risk certain risks normally considered diversifiable. For instance, if most of the bank holding companies in our sample have a common risk, such as lending to a particular sector of the economy, then a bank holding company with a high exposure to that sector will exhibit a high level of systematic risk.

ENDNOTES

1. A bank holding company is a company that owns or controls one or more banks. It may also own nonbank subsidiaries.

2. Of course, it is possible that large bank holding companies simply make larger loans rather than a greater number of loans to a wider variety of borrowers. In this case, there may be little or no diversification advantage of size.

3. There are several ways to carry out the risk decomposition. Our approach compares the stock returns of each bank holding company to the returns of a large sample of bank holding companies. Alternatively, the stock returns of each bank holding company could be compared with other variables measuring economic conditions, such as a stock market index or the level of interest rates. In Demsetz and Strahan (1995), we use three alternative approaches when decomposing total equity risk into its two components. As a check on the robustness of our methodology, we show that the size/risk relationships are similar in all three cases.

4. That is, risk is predominately related to some aspect of this particular bank holding company, perhaps a large concentration of loans to borrowers in a regional industry such as mining or agriculture.

5. We initially identified approximately 150 publicly traded bank holding companies by referring to the Bank Compustat database. We tracked these companies' stock returns and characteristics in each year between 1987 and 1993. Our analysis is based on those bank holding companies for which we could retrieve both stock return data and data describing bank holding company characteristics, and whose stock traded for at least thirty weeks in a given calendar year. There is some year-to-year variability in our sample size because several bank holding companies did not have traded stock in every year between 1987 and 1993. In the case of mergers, we dropped acquired companies from the sample after the date of acquisition. Acquirers remain in the sample.

6. Relationships derived using the pooled 1987-93 data are representative of those derived using annual data, with the exception of 1992 and 1993. Changes in the size/risk relationship in these years are discussed in the "Recent Changes" section. Our analysis focuses on the 1987-93 period because 1987 was the first year in which data describing certain bank holding company characteristics were available.

7. Other authors (Boyd and Gertler 1993 and Samolyk 1994) have also found that large banks held riskier portfolios than small banks during the 1980s and early 1990s.

8. Boyd and Runkle (1993) also find that large banks hold less capital than small banks.

9. Figures reported in Table 2 are based on those reported in Table 1 and coefficients from regressions with the log of firm-specific and the log of systematic risk as dependent variables and a number of bank holding company characteristics (including asset size) as independent variables. In particular, coefficients from a regression based on data from 1987 to 1993 are multiplied by differences in the characteristics of large and small bank holding companies in 1987 to derive figures reported in Table 2.

10. Levonian (1994) shows that bank accounting profits exhibit low correlation across states, suggesting that bank holding companies operating in many states may be able to reduce risk through diversification.

11. Each regression also includes an independent variable measuring the liquidity of each bank holding company's stock.

12. Although they do not focus on the role of size, Liang and Rhoades (1991) do find that the effects of diversification depend on banks' portfolio choices. Using balance-sheet data, they show that the risk-reducing benefits of diversification are partially offset by a positive relationship between diversification and leverage.

13. Large bank holding companies may also choose to operate with lower capital ratios because they have better access to funds through the capital markets. If large bank holding companies can raise new capital more quickly and more cheaply, they may have less need for a large capital cushion.

14. In addition, Diamond (1984) shows that diversification can actually reduce the cost of monitoring risky loans; hence, it may be efficient for risky lending to be concentrated in the hands of large, well-diversified bank holding companies.

15. On September 19, 1984, the Comptroller of the Currency testified before Congress that some banks were "too big to fail." For these banks, which were not explicitly named, all depositors would be insured. O'Hara and Shaw (1990) note that the *Wall Street Journal* named the eleven largest banks in reporting the story (on September 20) and go on to show that the stock returns on these eleven banks rose in response to the announcement of the too-big-to-fail policy.

16. Of course, large bank holding companies are likely to have established longstanding relationships with both borrowers and depositors. The desire to protect these relationships and the profits they generate may counterbalance the incentive problems inherent in the too-big-to-fail policy. As a result, the incentives for risk taking at the expense of the Federal Deposit Insurance Corporation are likely to be strong only at weakly capitalized institutions.

ENDNOTES (*Continued*)

17. The use of this "balanced panel" prevents us from generalizing our findings to all bank holding companies. We note, however, that the attrition rate was about the same for each of the first three size categories (about one-third) and only slightly smaller for the largest size category (about one-fifth), so the size distribution of the surviving bank holding companies is fairly representative of the overall size distribution.

18. This hypothesis, however, is difficult to test since the riskiness of the assets underlying bank holding company portfolios is not directly observable.

19. Recall that these figures are based on our sample of publicly traded bank holding companies and may not be fully representative of the entire population of bank holding companies.

20. This standard was added to the risk-based capital requirements because a bank could, in theory, hold no capital under these requirements if it held only very safe assets, such as government securities. See Spong (1994) for more detail on risk-based capital requirements and other recent regulatory changes.

21. Tier 1 capital includes those types of capital that provide the best protection against loss. The components of tier 2 capital can still protect against loss but are considered lower quality protection. See Spong (1994) for information on the components of tier 1 and tier 2 capital.

22. We focus on 1991 capital ratios because we are interested in changes in bank holding company behavior in 1992 and 1993. The tier 1 and total risk-based capital ratios are defined as tier 1 capital divided by risk-weighted assets and total capital divided by risk-weighted assets, respectively. The leverage ratio is defined as total capital divided by average assets.

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