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Abstract

This paper documents a positive relation between internationalization and bank risk. This is consistent with the empirical dominance of the *market risk hypothesis* – whereby internationalization increases banks' risk due to market-specific factors in foreign markets – over the *diversification hypothesis* – whereby internationalization allows banks to reduce risk through diversification of their operations. The results continue to hold following a variety of robustness tests, including endogeneity and sample selection bias. We also find that the magnitude of this effect is more pronounced during financial crises. The results appear to be at least partially explained by agency problems related to poor corporate governance.

***JEL Classification Codes*:** G21, G28, L25

***Keywords*:** Risk, Internationalization, Banking, Financial Crises, Corporate Governance

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1. Introduction

Economists generally believe that diversification into activities with returns that are not highly correlated with those of the existing portfolio reduces risk. However, this might not always be the case. If the diversification is into activities with higher risk, it could increase overall portfolio risk even if the returns on the activities are not highly correlated with those of the existing portfolio. The recent global financial crisis has reinvigorated the debate on the benefits of financial integration. During this crisis, risk seemed to be contagious across countries, suggesting that diversification across international borders may not have been effective.

As also observed during the crisis, bank risk can have a first-order effect on financial and economic stability (Laeven and Levine, 2009). To mitigate the destabilizing potential of such risk, national and international organizations have focused on implementing regulations to limit bank risk and avoid future financial crises.[1] Much of the focus of such reforms has been on constraining banks' risk within one country. However, Houston, Lin, and Ma (2012) and Ongena, Popov, and Udell (2013) suggest that banks may engage in regulatory arbitrage, circumventing strict domestic regulations by taking more risk abroad. This raises the question of how bank internationalization affects the risk of individual banks. This is the question we address in this paper.

The literature identifies a number of other determinants of bank risk, including bank capital (e.g., Koehn and Santomero, 1980; Kim and Santomero, 1988; Holmstrom and Tirole, 1997; Allen, Carletti, and Marquez, 2011; Mehran and Thakor, 2011; Berger and Bouwman, 2013), regulation and other government interventions (e.g., Laeven and Levine, 2009; Black and Hazelwood, 2013; Berger, Bouwman, Kick, and Schaeck, 2014; Duchin and Sosyura, 2014), competition (e.g., Keeley, 1990; Boyd and De Nicolo, 2005; Berger, Klapper, and Turk-Ariss, 2009; Martinez-Miera and Repullo, 2010), bank size (e.g., Demsetz and Strahan, 1997; Hakenes and Schnabel, 2011; Bhagat, Bolton, and Lu, 2012), and governance (e.g., Saunders, Strock, and Travlos, 1990; Laeven and Levine, 2009; Beltratti and Stulz, 2012; Berger, Imbierowicz, and Rauch, 2014).

However, to our knowledge no prior study focuses on the direct link between internationalization and bank risk.[2] Further, prior work has little to say about the effects of bank internationalization during

[1] Examples include the Dodd-Frank requirement that systemically important financial institutions in the U.S. receive additional supervision from the Federal Reserve and the Bank for International Settlements' Basel III capital and liquidity standards.

[2] A partial exception is Buch, Koch, and Koetter (2013). However, their focus is different – on risk and market power in an international context. As a side result, they find a weak negative relation between internationalization and risk for German banks. We find a very different result for U.S. banks.

financial crises. In addition, there is no research to our knowledge that examines agency problems in explaining bank internationalization decisions. This paper aims to fill these gaps in the literature.

There is also a literature that considers the effect of internationalization on nonfinancial firm risk. There are two opposing views. On the one hand, Hughes, Logue, and Sweeney (1975), Rugman (1976), Agmon and Lessard (1977), Amihud and Lev (1981), and Michel and Shaked (1986) document a lower risk for multinational corporations (MNCs) relative to purely domestic corporations. The most cited argument for the observed lower risk is the diversification benefit of generating cash flows in different countries. On the other hand, Bartov, Bodnar, and Kaul (1996) and Reeb, Kwok, and Baek (1998) find a higher risk for these MNCs due to greater volatility of cash flows. The most commonly advanced arguments for the observed higher risk are: foreign exchange risk (Solnik, 1974; Eun and Resnik, 1988; Black, 1990), political risk (Mahajan, 1990; Burgman, 1996; Cuervo-Cazurra, Maloney, and Manrakhan, 2007), increased agency problems and difficulties in effectively monitoring managers abroad (Lee and Kwok, 1988), and the presence of asymmetric information due to competition and unfamiliarity with the foreign markets (Reeb, Kwok, and Baek, 1998). These factors can offset the benefit from the diversification of MNCs' cash flows. Finally, Kwok and Reeb (2000) find that the effect of internationalization on the risk of MNCs might vary with home and host market conditions.

In contrast to the literature on nonfinancial firms, this paper focuses on banks because bank risk is a central issue affecting financial stability, business cycle fluctuations, and economic growth (Laeven and Levine, 2009). This paper also contributes to the broader literature on internationalization by examining risk within one important industry rather than across a number of very different industries with their confounding differences.

To investigate the impact of internationalization on bank risk, we first consider a simple model of an international bank's portfolio with two risky assets: a single foreign asset with expected return μ_F and standard deviation σ_F and a single domestic asset with expected return μ_D and standard deviation σ_D. The correlation between the two assets is ρ_{FD}, and the bank invests proportion w in the foreign asset. Our (inverse) measure of risk is *Z-score*, defined as the sum of a bank's mean return on assets and mean capitalization ratio divided by the standard deviation of return on assets. We assess the impact of the degree of internationalization w on *Z-score* by computing the partial derivative of *Z-score* with respect to w. We cannot unambiguously sign this derivative, but we use Matlab to gain insight as to how the sign varies with different values of the underlying parameters. Most findings are consistent with intuition.

From this model, we develop two hypotheses on the impact of internationalization on bank risk. The *diversification hypothesis* suggests that international banks may have lower risk because they diversify

their portfolios (e.g., DeLong, 2001; Amihud, DeLong, and Saunders, 2002; Laeven and Levine, 2007). For example, if asset returns are not highly correlated across countries (ρ_{FD} is low), internationally diversified banks may be safer because they are less exposed to domestic shocks (e.g., Diamond, 1984; Demsetz and Strahan, 1997) as long as the risk of the foreign asset is not too high relative to the risk of the domestic asset (i.e., σ_F is not too large relative to σ_D and μ_F is not too low relative to μ_D).

The alternative *market risk hypothesis* suggests that international banks may have higher risk due to market-specific factors that make foreign assets relatively risky (i. e. , σ_F high relative to σ_D and/or μ_F low relative to μ_D), unless this risk is offset by a low correlation ρ_{FD} (e.g., Winton, 2000; Amihud, DeLong, and Saunders, 2002). Foreign market conditions may cause international banks to face greater risks on their foreign assets. As in the nonfinancial firm risk literature, foreign exchange risk may make foreign assets riskier because that they are denominated in foreign currency (e.g., Brimmer and Dahl, 1975).[3] Further, local competition in the foreign markets may affect the time it takes for a new entrant to establish market share and to create lending relationships (e.g., Berger, Klapper, and Udell, 2001; Chari and Gupta, 2008). Another important factor is the local culture (e.g., Li and Guisinger, 1992), since it takes time to learn the local market's language, preferences, and informal institutions. Other market factors include the degree of regulatory, monetary, and legal complexity (e.g., Berger, Buch, DeLong, and DeYoung, 2004; Alibux, 2007), the degree of economic and political instability (e.g., Shapiro, 1985; Brewer and Rivoli, 1990), and the extent of market imperfections and asymmetric information problems in the foreign countries (e.g., Buch and DeLong, 2004; Gleason, Mathur, and Wiggins, 2006). In addition, there may be operational diseconomies associated with monitoring from a distance, consistent with the *home field advantage hypothesis* of Berger, DeYoung, Genay, and Udell (2000).

Importantly, both the *diversification hypothesis* and the *market risk hypothesis* may hold simultaneously for different sets of banks. All that we can do as researchers is determine which of these hypotheses has stronger empirical support, i.e., which hypothesis empirically dominates the other. To address this question, we use virtually all (15,988) U.S. commercial banks for the period 1989:Q1 to 2010:Q4, and evaluate whether international or purely domestic banks have more risk. We find that international banks have much higher risk than purely domestic banks. In addition, we document that a greater marginal degree of internationalization within the subset of internationalized banks is associated with higher risk. These results are consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*.

[3] Our data for the foreign assets is sourced from the Call Report, where this data is already converted into U.S. dollars, (eliminating the need for conversion from other currencies).

To ensure the robustness of our findings, we re-run our analyses using alternative proxies for bank internationalization and risk, alternative samples, and alternative estimation methods. We also address potential endogeneity issues of our internationalization variable. There are at least three possible sources of endogeneity. First, internationalization and risk taking may be simultaneously driven by unobservable bank characteristics. Second, our internationalization variable may be imperfectly measured. Third, there might be a potential causal link from risk taking to internationalization, as high risk level causes banks to diversify internationally to reduce this risk. We address the endogeneity concern in two ways. First, we conduct an instrumental variable (IV) analysis to extract the exogenous component of internationalization in assessing the influence of internationalization on risk. Second, we apply a propensity score matching (PSM) analysis to help dispel the competing explanation that our results may spuriously reflect differences in the characteristics of international and purely domestic banks. In each of these checks, we find that our main results remain unchanged.

In additional analyses, we examine the impact of internationalization on the three components of *Z-score* – mean return on assets, mean capitalization ratio, and standard deviation of returns – to identify the sources of the higher risk of internationalization. We find that internationalization is associated with a higher volatility of bank earnings, which might reflect higher risks that international banks face in the foreign markets. We also find that internationalization is associated with lower mean profitability, consistent with prior empirical evidence that banks' foreign operations are generally relatively inefficient (e.g., Berger, DeYoung, Genay, and Udell, 2000). In addition, internationalization is associated with higher capitalization, perhaps designed to offset part of the higher risks from the other sources.

We also examine publicly listed banks and banks in listed bank holding companies, which allows us to examine market-based risk measures. We find that listed international banks have higher market risk as measured by higher standard deviations of stock returns and lower Standard & Poor's credit ratings than their purely domestic counterparts, consistent with market participants being aware of the higher risk of international banks. We also separately examine financial crisis periods and non-crisis periods to investigate whether internationalization affects risk differently during financial crises. Our results suggest that the relation between internationalization and risk is stronger during financial crises.

Finally, our finding that internationalization is associated with higher risk raises the question of why banks internationalize. One potential explanation is higher returns, but our results seem to contradict this explanation, given that we find lower mean profitability for internationalized banks. Second, banks may become international as part of a defensive strategy to follow their important customers abroad by setting up offices in countries where their home country customers have foreign affiliates to avoid losing their clients' business. This strategy might not translate into large enough financial benefits to offset the

costs of internationalization. A third potential explanation is empire building by bank managers. Managers that internationalize may gain higher salaries and/or more prestige than domestic bank managers. This may occur if there are significant agency problems in banking. We test this last explanation and find that the positive relation between internationalization and bank risk is more pronounced in banks that are more likely to suffer from agency problems related to poor corporate governance, supporting the empire-building explanation.

In the following, Section 2 presents a simple model of an international bank's portfolio. Section 3 describes the data, variables, and summary statistics. Section 4 presents the main results and Section 5 provides the robustness tests. Section 6 discusses additional analyses. Section 7 concludes.

2. A simple model of an international bank's portfolio

Assume that an international bank has a simple portfolio with two risky assets: a foreign asset with expected return μ_F and standard deviation σ_F and a domestic asset with expected return μ_D and standard deviation σ_D. The correlation between the two assets is ρ_{FD} and the bank's ratio of foreign assets to total assets is w, which ranges from 0 to 1. The expected return of the portfolio is:

$$\mu_P = w\mu_F + (1-w)\mu_D. \tag{1}$$

The variance of the portfolio is:

$$\sigma_P^2 = w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D. \tag{2}$$

The standard deviation of the portfolio σ_p is:

$$\sigma_p = \sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}. \tag{3}$$

Our (inverse) measure of risk is *Z-score. Z-score* for an international bank is:

$$Z = \frac{\mu_P + (K/A)}{\sigma_p}, \tag{4}$$

where K/A represents the mean *Capitalization Ratio*.

We rewrite Z from equation (4) as:

$$Z = \frac{w\mu_F + (1-w)\mu_D + (K/A)}{\sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}}. \tag{5}$$

We attempt to assess the impact of internationalization on risk, that is, the effect of the foreign

assets ratio, w, on the *Z-score*:

$$\partial Z/\partial w = \frac{\partial\left[\frac{\mu_P + (K/A)}{\sigma_p}\right]}{\partial w}. \tag{6}$$

We show in Online Appendix Y that $\partial Z/\partial w$ can be written in terms of the basic parameters as:

$$\begin{aligned}\partial Z/\partial w = &\left[\frac{[(1-w)\sigma_D^2 + w\rho_{FD}\sigma_F\sigma_D]}{[w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D]^{\frac{3}{2}}}\right]\mu_F \\ &-\left[\frac{[w\sigma_F^2 + (1-w)\rho_{FD}\sigma_F\sigma_D]}{[w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D]^{\frac{3}{2}}}\right]\mu_D \\ &-\left[\frac{[w\sigma_F^2 - (1-w)\sigma_D^2 + (1-2w)\rho_{FD}\sigma_F\sigma_D]}{[w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D]^{\frac{3}{2}}}\right](K/A)\,.\end{aligned} \tag{7}$$

We cannot unambiguously sign this derivative, but we use Matlab to solve equation (7) by entering the following parameters and conditions:

$$w \in [0,1],\ \sigma_F\ \in (0,1),\ \sigma_D \in (0,1), \rho_{FD} \in [-1,1], \mu_F \in (0, 0.5), \mu_D \in (0,0.5), K/A \in (0,0.5). \tag{8}$$

We use starting values of 0 for w, 0.1 for σ_F, σ_D, μ_F, μ_D, and *K/A*, and -1 for ρ_{FD}, and increments of 0.1 for all.

The effect of higher w on Z depends crucially on both ρ_{FD} and the relative risk of the foreign asset (i.e., magnitudes of σ_F compared to σ_D and μ_F compared to μ_D). There are two clear-cut cases in which the correlation and the relative risks intuitively point to reduced or increased risk from more investment in the foreign asset.

Case 1 – Negative correlation and relatively low foreign asset risk: $\rho_{FD} \leq 0;\ \sigma_F < \sigma_D; \mu_F > \mu_D$.

Case 2 – Positive correlation and relatively high foreign asset risk: $\rho_{FD} > 0;\ \sigma_F > \sigma_D; \mu_F < \mu_D$.

The findings are as follows. In Case 1, we find that $\partial Z/\partial w$ is mostly positive: 75,876 positive solutions, 28,667 negative solutions, and 1 zero solution. This is intuitive and suggests that for most but not all values, more of the foreign asset reduces overall portfolio risk when the correlations of returns are negative and the foreign asset is relatively safe.

In Case 2, we find that $\partial Z/\partial w$ is mostly negative: 90,194 negative solutions, 4,832 positive solutions, and 14 zero solutions. This is intuitive and suggests that for most but not all values, more of the

foreign asset increases overall portfolio risk when the correlations of returns are positive and the foreign asset is relatively risky.

We also consider other possible cases in which there is either positive correlation with relatively low foreign asset risk ($\rho_{FD} > 0;\ \sigma_F < \sigma_D;\ \mu_F > \mu_D$) or negative correlation with relatively high foreign asset risk ($\rho_{FD} \leq 0;\ \sigma_F > \sigma_D;\ \mu_F < \mu_D$), as well as cases in which the mean and standard deviation relations go in opposite directions, and we find mixed results.[4]

The model suggests our two hypotheses regarding the effects of internationalization (w) on bank risk (Z): the *diversification hypothesis* and the *market risk hypothesis*. The *diversification hypothesis* that international banks have lower risk ($\partial Z/\partial w > 0$) will hold if asset returns are not highly correlated across countries (ρ_{FD} is low) as long as the foreign asset is not risky relative to the domestic asset (i.e., σ_F is not too large relative to σ_D and μ_F is not too low relative to μ_D). This is best exemplified by Case 1. The *market risk hypothesis* that international banks have higher risk ($\partial Z/\partial w < 0$) will hold if market-specific factors make the foreign asset relatively risky (i.e., σ_F high relative to σ_D, and/or μ_F low relative to μ_D) unless they are offset by a low correlation ρ_{FD}. This is best exemplified by Case 2.

3. Data, variables, and summary statistics

3.1 Sample banks

We acquire bank data from quarterly Call Reports, which contain financial information on all banks in the U.S. Our raw data cover the period 1986:Q1 to 2010:Q4, although our risk measure starts in 1989:Q1 because of the lag structure of our model. We adjust the data to be in real 2010:Q4 terms using the GDP price deflator. Our initial dataset comprises 1,069,609 bank-quarter observations. We omit observations that do not refer to commercial banks, leaving 969,053 observations. We next remove any bank-quarter observations with missing or incomplete financial data on basic accounting variables such as total assets and equity, as well as observations that have missing or negative data for income statement variables such as interest expenses, personnel expenses, and non-interest expenses, resulting in 964,150 bank-quarter observations. Following the procedure in Berger and Bouwman (2009), we further refine our sample by excluding observations with i) gross total assets (GTA)[5] less than or equal to $25 million and ii) no

[4] In summary, in Case 3, positive correlation and relatively low foreign asset risk, $\partial Z/\partial w$ is positive for most parameter values. In Case 4, negative correlation and relatively high foreign asset risk, $\partial Z/\partial w$ is mostly negative. In Case 5, relatively high foreign asset return and relatively high foreign asset risk, $\partial Z/\partial w$ is mostly negative. In Case 6, relatively low foreign asset return and relatively low foreign asset risk, $\partial Z/\partial w$ is mostly positive.

[5] Gross total assets (GTA) equals total assets plus the allowance for loan and lease losses and the allocated transfer risk reserve (a reserve for certain foreign loans). Total assets on Call Reports deduct these two reserves, which are held to cover potential credit losses. We add these reserves back to measure the full value of the assets financed.

outstanding loans or deposits (i.e., entities not engaged in deposit-taking or loan-making, which are required for banks to be considered commercial banks). These screens leave us with a final sample of 778,664 bank-quarter observations for 15,988 commercial banks over the entire sample period. Finally, to avoid distortions in ratios that contain equity, for all observations with total equity less than 1% of total assets, we replace equity with 1% of total assets.

3.2 Bank variables

3.2.1 Measures of risk

As noted, our main (inverse) measure of bank risk is *Z-Score*, with larger values indicating lower overall bank risk (e.g., Boyd and Runkle, 1993; Laeven and Levine, 2009; Houston, Lin, Lin, and Ma, 2010; Beltratti and Stulz, 2012). It is calculated as the sum of a bank's mean *ROA* (net income over GTA) and mean *Capitalization Ratio* (equity capital over GTA) divided by *Stdv. ROA* (the volatility of *ROA*). In our main analysis, we compute *Z-Scores* over a 12-quarter period, following a methodology similar to Berger, Klapper, and Turk-Ariss (2009) and Demirgüç-Kunt and Huizinga (2010).

We also employ several alternative measures of bank risk. We take the log of the 12-quarter *Z-score*. We also construct *Z-score* over 8 quarters and 20 quarters. We use *Stdv. ROE*, the standard deviation of *ROE* over 12 quarters, where ROE is net income over total equity. We also use the *Sharpe Ratio*, calculated as the risk-adjusted rate of return on equity (mean *ROE/Stdv. ROE*), following Demirgüç-Kunt and Huizinga (2010). In addition, we use *NPL Ratio*, the nonperforming loans ratio, a measure of financial stability calculated as the bank ratio of nonperforming loans (past due at least 90 days or in nonaccrual status) to total loans (e.g., Berger, Klapper, and Turk-Ariss, 2009), and *LLA Ratio*, the ratio of the loan and lease loss allowance to total loans.

3.2.2 Measures of internationalization

We construct several measures of bank internationalization, following Cetorelli and Goldberg (2012). Our main measure is *Foreign Assets Ratio*, the ratio of a bank's foreign assets to GTA.[6] A larger *Foreign Assets Ratio* indicates a higher degree of internationalization, while a ratio of 0 indicates that a bank has purely domestic operations. We also specify three alternative measures of internationalization. The first is *Bank Internationalization Dummy*, which takes the value 1 if *Foreign Assets Ratio* is positive, and 0 otherwise. The second is *Foreign Loans Ratio*, the ratio of a bank's foreign loans to the total loans of the bank. The third is *Foreign Deposits Ratio*, the ratio of foreign deposits to total deposits.

[6] Due to data limitations, we are only able to capture the assets in the foreign offices of U.S. banks, not the foreign assets in domestic offices. We also lack information on host countries where foreign offices of U.S. banks operate.

3.2.3 Control variables

To isolate the role of internationalization in bank risk, we employ a number of control variables for bank characteristics shown to affect a bank's risk outcome. We first control for *Income Diversification*. Demirgüç-Kunt and Huizinga (2010) and Baele, De Jonghe, and Vander Vennet (2007) find that a greater reliance on non-interest income is linked to more volatile returns. Stiroh (2006) finds a negative link between total bank risk and diversification of revenue.[7] We follow Laeven and Levine (2007) and construct *Income Diversification* as 1 – |(Net Interest Income – Other Operating Income)/(Total Operating Income)|.[8]

Following Demirgüç-Kunt and Huizinga (2010), we include *Size*, measured as the log of GTA, since prior research shows that bank size is an important determinant of international competitive success (e.g., Hirtle, 1991), and that risk varies with bank size. In particular, prior work shows that larger banks have a greater capacity to absorb risk (e.g., Berger, Bouwman, Kick, and Schaeck, 2014), economies of scale in foreign exchange management (e.g., Minh To and Tripe, 2002), and more stable earnings (e.g., De Haan and Poghosyan, 2012). Alternatively, larger banks may take on higher risk due to safety-net policies that can put them under the "too big to fail" umbrella (e.g., O'Hara and Shaw, 1990).

Our third control is the public status of the bank, *Listed*, since prior research shows that this factor affects risk (e.g., Nichols, Wahlen, and Wieland, 2009; Barry, Lepetit, and Tarazi, 2011). Publicly traded banks may have different risk behavior because they tend to be more informationally transparent, and are subject to more monitoring from capital markets. We construct *Listed* as a dummy that takes the value of 1 if a bank is listed or is part of a bank holding company that is listed, and 0 otherwise.

Fourth, we control for membership in a bank holding company, *BHC*. Such membership is expected to help a bank strengthen its position because the holding company is required to support its affiliates by injecting capital as needed. Consistent with this view, Houston, James, and Marcus (1997) find that bank loan growth depends on bank holding company membership. We construct *BHC* as a dummy that takes the value of 1 if the bank is part of a bank holding company, and 0 otherwise.

Our fifth control is *Overhead Costs*, which captures the bank's operating cost structure. Demirgüç-Kunt and Huizinga (2010) find that banks with high overhead costs are less stable. We construct *Overhead*

[7] In a study of European banks, LePetit, Nys, Rous, and Tarazi (2008) find that increased non-interest income exposure is positively linked to risk. Stiroh and Rumble (2006) also find that an increased share of volatile non-interest activities outweighs the diversification benefits. Houston, Lin, Lin, and Ma (2010) use a diversification index and find that diversification reduces risk.

[8] In unreported results, we also run our regression analysis using a measure of asset diversification, which is calculated as 1 – |(Net Loans – Other Operating Assets)/(Total Earning Assets)|. The relation between internationalization and risk does not change.

Costs as the ratio of total bank operating expenses to GTA.

Finally, we control for the effect of the regulatory environment on bank risk (e.g., Laeven and Levine, 2009; Berger and Bouwman, 2013). We control for potential differences in bank stability owing to a bank's primary federal regulator with three proxies. We include *FED* and *OCC*, dummies that equal 1 if the Federal Reserve or the Office of the Comptroller of the Currency, respectively, is the bank's primary federal regulator. We omit *FDIC*, a dummy that equals 1 if the Federal Deposit Insurance Corporation is the bank's primary federal regulator, to avoid perfect collinearity.

3.3 Summary statistics

Figure 1 Graph A plots the evolution of the numbers of U.S. commercial banks with foreign assets, foreign loans, and foreign deposits over our sample period (1989:Q1–2010:Q4). There is a decline in the number of international commercial banks with foreign assets, from 181 in 1989:Q1 to 53 in 2010:Q4, which could be due to the consolidation of the banking sector.[9] However, the total number of unique international banks over our entire sample period is 390, which is much larger than the number at the beginning of our sample period due to new entries and switches. A similar pattern obtains in the evolution of internationalization ratios in Figure 1 Graph B, with *Foreign Assets Ratio* declining from 0.23% to 0.05%, *Foreign Loans Ratio* declining from 0.16% to 0.05%, and *Foreign Deposits Ratio* declining to a lesser degree, from 0.35% to 0.18%.

In Figure 1 Graph C, we find that despite the decline in the number of international banks and internationalization ratios, there are increases in the dollar amounts of their foreign activities, foreign assets, foreign loans, and foreign deposits. Thus, the decline in the ratios was primarily due to domestic assets, loans, and deposits growing faster than corresponding foreign quantities over the sample period.

Figure 1 Graph D compares the risk (*Z-score*) of international commercial banks with purely domestic peers. This figure also depicts crisis periods, with banking crises (crises originating in the banking sector) represented by dark gray shaded areas and market crises (crises originating in capital markets) by light gray shaded areas following the definitions in Berger and Bouwman (2013) (discussed in more detail in Section 6.3). As shown, the mean *Z-score* of international banks is lower than that of purely domestic banks each year in the sample, with the exception of a short period prior to the recent subprime mortgage crisis. This is generally consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*. Comparing financial crises with normal times, the figure also reveals a steeper

[9] Cetorelli and Goldberg (2012) report in their Table II that the number of global banks was 247 in 1985, 170 in 1995, and 107 in 2005. Our numbers are slightly lower because we focus only on commercial banks, whereas Cetorelli and Goldberg include all banks in the Call Reports.

decline in the mean *Z-score* for international banks during financial crises. These raw data are generally consistent with a stronger dominance of the *market risk hypothesis* during crises.

Table 1 provides definitions and summary statistics for our variables. In terms of risk, commercial banks have a mean 12-quarter *Z-score* of 36.053, indicating that the average bank is very far from default, a mean *Stdv. ROE* of 0.035, and a mean *NPL Ratio* of 0.016. The internationalization measures indicate that on average 0.1–0.3% of U.S. commercial banks' operations are international, with some banks having very intense foreign operations during some of the bank-quarters (unreported). In terms of bank characteristics, the average commercial bank has a level of *Income Diversification* of 20%, and a *Size* of 11.9 (mean GTA of $0.968 billion). About 15% of the commercial banks are listed or part of a listed bank holding company (*Listed*) and about 70% are owned by a bank holding company (*BHC*). Also, the average commercial bank has *Overhead Costs* of 1.62. Finally, 10.6%, 30.9%, and 58.5% of the banks have the *FED*, the *OCC*, and the *FDIC* as their primary regulator, respectively.[10]

Table 2 presents correlations among the key variables. Banks with higher *Foreign Assets Ratios* exhibit lower *Z-scores*, suggesting that, consistent with Figure 4, these banks have a higher likelihood of default. Furthermore, international banks tend to have more *Income Diversification*, are larger (*Size*), are more likely to be publicly listed (*Listed*), are less likely to be members of bank holding companies (*BHC*), and have higher overhead costs (*Overhead Costs*). Banks that internationalize are also more likely to have the *FED* or the *OCC* as their primary regulator, likely because they tend to be among the larger banks that are either state-chartered members of the Federal Reserve or nationally-chartered.

4. Empirical results

In this section, we empirically analyze the effect of internationalization on bank risk. We first perform univariate tests that compare the risk of international versus purely domestic banks. We then conduct multivariate regressions with control variables included.

4.1 Univariate analysis

We compare the means and medians of our bank risk measures (*Z-score*, *Stdv. ROE*, *Sharpe Ratio*, *NPL Ratio*, and *LLA Ratio*) for the international bank and domestic bank subsamples in Table 3. The results in Panel A indicate that the mean (median) 12-quarter *Z-score* is 28.69 (20.24) for international banks compared to 36.16 (28.41) for domestic banks. These differences, which are statistically significant at the 1% level, support the view that international banks are riskier.

[10] These percentages do not sum up to exactly 100% due to rounding.

This result continues to hold using alternative measures of risk. For instance, the mean (median) logarithm of the 12-quarter *Z-score* is 0.35 (0.33) lower, the mean (median) 8-quarter *Z-score* is 7.40 (9.05) lower, and the mean (median) 20-quarter *Z-score* is 6.90 (6.88) lower for international banks. Moreover, the standard deviation of ROE is larger for international banks than their domestic peers, with the difference in the mean (median) of 0.005 (0.005). The *Sharpe Ratio* is smaller for international banks compared to domestic peers, with the difference in the mean (median) of 0.49 (-0.72). We also find that the ratio of nonperforming loans (*NPL Ratio*) and the ratio of loan loss allowances (*LLA Ratio*) are higher for international than domestic banks, with the difference in the mean (median) of 0.011 (0.006) and 0.013 (0.007), respectively. All of these differences are statistically significant, except for the mean difference of the *Sharpe Ratio*. Each of the findings above suggests that international banks are riskier.

Furthermore, Panel B compares the means and medians of 12-quarter Z-*score* for international banks and domestic banks by different bank size categories to mitigate the potential concern that our results are driven by a particular bank size group. We define small banks as having GTA less than $1 billion, medium-sized banks as having GTA between $1 billion and $5 billion, and large banks as having GTA greater than $5 billion. All size thresholds are measured in constant 2010:Q4 dollars. The results indicate that the mean (median) 12-quarter *Z-score* is 10.13 (8.85) lower for small international banks, 14.98 (10.50) lower for medium international banks, and 6.71 (5.13) for large international banks. All differences are statistically significant at the 1% level. Overall, our preliminary evidence provides strong support for the view that international banks are riskier than purely domestic banks, consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*.

4.2 Regression analysis

To examine the relation between internationalization and bank risk in a multivariate setting, we estimate several versions of the following model:

$$Risk_{i,t-k+1,t} = \alpha + \beta_1 \cdot Internationalization_{i,t-k} + \beta_2 \cdot Controls_{i,t-k} + \omega_t + \varepsilon_{i,t-k+1,t} \qquad (9)$$

where *Risk* is measured by *Z-score* and the other proxies outlined in Section 3.2.1, *Internationalization* is bank internationalization as measured by the proxies discussed in Section 3.2.2, *Controls* is the vector of bank control variables described in Section 3.2.3, ω denotes time fixed effects, and ε is an error term. Because risk is likely correlated within a bank over time, we adjust standard errors for clustering at the bank level.[11] The risk variables are measured over the *k* quarters from *t*-*k*+1 to *t*, while the independent variables

[11] We consider alternative ways to adjust the standard errors for possible dependence in the residuals in Section 5.3.

are measured in the quarter *t-k* to ensure that they are predetermined relative to the dependent variable.[12] We use *k*=12 in our main analysis and consider other values in Section 5.1. The main reasons for the time series dimension in our model is that we want to measure the average relation between internationalization and risk over many economic conditions over time (our main analysis).[13] In Section 6.3, we also analyze how the relation differs during financial crises versus normal times.

The results are presented in Table 4. Model 1 reports results from regressing *Z-score* on *Foreign Assets Ratio* (our main internationalization measure) using ordinary least squares (OLS). Controlling for bank characteristics and time fixed effects, the coefficient on *Foreign Assets Ratio* is negative and statistically significant at the 1% level. This result is also economically material – moving the *Foreign Assets Ratio* from 0 to 0.0992 (the mean of the *Foreign Assets Ratio* for the international banks in our sample), with all other independent variables held at their means, decreases *Z-score* by about 6.752 (from 38.429 to 31.677). This suggests that bank internationalization is associated with greater bank risk, consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*.

In Model 2, we replace *Foreign Assets Ratio* with *Bank Internationalization Dummy*. The coefficient estimate on *Bank Internationalization Dummy* is negative and statistically significant at the 1% level. This estimate is also economically material—moving *Bank Internationalization Dummy* from 0 to 1 (i.e., the bank internationalizes), with all other independent variables held at their means, decreases *Z-score* by about half from 38.617 to 19.066, again consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*. In Model 3, we assess the impact of the *Foreign Assets Ratio* for the subsample of banks with nonzero *Foreign Assets Ratio*. We find that international banks with greater foreign assets ratios are riskier. This suggests that in addition to internationalization status, the degree of bank internationalization also matters for bank risk.

Models 4 to 9 of Table 4 report additional results. In Model 4, we exclude too-big-to-fail entities, defined as banks with GTA greater than $100 billion, consistent with banks that were subject to stress tests or the Supervisory Capital Assessment Program (SCAP) and the Comprehensive Capital Analysis and Review (CCAR). In Model 5, we exclude the 20 most internationally active banking organizations, defined as entities with the largest *Foreign Assets Ratio* in each quarter. In Models 4 and 5, we continue to find that international banks are riskier, suggesting that our core result is not driven by too-big-to-fail or the most

[12] Some researchers argue that models with lagged independent variables help attenuate endogeneity concerns (e.g., Duchin, Ozbas, and Sensoy, 2010). However, we recognize that endogeneity might still be an issue. We address this concern in Section 5.4.

[13] In Online Appendix Z, Section Z.3, we explain that bank fixed effects may not be appropriate for this sample due to not having enough banks that switch their status over time. We also conduct two tests that suggest that these effects are not appropriate for our sample.

internationally active banks. Next, we report results by bank size to assess whether our main evidence is concentrated in a particular bank size class, since previous studies find differences in portfolio composition by bank size (e.g., Berger, Miller, Petersen, Rajan and Stein, 2005). In Models 6 to 8, we find that bank internationalization is associated with higher risk across all size classes. In Model 9, we analyze averages (e.g., the average risk, internationalization, and control variables) using one observation per bank, and the results are robust.

Turning to the bank controls, we find across nearly all models in Table 4 that firm size has positive coefficients, consistent with larger banks having better risk management skills and/or greater capacity to absorb losses through risk diversification, consistent with Berger, Bouwman, Kick, and Schaeck (2014). We also find that *Listed* has positive and significant coefficients, suggesting that public status is associated with less risk, consistent with Houston, Lin, Lin, and Ma (2010). We further find that BHC membership is associated with higher values of *Z-score*. Next, *Overhead Costs* enters with negative coefficients, consistent with the finding in Demirgüç-Kunt and Huizinga (2010) that banks with higher overhead costs are less stable. Finally, we find that the regulatory environment matters for bank risk. Specifically, we find that *FED* and *OCC* enter with positive and statistically significant coefficients, suggesting that Federal Reserve- and OCC-regulated banks are less risky than FDIC-regulated banks.

For bank holding companies, the risk of the group may be more relevant than the risk of individual banks. To account for this possibility, we consolidate the commercial banks in multibank holding companies at the holding company level (BHC) and re-run all of the regressions. These results are reported in Online Appendix Z Table Z.2, and are consistent with our previous evidence, suggesting that internationalization is associated with greater risk. In Online Appendix Z, Section Z.4 and Table Z.5, we examine the impact of internationalization on market-based risk measures for publicly listed banks and bank holding companies, and our main findings remain unchanged.

5. Robustness tests

5.1 Alternative measures of risk

In Table 5, we examine whether our main results are sensitive to alternative measures of bank risk. Unless specifically stated otherwise, these measures are also computed over the 12-quarter interval from *t–11* to *t*. In Model 1, we analyze the sensitivity of our results to using the log of *Z-score* as the dependent variable. This specification has the advantage of mitigating the impact of outliers. Next, we compute *Z-score* over alternative time intervals. Specifically, the dependent variable is *Z-score* computed over 8 quarters (from *t–7* to *t*) in Model 2 and *Z-score* computed over 20 quarters (from *t–19* to *t*) in Model 3. Next, in Model 4 we use as the dependent variable *Sharpe Ratio*, the risk-adjusted return on equity (mean

ROE/Stdv. ROE). In Model 5, we use *Stdv. ROE,* the standard deviation of *ROE*. In Model 6, we use *NPL Ratio*, the bank ratio of nonperforming loans to total loans. Finally, we report regression estimates using *LLA Ratio*, the ratio of loan and lease loss allowance to total loans, in Model 7. In Models 6 and 7, we measure the risk variables at the end of quarter *t*.[14] In each of the specifications, we find that the coefficient on *Foreign Assets Ratio* is statistically significant at the 5% level or better in the direction of internationalization being associated with more risk, reinforcing our finding of an empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*.

5.2 Alternative measures of internationalization

In Online Appendix Z Table Z.3, we examine whether our findings persist when we consider alternative internationalization measures. We use *Foreign Loans Ratio* (ratio of the bank's total foreign loans to total loans) and *Foreign Deposits Ratio* (ratio of the bank's foreign deposits to total deposits). We find that the coefficient on the internationalization variable is negative and statistically significant at the 1% level, suggesting that the positive relation between internationalization and risk is robust to using alternative measures of internationalization.

5.3 Alternative econometric specifications and standard errors

We also evaluate whether our core inferences hold when we employ alternative econometric specifications and alternative standard errors. Specifically, we control for cross-sectional and serial dependence using Newey-West, Prais-Winsten, Fama-MacBeth, and two-way clustering by bank and time to allow for correlations among different banks in the same quarter and across quarters for the same bank (Thompson, 2011). The results shown in Online Appendix Z Table Z.4 confirm our earlier evidence: the coefficient on *Foreign Assets Ratio* is negative and statistically significant at the 1% level in all cases.

5.4 Endogeneity and sample selection concerns

In addition, we perform tests to address the potential endogeneity of our internationalization variable, which could bias our findings. In particular, there could be a causal link from bank risk to internationalization. For example, banks with risky assets could have incentives to internationalize to diversify their risks. This may result in correlation between our internationalization variable and the error term, leading to spurious inferences on the effect of internationalization on bank risk. We conduct tests to

[14] For Models 1, 4, and 5, the independent variables are constructed as of quarter *t–12*, since the dependent variable is computed over *t–11* to t. For Model 2, the independent variables are constructed as of quarter *t–8*, while for Model 3, the independent variables are constructed as of quarter *t–20*. Finally, for Models 6 and 7, we lag the independent variables by 1 quarter as the dependent variables only contain contemporaneous components.

address this potential problem as well as the related concern of self-selection bias.

Instrumental variables. We use instrumental variable (IV) estimation to extract the exogenous component of bank internationalization in assessing the influence of internationalization on risk. A proper instrument should satisfy the requirements of relevance and exogeneity, that is, it must correlate with bank internationalization, but not be a direct cause of bank risk.

Our instrument is *Border State*, a dummy equal to 1 if a bank is headquartered in one of the U.S. states bordering an ocean, Canada, or Mexico, and 0 otherwise.[15] *Border State* should be positively correlated with internationalization, as banks in border states are more likely to have foreign operations. Also, the average bank in the sample was established 62.6 years ago, suggesting that for most cases, the bank choice of state headquarters location occurred long before the decision to internationalize, suggesting that the decision to locate in the state is not endogenous.

The IV regression results are reported in Panel A of Table 6. To facilitate comparison, we include the OLS results from Model 1 of Table 4 in the first column. We report the first-stage regression results in Model 2 and the second-stage results for the 2SLS estimation in Model 3.

The first-stage regression indicates that our instrumental variable, *Border State*, is positively and significantly (at the 1% level) related to internationalization. We perform two tests to check the suitability of the selected instrument. First, we conduct the Kleibergen-Paap under-identification test to evaluate the rank condition. We find that the Kleibergen-Paap *rk* LM rejects the null hypothesis at the 1% level (*rk LM* = 739.551 with a *p*-value less than 0.001), indicating that the model is well identified. Second, using an instrument that is weakly correlated with the endogenous explanatory variable can lead to large inconsistencies in the coefficient estimates. To examine the relevance of our IV, we conduct an *F*-test of the excluded exogenous variable in the first stage regression, in which the null hypothesis is that the instrument does not explain the variation in the *Foreign Assets Ratio*. We reject this null hypothesis at the 1% level (*F* = 720.795 with a *p*-value less than 0.001). The second-stage regression indicates that bank internationalization is associated with greater risk, consistent with our earlier evidence. The IV estimate is much larger in absolute value terms than the OLS estimate.[16] This suggests that in our main regressions,

[15] These states are: Alaska, Arizona, California, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Maine, Maryland, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Vermont, Virginia, and Washington.

[16] Documenting a much larger coefficient estimate for IV compared to OLS is consistent with Levitt (1996) and Berger and Bouwman (2009).

OLS may underestimate the causal effect of bank internationalization on risk.[17]

Propensity score matching analysis. To confront the issue of self-selection bias, we use propensity score matching (PSM) analysis, developed by Rosenbaum and Rubin (1983), closely following Lawrence, Minutti-Meza, and Zhang (2011).[18] We conduct both a univariate comparison between international and domestic banks and a regression analysis.

PSM analysis involves matching observations based on the probability of undergoing the treatment, which in our case is the probability of internationalizing. Specifically, PSM estimates the effect of internationalization on a bank's risk by comparing the risk (*Z-score*) of banks that expand into foreign markets (treatment group) with the risk of banks that have a similar probability of going international, but for which no such event takes place (control group). This quasi-experiment is conducted by matching each international bank with one or more domestic banks sharing similar characteristics as indicated by their propensity scores. The effect of internationalization is calculated as the average difference between the international group and the matched control group. To estimate a bank's propensity score, we use a probit model in which the dependent variable is *Bank Internationalization Dummy*, the indicator for whether the bank has positive foreign assets. The independent variables are bank characteristics from our main model, our instrumental variable, *Border State*, as well as time fixed effects.

We use several matching techniques. First, we use one-to-one matching without replacement, matching each international bank (treated group) to the nearest domestic (untreated) control bank. This technique ensures that we do not have multiple domestic banks assigned to the same international bank, which can lead to a smaller control group than the treated group. Second, we use one-to-one matching with replacement, which differs in that each treated bank is matched to the nearest control bank even if the latter is used more than once (Dehejia and Wahba, 2002). Finally, we use nearest-neighbor matching with n=2 and n=3 with replacement, which matches each international bank with the two and three domestic banks with the closest propensity scores, respectively.[19]

[17] In unreported results, we also try excluding the international banks from the top 1, 2, 3, 4, and 5 border states (in terms of number of banks) and alternatively try excluding the international banks from the top 1, 2, 3, 4, and 5 U.S. states (in terms of number of banks) and rerun the IV analysis. In all of these tests, the second stage estimate is close to the estimate reported here.

[18] As noted by Lawrence, Minutti-Meza, and Zhang (2011), PSM has important advantages such as: 1) the ability to produce samples in which the treated and untreated entities are similar, providing a natural framework to estimate the effects of treatment and firm characteristics; 2) independence from an explicit functional form (as opposed to Heckman selection models); and 3) the ability to estimate the treatment effects more directly as well as the ability to alleviate potential nonlinearities related to the treatment effects.

[19] In unreported tests, we compare the means of the bank characteristics used in the selection models across the international and domestic bank samples to assess the effectiveness of our propensity matching procedure.

We first estimate the internationalization effect on risk as the mean difference between international banks' risk and that of their matched domestic peers. We then perform regressions on the matched samples to control for observable confounders in the process of estimating the causal effects. Table 6 Panel B reports both univariate and regression tests.[20] In the univariate tests, we report *t*-statistics for the differences in risk between the treated and control groups for each of the four PSM techniques. Using one-to-one matching without replacement, we find that *Z-score* is 6.44 lower for international banks than for the control group. Applying the other three techniques, we obtain differences in *Z-score* of 5.96, 6.04, and 6.08, respectively. All differences are significant at the 1% level.

Turning to the regression analysis, we regress the *Z-score* on the *Foreign Assets Ratio* and all control variables and time fixed effects used in the main regression specification using only the treated and control banks. In all matched samples (Models 1 to 4), we continue to find a negative and statistically significant coefficient on *Foreign Assets Ratio,* consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*. This evidence helps dispel the competing explanation that our results above spuriously reflect differences in the characteristics of international banks and purely domestic banks, rather than the effect of internationalization on bank risk.[21]

6. Additional analyses

6.1 Z-score decomposition

To shed light on the channels through which bank internationalization affects risk, we decompose *Z-score* into its three components: mean *ROA*, mean *Capitalization Ratio,* and *Stdv. ROA*. Table 7 reports results of regressions of these components of *Z-score* on *Foreign Assets Ratio*. The regressions include the same control variables and time fixed effects as in our main specification.

Reassuringly, these results indicate that the distributions of the bank characteristics are statistically indistinguishable between the international and domestic samples at conventional levels.

[20] The number of banks included is larger than (the number of unique international banks)+(n+1), where n is the number of matches for each bank. This is because matches are done individually quarter-by-quarter as characteristics of the banks can change over time and thus a bank can be matched to different banks in different quarters. For one-to-one matching without replacement, we have 8,886 observations in the treated group and 8,886 observations in the control group. For one-to-one matching with replacement, we have 8,886 observations in the treated group and 5,835 observations in the control group. For nearest-neighbor matching with n=2 and replacement, and respectively nearest-neighbor matching with n=3 and replacement, we have 8,886 observations in the treated group (international banks), and 10,219 observations, and respectively 13,960 observations in the control group.

[21] In unreported results, we analyze changes in the *Z-score* when the internationalization status of our sample banks changes. The results suggest that, on average, banks seem to increase risk when they become international, but do not decrease risk when they revert back to domestic status. In our analysis we focus on the full sample of international and purely domestic banks rather than the switches between the two categories because the small number of switches may not provide a meaningful analysis.

In Model 1, bank internationalization is associated with lower profitability as measured by mean *ROA*, consistent with findings in DeYoung and Nolle (1996), Peek, Rosengren, and Kasirye (1999), and Berger, DeYoung, Genay, and Udell (2000). Our result is consistent with Goetz, Laeven, and Levine (2013), who find that bank geographical diversification across U.S. states is detrimental to bank performance. In Model 2, bank internationalization is associated with increased mean *Capitalization Ratio*, which reduces bank risk. To the extent that bank managers are aware that internationalization is associated with higher risk, they may want to partially offset this as a precautionary measure with a higher *Capitalization Ratio*. Similarly, to the extent that capital market participants and regulators are aware of the higher risks associated with internationalization activities, they may also pressure banks to increase their capital. In Model 3, bank internationalization is associated with increased volatility in bank profitability as measured by *Stdv. ROA*, which increases bank risk.

6.2 Internationalization and risk during financial crises

In Table 8, we examine the effect of internationalization and bank risk during financial crises and normal times to explore whether internationalization affects risk differently during financial crises. On the one hand, international banks may increase their risk less than purely domestic banks during financial crises because their exposure to shocks is lessened as they hold assets and deposits both in the domestic and foreign markets. This could offer them greater income diversification and risk-sharing, provide them with a stronger and more diversified deposit base, and ensure better liquidity provision through access to international capital markets (Cetorelli and Goldberg, 2011).

On the other hand, international banks may further increase their risk during financial crises because of their organizational complexity, making it difficult for management to deal with financial crises. International banks may also rely more often on inter-bank and capital markets for their funding, while domestic banks may rely more on insured deposits, which are less volatile during financial crises.

To identify financial crises, we follow Berger and Bouwman's (2013) definitions and dates.[22] Specifically, we use two banking crises (crises that originated in the banking sector) – the credit crunch (1990:Q1–1992:Q4) and the subprime lending crisis (2007:Q3–2009:Q4) – and two market crises (crises that originated in the financial market) – the Russian debt crisis/Long Term Capital Management (LTCM) bailout (1998:Q3–1998:Q4), and the bursting of the dot.com bubble and September 11 (2000:Q2–2002:Q3).[23] We first include the interaction term *Foreign Assets Ratio* × *Financial Crises* in Model 1 to

[22] Other studies using the same financial crises include Lee (2014), Saheruddin (2014), Berger and Bouwman (2015), Roman (2015), and Temesvary (forthcoming).

[23] This last set of events is considered a single crisis because there was essentially no significant break between them. In March 2000, the Nasdaq composite index peaked, and then began its descent. After the bubble burst, many

test whether there is a difference in the effects of the *Foreign Assets Ratio* during financial crises. In Models 2 and 3, we include separate interaction terms with a *Banking Crises* dummy and a *Market Crises* dummy, respectively. In Model 4, we include interactions with both the *Banking Crises* and *Market Crises* dummies.[24]

The results suggest that the impact of bank internationalization on risk is higher during financial crises than in normal times, as indicated by the negative coefficient on the interaction term *Foreign Assets Ratio* × *Financial Crises* in Model 1.[25] When we split financial crises into banking crises and market crises, the effect of internationalization on risk is more pronounced during market crises in Models 2, 3, and 4. In unreported results we conduct a *t*-test for the equality of the effects of internationalization for the two types of crises from Model 4 and find that the coefficients of the two interaction terms are statistically significantly different from one another (t = 2.702). Our result on market crises may be due to recent developments that have made banking organizations more dependent on the capital markets (Gennaioli, Shleifer, and Vishny, 2012; IMF Financial Stability Report, 2012). The smaller increase in risk as a result of internationalization during banking crises may also be due to internationalized banks reducing their risks more or receiving more government help during these crises.

6.3 Why do banks internationalize?

Our findings raise the question of why banks internationalize. We offer three potential explanations. First, banks may internationalize to achieve higher returns (e.g., Galema, Koetter, and Liesegang, 2015). However, our results seem to contradict this explanation, given that we find lower mean profitability for internationalized banks. Second, banks may follow their important customers abroad as part of a defensive strategy by setting up offices in countries where their home country customers have foreign affiliates to avoid losing their clients' business and maintain existing relationships (e.g., Brimmer and Dahl, 1975; Goldberg and Saunders, 1981; Grosse and Goldberg, 1991; Brealey and Kaplanis, 1996). Although this phenomenon might occur, it is unlikely to explain our results, as we would expect that such a strategy

dot.com's ran out of capital and were acquired or filed for bankruptcy. The U.S. economy slowed down and business investments fell. The 9/11 terrorist attacks occurred before the economy had recovered and may have exacerbated the stock market downturn. By 2002:Q3, the Nasdaq index had fallen by 78%, wiping out $5 trillion in market value of mostly technology firms (adapted from Berger and Bouwman, 2013). To address concern about including 9/11 as a market event (joint with the dot.com bubble), in unreported robustness checks, we try counting the 9/11 quarter and rest of this crisis as normal times, and also try excluding these quarters entirely from the sample. In both cases, the results are robust.

[24] We do not include the financial crises dummies as stand-alone variables because they would be subsumed by the time fixed effects. However, in unreported tests, we replace the time fixed effects with the financial crises dummies and find consistent results.

[25] In a theoretical framework, Wagner (2011) discusses a possibility where the probability of joint liquidation of assets during a crisis may lead banks to forgo some diversification benefits.

should at least translate into large enough financial benefits from servicing important customers abroad to offset the costs of bank internationalization.[26] Third, internationalization could be driven by empire-building behavior of bank managers (e.g., Jensen and Meckling, 1976; Jensen, 1986; Roll, 1986; Stulz, 1990). Managers that enlarge their banks through international activities may gain higher compensation and/or more prestige than domestic bank managers. This might occur if there are significant agency problems in banking, particularly if these agency problems are intensified by bank diversification (e.g., Laeven and Levine, 2007; Goetz, Laeven, and Levine, 2013).

We investigate whether empire building is a potential explanation for our results. Our empirical strategy involves estimating our model for subsamples of banks with varying levels of agency problems due to differences in corporate governance. This analysis is limited to publicly listed banks because corporate governance data are available only for these banks.

Following prior research, we consider various measures of corporate governance.[27] We first construct three measures of institutional ownership: *Institutional Ownership*, the ratio of institutional share holdings to bank outstanding shares; *Pension Fund Ownership*, the ratio of public pension funds' holdings to bank outstanding shares, where the list of public pension funds is from Dittmar and Mahrt-Smith (2007); and *Long Term Institutional Ownership*, the ratio of holdings by long-term institutions to bank outstanding shares following Gaspar, Massa, and Matos (2005). Prior evidence suggests that institutional investors, particularly activist investors such as public pension funds and long-term institutional investors, have the incentives and ability to monitor managers (e.g., Gillan and Starks, 2000; Gaspar, Massa, and Matos, 2005; Chen, Harford, and Li, 2007). For all three measures, a lower ownership ratio would indicate less monitoring by institutional investors and potentially higher agency problems.

We also construct a measure of analyst coverage, *Number of Analysts*, which is the number of financial analysts providing earnings forecasts for the bank in each quarter. Prior research suggests that analyst coverage enhances corporate transparency, making managerial extraction of private benefits more difficult (e.g., Lang, Lins, and Miller, 2004).

CEO Duality is an indicator variable for whether the CEO is also chairman of the board. CEO

[26] There is also some evidence that international banks do not always rely heavily on a "follow your customer" strategy to support their multinational expansion (e.g., Engwall and Wallenstål, 1988; Hellman, 1996; Miller and Parkhe, 1998; Seth, Nolle, and Mohanty, 1998).

[27] We obtain data on corporate governance from multiple sources. We retrieve the institutional ownership data from Thomson-Reuters Institutional Holdings (13F) Database and the analyst coverage data from I/B/E/S. In addition, we manually collect data on CEO duality and insider ownership from SEC EDGAR DEF 14A proxy filings and 10K reports for the time period 1994–2010. Our corporate governance data starts in 1994, which corresponds to the date when the data became publicly available on the SEC EDGAR.

duality may be indicative of agency problems because it may restrict the information flow to directors and undermine the effectiveness of board oversight (e.g., Jensen, 1993; Brickley, Coles, and Jarrell, 1997).

Insider Ownership is the ratio of shares owned by insiders (directors and executive officers as reported in the DEF 14A report) divided by total outstanding shares. Prior research finds a curvilinear relation between firm valuation and insider ownership (e.g., Stulz, 1988; McConnell and Servaes, 1990), suggesting that insiders with relatively low ownership and relatively high ownership are entrenched. With very low ownership, insiders externalize much of the outcome of their actions. With very high ownership, they secure enough control of the firm to be able to misuse its assets for their personal benefit.

Based on prior corporate governance literature, we identify the following groups of banks as being more likely to have severe agency problems: lower institutional ownership, lower public pension fund ownership, lower long-term institutional ownership, lower analyst coverage, CEO is chairman, and very low and very high levels of insider ownership.

Our results are reported in Table 9. In Panel A, we use *Institutional Ownership* in Models 1 and 2, *Pension Fund Ownership* in Models 3 and 4, and *Long Term Institutional Ownership* in Models 5 and 6. For each ownership variable, we report the results for subsamples of below-median (higher agency problems) and above-median (lower agency problems) ownership. The coefficient estimates on *Foreign Assets Ratio* are negative and significant at the 1% level, but are larger in absolute value in the subsamples of banks with higher agency problems (Models 1, 3, and 5) relative to the subsamples with lower agency problems (Models 2, 4, and 6). Importantly, for each ownership variable, the difference in the *Foreign Assets Ratio* coefficient between the subsamples is statistically significant at the 1% level. These results suggest that the positive relation between internationalization and bank risk is stronger for banks that are more likely to have higher agency problems, supporting the empire-building explanation.[28]

In Panel B, we use the *Number of Analysts* and *CEO is Chairman* as indicators of agency problems. We find that the coefficient estimate on *Foreign Assets Ratio* is negative and larger in absolute value in the subsamples of banks with below-median analyst coverage (Model 1) and CEO duality (Model 4). These differences between the subsamples are significant at the 1% level. Again, these results suggest that the relation between internationalization and bank risk is stronger in banks suffering from more severe agency problems, supporting the empire-building explanation.

Finally, in Panel C we use *Insider Ownership* to indicate agency problems. To account for

[28] In unreported results, we also run tests alternatively using the numbers of institutional investors, pension funds, and long-term institutional investors and obtain qualitatively similar results.

nonlinearity of the relation between insider ownership and firm value, we split the sample according to the 20th and 80th percentiles of insider ownership.[29] We consider insider ownership below the 20th percentile and above the 80th percentile to be indicative of more agency problems. We find that the coefficient estimates on *Foreign Assets Ratio* are negative and significant only in the subsamples of banks with more agency problems (Models 1 and 3), consistent with the curvilinear relation between firm valuation and insider ownership documented in the literature. An *F*-test rejects the null hypothesis of equality of these coefficients at the 1% level. Again, these results suggest that the internationalization-risk relation is stronger for banks that are more likely to have severe agency problems.

In summary, our results suggest that the positive relation between internationalization and bank risk is consistently stronger for banks that are more likely to have high agency problems due to poor corporate governance, supporting the empire-building explanation.[30]

7. Conclusions

This paper is the first to assess the role of internationalization in bank risk using U.S. bank data. We find strong, robust evidence that the more internationalized the bank, the higher the risk. We use a number of different measures of internationalization and risk, employ various econometric procedures to control for potential endogeneity and sample selection biases, and consider different subsamples. The data persistently suggest that internationalization is associated with higher bank risk, consistent with the empirical dominance of the *market risk hypothesis* over the *diversification hypothesis*. This effect appears to be more pronounced during financial crises, particularly market crises. Additional results suggest that capital market participants recognize the difference in risk between international and domestic banks.

Our findings raise the question of why banks internationalize. We rule out higher returns and follow-your-customer as primary explanations because of our finding that returns are lower for internationalized banks. A third potential explanation is empire building by bank managers to gain higher compensation and/or more prestige, which may occur if there are significant agency problems in these banks due to poor corporate governance. We test this explanation and find that the positive relation between internationalization and bank risk tends to be much stronger for banks that are more likely to have severe agency problems, supporting the empire-building explanation.

This paper contributes to two strands of research. First, it adds to the literature on bank risk by introducing internationalization as a factor influencing risk and sets the groundwork for further research on

[29] In unreported results, we use cutoffs of the 25th and 75th percentiles. The results are qualitatively similar.

[30] In unreported results, we repeat these tests using interactions and we obtain similar evidence.

bank internationalization. Although some policymakers, practitioners, and researchers point to the benefits of geographical risk diversification resulting from the internationalization of banks, our results suggest that this effect is dominated by other factors. Specifically, our results suggest that the additional local market risks taken on following international expansion outweigh the benefits of diversification.

Second, this paper contributes to the broader internationalization literature by examining risk within one important industry rather than across diverse industries with their confounding differences. We find that bank internationalization is associated with higher risk in an industry in which risk is highly monitored by bank supervisors as well as shareholders and debtholders. These findings suggest that authorities might consider internationalization as an additional factor in bank supervision and regulation.

These results should be interpreted with caution. First, this is only one study on the topic of internationalization and bank risk and may not fully capture the general relation between bank internationalization and risk. Second, we do not know the extent to which these results may generalize to other nations, therefore more research may be needed using data from other countries. It is possible that the U.S. may have relatively safer domestic assets than other countries, and so the results may not generalize.[31] Third, the Call Report data does not allow us to identify the foreign host countries in which the banks have assets. Our results may mask important differences across host nations. In particular, it is likely that internationalization into some nations increases risk, and into other nations reduces risk. Finally, we acknowledge that the identification may not be perfect. It is generally hard to find an instrument that determines internationalization, but it is not a direct determinant of bank risk. However, the fact that our findings hold up to the IV analysis and so many other robustness checks gives us a reasonable amount of confidence in the documented findings.

[31] There is some evidence consistent with higher risk for international banks headquartered in other nations. Using a dataset of 903 banks spanning 84 countries for the 1999 to 2009 period, Bertay, Demirgüç-Kunt, and Huizinga (2015) find that international banks have higher interest expenses than purely domestic institutions.

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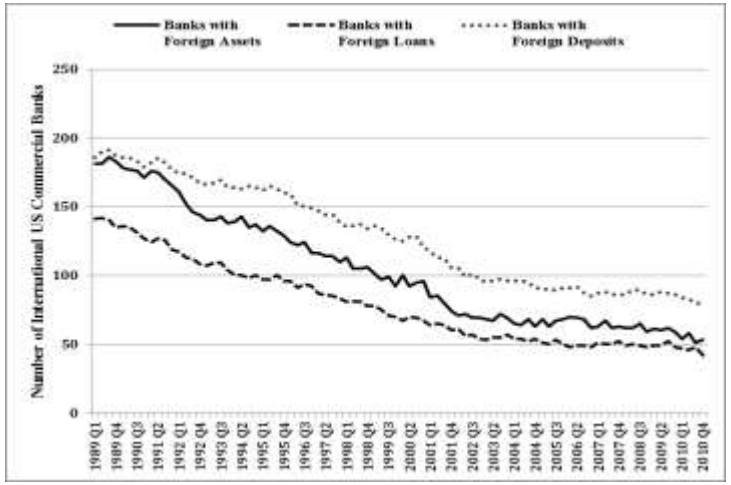
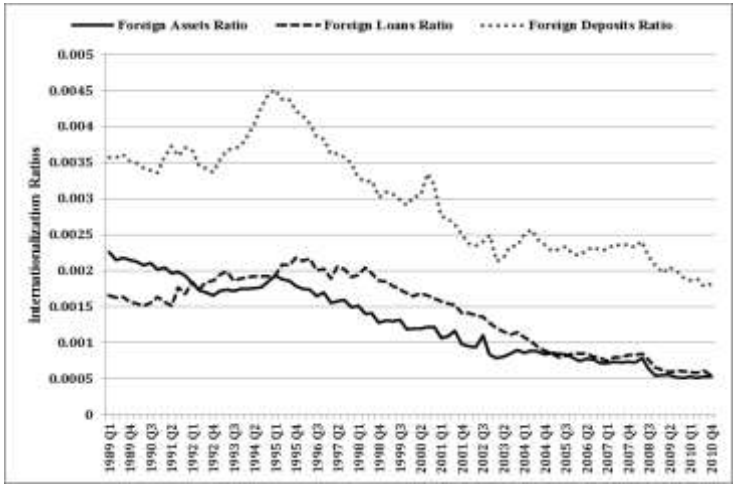
Figure 1: International U.S. Commercial Banks Dynamics

Graph A shows the evolution of bank internationalization over our sample period. It plots the number of international U.S. commercial banks for each quarter in our sample period. Three dimensions of bank internationalization are considered: foreign assets, foreign loans, and foreign deposits. Graph B plots the mean internationalization ratios of U.S. commercial banks by quarter. Three dimensions of bank internationalization are considered: foreign assets, foreign loans, and foreign deposits. Graph C plots the actual dollar amount (billions) of U.S. commercial banks' foreign activities by quarter. Three dimensions of bank internationalization are considered: foreign assets, foreign loans, and foreign deposits. Graph D compares the risk (mean *Z-score*) of international commercial banks versus purely domestic banks during our sample period. This figure depicts financial crisis periods in shaded gray areas: Banking Crises in dark gray and Market Crises in light gray. For all graphs, the sample period illustrated is 1989:Q1 to 2010:Q4.

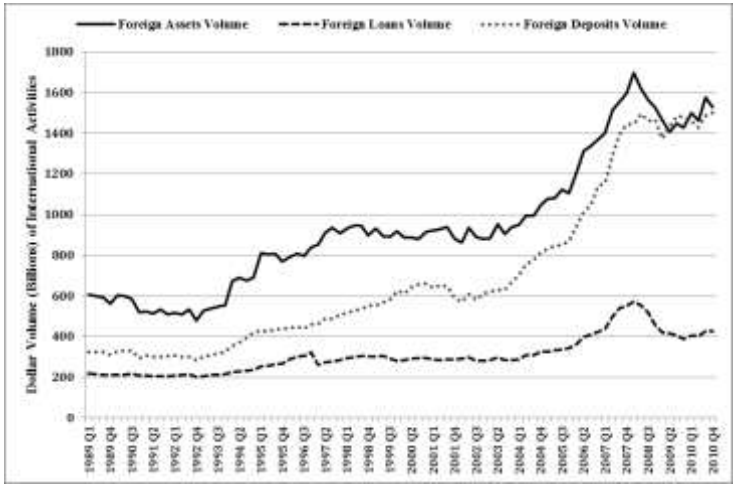
Graph A: International U.S. Commercial Banks over Time



Graph B: Different Internationalization Ratios over Time



Graph C: Total Volumes of International Activities over Time



Graph D: Mean *Z-score* for International Banks vs. Domestic Banks

Table 1. Variable Definitions and Summary Statistics

This table presents variable definitions and reports summary statistics for the full sample of U.S. commercial banks used in the analysis. All variables using dollar amounts are expressed in real 2010:Q4 dollars using the implicit GDP price deflator.

Variable	*Definition*	*Mean*	*Median*	*Std*	*25p*	*75p*
Risk Variables						
Z-score (12 quarters)	A bank measure of financial risk calculated as [Avg.(ROA) + Avg.(Equity/GTA)]/Stdv. ROA; a larger value indicates lower overall bank risk. Means of ROA and Equity/GTA as well as the standard deviation of ROA are computed over the previous 12 quarters (*t-11* to *t*).	36.053	28.287	30.754	14.459	48.771
Log of Z-score (12 quarters)	A bank measure of financial risk calculated as the logarithm of *Z-score (12 quarters)*.	3.198	3.343	1.001	2.674	3.888
Z-score (8 quarters)	A bank measure of financial risk calculated as [Avg.(ROA) + Avg.(Equity/GTA)]/Stdv. ROA; a larger value indicates lower overall bank risk. Means of ROA and Equity/GTA as well as the standard deviation of ROA are computed over the previous 8 quarters (*t-7* to *t*).	42.561	32.564	38.504	16.415	56.988
Z-score (20 quarters)	A bank measure of financial risk calculated as [Avg.(ROA) + Avg.(Equity/GTA)]/Stdv. ROA; a larger value indicates lower overall bank risk. Means of ROA and Equity/GTA as well as the standard deviation of ROA are computed over the previous 20 quarters (*t-19* to *t*).	29.805	23.830	24.374	12.425	40.460
Sharpe Ratio	The risk-adjusted return on equity defined as ROE/Stdv. ROE. ROE is defined as the ratio of net operating income to total equity.	6.477	3.238	157.687	1.911	5.937
Stdv. ROE	The standard deviation of ROE calculated over the previous 12 quarters (*t-11 to t* .) ROE is defined as the ratio of net operating income to total equity.	0.035	0.031	0.021	0.019	0.048
NPL Ratio	A measure of financial stability defined as the ratio of nonperforming loans (past due at least 90 days or in nonaccrual status) to total loans; a higher value indicates a riskier loan portfolio.	0.016	0.009	0.025	0.003	0.020
LLA Ratio	A measure of risk defined as the ratio of loan and lease loss allowance to bank total loans; a higher value indicates higher risk.	0.022	0.018	0.021	0.014	0.024
Idiosyncratic Risk	A measure of bank idiosyncratic risk calculated at the end of each calendar quarter using bank stock daily returns over the previous 12 months. Specifically, we regress each bank's stock returns on the Fama-French three factors (Market, HML, and SMB) and the momentum factor (UMD), and then construct *Idiosyncratic Risk* as the standard deviation of the regression's residuals.	0.025	0.020	0.019	0.015	0.029
Total Bank Risk	The standard deviation of daily stock returns over the previous 12 months (Esty, 1998) computed at the end of each calendar quarter.	0.027	0.022	0.020	0.016	0.030
Merton Default Probability	The normal transform of the distance-to-default measure using bank-level stock return data from CRSP and financial data from the Call Report. Details for this measure are shown in footnote 20 in the text. .	0.033	0.000	0.112	0.000	0.009
S&P Credit Rating	Based on S&P Domestic Long-Term Issuer Credit Rating, *S&P Credit Rating* equals 8 if the bank has an S&P rating of AAA, 7 if AA, 6 if A, 5 if BBB, 4 if BB, 3 if B, 2 if CCC, and 1 if CC.	2.282	1.000	1.814	1.000	4.000
S&P Investment Grade	A dummy equal to 1 if the bank has a credit rating of BBB or higher (investment grade), and 0 otherwise.	0.354	0.000	0.478	0.000	1.000
Internationalization Variables						
Foreign Assets Ratio (full sample)	A measure of bank internationalization defined as the ratio of foreign total assets to GTA of the bank; a larger value indicates a higher degree of internationalization and a ratio of 0 refers to purely domestic banks.	0.001	0.000	0.021	0.000	0.000
Foreign Assets Ratio (international banks only)	A measure of bank internationalization defined as the ratio of foreign total assets to GTA of the bank; a larger value indicates a higher degree of internationalization.	0.099	0.035	0.145	0.006	0.126
Bank Internationalization Dummy	A dummy that takes a value of 1 if ratio of the foreign total assets to GTA of the bank is positive, and 0 otherwise.	0.015	0.000	0.120	0.000	0.000
Foreign Loans Ratio	A measure of bank internationalization defined as the ratio of foreign total loans to total loans of the bank; a larger value indicates a higher degree of internationalization.	0.002	0.000	0.025	0.000	0.000
Foreign Deposits Ratio	A measure of bank internationalization defined as the ratio of foreign total deposits to total deposits of the bank; a larger value indicates a higher degree of internationalization.	0.003	0.000	0.038	0.000	0.000

Variable	*Definition*	*Mean*	*Median*	*Std*	*25p*	*75p*
Control Variables						
Income Diversification	A measure of diversification across different sources of income, calculated as 1-| (Net Interest Income - Other Operating Income)/Total Operating Income|.	0.200	0.216	0.158	0.079	0.332
Size	The logarithm of GTA.	11.904	11.649	1.168	11.094	12.386
Listed	A dummy that takes a value of 1 if the bank is listed on a stock exchange or is part of a bank holding company that is listed on a stock exchange, and 0 otherwise.	0.146	0.000	0.353	0.000	0.000
BHC	A dummy that takes a value of 1 if the bank is owned by a bank holding company, and 0 otherwise.	0.695	1.000	0.460	0.000	1.000
Overhead Costs	A proxy for the bank's cost structure calculated as the ratio of overhead expenses to GTA.	1.621	1.592	0.362	1.323	1.922
FED	A dummy indicating whether the bank is a state-chartered Federal Reserve member, that is, the Federal Reserve is the bank's primary federal regulator, and 0 otherwise.	0.106	0.000	0.308	0.000	0.000
OCC	A dummy indicating whether the bank has a national bank charter, that is, the bank's primary federal regulator is the Office of the Comptroller of the Currency (OCC), and 0 otherwise.	0.309	0.000	0.462	0.000	1.000
FDIC	A dummy that takes a value of 1 for non-member banks that have the Federal Deposit Insurance Corporation (FDIC) as a primary regulator, and 0 otherwise.	0.585	1.000	0.493	0.000	1.000
Time FE	Time fixed effects, represented by dummies for each quarter of the sample period.					
Instrumental Variable						
Border State	A dummy that takes a value of 1 if a bank is headquartered in one of the U.S. states having a border with an ocean, Canada, or Mexico, and 0 otherwise.	0.471	0.000	0.499	0.000	1.000
Other Variables						
ROA	Ratio of net income to bank GTA.	0.009	0.011	0.027	0.007	0.014
Capitalization Ratio	The bank capitalization ratio, measured as equity capital to GTA; a lower ratio indicates higher bank distress.	0.098	0.089	0.042	0.089	0.042
Stdv. ROA	The standard deviation of ROA calculated over the previous 12 quarters (*t-11* to *t*). ROA is defined as the ratio of net operating income to GTA.	0.008	0.004	0.016	0.002	0.008
Financial Crises	A dummy that takes a value of 1 for a financial crisis period, and 0 otherwise, following Berger and Bouwman (2013).	0.346	0.000	0.476	0.000	1.000
Banking Crises	A dummy that takes a value of 1 for a banking crisis period, and 0 otherwise. A banking crisis is a crisis that originated in the banking sector, following Berger and Bouwman (2013).	0.223	0.000	0.416	0.000	0.000
Market Crises	A dummy that takes a value of 1 for a market crisis period. A market crisis is a crisis that originated in the capital markets, following Berger and Bouwman (2013).	0.123	0.000	0.328	0.000	0.000
Normal Times	A dummy that takes a value of 1 for a normal time period, and 0 otherwise. A normal time period is a period other than a financial crisis period, following Berger and Bouwman (2013).	0.654	1.000	0.476	0.000	1.000
Institutional Ownership	The ratio of institutional share holdings to bank outstanding shares.	0.200	0.138	0.203	0.041	0.302
Pension Fund Ownership	The ratio of public pension funds' holdings to bank outstanding shares. The list of public pension funds is from Dittmar and Mahrt-Smith (2007).	0.007	0.001	0.012	0.000	0.007
Long-term Institutional Ownership	The ratio of holdings by long-term institutions to bank outstanding shares following Gaspar, Massa and Matos (2005).	0.070	0.044	0.079	0.009	0.110
Analyst Coverage	The number of financial analysts providing earnings forecasts for the bank in each quarter.	6.027	3.000	6.928	1.000	8.000
CEO Duality	An indicator variable for whether the CEO is the chairman of the board.	0.445	0.000	0.497	0.000	1.000
Insider Ownership	The ratio of shares owned by insiders (all directors and executive officers as a group as reported in the DEF 14A report) to bank outstanding shares.	0.167	0.130	0.133	0.069	0.232

Table 2. Correlations among Selected Variables

This table reports pair-wise correlations among the key variables used in the regression analysis. Table 1 shows definitions for all variables. *** indicates significance at the 1% level.

	Z-score	*Foreign Assets Ratio*	*Income Diversification*	*Size*	*Listed*	*BHC*	*Overhead Costs*	*FED*	*OCC*
Z-score	1								
Foreign Assets Ratio	-0.023***	1							
Income Diversification	0.040***	0.077***	1						
Size	0.128***	0.229***	0.174***	1					
Listed	0.063***	0.049***	0.130***	0.423***	1				
BHC	0.077***	-0.006***	0.029***	0.056***	0.0696***	1			
Overhead Costs	-0.259***	0.019***	0.431***	-0.072***	0.0379***	-0.081***	1		
FED	0.036***	0.037***	-0.028***	0.076***	0.0643***	0.023***	-0.046***	1	
OCC	0.018***	0.007***	0.056***	0.130***	0.0922***	-0.023***	0.086***	-0.231***	1

Table 3. Internationalization and Bank Risk: Univariate Analysis

This table reports univariate comparison tests for bank risk and other controls between international banks and purely domestic banks. Panel A reports results for the full sample. Panel B reports differences in *Z-score* by bank size. Table 1 shows definitions for all variables. *** indicates significance at the 1% level.

Panel A: Full Sample

	International Banks			Purely Domestic Banks			Difference in Means International – Domestic		Difference in Medians International – Domestic	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Variable	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**Difference**	**T-Stat**	**Difference**	**Wilcoxon M-W Statistic**
Z- score (12 quarters)	10,376	28.694	20.236	690,300	36.164	28.415	-7.470***	-24.6	-8.179***	-33.9
Log of Z-score (12 quarters)	10,337	2.856	3.013	689,604	3.204	3.348	-0.348***	-35.1	-0.335***	-33.5
Z- score (8 quarters)	10,376	35.273	23.648	690,300	42.670	32.697	-7.398***	-19.4	-9.049***	-30.7
Z- score (20 quarters)	10,376	23.013	17.051	690,300	29.907	23.933	-6.895***	-28.6	-6.882***	-35.8
Stdv. ROE	10,376	0.040	0.037	690,300	0.035	0.031	0.005***	24.8	0.005***	21.1
Sharpe Ratio	10,212	6.960	2.529	678,290	6.469	3.250	0.491	0.3	-0.721***	-21.7
NPL Ratio	11,499	0.027	0.015	767,162	0.016	0.009	0.011***	44.5	0.006***	43.4
LLA Ratio	11,499	0.034	0.024	767,165	0.022	0.018	0.013***	65.4	0.007***	59.7

Panel B: Risk (*Z- score*) *(12 quarters)* by Bank Size

	International Banks			Purely Domestic Banks			Difference in Means International - Domestic		Difference in Medians International – Domestic	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Bank Size (GTA)	**N**	**Mean**	**Median**	**N**	**Mean**	**Median**	**Difference**	***t*-stat**	**Difference**	**Wilcoxon M-W Stat**
Small (≤ 1 Billion)	2,400	25.707	19.453	651,483	35.836	28.298	-10.129***	-16.4	-8.846***	-19.8
Medium (1-5 Billion)	1,740	28.012	21.903	30,616	42.989	32.399	-14.977***	-15.8	-10.495***	-16.9
Large (> 5 Billion)	6,236	30.034	20.194	8,201	36.743	25.322	-6.709***	-11.6	-5.128***	-13.8

Table 4. Internationalization and Bank Risk: Regression Analysis

This table reports regression estimates of the relation between internationalization and bank risk. The dependent variable is *Z-score* (12 quarters). The main internationalization measure is the *Foreign Assets Ratio*. Model 1 is an OLS regression with time fixed effects, Model 2 uses *Bank Internationalization Dummy* as a proxy of internationalization, Model 3 includes international banks only, Model 4 excludes too-big-to-fail (*TBTF*) banks, Model 5 excludes the top 20 banks with the most intensive foreign activity each quarter, Model 6 includes small banks defined as banks with GTA <$1 Billion, Model 7 includes medium-sized banks defined as banks with GTA between $1 and $5 Billion, Model 8 includes large banks defined as banks with GTA over $5 Billion, and Model 9 includes an analysis of averages using one observation per bank. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: *Z-Score*								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Independent Variables:	**Full Sample**	**Full Sample**	**International Banks Only**	**Exclude *TBTF***	**Exclude Top 20 International Banks**	**Small Size (GTA ≤ $1 Bill)**	**Medium Size ($1 Bill < GTA ≤ $5 Bill)**	**Large Size (GTA > $5 Bill)**	**Analysis of Averages**
Foreign Assets Ratio	-68.064***		-15.884**	-61.465***	-90.924***	-47.035***	-49.981***	-31.945***	-82.861***
	(-8.725)		(-2.167)	(-6.139)	(-7.072)	(-4.105)	(-4.704)	(-2.706)	(-10.718)
International Bank Dummy		-19.551***							
		(-11.808)							
Income Diversification	0.957	0.923	-4.624	1.327	0.910	1.782	-12.203*	-16.791*	35.045***
	(0.720)	(0.695)	(-0.550)	(0.996)	(0.683)	(1.345)	(-1.701)	(-1.652)	(26.686)
Size	2.496***	3.038***	-0.017	3.250***	2.604***	5.447***	2.757***	1.323	2.017***
	(11.514)	(13.714)	(-0.024)	(14.254)	(11.958)	(20.255)	(2.710)	(1.476)	(10.239)
Listed	2.893***	2.847***	7.210***	2.827***	2.821***	4.264***	2.253	6.214***	5.328***
	(4.672)	(4.641)	(2.912)	(4.528)	(4.549)	(6.512)	(1.269)	(2.989)	(8.823)
BHC	1.300***	1.120***	-2.149	1.125***	1.295***	0.615	4.485**	0.674	1.412***
	(3.457)	(2.988)	(-0.824)	(2.993)	(3.444)	(1.634)	(2.060)	(0.272)	(3.674)
Overhead Costs	-38.817***	-38.526***	-26.203***	-38.647***	-38.899***	-38.379***	-31.110***	-25.345***	-35.261***
	(-54.022)	(-53.653)	(-6.478)	(-53.434)	(-53.984)	(-51.450)	(-12.741)	(-7.874)	(-56.951)
FED	2.475***	2.472***	-2.936	2.455***	2.530***	2.473***	-0.541	0.505	2.330***
	(3.743)	(3.753)	(-0.613)	(3.709)	(3.818)	(3.619)	(-0.226)	(0.124)	(4.070)
OCC	1.300***	1.380***	-7.626**	1.430***	1.299***	1.543***	-0.665	-8.614***	1.335***
	(2.996)	(3.194)	(-2.027)	(3.304)	(2.995)	(3.551)	(-0.329)	(-2.646)	(3.827)
Constant	53.255***	46.567***	64.909***	44.337***	58.119***	24.793***	61.110***	40.689***	59.246***
	(19.109)	(16.353)	(5.434)	(15.163)	(21.352)	(7.450)	(4.663)	(2.720)	(24.350)
Time FE	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**NO**
Observations	600,055	600,055	8,886	593,939	598,340	557,607	29,295	13,153	13,448
R-squared	0.148	0.150	0.154	0.151	0.148	0.161	0.147	0.166	0.249
N-Clusters(Bank)	13448	13448	319	13402	13439	12901	1324	428	

Table 5. Alternative Measures of Risk

This table reports regression estimates of the relation between internationalization and bank risk. The dependent variable are *Log of Z-score* (over prior 12 quarters) in Model 1, *Z-score* (over prior 8 quarters) in Model 2, *Z-score* (over prior 20 quarters) in Model 3, *Sharpe Ratio* (over prior 12 quarters) in Model 4, *Stdv. ROE* in Model 5, *NPL Ratio* in Model 6, and *LLA Ratio*.is *Z-score* (12 quarters) in Model 7. *Foreign Assets Ratio* is the measure of bank internationalization. All models include time fixed effects. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Alternative Measures of Risk						
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Independent Variables:	***Log of Z-score*** **(over 12 quarters)**	***Z-score*** **(over 8 quarters)**	***Z-score*** **(over 20 quarters)**	***Sharpe Ratio*** **(12 quarters)**	***Stdv. ROE*** **(over 12 quarters)**	***NPL Ratio*** **(Nonperforming Loans)**	***LLA Ratio*** **(Loan Loss Allowance)**
Foreign Assets Ratio	-1.999***	-78.231***	-59.208***	-29.948***	0.035***	0.055**	0.061***
	(-6.544)	(-8.224)	(-8.759)	(-3.706)	(6.420)	(2.135)	(2.865)
Income Diversification	0.197***	-0.617	3.357***	2.543	0.001	-0.003**	-0.000
	(5.029)	(-0.423)	(2.625)	(0.812)	(0.778)	(-2.503)	(-0.357)
Size	0.024***	3.282***	1.894***	1.507**	-0.001***	0.001***	0.000***
	(4.278)	(13.780)	(9.136)	(2.417)	(-9.392)	(6.056)	(2.639)
Listed	0.076***	5.055***	0.496	2.636*	-0.002***	-0.004***	0.001***
	(4.626)	(7.533)	(0.819)	(1.727)	(-7.547)	(-13.455)	(2.696)
BHC	0.060***	1.783***	0.664*	-0.631	-0.001***	-0.001***	-0.002***
	(5.751)	(4.339)	(1.869)	(-0.575)	(-3.369)	(-5.024)	(-6.690)
Overhead Costs	-1.334***	-44.649***	-32.296***	-5.240***	0.020***	0.016***	0.006***
	(-63.319)	(-56.272)	(-47.134)	(-4.574)	(44.892)	(25.312)	(7.661)
FED	0.063***	2.573***	2.461***	-1.654***	-0.001***	-0.001***	-0.001**
	(3.692)	(3.594)	(3.881)	(-2.857)	(-4.070)	(-3.385)	(-2.005)
OCC	0.021*	1.208**	1.396***	-0.293	-0.001**	0.000*	0.001***
	(1.797)	(2.531)	(3.419)	(-0.334)	(-2.219)	(1.955)	(4.328)
Constant	4.391***	49.990***	40.611***	-3.071	0.017***	0.004*	0.009***
	(58.182)	(16.309)	(15.686)	(-0.394)	(10.864)	(1.954)	(4.618)
Time FE	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Observations	599,746	656,175	498,015	591,760	600,055	762,671	762,674
R-squared	0.185	0.138	0.144	0.000	0.125	0.115	0.063
N-Clusters(Bank)	13,423	14,389	11,868	13,365	13,448	15,750	15,750

Table 6. Endogeneity

Panel A: IV Model

Panel A presents the results of instrumental variable (IV) estimation that controls for the endogeneity of bank internationalization. The instrument is *Border State*, a binary indicator for whether a bank is headquartered in a state that borders an ocean, Canada, or Mexico. Model 1 (baseline model) is an OLS regression. Models 2 and 3 are the first- and second-stage regressions of the IV estimation. The row labeled "*F*-statistic" reports the *F*-statistic of the test on whether the IV is significant in the first-stage regression. All models include time fixed effects. Table 1 provides definitions for all variables. Robust *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	(1)	(2)	(3)
Independent Variables:	**OLS**	**IV 2SLS First Stage**	**IV 2SLS Second Stage**
Foreign Assets Ratio	-68.064***		-200.382***
	(-8.725)		(-4.115)
Border State		0.001***	
		(26.988)	
Income Diversification	0.957	0.004***	1.413***
	(0.720)	(14.493)	(3.820)
Size	2.496***	0.005***	3.249***
	(11.514)	(43.595)	(11.659)
Listed	2.893***	-0.004***	2.251***
	(4.672)	(-29.665)	(8.030)
BHC	1.300***	-0.000***	1.197***
	(3.457)	(-6.075)	(13.463)
Overhead Costs	-38.817***	0.001***	-38.694***
	(-54.022)	(4.402)	(-216.549)
FED	2.475***	0.002***	2.669***
	(3.743)	(11.352)	(17.620)
OCC	1.300***	-0.001***	1.128***
	(2.996)	(-23.130)	(10.733)
Constant	53.255***	-0.060***	44.179***
	(19.109)	(-42.759)	(12.999)
Time FE	**YES**	**YES**	**YES**
Observations	600,055	600,055	600,055
R-squared	0.148	0.065	0.139
F-Statistic		720.795***	

Panel B: Propensity Score Matching

Panel B reports the difference in *Z-score* between international banks and matched purely domestic banks. Four different propensity score matching (PSM) methods are used to construct the control sample of purely domestic banks: 1:1 matching without replacement, 1:1 matching with replacement, nearest neighbor (n=2), and nearest neighbor (n=3). The propensity scores are computed from a probit model that uses the same control variables as in the baseline model (Model 1 in Table 4) plus the instrumental variable, *Border State*. Panel B also shows regression estimates of the relation between internationalization and bank risk on the four PSM samples. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: *Z-score*				
Propensity Score Matching Estimation	**Treated (International)**	**Controls**	**Difference**	***t*-stat**
1:1 Matching without replacement	29.33	35.77	-6.44***	-12.28
1:1 Matching with replacement	29.33	35.28	-5.96***	-4.42
Nearest neighbor (n=2)	29.33	35.36	-6.04***	-5.53
Nearest neighbor (n=3)	29.33	35.41	-6.08***	-6.15

Dependent Variable: *Z-Score*				
	(1)	**(2)**	**(3)**	**(4)**
Independent Variables:	**1:1 Matching without replacement**	**1:1 Matching with replacement**	**Nearest neighbor (n=2)**	**Nearest neighbor (n=3)**
Foreign Assets Ratio	-24.552***	-24.329***	-27.596***	-28.733***
	(-3.483)	(-3.531)	(-3.918)	(-4.085)
Income Diversification	-9.697	-10.014	-10.977*	-11.538**
	(-1.493)	(-1.543)	(-1.826)	(-2.013)
Size	-0.912*	-0.836	-1.199**	-1.336***
	(-1.779)	(-1.627)	(-2.533)	(-2.951)
Listed	5.515***	5.362***	4.343***	3.743***
	(3.341)	(3.179)	(2.861)	(2.648)
BHC	0.887	-0.022	1.454	1.896
	(0.516)	(-0.012)	(0.937)	(1.340)
Overhead Costs	-28.404***	-29.423***	-31.123***	-32.228***
	(-11.067)	(-10.451)	(-12.578)	(-14.335)
FED	1.681	0.213	1.768	1.948
	(0.540)	(0.065)	(0.639)	(0.790)
OCC	-5.327**	-5.304**	-4.000**	-3.404**
	(-2.557)	(-2.417)	(-2.135)	(-2.015)
Constant	77.760***	79.442***	89.190***	93.349***
	(9.570)	(10.011)	(12.257)	(13.866)
Time FE	**YES**	**YES**	**YES**	**YES**
Observations	17,772	14,721	19,105	22,846
R-squared	0.149	0.154	0.153	0.155
N-Clusters(Bank)	2,020	1,999	2,750	3,220

Table 7. *Z-score* Decomposition

This table reports regression estimates of the relation between internationalization and the components of *Z-score*. The dependent variables are mean *ROA* in Model 1, mean *Capitalization Ratio* in Model 2, and *Stdv. ROA* in Model 3. *Foreign Assets Ratio* is the measure of bank internationalization. All models include time fixed effects. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: *Z-Score* Components		
	(1)	**(2)**	**(3)**
Independent Variables:	**Mean *ROA***	**Mean *Capitalization Ratio***	***Stdv. ROA***
Foreign Assets Ratio	-0.018***	0.050**	0.009**
	(-6.152)	(2.016)	(2.475)
Income Diversification	0.011***	0.002	0.000
	(14.418)	(0.703)	(0.575)
Size	0.000*	-0.004***	0.000**
	(1.743)	(-11.474)	(2.309)
Listed	0.000	-0.003***	-0.000
	(0.551)	(-3.660)	(-1.378)
BHC	0.000	-0.011***	-0.001***
	(0.323)	(-17.886)	(-8.397)
Overhead Costs	-0.006***	-0.030***	0.010***
	(-11.590)	(-13.605)	(18.781)
FED	-0.001***	-0.002***	-0.000***
	(-4.208)	(-2.606)	(-2.903)
OCC	0.000	-0.001**	0.000
	(0.330)	(-2.080)	(0.510)
Constant	0.010***	0.208***	-0.005***
	(7.150)	(37.888)	(-2.962)
Time FE	**YES**	**YES**	**NO**
Observations	600,055	600,055	600,055
R-squared	0.101	0.136	0.036
N-Clusters(Bank)	13,448	13,448	13,448

Table 8. Internationalization and Bank Risk during Financial Crises

This table reports regression estimates of the relation between internationalization and bank risk during financial crises and normal times. The construction of the financial crisis periods follows Berger and Bouwman (2013). The dependent variable is *Z-score* (12 quarters). All models include time fixed effects. *Foreign Assets Ratio* is the measure of bank internationalization. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: *Z-score*			
	(1)	**(2)**	**(3)**	**(4)**
Independent Variables:	***Financial Crises***	***Banking Crises***	***Market Crises***	***Banking Crises* and *Market Crises***
Foreign Assets Ratio	-61.650***	-65.164***	-65.985***	-61.647***
	(-7.452)	(-7.875)	(-8.443)	(-7.452)
Foreign Assets Ratio* × *Financial Crises	-16.856***			
	(-3.490)			
Foreign Assets Ratio* × *Banking Crises		-10.967*		-14.491**
		(-1.662)		(-2.260)
Foreign Assets Ratio* × *Market Crises			-17.903**	-22.259***
			(-2.032)	(-2.672)
Income Diversification	0.950	0.949	0.963	0.953
	(0.714)	(0.714)	(0.725)	(0.717)
Size	2.498***	2.498***	2.496***	2.498***
	(11.525)	(11.520)	(11.514)	(11.523)
Listed	2.893***	2.893***	2.894***	2.894***
	(4.673)	(4.672)	(4.674)	(4.674)
BHC	1.300***	1.299***	1.301***	1.300***
	(3.458)	(3.456)	(3.460)	(3.459)
Overhead Costs	-38.809***	-38.815***	-38.812***	-38.808***
	(-54.002)	(-54.015)	(-54.014)	(-54.003)
FED	2.475***	2.473***	2.478***	2.476***
	(3.742)	(3.740)	(3.747)	(3.744)
OCC	1.300***	1.300***	1.300***	1.300***
	(2.996)	(2.996)	(2.996)	(2.996)
Constant	53.214***	53.234***	53.247***	53.216***
	(19.097)	(19.100)	(19.109)	(19.098)
Time FE	**YES**	**YES**	**YES**	**YES**
Observations	600,055	600,055	600,055	600,055
R-squared	0.148	0.148	0.148	0.148
N-Clusters(Bank)	13,448	13,448	13,448	13,448

Table 9. Role of Corporate Governance for the Impact of Internationalization on Bank Risk

This table reports regression estimates of the relation between internationalization and bank risk conditional on the magnitude of agency problems. The dependent variable is *Z-score* (12 quarters). The main internationalization measure is the *Foreign Assets Ratio*. The following are banks that are more likely to suffer from agency problems: less institutional ownership, less public pension fund ownership, and less long-term institutional ownership (Panel A); less analyst coverage and CEO is chairman (Panel B); and relatively low and relatively high levels of insider ownership (Panel C). All models include time fixed effects. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Institutional Ownership

	Institutional Ownership		***Pension Fund Ownership***		***Long-Term Institutional Ownership***	
	≤ median	**> median**	**≤ median**	**> median**	**≤ median**	**> median**
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Independent Variables:	***Z-score***	***Z-score***	***Z-score***	***Z-score***	***Z-score***	***Z-score***
Foreign Assets Ratio	-174.189***	-47.810***	-250.119***	-42.306***	-264.529***	-43.954***
	(-7.639)	(-3.601)	(-5.653)	(-3.171)	(-4.433)	(-3.381)
Income Diversification	22.637**	6.360	18.040**	5.665	16.066*	9.408
	(2.389)	(0.648)	(2.008)	(0.599)	(1.778)	(0.974)
Size	3.184**	-1.399	5.162***	-2.252**	4.772***	-2.212**
	(2.277)	(-1.500)	(3.674)	(-2.506)	(3.502)	(-2.392)
BHC	1.197	-4.088	-2.410	-4.757	0.291	-5.373
	(0.287)	(-0.831)	(-0.635)	(-0.971)	(0.076)	(-1.087)
Overhead Costs	-51.130***	-40.862***	-57.691***	-34.777***	-51.913***	-39.418***
	(-9.737)	(-7.896)	(-10.987)	(-7.855)	(-10.180)	(-7.837)
FED	4.073	5.321	9.342**	2.041	3.964	5.348*
	(1.036)	(1.617)	(2.424)	(0.648)	(1.099)	(1.721)
OCC	5.323	9.415***	8.953**	7.979***	3.349	10.934***
	(1.520)	(2.763)	(2.521)	(2.595)	(0.998)	(3.432)
Constant	74.228***	134.312***	86.329***	149.069***	22.616	151.726***
	(3.607)	(8.039)	(3.925)	(8.835)	(1.103)	(9.969)
Time FE	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Observations	12,519	17,434	11,685	18,268	11,879	18,074
R-squared	0.182	0.146	0.191	0.159	0.175	0.159
N-Clusters(Bank)	718	656	747	678	757	700
	Institutional Ownership		***Pension Fund Ownership***		***Long-Term Institutional Ownership***	
t-test for equality of the *Foreign Assets Ratio* coefficients across subsamples	-4.789***		-4.497***		-3.612***	

Panel B: Analyst Coverage and CEO Duality

	Number of Analysts		*CEO Duality*	
	≤ median	**> median**	**NO**	**YES**
	(1)	**(2)**	**(3)**	**(4)**
Independent Variables:	***Z-score***	***Z-score***	***Z-score***	***Z-score***
Foreign Assets Ratio	-167.039***	-43.260***	2.148	-54.929***
	(-7.453)	(-3.029)	(0.096)	(-3.337)
Income Diversification	15.467	-6.304	-15.047	21.926*
	(1.274)	(-0.469)	(-1.496)	(1.682)
Size	1.137	-2.395*	-0.262	-1.849*
	(0.688)	(-1.742)	(-0.220)	(-1.678)
BHC	0.909	-10.863	0.778	-7.767
	(0.186)	(-1.386)	(0.105)	(-1.272)
Overhead Costs	-45.901***	-32.286***	-43.367***	-46.187***
	(-6.829)	(-4.893)	(-8.789)	(-7.660)
FED	4.140	5.431	-3.476	6.136
	(0.982)	(1.297)	(-0.785)	(1.465)
OCC	7.197*	7.366*	5.275	7.882*
	(1.800)	(1.760)	(1.260)	(1.925)
Constant	115.740***	145.439***	134.051***	158.309***
	(4.043)	(6.792)	(5.761)	(8.597)
Time FE	**YES**	**YES**	**YES**	**YES**
Observations	8,933	9,082	11,004	9,822
R-squared	0.171	0.157	0.158	0.152
N-Clusters(Bank)	613	374	550	435

	Number of Analysts	*CEO Duality*
t-test for equality of the *Foreign Assets Ratio* coefficients across subsamples	-4.658***	-2.0493**

Panel C: Insider Ownership

	Insider Ownership		
	≤ p20	**(p20, p80]**	**> p80**
	(1)	**(2)**	**(3)**
Independent Variables:	***Z-score***	***Z-score***	***Z-score***
Foreign Assets Ratio	-26.200*	16.037	-316.526***
	(-1.755)	(0.653)	(-5.751)
Income Diversification	9.306	7.407	-29.911**
	(0.617)	(0.667)	(-2.461)
Size	-4.308***	0.458	4.300**
	(-3.071)	(0.359)	(2.368)
BHC	-8.654	-8.302	-0.487
	(-0.882)	(-1.167)	(-0.044)
Overhead Costs	-35.687***	-47.123***	-34.272***
	(-5.201)	(-7.683)	(-6.590)
FED	6.987	-1.419	-3.572
	(1.219)	(-0.339)	(-0.675)
OCC	12.256**	3.848	1.706
	(2.166)	(0.981)	(0.356)
Constant	178.817***	129.416***	86.203***
	(7.619)	(5.195)	(2.792)
Time FE	**YES**	**YES**	**YES**
Observations	4,718	12,327	3,631
R-squared	0.171	0.148	0.210
N-Clusters(Bank)	224	575	216

	Insider Ownership
F-test for equality of the *Foreign Assets Ratio* coefficients across subsamples	15.56***

Appendix Y – Model Details (for online publication only)

We assess the impact of internationalization on risk, that is, the effect of the foreign assets ratio, *w*, on the *Z-score*:

$$\partial Z/\partial w = \frac{\partial\left[\frac{\mu_P + (K/A)}{\sigma_p}\right]}{\partial w}. \tag{Y1}$$

Given that the expected return of the portfolio is:

$$\mu_P = w\mu_F + (1-w)\mu_D, \tag{Y2}$$

and the standard deviation of the portfolio σ_p is:

$$\sigma_p = \sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}\,, \tag{Y3}$$

the impact of the foreign assets ratio (w) on the *Z* of the international bank is:

$$\partial \mathrm{Z}/\,\partial \mathrm{w} = \frac{\partial\left[\frac{w\mu_F + (1-w)\mu_D + (K/A)}{\sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}}\right]}{\partial w}. \tag{Y4}$$

Equation (A4) is equivalent to:

$$\begin{aligned}\partial Z/\partial w = &\frac{\partial\left[\frac{w\mu_F}{\sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}}\right]}{\partial w} \\ &+ \frac{\partial\left[\frac{(1-w)\mu_D}{\sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}}\right]}{\partial w} \\ &+ \frac{\partial\left[\frac{(K/A)}{\sqrt{w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D}}\right]}{\partial w}.\end{aligned} \tag{Y5}$$

After taking the derivatives, we obtain:

$$\partial Z/\partial w = \left[\frac{[(1-w)\sigma_D^2 + w\rho_{FD}\sigma_F\sigma_D]}{[w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D]^{\frac{3}{2}}}\right]\mu_F$$
$$-\left[\frac{[w\sigma_F^2 + (1-w)\rho_{FD}\sigma_F\sigma_D]}{[w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D]^{\frac{3}{2}}}\right]\mu_D \qquad \text{(Y6)}$$
$$-\left[\frac{[w\sigma_F^2 - (1-w)\sigma_D^2 + (1-2w)\rho_{FD}\sigma_F\sigma_D]}{[w^2\sigma_F^2 + (1-w)^2\sigma_D^2 + 2w(1-w)\rho_{FD}\sigma_F\sigma_D]^{\frac{3}{2}}}\right](K/A)\,,$$

which is the same as equation (7) in Section 2.

Appendix Z: Other Robustness Tests (for online publication only)

Z.1 Change analysis

In this section, we conduct an analysis of changes in the Z-score when the internationalization status of our sample banks changes. The results are reported in Table Z.1.

In Panel A, we examine instances when a purely domestic bank becomes international. For a meaningful comparison, we require that a bank remains in the domestic status for at least 12 quarters before the switch and remains in international status for at least 12 quarters after the switch (excluding cases of banks that switch more than once). There are 24 such switches. We compare the means and medians of Z-score during the previous 12 quarters before the switch with the means and medians of Z-score of the bank in the 12 quarters immediately after the switch. These differences are statistically significant at the 5% level and show a decline in the banks' mean (median) Z-score of 5.44 (9.04), providing support for the view that banks are riskier when they internationalize, supporting our main results.

In Panel B, we analyze the changes in the Z-score when an international bank switches to a purely domestic status. Again, we impose the condition that banks remain in the same status for at least 12 quarters (excluding cases of banks that switch more than once). There are 18 such switches. We compare the means and medians of Z-score during the 12 quarters before the switch with the means and medians of Z-score of the bank in the 12 quarters immediately after the switch. Both the mean and median differences of banks' Z-score are not significant.

The results of the change analysis suggest that, on average, banks seem to increase risk when they become international, but do not decrease risk when they revert to domestic status. In the main part of the paper, we focus on the full sample of international and purely domestic banks rather than the switches between the two categories because the small number of switches may not provide a meaningful analysis.

Z.2 Consolidating at the holding company (BHC) level

For bank holding companies, it might be that the risk of the group is more relevant than the risk of individual banks. To account for this possibility, we consolidate the commercial banks in multibank holding companies at the holding company level (BHC) and re-run all of the regressions. These results are reported in Table Z.2, and are consistent with our previous evidence, suggesting that internationalization is associated with greater risk.

Z.3 Model feasibility

We investigate whether the research question we study could also be addressed using a model with bank fixed effects in addition to time fixed effects.

Bank fixed effects may not be appropriate for this sample due to not having enough banks that switch their status over time: Because so few banks switch between purely domestic and international status, the relationship between risk and internationalization we are capturing likely comes from cross-sectional (between) rather than time-series (within) variation in internationalization. Zhou (2001) shows that in such cases, the firm fixed-effect estimator may fail to detect a relationship even if one truly exists.[1]

We conduct two tests to better understand whether bank fixed effects are appropriate in our setting. First, we compare within and between variation in internationalization. For the between variation, we calculate the standard deviation of internationalization by year across banks, and then take the average across years. For the within variation, we calculate the standard deviation of internationalization by bank across years, and then take the average across all banks. If the between variation is much bigger than the within, then bank fixed effects are not recommended, and this is what we find. In particular, the between variation is about 28 times higher than the within variation (not shown).

Second, we examine the serial correlation coefficient of internationalization. Zhou (2001) stresses that if there is small within-firm variation in the explanatory variable (in our case, Foreign Assets Ratio), firm fixed effects become inappropriate and reduce the power to detect an effect, if one exists. We find that the serial correlation of the Foreign Assets Ratio is 0.9785, implying that the internationalization is highly persistent, again suggesting that bank fixed effects are not appropriate (not shown). For these reasons, we exclude bank fixed effects from the model.

Z.4 Accounting and market risk measures for listed banks and bank holding companies

In Table Z.5, we investigate whether our main results are sensitive to examining the subsample of publicly listed banks and those in publicly traded holding companies. This allows us to analyze the impact of internationalization on bank risk using several market-based risk measures. We aggregate banks in the Call Reports at the holding company level and merge the resulting sample with CRSP to obtain stock returns

[1] Zhou (2001) notes that when the temporal variation in the key independent variable x is small, including firm fixed effects eliminates too much of the variation in x to accurately estimate its coefficient. This argument goes back to Griliches and Hausman (1986) who show that firm fixed effects estimates of production functions produce parameter estimates that are "too small" because the fixed effects exacerbate existing measurement error problems. Intuitively, by removing all of the between variation, firm fixed effects remove so much variation such that what remains - the within variation - is dominated by the variation of the measurement error in x. The result is a sharp attenuation bias in the parameter estimate of x.

and with Compustat to obtain S&P credit ratings. We first employ the 12-quarter accounting *Z-score* as above as our dependent variable for this subsample of banks in Model 1. Despite the dramatic decrease in the number of observations (29,953 listed banks compared to 600,953 in the full sample), our core evidence persists in this subsample of banks.

We construct three measures of bank market risk based on stock returns. First, we estimate Carhart's (1997) four-factor model for each bank at the end of each calendar quarter using daily stock returns over the previous 12 months. Specifically, we regress each bank's stock returns on the Fama and French (1993) three factors (Market, HML, and SMB) and the momentum factor (UMD), and then construct *Idiosyncratic Risk* as the standard deviation of the regression's residuals. Second, at the end of each calendar quarter, we compute *Total Bank Risk* as the standard deviation of daily stock returns over the previous 12 months (Esty, 1998). Third, we compute *Merton Default Probability* as the normal transform of the distance-to-default measure (Merton, 1974) using bank-level stock return data from CRSP and financial data from the Call Report.[2] We use *Idiosyncratic Risk*, *Total Bank Risk*, and *Merton Default Probability* as our measures of bank risk in Models 2, 3, and 4 respectively.

Finally, we create two measures of bank market risk based on credit ratings. First, we convert the quarter-end long-term issuer credit ratings compiled by Standard & Poor's (S&P) to a numeric scale. Specifically, we create *S&P Credit Rating* by assigning a value of 8 if the bank has an S&P rating of AAA, 7 if AA, 6 if A, 5 if BBB, 4 if BB, 3 if B, 2 if CCC, and 1 if CC. Second, we create the dummy *S&P Investment Grade*, which is equal to 1 if the bank has a credit rating of BBB or higher, and 0 otherwise. Higher values of these two variables indicate lower risk.[3] We consider the effect of internationalization on *S&P Credit Rating* using an ordered probit analysis in Model 5 and *S&P Investment Grade using* a simple probit analysis in Model 6.

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[2] We model the market equity value of a bank as a call option on the bank's assets, where we use the market value of equity to proxy for the market value of the bank and total liabilities to proxy for the face value of debt following Acharya, Anginer, and Warburton (2013). The call option on the bank's assets is given as follows: (i) $V_E = V_A e^{-T} N(d_1) - X e^{-T} N(d_2) + (1 - e^{-T}) V_A$; $d_1 = [ln(V_A/X) + (r + s_A^2/2)T]/s_A\sqrt{T}$; $d_2 = d_1 - s_A\sqrt{T}$, where V_E is the market value of a bank, V_A is the value of the bank's total assets, X is the face value of debt proxied by the total bank liabilities, T equals 1 year, r is the market yield on U.S. Treasury Securities at 1-year constant maturity, which we take to be the risk-free rate, s_A is the volatility of the value of assets, which is related to equity volatility s_E, which is the standard deviation of daily equity returns over each time period calculated as follows: (ii) $s_E = [V_A e^{-T} N(d_1) s_A]/ V_E$. We simultaneously solve equations (i) and (ii) to obtain the values of V_A and s_A. Once we determine V_A, we follow Hillegeist, Keating, Cram, and Lundstedt (2004) and Acharya, Anginer, and Warburton (2013) and compute a bank's asset returns as $m = max\left[\left(V_{A,t}/V_{A,t-1}\right) - 1, r\right]$. Finally, we compute the *Merton Default Probability* as $N\left[-(ln[V_A/X] + [m - (s_A^2/2)T])/s_A\sqrt{T}\right]$.

[3] We exclude unrated banks from this analysis.

The results in Table Z.5 indicate that international public banks have higher idiosyncratic risk, higher total bank risk, higher probability of default, and lower credit ratings than purely domestic public banks, suggesting that capital market participants recognize the higher risk of international banks.

Table Z.1: Change Analysis

This table reports the results from two change analyses over the (-12 quarters, +12 quarters) time window. Panel I compares the means and medians of *Z-score* when banks switch from purely domestic to international. Panel II compares the means and medians of *Z-score* when banks switch from international to purely domestic. Table 1 shows definitions for all variables. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Panel A. Banks Switching from Purely Domestic to International Status

Change from *Domestic to International*	**Number of Changes**	***Z-score* for *Domestic* Banks (12 Quarters before Banks Become International**		***Z-score* for *International* Banks (12 Quarters after Banks Become International**		**Difference in Means *International – Domestic***		**Difference in Medians *International - Domestic***	
	(1)	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
		Mean	**Median**	**Mean**	**Median**	**Difference**	***t*-stat**	**Difference**	**Wilcoxon M-W Statistic**
(-12 Quarters, + 12 Quarters)	24	39.128	31.639	33.687	22.566	-5.441**	-2.1	-9.073**	-2.2

Panel B. Banks Switching from International to Purely Domestic Status

Change from *International to Domestic*	**Number of Changes**	***Z-score* for *International* Banks (12 Quarters before Banks Become Domestic)**		***Z-score* for *Domestic* Banks (12 Quarters after Banks Become Domestic)**		**Difference in Means *Domestic – International***		**Difference in Medians *Domestic – International***	
	(1)	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**
		Mean	**Median**	**Mean**	**Median**	**Difference**	***t*-stat**	**Difference**	**Wilcoxon M-W Stat**
(-12 Quarters, + 12 Quarters)	18	38.534	34.881	42.954	34.035	4.420	1.42	-0.851	-1.18

Table Z.2 Internationalization and Bank Risk: Regression Analysis (BHC Level)

This table reports regression estimates of the relation between internationalization and bank risk using data aggregated at the bank holding company (BHC) level. The dependent variable is *Z-score* (12 quarters). The main internationalization measure is the *Foreign Assets Ratio*. Model 1 is an OLS regression with time fixed effects, Model 2 uses *Bank Internationalization Dummy* as a proxy of internationalization, Model 3 includes international banks only, Model 4 excludes too-big-to-fail (*TBTF*) banks, Model 5 excludes the top 20 banks with the most intensive foreign activity each quarter, Model 6 includes small banks defined as banks with GTA <$1 Billion, Model 7 includes medium-sized banks defined as banks with GTA between $1 and $5 Billion, Model 8 includes large banks defined as banks with GTA over 5 Billion, and Model 9 includes an analysis of averages using one observation per bank. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: *Z-Score*								
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
Independent Variables:	**Full Sample**	**Full Sample**	**International Banks Only**	**Exclude *TBTF***	**Exclude Top 20 International Banks**	**Small Size (GTA ≤ $1 Bill)**	**Medium Size ($1 Bill < GTA ≤ $5 Bill)**	**Large Size (GTA > $5 Bill)**	**Analysis of Averages**
Foreign Assets Ratio	-87.159***		-27.186***	-70.464***	-116.299***	-62.405***	-68.028***	-47.006***	-97.715***
	(-9.406)		(-3.195)	(-6.195)	(-6.491)	(-4.153)	(-5.251)	(-3.451)	(-9.098)
International Bank Dummy		-23.007***							
		(-11.148)							
Income Diversification	0.767	0.608	-6.434	0.935	0.745	1.760	-8.115	1.882	30.535***
	(0.508)	(0.402)	(-0.624)	(0.618)	(0.492)	(1.193)	(-0.864)	(0.137)	(22.787)
Size	4.145***	4.686***	0.438	5.154***	4.302***	6.233***	2.180	-2.017	3.427***
	(15.963)	(17.979)	(0.448)	(19.267)	(16.600)	(21.055)	(1.634)	(-1.414)	(14.758)
Listed	1.762	2.222**	11.656***	2.203*	1.656	1.826	6.968***	7.870**	4.942***
	(1.539)	(1.974)	(3.280)	(1.894)	(1.443)	(1.307)	(3.478)	(2.256)	(4.056)
BHC	-1.274**	-1.337***	8.202*	-1.419***	-1.302***	-1.610***	-1.253	9.029	-0.759**
	(-2.525)	(-2.653)	(1.807)	(-2.819)	(-2.581)	(-3.229)	(-0.293)	(1.326)	(-2.106)
Overhead Costs	-40.431***	-40.013***	-26.374***	-40.146***	-40.473***	-40.105***	-38.313***	-29.501***	-36.524***
	(-48.580)	(-48.169)	(-5.560)	(-48.223)	(-48.475)	(-46.995)	(-11.841)	(-5.602)	(-54.950)
FED	2.427***	2.478***	-9.241**	2.580***	2.546***	2.605***	1.764	2.008	2.728***
	(3.178)	(3.260)	(-2.069)	(3.377)	(3.329)	(3.305)	(0.612)	(0.415)	(4.243)
OCC	2.444***	2.644***	-9.448**	2.641***	2.481***	2.514***	4.017*	-0.993	3.131***
	(4.858)	(5.288)	(-2.539)	(5.272)	(4.933)	(4.997)	(1.749)	(-0.236)	(7.881)
Constant	60.897***	53.971***	72.818***	48.516***	59.174***	35.385***	93.941***	121.499***	47.709***
	(17.375)	(15.414)	(5.139)	(13.559)	(16.880)	(9.017)	(4.907)	(5.069)	(16.365)
Time FE	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**	**NO**
Observations	471,599	471,615	7,049	464,974	469,985	436,331	24,554	10,714	12,873
R-squared	0.165	0.168	0.164	0.170	0.166	0.171	0.153	0.147	0.273
N-Clusters(Bank)	12873	12875	268	12776	12860	12281	1122	348	

Table Z.3 Alternative Measures of Bank Internationalization

This table reports regression estimates of the relation between internationalization and bank risk. The dependent variable is *Z-score* (12 quarters). The internationalization measures are *Foreign Assets Ratio* in Model 1, *Foreign Loans Ratio* in Model 2, and *Foreign Deposits Ratio* in Model 3. All models include time fixed effects. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

Dependent Variable: *Z-Score*			
	(1)	**(2)**	**(3)**
Independent Variables:	***Foreign Assets Ratio***	***Foreign Loans Ratio***	***Foreign Deposits Ratio***
Internationalization Ratio	-68.064***	-50.636***	-43.267***
	(-8.725)	(-9.045)	(-8.281)
Income Diversification	0.957	0.883	1.220
	(0.720)	(0.665)	(0.918)
Size	2.496***	2.375***	2.571***
	(11.514)	(10.996)	(11.762)
Listed	2.893***	3.019***	2.855***
	(4.672)	(4.867)	(4.613)
BHC	1.300***	1.296***	1.241***
	(3.457)	(3.448)	(3.304)
Overhead Costs	-38.817***	-38.732***	-38.746***
	(-54.022)	(-53.890)	(-54.025)
FED	2.475***	2.482***	2.469***
	(3.743)	(3.748)	(3.733)
OCC	1.300***	1.370***	1.263***
	(2.996)	(3.155)	(2.912)
Constant	53.255***	54.567***	52.318***
	(19.109)	(19.646)	(18.621)
Time FE	**YES**	**YES**	**YES**
Observations	600,055	600,055	600,055
R-squared	0.148	0.147	0.148
N-Clusters(Bank)	13,448	13,448	13,448

Table Z.4 Alternative Econometric Specifications and Standard Errors

This table reports regression estimates of the relation between internationalization and bank risk. The dependent variable is *Z-score* (12 quarters). *Foreign Assets Ratio* is the measure of bank internationalization. Model 1 (baseline model) is an OLS regression with time fixed effects and standard errors clustered by bank, Model 2 uses Newey-West standard errors, Model 3 uses Prais-Winsten standard errors, Model 4 uses Fama-MacBeth standard errors, and Model 5 uses two-way clustered standard errors by bank and time. Table 1 provides definitions for all variables. *t*-statistics are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: *Z-Score*				
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Independent Variables:	**OLS w/ Time FE & Bank Clusters**	**Newey-West w/Lags**	**Prais-Winsten**	**Fama MacBeth**	**Two-way Clustering By Bank & Time**
Foreign Assets Ratio	-68.064***	-61.317***	-31.286***	-66.712***	-61.317***
	(-8.725)	(-25.476)	(-5.818)	(-16.430)	(-7.015)
Income Diversification	0.957	15.963***	-5.907***	2.082	15.963***
	(0.720)	(42.188)	(-26.760)	(1.588)	(9.819)
Size	2.496***	1.531***	2.609***	2.748***	1.531***
	(11.514)	(22.949)	(28.974)	(11.020)	(4.015)
Listed	2.893***	4.212***	2.985***	2.070***	4.212***
	(4.672)	(18.769)	(10.157)	(5.562)	(5.759)
BHC	1.300***	0.629***	0.756***	1.239***	0.629
	(3.457)	(5.199)	(5.373)	(7.266)	(1.434)
Overhead Costs	-38.817***	-28.725***	-4.763***	-38.502***	-28.725***
	(-54.022)	(-168.170)	(-36.639)	(-59.272)	(-26.439)
FED	2.475***	2.691***	1.885***	2.479***	2.691***
	(3.743)	(13.065)	(7.196)	(18.656)	(3.950)
OCC	1.300***	2.083***	0.554***	1.457***	2.083***
	(2.996)	(16.168)	(3.290)	(9.583)	(4.061)
Constant	53.255***	62.457***	15.067***	66.084***	62.457***
	(19.109)	(75.380)	(13.716)	(27.934)	(17.232)
Time Effects	**YES**	**NO**	**NO**	**NO**	**NO**
Observations	600,055	600,055	600,055	600,055	600,055
R-squared	0.148		0.162	0.105	0.102
N-Clusters(Bank)	13,448				13,447

Table Z.5 Accounting and Market Risk Measures for Listed Banks and Bank Holding Companies

This table reports regression estimates of the relation between internationalization and bank risk. The dependent variables are *Z-score* in Model 1 (baseline model), *Idiosyncratic Risk* in Model 2, *Total Bank Risk* in Model 3, *Merton Default Probability* in Model 4, *S&P Credit Rating* in Model 5, and *S&P Investment Grade* in Model 6. Models 1 to 4 are OLS regressions. Model 5 is an ordered logit regression (intercepts of this model are not shown). Model 6 is a logit regression. *Foreign Assets Ratio* is the measure of bank internationalization. All models include time fixed effects. Table 1 provides definitions for all variables. Robust *t*-statistics adjusted for bank clustering are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels, respectively.

	Dependent Variable: Risk					
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Independent Variables:	***Z-score***	***Idiosyncratic Risk***	***Total Bank Risk***	***Merton Default Probability***	***S&P Credit Rating***	***S&P Investment vs. Speculative***
Foreign Assets Ratio	-60.236***	0.016***	0.015***	0.032**	-0.694***	-6.189***
	(-4.534)	(4.167)	(3.633)	(2.026)	(-2.971)	(-19.603)
Income Diversification	14.606**	-0.005	-0.005	-0.021	1.317***	0.715***
	(1.983)	(-1.220)	(-1.212)	(-1.035)	(8.458)	(3.103)
Size	-0.659	-0.003***	-0.002***	-0.008***	0.594***	0.999***
	(-0.907)	(-9.065)	(-6.766)	(-4.346)	(38.863)	(35.655)
BHC	-0.600	-0.004	-0.004*	-0.011	-0.448***	-0.523***
	(-0.176)	(-1.628)	(-1.777)	(-1.265)	(-6.980)	(-3.436)
Overhead Costs	-46.186***	0.011***	0.012***	0.048***	0.076	0.516***
	(-12.036)	(6.557)	(6.725)	(5.479)	(0.923)	(3.750)
FED	5.632**	-0.001	-0.001*	-0.005	0.318***	0.087
	(2.072)	(-1.329)	(-1.794)	(-1.335)	(9.953)	(1.406)
OCC	8.195***	-0.002***	-0.003***	-0.014***	0.135***	0.099*
	(3.149)	(-3.264)	(-3.591)	(-3.286)	(4.244)	(1.915)
Constant	137.480***	0.052***	0.041***	0.072***		-26.387***
	(10.593)	(11.667)	(9.075)	(3.360)		(-45.523)
Time FE	**YES**	**YES**	**YES**	**YES**	**YES**	**YES**
Observations	29,953	29,816	29,816	29,176	10,022	10,022
R-squared	0.155	0.350	0.154	0.174	0.379	0.722
N-Clusters(Bank)	941	941	941	933		