Do banks benefit from internationalization? Revisiting the market power-risk nexus

Claudia M. Buch
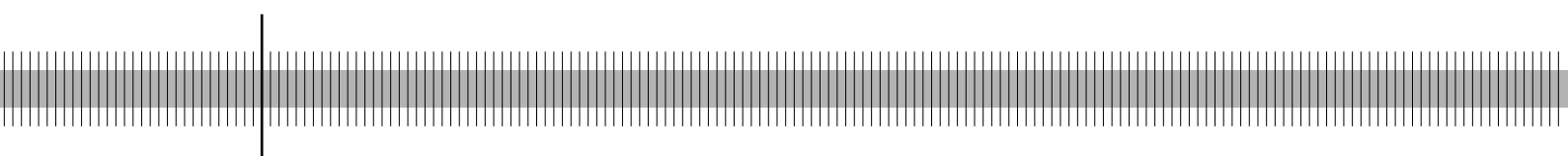(University of Tübingen, IAW and CESifo)

Cathérine Tahmee Koch
(University of Zurich)

Michael Koetter
(University of Groningen)

Abstract

Recent developments on international financial markets have called the benefits of bank globalization into question. Large, internationally active banks have acquired substantial market power, and international activities have not necessarily made banks less risky. Yet, surprisingly little is known about the actual link between bank internationalization, bank risk, and market power. Analyzing this link is the purpose of this paper. We jointly estimate the determinants of risk and market power of banks, and we analyze the effects of changes in terms of the number of foreign countries (the extensive margin) and the volume of foreign assets (the intensive margin). Our paper has four main findings. First, there is a strong negative feedback effect between risk and market power. Second, banks with higher shares of foreign assets, in particular those held through foreign branches, have higher market power at home. Third, holding assets in a large number of foreign countries tends to increase bank risk. Fourth, the impact of internationalization differs across banks from different banking groups and of different size.

Non-technical summary

Recent developments on international financial markets have called the benefits of bank globalization into question. Large, internationally active banks have acquired substantial market power, and international activities of banks have not necessarily reduced bank risk. Given these perceptions, surprisingly little is known about the actual link between bank internationalization, bank risk, and market power. Analyzing this link is the purpose of this paper. We use a novel and very detailed bank-level sample on external positions of German banks provided by the *Deutsche Bundesbank*. The data provide cross-border positions of all domestic parent banks as well as reports submitted by branches and subsidiaries located abroad. Based on these data, we develop a number of indicators measuring the international activities of German banks operating abroad.

The data allow painting a nuanced picture of banks' internationalization strategies. We can distinguish the number of countries in which banks are active (the extensive margin) from the volume of foreign assets (the intensive margin), and we compute these measures for different modes of entry into foreign markets (cross-border asset holdings, foreign branches, foreign subsidiaries). From the *Bundesbank*'s bank-level databases, we also obtain information on banks' probabilities of distress, and we estimate a Lerner index as a bank-specific measure of market power. We use these data to analyze whether the internationalization of banks affects their probability of distress and their domestic market power.

Understanding the risk-market power trade-off for internationally active banks is of key importance for policymakers. The recent financial crisis has unveiled that diversification benefits derived from international integration have to be weighed against larger exposure of international banks to risks. Yet, designing appropriate policy responses requires better insights into the link between bank risk and international activities of banks. Our results inform this debate since they provide evidence on the impact of internationalization on the performance of banks.

Our analysis has four main findings:

First, there is a negative correlation between market power and the probability to experience a distress event for German banks. This finding is in line with theoretical models suggesting that higher market power increases profits and allows banks to build up buffers against loan losses.

Second, banks with higher shares of cross-border assets either held directly by their domestic headquarters or by foreign branches have higher market power at home. We also find that large banks in Germany do not necessarily enjoy higher market power. Instead, after controlling for other bank-specific characteristics, market power and size are negatively correlated.

Third, banks that maintain a foreign presence in a large number of foreign countries are more likely to reveal above-average probabilities of distress. One explanation for this finding is that maintaining a large international banking network is costly.

Fourth, banks which differ in terms of size and banks from different banking group benefit differently from internationalization. Commercial and savings banks tend to improve their risk-return trade-off; cooperative banks tend to worsen their risk-return trade-off. Also, bank size has an impact.

More research is certainly required to check the robustness of our results using data from other countries and time periods. Perhaps the most important shortcoming of our data is that they do not include full information on off-balance sheet activities. Hence, an important channel of international activities is not included. Overall though, our results suggest that the benefits ensuing from internationalization in terms of increasing margins and reduced risk are rather small. Even for those banks that can achieve higher levels of market power through internationalization, the marginal effects of going abroad are relatively small compared to the domestic determinants of market power. At the same time, and perhaps contrary to conventional wisdom, internationalization has a rather limited impact on bank distress. Instead, the most important determinants of bank risk are their very market power and profitability as well as their hidden reserves.

Nicht-technische Zusammenfassung

Die jüngsten Ereignisse auf den internationalen Finanzmärkten haben bei Vielen die Vorteile der Globalisierung des Bankensystems in Frage gestellt. Die großen, international tätigen Banken haben zum Teil eine erhebliche Marktmacht, und internationale Aktivitäten haben Banken nicht notwendigerweise weniger risikoreich gemacht. Gegeben diese Wahrnehmung gibt es überraschend wenig empirische Evidenz für den Zusammenhang von Risiko und Marktmacht bei Banken einerseits und den Grad der internationalen Tätigkeit von Banken andererseits. Diesem Zusammenhang widmet sich dieses Papier. Wir nutzen einen Datensatz auf Basis des Auslandsstatus der deutschen Banken, der von der Deutschen Bundesbank bereitgestellt wird.

Diese Daten ermöglichen es uns, ein sehr differenziertes Bild der internationalen Tätigkeit deutscher Banken zu zeichnen. Wir können nicht nur untersuchen, ob Banken im Ausland tätig sind, sondern auch wie groß das Volumen ihrer Tätigkeit im Ausland ist und über welchen Kanal sie im Ausland operieren. Die Daten der Bundesbank liefern uns zusätzlich Informationen über das Auftreten von Schieflagen bei einzelnen Banken (*distress*), und wir können ein bankspezifisches Maß für die Marktmacht jeder einzelnen Bank, den sogenannten Lerner-Index, berechnen. Wir nutzen diese Daten zur Untersuchung der Frage, ob es einen Zusammenhang zwischen dem Auftreten einer Schieflage, der Marktmacht im Inland und dem Grad der Internationalisierung gibt.

Ein besseres Verständnis des *Trade offs* zwischen Risiko und Marktmacht der Banken vor dem Hintergrund der Globalisierung ist aus verschiedenen Gründen wichtig für die aktuelle Politikdebatte zur Regulierung der Banken. Die Finanzkrise, die im Jahr 2007 begann, hat nicht nur die Vorteile der Globalisierung im Sinne einer besseren Diversifizierung von Risiken gezeigt. Sie hat auch verdeutlicht, dass Banken gerade durch ihr Auslandsgeschäft Risiken ausgesetzt sein können. Eine angemessene wirtschaftspolitische Antwort auf die Krise erfordert jedoch Informationen über den tatsächlichen Zusammenhang zwischen Risiken, Marktmacht und Globalisierung der Banken wie sie unsere Untersuchung liefert.

Unsere Untersuchung hat vier zentrale Ergebnisse:

Erstens finden wir für deutsche Banken einen negativen Zusammenhang zwischen der Marktmacht einer Banken und der Wahrscheinlichkeit, dass eine Bank in eine Schieflage gerät. Eine Erklärung hierfür ist, dass Banken mit größeren Gewinnmargen Risiken besser abfedern können.

Zweitens haben Banken, die Aktiva im Ausland halten – sei es über die inländische Mutterbank, sei es über Zweigstellen im Ausland – eine größere Marktmacht im Inland. Unsere Ergebnisse zeigen auch, dass dies kein reiner Größeneffekt ist. Große Banken haben

vielmehr eine geringere Marktmacht als ansonsten vergleichbare kleinere Banken, wenn man andere Einflussfaktoren auf die Marktmacht berücksichtigt.

Drittens geraten Banken mit Niederlassungen in einer Vielzahl von Ländern im Ausland häufiger in Schieflagen als Banken, die nicht oder nur in wenigen Ländern aktiv sind. Dieser Effekt könnte sich durch die Kosten der Aufrechterhaltung eines großen internationalen Netzwerks erklären.

Viertens unterscheiden sich die Effekte des Auslandsengagements in gewisser Weise je nach Typ und Größe einer Bank. Beispielsweise erhöht ein Auslandsengagement bei den Privatbanken und den Sparkassen tendenziell die Marktmacht und senkt das Risiko einer Schieflage, während dies bei den Genossenschaftlichen Banken nicht in dem Maße gilt.

Es bedarf sicherlich weiterer Forschungsarbeiten, um die Robustheit unserer Ergebnisse für andere Länder und Untersuchungszeiträume zu testen. Eine Schwäche unserer Analyse ist sicherlich, dass in unseren Daten keine detaillierten Informationen über außerbilanzielle Geschäfte enthalten sind. Insgesamt zeigen die Ergebnisse jedoch, dass die positiven Effekte der Globalisierung der Banken im Sinne von Marktmacht und Risiko in ökonomischer Hinsicht eher gering sind. Dies gilt selbst für die großen Banken, die global und an vielen Standorten tätig sind. Gleichzeitig und vielleicht entgegen oftmals geäußerter Meinungen hat die Globalisierung nur einen geringen Einfluss auf das Risiko einer Schieflage. Wichtigste Determinanten des Risikos von Banken sind vielmehr deren Profitabilität und der Umfang ihrer stillen Reserven.

Contents

Do banks benefit from internationalization?
Revisiting the market power-risk nexus[*]

1 Motivation

Recent developments on international financial markets have called the benefits of bank globalization into question. Large, internationally active banks have acquired substantial market power, and international activities of banks have not necessarily made banks less risky (Giannetti 2007).[1] Given these perceptions, surprisingly little is known about the actual link between bank internationalization, bank risk, and market power. Analyzing this link is the purpose of this paper. We use a novel and very detailed bank-level dataset provided by the *Deutsche Bundesbank* including balance sheets and income statements of all German banks, of their foreign branches and subsidiaries.

The data allow painting a nuanced picture of banks' internationalization strategies. Since information on banks' foreign assets is not subject to reporting thresholds,[2] we can distinguish the number of countries in which banks are active (the extensive margin) from the volume of foreign assets relative to total assets (the intensive margin), and we compute these measures for different modes of entry into foreign markets (cross-border asset holdings, foreign branches, foreign subsidiaries). From the Bundesbank's bank-level databases, we also obtain information on banks' probabilities of distress (Kick and Koetter 2007), and we estimate the Lerner index as a bank-specific measure of market power following Koetter and Poghosyan (2009). We use these data to analyze whether the internationalization of banks affects their probability of distress and their domestic market power.

[1] Also, De Jonghe (2010) shows that universal, diversified banks are less stable then specialized peers. For an excellent survey on the role of market power in banking and risk-taking, see Beck (2008).

[2] In a companion paper, we study the bank-level and country-level determinants of German banks' foreign activities (Buch, Koch, Koetter 2009). Foreign assets do not include off-balance sheet items with the exception of so-called irrevocable credit commitments.

Methodologically, we use a system estimator, which takes the simultaneous determination of risk and market power at the bank level into account. We address the potential endogeneity of foreign assets by adapting the methodology proposed by Frankel and Romer (1999). They suggest using the geographic component of international trade as an instrument for actual trade. We adapt their methodology to a panel context because, for the individual bank, we can use foreign GDP as an exogenous variable.

In studying bank internationalization and banks' risk-market power trade-off simultaneously, we link two strands of previous literature which, so far, stand mainly in isolation.

First, literature on the internationalization of banks typically focuses on the determinants of the cross-border expansions of banks (Berger et al. 2003, Buch and Lipponer 2007, de Haas and van Lelyveldt 2010, Focarelli and Pozzolo 2005). This literature finds that regulatory and cultural barriers limit the international expansion of banks, and that more profitable and larger banks find it easier to overcome these barriers (Calzolari and Loranth 2010).

Second, while there is a large set of studies looking at the determinants of risks in banking (De Nicolò 2001, González 2005, Nier and Baumann 2003), only a few papers address the impact of the internationalization of banks. Amihud et al. (2002), for instance, examine risk effects of cross-border bank mergers. Analyzing changes in market risk and stock price reactions, they find that, on average, cross-border bank mergers do not change the risk of acquiring banks. Méon and Weill (2005) study the impact of cross-border mergers in Europe on banks' exposure to macroeconomic risks. They find that loan portfolios provide a sub-optimal risk-return trade-off, and that there are potential gains in risk diversification from cross-border mergers. Our study takes a broader perspective since we analyze all modes of entry into foreign markets, not just entry through mergers and acquisitions. In terms of the effects of internationalization on risk, we find that being active in a large number of countries increases rather than decreases bank risk. This result is driven by the cooperative banks in our sample, and it suggests that the costs of monitoring a large portfolio outweigh the benefits in terms of diversification.

There is also an abundant literature on the risk-market power nexus for banks. In a recent survey, Beck (2008) concludes that cross-country studies point mostly to a positive relationship between competition and stability in the banking system.[3] We are not aware of previous literature analyzing the impact of bank internationalization on the link between risk and market power of banks.[4] We find a negative relationship between banks' market power and risk. In this sense, our results are in line with the theoretical model developed by Allen

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[3] Beck (2008) also points out that using concentration as a proxy for competition gives mixed results. In this paper, we use a bank-level measure for banks' market power as a proxy for the intensity of competition that a particular bank is facing.

[4] For German banks, Behr et al. (2007) analyze the impact of diversification on banks' risk-return-characteristics, but they do not take the international dimension into account.

and Gale (2004) and Martinez-Miera and Repullo (2008) who argue that less intense competition increases margins and thus buffers against loan losses.

Understanding the risk-market power trade-off for internationally active banks is of key importance for policymakers. Under the impression of the global financial crisis that has started in 2007, the benefits of international banking in terms of a more efficient allocation of risks on international markets seem fairly illusive. The crisis has unveiled that international integration not only brings about diversification benefits but also exposes banks to risks. Some recently proposed policy measures and regulatory initiatives could even limit the international activities of banks (BIS 2009, IMF 2009). Yet, designing appropriate policy responses requires better insights into the link between bank risk and international activities of banks. Our results inform this debate. They reveal that internationalization has a relatively weak impact on bank risk.

In addition, the crisis has spawned a discussion about the systemic implications of risks at large banks and on the need to impose stricter regulations on large, systemically important banks (see, e.g., Tarashev et al. 2009). This debate has largely ignored the possible link between market power and bank internationalization. As for non-financial firms, internationalization may generate an endogenous increase in bank productivity and market power. Indeed, our previous results (Buch et al. 2009) show that there is an endogenous self-selection of more productive and large banks into foreign markets. This paper adds to this discussion by showing the impact of bank globalization on the domestic market power in banking. We in fact find that banks with a higher volume of foreign assets, in particular those held by foreign branches, enjoy greater market power at home. It is important to note in this context that large banks in Germany not necessarily enjoy also greater market power. Instead, after controlling for other bank-specific characteristics, market power and size are negatively correlated.

In the following second Part, we derive theoretical hypotheses on the impact of internationalization on the risk-market power nexus for banks. In Part three, we present the data and descriptive statistics. In Part four, we describe the empirical model, and in Part five we present the regression results. Part six summarizes the evidence.

2   Theoretical Hypotheses and Previous Findings

In this paper, we empirically analyze the link between different measures of bank internationalization and two key outcome variables for banks. As regards bank internationalization, we distinguish foreign expansions of banks along the intensive margin (the volume of foreign assets relative to total assets) from the extensive margin (the number of countries in which banks are present). We also compute these measures for different modes

of market entry, i.e. cross-border lending, foreign subsidiaries, and foreign branches. The corresponding outcome variables are risk and market power of the banks' overall business. Risk is measured as the banks' probability of distress; market power is measured by the banks' Lerner index (see Section 3).

To the best of our knowledge, there is no single theoretical model available which would provide us with hypotheses on the link between these variables. Below, we summarize implications of the previous literature, which allow deriving hypotheses on the various outcomes of our model.

H1: The expected impact of internationalization on the degree of market power at home is positive.

Empirically, we will measure banks' domestic market power by the Lerner index, which is defined as the mark-up between the banks' average revenues and its marginal costs (see Section 3.4). We expect a positive long-run impact of internationalization on banks' market power at home. In the short-run, and in particular during the early expansion period, the cost effects of internationalization might dominate, and measured market power might even decline. In the long-run, banks can be expected to maintain foreign operations only if they ultimately perceive a positive impact on their market position.

The different channels of internationalization entail different fixed and variable costs, which could be reflected in our measure of bank market power. Cross-border asset holdings denote the channel of internationalization which entails low fixed costs but the highest variable costs since information on foreign markets is harder to obtain without having foreign affiliates. Entry through branches and through subsidiaries involves comparatively high fixed costs, but variable costs are lower instead. Fixed costs, in turn, tend to be higher for subsidiaries than for branches, because subsidiaries are legally independent, hold their own equity, and are subject to host-country supervisory control. Hence, subsidiaries demand the highest costs in terms of capital requirements and particular focus on regulatory burden.

H2: A greater degree of diversification of foreign assets lowers bank risk. The impact of a higher volume of assets per se is ambiguous.

If banks behave as portfolio managers, they optimize their expected utility as a positive function of expected profits and a negative function of expected portfolio risk (Rochet 2008). In an international context, foreign entry should have the potential to reduce banks' (and thus regulators') risk of insolvency (see, e.g., Berger 2000). This conventional wisdom is based on the notion that it is better for a bank not to put all its "eggs in one basket" (Winton 1999), hence geographic diversification might be a risk-reducing strategy. According to this interpretation, the impact of internationalization on bank risk depends on the correlation between domestic and foreign returns and on the volatility of foreign markets. Risk might

decrease if assets are sufficiently diversified, but risk might increase if diversification is limited and/or if foreign markets are risky.

The extensive margin, which we measure through the number of countries in which banks are active, can be interpreted as one measure of portfolio diversification. Accordingly, the expected impact on risk is negative. We expect different results for subsidiaries and branches, as branches are more geared towards retail lending while subsidiaries act as portfolio managers. In contrast, the share of foreign activities in total assets per se (the intensive margin) would have no clear-cut impact on bank risk.

However, offsetting the perceived benefits of international diversification are at least two potential costs that may well enhance bank risk. The first risk-increasing effect comes from the incentives banks have to shift risk when the regulatory safety net and its associated implicit and explicit guarantees are underpriced (John et al. 1991, John et al. 2000). A second reason why cross-border activities may increase risk concerns "who is watching the eggs in the basket" (Winton 1999). By extending its operations into new overseas markets, a bank is confronted with potentially new and risk-increasing monitoring problems related to the loan customer base or the operating cost structure of a large international portfolio. If monitoring and information costs are high, bank risk might increase.

H3: The link between market power and bank risk is ambiguous.

In our empirical model, we will also analyze how market power and risk influence each other. Allen and Gale (2004) suggest a negative relation between bank risk and market power because more concentrated banking systems reduce incentives of bankers to lend recklessly. Moreover, more concentrated systems can be supervised more effectively by regulators. In contrast, Boyd and de Nicolo (2005) argue that increasing market power of banks increases risk taking, because banks can roll-over higher risk associated with lower quality loans by charging higher interest rates from customers. If borrowers endogenously choose the risk of their project, an increase in lending rates then increases risk due to an adverse selection effect. Martinez-Miera and Repullo (2008) show that this *risk shifting effect* is due to the assumption that loan default rates are perfectly correlated. They introduce imperfect correlation of loan default rates and show that there is an additional *margin effect*: More competition lowers loan rates as well as revenues from non-defaulting loans and thus reduces buffers against loan losses. This results in banks becoming riskier.[5] The net effect is ambiguous.

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[5] In Caminal and Matutes (2002) the link between risk and competition is ambiguous as well; it depends on the banks' trade-off between monitoring and credit rationing.

3 Data and Descriptive Statistics

We use several bank-level datasets of German banks, which have kindly been provided by the *Deutsche Bundesbank* to test the above hypotheses. The data are confidential and can be used on the premises of the *Bundesbank*, only. The main novelty of this paper is that we draw on a detailed database on banks' international assets. The so-called "External Position Report" provides comprehensive information on the international assets of German banks, their foreign branches, and their foreign subsidiaries year-by-year, and country-by-country[6]. We use this database for the years 2003-2006 since reporting thresholds on international positions have been abolished in 2002. Hence, we do not face problems due to truncation or censoring. In addition, the supervisory data on distress events, which we use to estimate bank risk, is not available after 2006.

We complement the "External Position Report" with information from the balance sheets and income statements of all banks operating in Germany between 2002 and 2006. Each bank which holds a German banking license is required to submit these data to the supervisory authority. Details on the data specification and definitions are given in the Appendix.

3.1 *Measuring Bank Internationalization*

The "External Position Report" contains information on cross-border assets held by the bank's domestic headquarters, on foreign assets held by a bank's foreign branches, and foreign subsidiaries. Establishing branches and subsidiaries is a much more cost-intensive channel of entering foreign markets, and only relatively few German banks use this mode of entry. On average, only 28 out of a total of 2,235 banks are purely domestic, 27 maintain only foreign branches, and 37 run subsidiaries and/or branches. The largest group consists of banks that hold international assets in at least one foreign country (2,143).[7]

Using this information, we compute two broad measures of internationalization at the bank level, which in turn are differentiated by the mode of foreign market entry.

Our first measure of bank internationalization is the volume of foreign activities relative to total assets, i.e. the intensive margin. We link branches and subsidiaries located in host country h to their domestic parent bank i. We aggregate all assets held in destination country j across the different modes of foreign activity and use a composite foreign asset. We do not distinguish between different types of assets to keep the analysis tractable.[8] Apart from the

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[6] The "External Position Report", however, does not cover off-balance sheet activities.

[7] See Buch, Koch, and Kötter (2009) for details.

[8] Note that the data do not allow netting out positions which a parent bank makes available to its foreign affiliate and which, in turn, its foreign affiliate holds as a cross-border position against a third country.

aggregate measure of cross-border assets, we also consider the share of cross-border assets held by the domestic headquarters, foreign branches, and foreign subsidiaries separately.

Our second measure of bank internationalization describes the extensive margin. We compute the number of countries in which a bank holds cross-border assets as well as the number of countries in which this bank runs foreign branches and/or subsidiaries. If a bank holds several branches or subsidiaries in a particular country, we aggregate this information to obtain one observation per bank, country, and mode of market entry (branches or subsidiaries). In case of cross-border assets, our measure of the extensive margin is the number of countries in which a particular bank holds assets.

3.2 Measuring Bank Risk

Bank risk can be measured in several ways. Previous literature has used a bank's *z*-score, non-performing loans, or the volatility of bank-level variables such as reserves, profits, or non-performing loans (Beck 2008, Behr et al. 2007, Corvoisier and Gropp 2002, De Guevara and Maudos 2007b). Yet, these measures do not provide information on actual failures of banks. Our measure of bank risk is a direct measure of the probability to experience a distress event. Distress events are defined by regulatory interventions, and information on these events is obtained from the distress database of the *Deutsche Bundesbank*. This database comprises distress events that range from weak incidences to forced exit by means of restructuring mergers ordered by the Federal Financial Supervision Authority (*Bundesanstalt für Finanzdienstleistungsaufsicht – BaFin*). See Kick and Koetter (2007) and the Data Appendix for a description and analysis.

Overall, the majority of banks (about 95%) has not reported any distress event during the observation period. In total, there have been 26 weaker distress events such as mandatory announcements by individual banks to the supervisory authority or official warnings by the *BaFin* and 240 more severe events such as direct interventions into the ongoing business of a bank by the *BaFin* or events that reflect the disappearance of a bank from active business operations such as closure of a bank or restructuring mergers. In our baseline specifications, we use a dummy variable that indicates the occurrence of any such event as the dependent variable; to check which events drive our results, we also distinguish between severe and weak events as defined above.

The distress indicator has the advantage that it captures the occurrence of an actual distress event and thus of actual bank risk. Yet, larger banks have not experienced such an event under the period of observation. Hence, it measures risk for smaller banks only. To obtain a measure of risk for all banks, we follow Hale and Santos (2008) and Demirgüc-Kunt et al. (2008) and additionally compute a *z*-score given by $z = \dfrac{-(E/A + \rho)}{\sigma}$ where E/A is a bank's

capital-asset-ratio, ρ is the mean of a bank's profits, and σ denotes the standard deviation of profitability. We calculate the z-score using a rolling 5-year window. Hence, the z-score measure increases if the standard deviation of profits increases, and it falls in the degree of capitalization and mean returns. The z-score measures the number of standard deviation of profits (below the mean) by which profits would have to fall until equity capital has been eroded (Hale and Santos 2008).

3.3   *Measuring Market Power*

We use the Lerner index to measure the domestic market power of individual banks. Lerner indices give the mark-up between average revenues and marginal cost, scaled by average revenues. They provide two clear advantages over other measures of market power. First, the Lerner index nests different models of competition and, second, it yields a measure at the level of the individual bank (Degryse et al. 2009). A higher Lerner index indicates a lower degree of competition (a higher degree of market power).

We obtain both arguments used to compute the Lerner index from stochastic cost and profit frontier analysis and thus have competition measures net off operational slack (Koetter et al. 2008). Marginal costs are the total derivative of estimated operating cost frontiers with respect to four outputs (interbank loans, customer loans, securities, and off-balance sheet items). By analogy to possible slack on the cost side, we obtain average revenues from profits predicted by a stochastic profit frontier, scaled by total assets so as to avoid confounding profit inefficiencies and realized (monopoly power) revenues. To account for the three-tier banking structure in Germany, we estimate both frontiers as latent classes, previously shown in Koetter and Poghosyan (2009).[9] The underlying reason is that banks operate under different technology regimes.

Summary statistics for the bank-level variables are provided in Table 2. Lerner indices are on average 23 points, which is in line with results reported by De Guevara and Maudos (2007a) for a sample of European banks and Koetter and Poghosyan (2009) for German banks. Since both, Lerner indices and distress events, are (partly) derived from annual accounting data, all covariates are specified with a lag of one year to avoid simultaneity by construction.

Finally, average revenues and marginal costs comprise revenues and costs of domestic operations (including cross-border asset holdings) and of operating foreign branches but not of operating foreign subsidiaries.

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[9] See Koetter and Poghosyan (2009) for a more detailed discussion and for robustness tests.

4   Empirical Model and Regression Results

4.1   Simultaneous Equation Model

We need an empirical model which allows estimating the link between bank risk (probability of distress) and market power (Lerner index) jointly, and which allows analyzing the impact of internationalization on the risk-market power nexus.

Simultaneous equation models based on two continuous variables have previously been applied in the banking literature (Kwan and Eisenbeis 1997).[10] However, one of the variables that we are interested in (the probability of distress) is binary, and requires a system estimator which allows for binary variables. We thus employ an instrumental-variables estimation using the procedure suggested by Rivers and Vuong (1988) and described in Wooldridge (2002) for systems with one of the endogenous variables being binary.[11]

Let the market power of banks be proxied by the Lerner index. Hence, the market-power equation has $y_{1,it} = y_{1,it}^{*}$ as a fully observed, continuous variable on the left-hand side. The risk equation uses the probability of distress as the dependent variable. As this probability is not observable, we proxy it by the binary indicator of an observable distress event, such that $y_{2,it} = I(y_{2,it}^{*} > 0)$. In the structural-form setup, the dependent variables influence each other, i.e. risk influences market power and market power impacts on risk.

To estimate the system, the following reduced-form equations are needed:

$$y_{1,it} = \Pi'_1 \mathbf{X}_{it-1} + v_{1,it} \tag{1a}$$

$$y_{2,it} = \Pi'_2 \mathbf{X}_{it-1} + v_{2,it} \tag{1b},$$

where *i* is a bank-index and *t* denotes time. The market-power equation (1a) is estimated using OLS and yields the (*K* x 1)-vector of parameter coefficients $\hat{\Pi}'_1$. The risk equation (1b) is estimated using a probit model to obtain the (*K* x 1)-vector of parameter coefficients $\hat{\Pi}'_2$. Both equations draw on the same vector of independent variables $\mathbf{X}_{it-1}$ which contain lagged values to account for simultaneity. From equation (1a), we compute residuals from the difference between the true market-power variable (the Lerner index) and fitted values $\hat{v}_{1,it} = y_{1,it} - \hat{y}_{1,it} = y_{1,it} - \hat{\Pi}'_1 \mathbf{X}_{it-1}$.

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[10]   Previous literature has typically not formulated this problem in a system context. De Guevara and Maudos (2007b), for instance, use a single regression setting and regress the Lerner index on the probability of distress. Alternatively, Jiménez et al (2007) reverse the causality and regress risk proxies on competition measures.

[11] Maddala (1983) suggests estimating reduced-form equations for each endogenous variable. According to this method, the binary (continuous) dependent variable is estimated using a probit (OLS) model. In case of the continuous dependent variable, predicted values from the probit reduced-form estimation are then used as right-hand side regressors.

Next, we estimate our main structural equations of interest:

$$y_{1,it} = \gamma_1 \hat{y}^*_{2,it} + \beta'_1 \mathbf{X}_{1,it-1} + \varepsilon_{1,it} \tag{2a}$$

$$y^*_{2,it} = \gamma_2 y_{1,it} + \beta'_2 \mathbf{X}_{2,it-1} + \theta \hat{v}_{1,it} + \varepsilon_{2,it} \tag{2b},$$

where $\mathbf{X}_{1,it-1}$ and $\mathbf{X}_{2,it-1}$ are the exogenous explanatory variables affecting risk and market power, respectively. Both include measures of internationalization. Fixed effects (time-fixed effects, regional and banking-group dummies) are included to control for the state of the macroeconomy.[12] Equation (2a) is estimated using OLS, and equation (2b) is estimated using a probit model. We address the fact that equations (2a) and (2b) include generated regressor by bootstrapping the standard errors.

The simultaneity between banks' choices of market power and risk is captured in the following way. In the market-power equation (2a), we insert fitted values from the probit estimation of the risk equation (1a). In the risk equation, we insert the residuals from the continuous reduced-form equation ($\hat{v}_{1,it}$) along with the true continuous variable, i.e. the Lerner index $y_{1,it}$.[13] Rivers and Vuong (1988) recommend this procedure as the probit estimation relies on non-linear estimation techniques. A side-benefit of this setup lies in the implicit test for exogeneity of the Lerner index in the risk equation (Winkelmann and Boes 2009). A z-test of the $H_0 : \theta = 0$ indicates whether the true Lerner index $y_{1,it}$ is exogenous to the probability of distress.[14] Results reported in Tables 3-5 below show that risk and market power are not independent. Instead, the Lerner residuals are usually significant in the risk equation, and we can reject the null of exogeneity between Lerner and our binary risk indicator.

Our results suggest that the joint estimation of both equations is a reasonable specification. Generally, the cross-terms are negative and significant. Hence, our results are in line with theoretical models by Allen and Gale (2004) or the margin effect stressed in Martinez-Miera and Repullo (2008). Moreover, Table 4 shows that this finding – as some of the remaining results – is driven by the cooperatives as the largest banking group in the sample.

4.2 Regression Results

We organize our regression results as follows. Table 3a provides results of OLS regressions using the Lerner index as the dependent variable; Table 3b provides results of probit

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[12] The main qualitative results remain unchanged if we control for regional macroeconomic developments such as the regional insolvency rate or GDP growth.

[13] Alvarez and Glasgow (2000) support this combination of two-stage probit least squares and two-stage conditional maximum-likelihood techniques to benefit from the explicit test of exogeneity in the binary equation.

[14] Implementing fitted values from the market-power equation (1a) into the structural equation (2a) instead of the combination of residuals and the true Lerner index would mean that we try to estimate a probit model with an unknown scaling factor which would not grant valid inference.

estimation, using the probability of experiencing a distress event as the dependent variable. In both empirical models, we allow for feedback effects between market power and risk, as described above. The overall fit of our model is quite good with an adjusted R^2 of about 0.42 for the market power equation and a pseudo-R^2 of 0.25 for the risk equation. The following tables split up the sample by banking group (Table 4a and 4b). Finally, we run several robustness tests to account for the potential endogeneity of the internationalization variable (Table 5a and 5b).

4.2.1 Determinants of Market Power (Lerner Index)

Table 3a provides regression results for market power as the dependent variable. A higher volume of foreign activities (i.e. expanding along the intensive margin) has a positive impact on market power. In this sense, our results are in line with Hypothesis H1. This effect is driven by cross border assets held through domestic headquarters and through foreign branches. A higher volume of foreign activities of subsidiaries lowers market power at home. This finding is consistent with the hypothesis that subsidiaries are a particularly costly way of entering foreign markets and that branching is geared towards retail activities.

Being active in a larger number of countries (i.e. expanding along the extensive margin) has a negative impact on market power at home. This shows that foreign expansions are costly and squeeze profit margins. In unreported regressions, we have checked whether threshold effects drive this result, i.e. whether increasing international activities beyond a certain number of countries (10 for cross-border assets, 5 for countries with foreign affiliates) drives this result. This is in fact the case: the negative impact of the extensive margin is driven by banks which are present in more than 10 countries. Generally though, the impact of internationalization on market power is relatively small compared to the impact of the control variables included as most of the estimated coefficients are substantially smaller.

For the control variables, we mostly obtain significant and expected results. The *share of fee income* measures whether banks can retain their market power by substituting traditional interest income with fee income (Allen and Santomero 2001, De Young and Rowland 2001). We find a positive relationship between the share of fee income and the Lerner index.

Larger banks might be able to charge high mark-ups due to their dominant role in output markets, but they may also enjoy market power due to economies of scale in funding markets. We include a discrete variable to indicate the size quintile of banks' total assets (from 1 to 5).[15] Results show a negative link between size and market power as, in Germany, smaller savings and cooperative banks enjoy substantial market power in regional and niche markets.

We measure the degree of specialization of banks' activities using *Hirschman-Herfindahl indices* computed across different asset categories. A higher degree of specialization can have

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[15] Results are qualitative identical if we use log size instead.

at least three distinct effects on the performance of banks. First, specialization in certain banking activities may yield benefits in terms of higher margins if banks succeed in developing superior skills compared to other intermediaries (Goddard et al. 2007). Second, economies of scope can increase the competitiveness of banks (Berger et al. 1987, Ferrier et al. 1993). Third, in response to increasing deregulation, some banks have ventured into novel business activities, such as off-balance sheet activities (Stiroh 2004) to substitute for eroding interest margins (Amel et al. 2004). Lacking specific expertise, such strategies could lower returns and increase volatility and thus risk (De Young and Rowland 2001). According to the first two effects, the impact of specialization would be positive, but the last effect could have a negative impact. Our results support the positive impact of greater specialization – focusing on certain activities, increases market power. Regional concentration (the number of branches in each region and the number of new acquisitions) enhances market power as well.

As a final control variable, we include a dummy for publicly incorporated banks, and we find a significantly negative impact on market power.

Splitting the sample by type of bank also brings about interesting differences (Table 4a). For cooperative banks, being active abroad has no significant impact on market power. For savings banks, a greater volume of foreign assets lowers market power while holding assets in a large number of markets increases risk. For commercial banks, we find the positive impact of the intensive margin that is also present in the full sample.

4.2.2 Determinants of Risk (Probability of Distress)

Table 3b shows the determinants of the probability of distress for German banks. As regards the impact of internationalization on bank risk, the key results might seem rather unexpected at first sight: holding assets in a larger number of countries increases rather than decreases bank risk. This result contradicts the prior that diversification lowers risk. Recall, however, that there is an additional counterbalancing effect, namely the monitoring costs associated with the management of a large and complex portfolio (Winton 1999). As a result, bank risk may well increase in response to an expansion into a larger number of countries. This interpretation is supported by the fact that the risk-increasing effect of expansions along the extensive margin is driven by the cooperative banks and thus the banking group which, arguably, is the least experienced internationally (Table 4b). For the remaining banking groups, the extensive margin has an insignificant impact.

The volume of activities (intensive margin) has an insignificant impact on bank risk. This result is, in fact, not unexpected as we have argued that the degree of diversification rather than the scale of foreign activities should matter for bank risk (Hypothesis H2).

In addition to the internationalization variables, we include a standard vector of control variables which conditions the likelihood of distress on CAMEL covariates capturing various aspects of bank-specific risks (capitalization, asset quality, managerial skill, earnings, and

liquidity) (Acharya and Yorulmazer 2007). From a theoretical point of view, we expect more profitable, better capitalized, and banks with a less risky asset portfolio to be less likely to experience a distress event. The signs for the control variables are in line with these expectations and with previous literature (Kick and Koetter 2007). Banks with a lower level of hidden reserves and with a lower return on equity are more likely to experience a distress event (Berger 1995). In line with e.g. Wheelock and Wilson (1995), higher cost efficiency lowers bank risk. Higher profit efficiency, in turn, has only a weakly significant positive impact on risk. This result corroborates the well-known negative correlation between cost and profit efficiency measures (Bauer et al. 1998), which underpins that both concepts measure different types of optimal behavior of bank managers: the realization of optimal profits seems to involve inevitably higher risk-taking while economizing on costs does not. The core capital ratio, the share of non-performing loans, and the cost-to income ratio have no significant impact.

4.3 Endogeneity of Foreign Assets

Apart from the endogeneity of risk and return at the bank level, the potential endogeneity of the internationalization variables is a concern. Banks engaged in risky domestic activities could venture abroad to offset high risk at home. Moreover, one would also expect banks to be more active internationally if this rewards them with greater market power at home.

We address potential endogeneity of foreign assets in three ways: (i) by adopting a proxy for the exogenous component of banks' foreign assets; (ii) by using lagged foreign status; and (iii) by focusing on banks which have changed foreign status only.

Turning to the first measure, we adopt a methodology that has been suggested in the empirical literature studying the link between trade openness and growth at the country-level. Frankel and Romer (1999) propose to measure the causal impact of trade on growth by employing geographic variables as an (exogenous) instrument for foreign trade. Their method is based on a two-step estimation model. In a first step, a bilateral openness equation is specified. Predicted bilateral openness measures from this equation are then aggregated to obtain a measure of aggregate openness which is related to a set of exogenous variables only. In a second step, predicted openness is used as an instrument in a regression explaining the impact of openness on GDP per capita.

This method does not fully suit our panel context, since geographic variables used to extract the exogenous component of trade are time-invariant. A time-varying exogenous explanatory variable is thus required for the first-stage regression. In our setup drawing on bank-level data, essentially all foreign macroeconomic variables can be considered exogenous from the individual bank's perspective. Hence, our modified Frankel-Romer regression looks as follows:

$$FA_{ijt} = a_0 + a_{i,1}Dist_j + a_{i,2}GDP^*_{jt} + \varepsilon_{ijt} \tag{3}$$

where FA_{ijt} is the share of foreign assets across modes relative to total assets of bank i held in country j in year t, $Dist_j$ is the geographic distance between Germany and country j, GDP^*_{jt} is foreign GDP which is exogenous to the individual bank i, and ε_{ijt} is an error term which captures the bank-specific determinants of foreign assets shares such as risk and market power. We estimate equation (3) bank-by-bank using OLS to obtain bank-specific regression coefficients.

The predicted values from this equation are used to obtain a bank-specific instrument which draws on geographic components and exogenous country-variables of bilateral openness. Re-writing (3) in matrix form $FA_{ijt} = \mathbf{a}_i'\Theta_{jt} + \varepsilon_{ijt}$ where $\mathbf{a}_i$ is the vector of coefficients and Θ_{jt} is the vector of right-hand-side variables, bank i's overall predicted foreign assets are given by: $\hat{FA}_{ijt} = \sum_j \hat{\mathbf{a}}_i'\Theta_{jt}$.

For the predicted foreign asset share to be a good instrument for the actual foreign asset share, it should be sufficiently highly correlated. This is indeed the case. The correlation between the predicted and the actual foreign asset share at the bank-level (i.e. aggregated across all countries) is 0.58. To eliminate the country dimension in the data, we aggregate these foreign asset shares across all countries.

Results are reported in Column (2) of Table 5a and Table 5b. They are qualitatively unchanged from those using the actual volume of foreign assets: expansions along the intensive margin increase market power, these expansions have no impact on risk, market power and risk are negatively correlated, and the remaining control variables retain their signs and significance.

The second device to account for the endogeneity of foreign assets is to use foreign status lagged by two periods as a right-hand side variable. The underlying reasoning is that current market power and risk are unlikely to have affected internationalization decisions taken in the past. This method also addresses the fact that up-front costs of international expansions may be high and that a positive effect on market power may materialize only over time. Results in Column (3) of Table 5 are very similar to those using the actual or the predicted share of foreign assets. However, the usefulness of this method is limited by the fact that foreign status may be persistent.

Finally, we use information on *changes* in foreign status, i.e. we use first differences of the extensive margin as a right-hand side variable. Again, we lag this variable by two periods, and we distinguish entry and exits. The new indicator equals One if a given bank has left any foreign market two years ago and Zero otherwise. Finally, we include a similar variable using the number of countries from which the bank has withdrawn. Results in Columns (4) and (5)

of Table 5a and 5b show that past exits have a negative impact on market power and no impact on risk.

4.4 Robustness

To check the robustness of our results, we have divided the sample into weak and severe distress events, we have used the *z*-score described in Section 3.2 as an alternative risk measure, and we have dropped explanatory variables one by one. Results are not reported but are available upon request.

Splitting the sample into weak and severe distress events provides qualitatively identical results compared to those reported above: the mutual negative impact of market power on return (vice versa) survives the robustness check. As to internationalization, expansions along the extensive margin lower market power while expansions along the intensive margins increase market power. Effects on risk are insignificant.

Using the *z*-score as an alternative risk measure basically confirms the negative correlation between risk and market power, but the impact of predicted Lerner indices on the *z*-score are sometimes insignificant. The impact of internationalization on market power is mostly replicated in that the extensive margin exercises a negative impact, whereas banks benefit from more market power if they expand along the intensive margin. As before, internationalization has no significant impact on risk. Results for the remaining explanatory variables do not change.

We also exclude individual explanatory variables one by one to check whether some of our results might be driven by multicollinearity. This is not the case.

Finally, splitting the sample by size reveals differences between small and large banks. For all but the mid-sized banks, a higher volume of cross-border assets has a positive effect. The impact of expansions along the extensive margin on market power at home varies across banks of different size. For the smallest 40% of the banks, it is negative but insignificant. For the mid-sized and large banks, it is positive. The negative and significant impact for the full sample is driven by the "upper-middle" sized banks in the fourth size quintile. One interpretation of this non-linear effect might be that these banks are too large to gain a competitive edge from foreign expansions as the mid-sized banks do, but that they are too small to reap the true scale economies as the very large banks do.

5 Conclusions

The purpose of this paper has been to analyze whether and through which channels the internationalization of banks affects their risk-market power trade-off. We use a very detailed

dataset on German banks, which provides information on actual distress events (our measure of banks' risk), banks' market power (our bank-level measure of competition), and comprehensive data about banks' international activities. We can distinguish between different modes of entry into foreign markets such as cross-border assets, foreign branches, and foreign subsidiaries. Hence, we depart from previous literature by analyzing the risk-market power nexus for banks from an international angle. Methodologically, our results differ because we simultaneously model risk and market power.

Our analysis has four main findings:

First, there is a negative correlation between market power and the probability to experience a distress event for German banks. This negative relationship between risk and return is in line with the theoretical model by Allen and Gale (2004) or the margin effect stressed by Martinez-Miera and Repullo (2008). According to this explanation, more profitable banks can build up buffers against loan losses.

Second, banks with higher shares of cross-border assets either held directly by their domestic headquarters or by foreign branches have higher market power at home. We also find that large banks in Germany not necessarily enjoy also greater market power. Instead, after controlling for other bank-specific characteristics, market power and size are negatively correlated.

Third, banks with a foreign presence in a large number of foreign countries are more likely to reveal above-average probabilities of distress, possibly because of the costs of maintaining a large international banking network.

Fourth, banks of different size and from different banking groups benefit differently from internationalization. Commercial and savings banks tend to improve their risk-return trade-off; cooperative banks tend to worsen their risk-return trade-off. Also, bank size has an impact. Hence, the substantial heterogeneity across banks at the national level is also reflected in a heterogeneous impact of bank globalization.

More research is certainly required to check the robustness of our results using data for other countries and time periods. One shortcoming of our analysis is certainly that our data do not include full information about off-balance sheet activities of banks. Overall though, our results suggest that both the benefits of internationalization in terms of increasing margins and reduced risk are rather small. Even for the banks that can increases their market power through internationalization, the marginal effects of going abroad are relatively small compared to the domestic determinants of market power. At the same time, and perhaps contrary to the conventional wisdom, internationalization has only a limited impact on bank distress. Instead, the most important determinants of bank risk are their market power and profitability as well as their hidden reserves.

6 References

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7 Data Appendix

All bank data are obtained from unconsolidated balance sheets, profit and loss accounts, and audit reports reported annually by all banks to the German central bank (*Deutsche Bundesbank*). Variables used for both the productivity estimation and the CAMEL vector are corrected for outliers by truncating at the 1st and 99th percentiles, respectively. Level variables are deflated with the consumer price index.

Bank-level variables

Acquisitions: The number of acquisitions per regional agglomeration area.

Assets: Gross total assets. An indicator variable based on the size distribution of total assets per year ranging from 1 (low) to 5 (high).

Banking groups: An indicator variable ranging from 1 to 4 for large banks, regional commercial, regional savings, and cooperative banks. "Large" banks comprise the head institutions of the savings (*Landesbanken*) and cooperative bank sector as well as the largest commercial banks. "Commercial banks" are privately owned, but not necessarily publicly listed banks. "Savings" banks are (local) government owned regional banks. "Cooperative" banks are mutually owned regional banks.

Branches: The number of branches per bank relative to total assets.

Capitalization: Core capital in per cent of gross total assets.

Cost efficiency: Cost efficiency obtained from a latent stochastic cost frontier analysis with two technology regimes.

Cost-income ratio: Personnel expenditure in per cent of total administrative cost.

Customer loans: Loans to corporate customers and individuals.

Equity: Gross total equity in millions of euro.

Herfindahl index (output categories): Diversification indicator across four output categories of banks, interbank loans, customer loans, bonds and stocks, and notional values of granted guarantees and credit commitments, calculated as the sum of squared shares of each product category.

Interbank loans: Loans to banks and other depository institutions.

Loan-loss-provisions: Stock of loan-loss provisions in per cent of gross total loans.

Non-performing loans: Loans with latent risks according to central bank auditors in per cent of total audited loans.

Off-balance sheet items: Granted credit guarantees and commitments.

Physical capital: Fixed assets including IT-capital stock in millions of euro.

Profit efficiency: Profit efficiency obtained from a latent stochastic profit frontier analysis with two technology regimes.

<u>Publicly incorporated banks</u>: Indicator variable equal to 1 if the bank is publicly incorporated, either as joint stock or public limited company (*Aktiengesellschaft (AG); Kommanditgesellschaft auf Aktien (KG a.A.); Gesellschaft mit beschraenkter Haftung (GmbH)*).

<u>Reserves</u>: Hidden reserves according to §340f of the German commercial code in per cent of gross total assets.

<u>Return on equity (ROE)</u>: Operating result including net interest, fee, commission and trading income in per cent of equity capital.

<u>Securities</u>: Bonds and stocks.

<u>Share of fee income</u>: Provision and fee income relative to total operating gross revenues.

External Position Report

Data on the international assets of German banks are taken from the External Position report (*Auslandsstatus*) of the *Deutsche Bundesbank*. They are confidential and can be used on the premises of the *Bundesbank* only.

<u>International assets</u>: Loans and advances to banks, companies, governments, bonds and notes, foreign shares and other equity, participation abroad, denominated or converted into Euro. Irrevocable credit commitments are included but other off-balance sheet items are not. For a more detailed description of this data base see (Fiorentino et al. 2010).

<u>Branches and subsidiaries</u>: Foreign affiliates of German parent banks. Branches do not have an independent legal status, whereas subsidiaries do. We attribute assets held by affiliates to the country in which they are located.

<u>List of countries</u>:

Argentina	Estonia	Mauritius	Slovakia
Australia	Finland	Mexico	Slovenia
Austria	France	Morocco	South Africa
Belgium	Greece	Netherlands	South Korea
Bosnia	Hong Kong	Netherlands Antilles	Spain
Brazil	Hungary	New Zealand	Sri Lanka
Bulgaria	India	Norway	Sweden
Canada	Indonesia	Pakistan	Switzerland
Cayman Islands	Ireland	Panama	Taiwan
Chile	Israel	Peru	Thailand
China	Italy	Philippines	Turkey
Colombia	Japan	Poland	Ukraine
Cote d'Ivoire	Jordan	Portugal	United Arab Emirates
Croatia	Latvia	Qatar	United Kingdom
Cyprus	Lithuania	Romania	United States
Czech Republic	Luxemburg	Russia	Uruguay
Denmark	Malaysia	Saudi Arabia	Vietnam
Egypt	Malta	Singapore	

Data on Bank Risk

To measure the soundness of the German banking sector, we use confidential information from the distress database of the *Deutsche Bundesbank* for individual banks at an annual frequency. These data allow for a distinction between different distress categories that differ in terms of severity of distress observed:

o   Mandatory announcements by individual banks to the supervisory authority (Distress Category I),

o   Official warnings by the *Bundesanstalt für Finanzdienstleistungsaufsicht (BaFin)* (Distress Category II),

o   Direct interventions into the ongoing business of a bank by the *BaFin* (Distress Category III), and

o   All events that reflect the disappearance of a bank from active business operations such as closure of a bank or restructuring mergers (Distress Category IV).

Table 1: Descriptive Statistics Internationalization

This Table gives the descriptive statistics for the measures of portfolio diversification and the market power in foreign markets described in Section 3.2. The number of observations (n) gives the number of bank-year observations.

	Full sample used in regressions ($n = 6,752$)	Banks with foreign subsidiaries ($n = 129$)	Banks with foreign branches ($n = 137$)
Extensive margin			
Number of destination countries	13.670	46.920	42.550
Number of foreign branches of bank i	0.921	4.240	4.540
Number of foreign subsidiaries of bank i	0.726	3.798	3.124
Intensive margin			
Foreign assets (cross-border) / total assets	4.171	22.828	23.630
Foreign assets (branches) / total assets	0.250	10.416	12.311
Foreign assets (subsidiaries) / total assets	0.135	7.088	4.633

Table 2: Descriptive Statistics

This Table gives the descriptive statistics for explanatory variables used in the regressions for risk (probability of distress) and market power (Lerner index). All ratios and changes are measured in percent. Moments are based on lagged values used in regressions. 7,752 observations.

	Mean	Standard deviation	1st percentile	99th percentile
Internationalization				
Total foreign assets / total assets	4.75	8.51	0.01	46.48
Extensive margin	13.74	9.48	2.00	54.00
Market power (Lerner index)				
Acquisitions	1.92	2.47	0.00	12.00
Branches	29.21	21.28	0.20	100.45
Cost efficiency	84.43	9.84	56.25	98.34
Herfindahl index (output categories)	46.29	8.85	29.42	71.10
Lerner index	0.23	0.11	-0.07	0.05
Profit efficiency	73.43	12.79	27.50	92.29
Public incorporated (0/1)	0.04	0.19	0.00	1.00
Share of fee income	12.21	5.05	2.29	28.93
Size quintile	3.08	1.39	1.00	5.00
Risk (Probability of distress)				
Capitalization	5.64	2.13	2.60	10.86
Customer loans	58.99	12.70	22.73	83.75
Non-performing loans	8.68	7.13	0.31	32.91
Probability of distress	0.03	0.16	0.00	1.00
Reserves	1.54	1.04	0.00	4.60
Return on equity	0.12	0.09	-0.15	0.34

Table 3: Baseline Regression Results

This Table gives regression results for simultaneously estimating the probability of distress and the market power of banks (Lerner index) as described in Section 4.1. Estimations of the Lerner index in Table (a) use OLS, estimations of the probability of distress in Table (b) use a probit model. All explanatory variables are lagged by one period. Dummies for different banking groups, time, and regional fixed effects are included but not reported. Extensive margin = number of countries in which bank is present, intensive margin = foreign assets / total assets. Table (a) depicts standardized coefficients in brackets, Table (b) reports marginal effects. ***, **, * = significant at the 1%, 5%, 10%-level drawing on bootstrapped standard errors.

(a) Market Power (Lerner Index)

	(1)	(2)	(3)	(4)	(5)
Predicted risk	-0.0546***	-0.0545***	-0.0546***	-0.0547***	-0.0551***
	(-0.420)	(-0.420)	(-0.422)	(-0.427)	(-0.426)
Share of fee income	0.00213***	0.00226***	0.00227***	0.00225***	0.00220***
	(0.0951)	(0.101)	(0.101)	(0.100)	(0.0982)
Size quintile	-0.00525***	-0.00223	-0.00213	-0.00321**	-0.00274**
	(-0.0648)	(-0.0275)	(-0.0263)	(-0.0396)	(-0.0338)
Herfindahl index (output categories)	0.00139***	0.00144***	0.00149***	0.00127***	0.00134***
	(0.109)	(0.113)	(0.117)	(0.0993)	(0.105)
Publicly incorporated (0/1)	-0.0258*	-0.0254**	-0.0252*	-0.0177	-0.0264**
	(-0.0427)	(-0.0420)	(-0.0417)	(-0.0293)	(-0.0436)
Branches	0.000268***	0.000259**	0.000260***	0.000275***	0.000265***
	(0.0505)	(0.0489)	(0.0491)	(0.0520)	(0.0501)
Acquisitions	0.00164***	0.00152***	0.00144***	0.00185***	0.00167***
	(0.0361)	(0.0334)	(0.0316)	(0.0407)	(0.0367)
Extensive margin		-0.000771***	-0.000751***	-0.000423**	-0.000592***
		(-0.0644)	(-0.0628)	(-0.0353)	(-0.0494)
Foreign assets / total assets		0.000787***			
		(0.0592)			
Foreign assets (cross-border) / total assets			0.00104***		
			(0.0587)		
Foreign assets (subsidiaries) / total assets				-0.00929***	
				(-0.108)	
Foreign assets (branches) / total assets					0.00244***
					(0.0586)
Observations	6,752	6,752	6,752	6,752	6,752
Adjusted R^2	0.415	0.419	0.419	0.418	0.423

(b) Risk (Probability of Distress)

	(1)	(2)	(3)	(4)	(5)
Lerner	-0.165***	-0.123**	-0.122***	-0.113**	-0.122**
	(0.0459)	(0.0560)	(0.0404)	(0.0560)	(0.0476)
Lerner residuals	0.138***	0.0963*	0.0952**	0.0879*	0.0961**
	(0.0426)	(0.0529)	(0.0419)	(0.0485)	(0.0452)
Core capital ratio	0.00143	0.00105	0.000907	0.000853	0.000989
	(0.00110)	(0.00149)	(0.000836)	(0.00104)	(0.00132)
Reserves	-0.00568***	-0.00658***	-0.00655***	-0.00652*	-0.00650***
	(0.00150)	(0.00158)	(0.00176)	(0.00356)	(0.00118)
Customer loan share	0.000104	0.000101	0.000116	6.36e-05	9.03e-05
	(9.47e-05)	(8.54e-05)	(7.73e-05)	(5.34e-05)	(5.92e-05)
Non-performing loans	-9.51e-05	-6.78e-05	-7.29e-05	-5.95e-05	-6.76e-05
	(0.000108)	(8.49e-05)	(0.000104)	(0.000132)	(0.000102)
Cost-income ratio	0.000122	0.000112	0.000119	0.000111	0.000111
	(0.000134)	(0.000158)	(0.000138)	(0.000149)	(0.000133)
Return on equity	-0.0337***	-0.0365***	-0.0365***	-0.0368*	-0.0366***
	(0.00947)	(0.0119)	(0.0110)	(0.0190)	(0.0105)
Cost efficiency	-0.000203***	-0.000229***	-0.000224**	-0.000211**	-0.000229***
	(7.38e-05)	(8.24e-05)	(9.85e-05)	(9.85e-05)	(6.84e-05)
Profit efficiency	0.000151*	0.000103	0.000104	8.57e-05	0.000103
	(7.75e-05)	(9.44e-05)	(6.52e-05)	(7.85e-05)	(0.000108)
Extensive margin		0.000178	0.000167	0.000228	0.000188
		(0.000113)	(0.000161)	(0.000163)	(0.000122)
Foreign assets / total assets		3.84e-05			
		(0.000152)			
Foreign assets (cross-border) / total assets			0.000143		
			(0.000194)		
Foreign assets (subsidiaries) / total assets				-0.00266	
				(0.0202)	
Foreign assets (branches) / total assets					8.52e-05
					(0.000290)
Observations	6,752	6,752	6,752	6,752	6,752
Pseudo R^2	0.245	0.247	0.248	0.252	0.248

Table 4: Regression Results by Banking Group

This Table gives regression results for simultaneously estimating the probability of distress and the market power of banks (Lerner index) as described in Section 4.1. Estimations of the Lerner index in Table (a) use OLS, estimations of the probability of distress in Table (b) use a probit model. All explanatory variables are lagged by one period. Dummies for different banking groups, time, and regional fixed effects are included but not reported. Extensive margin = number of countries in which bank is present, intensive margin = foreign assets / total assets. Table (a) depicts standardized coefficients in brackets, Table (b) reports marginal effects. ***, **, * = significant at the 1%, 5%, 10%-level drawing on bootstrapped standard errors.

(a) Market Power (Lerner Index)

	(1) Full sample	(2) Commercial banks	(3) Savings banks	(4) Cooperative banks
Predicted risk	-0.0545***	-0.00364**	-0.0156***	-0.0756***
	(-0.420)	(-0.219)	(-0.538)	(-0.604)
Share of fee income	0.00226***	0.00127	0.00372***	0.00330***
	(0.101)	(0.109)	(0.111)	(0.121)
Size quintile	-0.00223	-0.0670***	-0.0135***	0.00572***
	(-0.0275)	(-0.481)	(-0.142)	(0.0647)
Herfindahl index (output categories)	0.00144***	0.00259***	0.00219***	0.000553***
	(0.113)	(0.257)	(0.239)	(0.0430)
Publicly incorporated (0/1)	-0.0254**	-0.0308		0.0181*
	(-0.0420)	(-0.0805)		(0.0135)
Branches	0.000259***	-0.00153	0.00106***	0.000463***
	(0.0489)	(-0.0903)	(0.120)	(0.0987)
Acquisitions	0.00152***	-0.000658	-0.00293***	0.00356***
	(0.0334)	(-0.0161)	(-0.0777)	(0.0769)
Foreign assets / total assets	0.000787***	0.00150***	-0.00242***	-0.000419
	(0.0592)	(0.235)	(-0.0982)	(-0.0140)
Extensive margin	-0.000771***	0.000628	0.000530*	-0.000396
	(-0.0644)	(0.0526)	(0.0632)	(-0.0234)
Observations	6,752	218	1,173	4,710
Adjusted R^2	0.419	0.246	0.448	0.390

(b) Risk (Probability of Distress)

	(1) Full sample	(2) Commercial banks	(3) Savings banks	(4) Cooperative banks
Lerner	-0.123**	4.24e-05	7.97e-05	-0.217***
	(0.0572)	(0.0256)	(0.0217)	(0.0650)
Lerner residuals	0.0963*	-0.000128	-0.000109	0.180***
	(0.0566)	(0.0828)	(0.0289)	(0.0656)
Core capital ratio	0.00105	-6.86e-07	-1.45e-05	0.00308
	(0.00134)	(0.000620)	(0.00448)	(0.00220)
Reserves	-0.00658***	-1.70e-05	-2.32e-05	-0.00657***
	(0.00142)	(0.0148)	(0.00771)	(0.00224)
Customer loan share	0.000101	6.00e-08	-1.23e-08	8.08e-05
	(8.39e-05)	(4.23e-05)	(5.80e-06)	(0.000151)
Non-performing loans	-6.78e-05	5.84e-07	1.32e-06	-0.000333**
	(9.12e-05)	(0.000525)	(0.000453)	(0.000149)
Cost-income ratio	0.000112	4.35e-07	2.72e-07	0.000122
	(0.000117)	(0.000478)	(0.000116)	(0.000167)
Return on equity	-0.0365***	-0.000450	-6.53e-05	-0.0375***
	(0.0112)	(0.338)	(0.0225)	(0.0143)
Cost efficiency	-0.000229***	-2.29e-09	-1.61e-06	-2.40e-05
	(6.79e-05)	(5.46e-05)	(0.000547)	(0.000132)
Profit efficiency	0.000103	-1.02e-06	-8.14e-07	0.000363**
	(7.97e-05)	(0.000753)	(0.000257)	(0.000147)
Foreign assets / total assets	3.84e-05	4.72e-07	-3.58e-06	-0.000226
	(0.000174)	(0.000406)	(0.00127)	(0.000320)
Extensive margin	0.000178**	1.57e-06	9.31e-07	0.000388***
	(8.71e-05)	(0.00109)	(0.000313)	(0.000138)
Observations	6,752	218	1,181	4,710
Pseudo R^2	0.247	0.318	0.528	0.249

Table 5: Endogeneity of Foreign Status

This Table gives regression results for simultaneously estimating the probability of distress and the market power of banks (Lerner index) as described in Section 4.1. Estimations of the Lerner index in Table (a) use OLS, estimations of the probability of distress in Table (b) use a probit model. All explanatory variables are lagged by one period. Dummies for different banking groups, time, and regional fixed effects are included but not reported. *Entry (0/1)* is a dummy variable which is equal to one if a bank has increased the number of foreign countries in which it is active, *Exit (0/1)* is a dummy variable which is equal to one if a bank has lowered the number of countries. *Exit (number)* and *Entry (number)* are the corresponding variables using the absolute value of the count of countries from which a bank has withdrawn or into which a bank has newly expanded. Extensive margin = number of countries in which bank is present, intensive margin = foreign assets / total assets. Table (a) depicts standardized coefficients in brackets, Table (b) reports marginal effects. ***, **, * = significant at the 1%, 5%, 10%-level drawing on bootstrapped standard errors.

(a) Market Power (Lerner Index)

	(1)	(2)	(3)	(4)	(5)
Predicted risk	-0.0545***	-0.0545***	-0.0569***	-0.0603***	-0.0595***
	(-0.420)	(-0.420)	(-0.454)	(-0.497)	(-0.494)
Share of fee income	0.00226***	0.00216***	0.00213***	0.00165***	0.00163***
	(0.101)	(0.0964)	(0.0980)	(0.0813)	(0.0799)
Size quintile	-0.00223	-0.00561***	-0.00470***	-0.00167	-0.00222
	(-0.0275)	(-0.0693)	(-0.0594)	(-0.0218)	(-0.0289)
Herfindahl index (output categories)	0.00144***	0.00147***	0.00122***	0.00108***	0.00108***
	(0.113)	(0.116)	(0.0977)	(0.0872)	(0.0869)
Branches	0.000259***	0.000266***	0.000262**	0.000335***	0.000324***
	(0.0489)	(0.0503)	(0.0481)	(0.0618)	(0.0596)
Acquisitions	0.00152***	0.00132**	-0.000519	-0.00281***	-0.00304***
	(0.0334)	(0.0291)	(-0.0114)	(-0.0468)	(-0.0507)
Publicly incorporated (0/1)	-0.0254**	-0.0277*	-0.0194	0.00345	0.00314
	(-0.0420)	(-0.0457)	(-0.0325)	(0.00604)	(0.00549)
Foreign assets / total assets	0.000787***				
	(0.0592)				
Extensive margin	-0.000771***				
	(-0.0644)				
Intensive margin (Frankel Romer)		0.000786***			
		(0.0586)			
Total foreign assets / total assets (t-2)			0.000491		
			(0.0358)		
Entry (0/1) (t-2)				0.000944	
				(0.00439)	
Exit (0/1) (t-2)				-0.0192***	
				(-0.0867)	
Entry (number) (t-2)					0.000967
					(0.0182)
Exit (number) (t-2)					-0.00465***
					(-0.0663)
Observations	6,752	6,752	4,938	2,881	2,881
Adjusted R^2	0.419	0.417	0.370	0.425	0.424

(b) Risk (Probability of Distress)

	(1)	(2)	(3)	(4)	(5)
Lerner	-0.123***	-0.164***	-0.161***	-0.193***	-0.184
	(0.0462)	(0.0412)	(0.0614)	(0.0664)	(0.147)
Lerner residuals	0.0963**	0.137***	0.137**	0.171***	0.164
	(0.0446)	(0.0374)	(0.0548)	(0.0643)	(0.139)
Core capital ratio	0.00105	0.00137	0.00264	0.00413**	0.00387
	(0.00111)	(0.000847)	(0.00171)	(0.00189)	(0.00370)
Reserves	-0.00658***	-0.00565***	-0.00297**	-0.00210	-0.00227
	(0.00203)	(0.00164)	(0.00143)	(0.00225)	(0.00221)
Customer loan share	0.000101	0.000125**	8.34e-05	2.78e-05	3.22e-05
	(7.36e-05)	(5.47e-05)	(0.000102)	(0.000127)	(0.000102)
Non-performing loans	-6.78e-05	-0.000107	-0.000153	-7.10e-05	-7.14e-05
	(9.09e-05)	(0.000105)	(0.000110)	(0.000105)	(5.97e-05)
Cost-income ratio	0.000112	0.000144	8.17e-05	0.000174	0.000169**
	(0.000142)	(0.000124)	(9.76e-05)	(0.000255)	(8.23e-05)
Return on equity	-0.0365***	-0.0340***	-0.0228**	-0.0191	-0.0194
	(0.0120)	(0.0119)	(0.00946)	(0.0166)	(0.0142)
Cost efficiency	-0.000229***	-0.000200***	-0.000146**	-5.61e-05	-6.74e-05
	(8.23e-05)	(6.06e-05)	(7.01e-05)	(0.000113)	(0.000125)
Profit efficiency	0.000103	0.000158**	0.000196*	0.000261**	0.000252
	(8.21e-05)	(7.10e-05)	(0.000105)	(0.000119)	(0.000213)
Foreign assets / total assets	3.84e-05				
	(0.000164)				
Extensive margin	0.000178*				
	(9.88e-05)				
Intensive margin (Frankel Romer)		0.000142			
		(0.000112)			
Total foreign assets / total assets (t-2)			-7.90e-06		
			(0.000207)		
Entry (0/1) (t-2)				0.000448	
				(0.00185)	
Exit (0/1) (t-2)				-0.00326**	
				(0.00154)	
Entry (number) (t-2)					0.000264
					(0.000462)
Exit (number) (t-2)					-0.000821
					(0.000681)
Observations	6,752	6,752	4,938	2,881	2,881
Pseudo R^2	0.247	0.245	0.262	0.275	0.276

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