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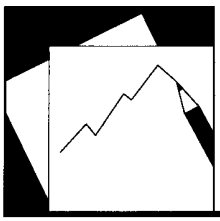

IMF Working Paper

Cooperative Banks and Financial Stability

Heiko Hesse and Martin Čihák

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IMF Working Paper

Monetary and Capital Markets Department

Cooperative Banks and Financial Stability

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Abstract

This Working Paper should not be reported as representing the views of the IMF.
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Cooperative banks are an important, and growing, part of many financial systems. This paper empirically analyzes the role of cooperative banks in financial stability. Contrary to some suggestions in the literature, we find that cooperative banks are more stable than commercial banks. This finding is due to the lower volatility of the cooperative banks' returns, which more than offsets their lower profitability and capitalization. This is most likely due to cooperative banks' ability to use customer surplus as a cushion in weaker periods. We also find that in systems with a high presence of cooperative banks, weak commercial banks are less stable than they would be otherwise. The overall impact of a higher cooperative presence on bank stability is positive on average but insignificant in some specifications.

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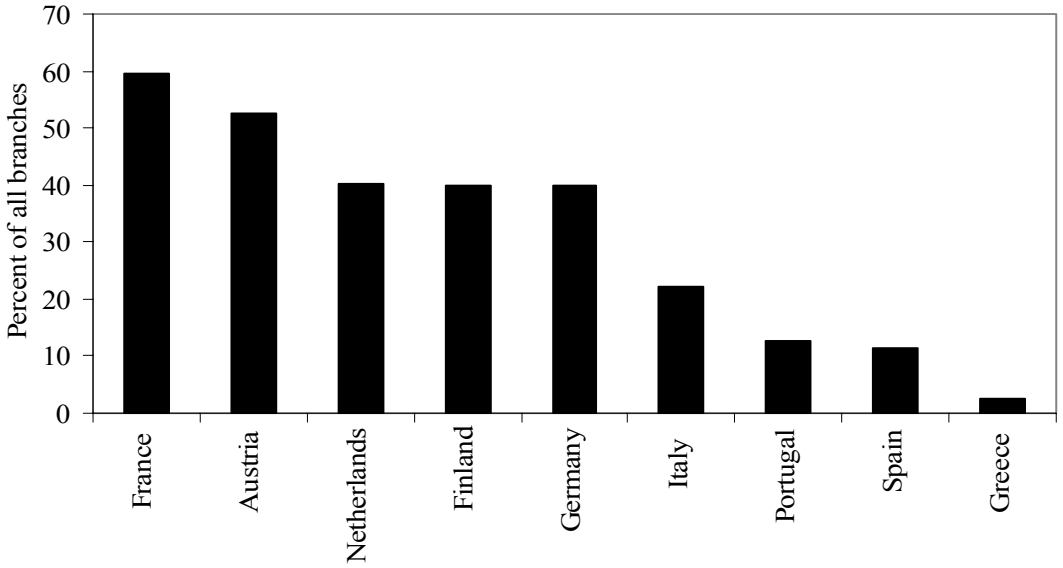
I. MOTIVATION AND LITERATURE OVERVIEW

Cooperative (mutual) banks are an important part of many financial systems.[2] In a number of countries, they are among the largest financial institutions when considered as a group. Moreover, the share of cooperative banks has been increasing in recent years; in the sample of banks in advanced economies and emerging markets analyzed in this paper, the market share of cooperative banks in terms of total banking sector assets increased from about 9 percent in the mid-1990s to about 14 percent in 2004.

Cooperative banks are particularly numerous and large in Europe. The five largest cooperative banks in the European Union (EU) rank among the EU's top 25 banking groups in terms of consolidated equity. Reflecting the cooperative banks' focus on retail banking, their market share in retail business is even more substantial: for example, five EU member countries have more than a 40 percent market share of cooperative banks in terms of branch networks (Figure 1). In non-European advanced economies and emerging markets, the share of cooperative banks is generally lower, but there are several countries where they play a non-negligible role.[3]

Figure 1. Cooperative Banks: Retail Market Shares in Selected Countries



Source: OECD's *Bank Profitability Report*; and authors' calculations.

[2] We use the term "cooperative bank" to include also credit unions. The main distinctive feature of credit unions is that their customers are identical with members. In other cooperative banks, not all customers are members.

[3] For more background on institutional history and structure of cooperative (mutual) banking, see Fonteyne (forthcoming) and Cuevas and Fischer (2006).

The importance of cooperative banks—and in particular the implications of their specific nature for financial stability—has not yet received appropriate attention in the empirical literature. The literature devotes disproportionately little attention to cooperative banks in comparison with commercial banks, smaller than would correspond, for example, to their market share. For example, only about 0.1 percent of all banking-related entries in EconLit, a major database of economic research, relates to cooperative banking.[4] This contrasts with the share of cooperative banks, which account on average for about 10 percent of banking system assets in advanced economies and emerging markets, reaching as much as 30 percent in some countries in terms of assets (and even more in terms of branches—see Figure 1). Most of the EconLit entries devoted to cooperative banks deal with specific country cases or with issues relating to efficiency rather than those relating to financial stability. For example, Brunner and others (2004) analyze revenue and cost efficiency of cooperative banks in France, Germany, Italy, and Spain, finding that cooperative banks are not less effective at managing revenues and costs than commercial banks.

The regulatory framework, including the recent amendments, is also generally designed with commercial banks in mind. For example, the third pillar of the New Basel Capital Accord (Basel II)—which relies on extensive disclosure to ensure that banks are subject to market discipline—has significantly reduced effectiveness in the case of cooperative banks (Fonteyne, 2007). Cooperatives' disclosure practices and requirements are substantially below those of commercial banks, especially listed ones. Even if disclosure were adequate, there are rarely markets that could exert effective disciplining pressure. Shareholder pressure cannot be relied upon and cooperatives do not rely much on interbank markets or debt issuance as sources of funds. Finally, loyal and insured retail depositors are not likely to exert an effective market disciplining effect either at an early enough stage.

Macroprudential work on financial systems, such as the IMF's Financial System Stability Assessment reports (FSSAs), Article IV staff reports, and the *Global Financial Stability Report*, as well as reports on financial stability published by central banks (for a survey, see Čihák, 2006) pay relatively little attention to cooperative banks. Fonteyne (forthcoming) cites the FSSAs for France and Germany as two reports that devoted some attention to cooperative banks; however, the references to cooperative banks in those reports focused on mutual support and deposit insurance mechanisms, efficiency, and financial sector consolidation issues, rather than on financial stability implications.

Several authors have noted in passing the potential of cooperative banks to increase the fragility of financial systems. For example, commenting on a finding by Barth, Caprio, and

[4] A search of the EconLit database was carried out on June 15, 2006, looking for all entries that had "banks" or "banking" among keywords or in the abstract. A search was then run for those that referred to "cooperative banks," "cooperative banking," or "mutual financial institution(s)."

Levine (1999) that a higher degree of government ownership of banks tends to be associated with higher fragility of financial systems, Goodhart (2004) interprets this result as perhaps indicating that the presence of any non-profit-maximizing banking entities may make financial systems more fragile.

Goodhart does not elaborate on the underlying mechanism of this relationship between the presence of non-profit-maximizing entities and financial stability, but possible mechanisms are not difficult to envision in the case of cooperative banks. Cooperative banks' stated objective is not to maximize profits, but rather their members' consumer surplus; this is in some cases complemented by additional objectives that seek to contribute to the well-being of stakeholders other than member-consumers, such as employees.[5] If a cooperative bank's pursuit of objectives other than profit maximization results in very low profitability, its balance sheet risks grow faster than its capital, leading to deteriorating solvency. If cooperative banks accept lower profitability as the price to pay for delivering financial services at below-market prices to retail clients, they may pull down the profitability of the banking system, with negative repercussions for other banks' soundness.

The literature's verdict on cooperative banks' role in financial stability is less than clear. Several papers suggest that cooperative banks may have more difficulties adjusting to adverse circumstances and changing risks. For example, Brunner and others (2004) note that the Swedish cooperative banking sector did not survive the crisis of the early 1990s in a cooperative form, as it faced high marginal costs of capital—the need to restore capital was a major factor in the decision to demutualize. Fonteyne (forthcoming) suggests that cooperative banks may be more vulnerable to shocks in credit quality and interest rates, because they are more focused on traditional financial intermediation than other institutions, and therefore have higher exposures to credit and interest rate risk. At the same time, several studies suggest that cooperative banks have generally lower incentives to take on risks. For example, Hansmann (1996) and Chaddad and Cook (2004) find that mutual financial institutions in the United States tend to adopt less risky strategies than demutualized ones.

Whether cooperative banks have a positive or negative impact on financial stability therefore remains an empirical question. We address this question by analyzing individual bank data for major advanced economies and emerging markets. We examine two related issues:

[5] In addition, some authors have suggested that due to relatively less oversight by members, as opposed to owners in a commercial bank, managers in cooperative banks may be more likely to pursue their own goals (e.g., "empire building") rather than members' interests, potentially hurting their stability. Fonteyne (forthcoming) discusses cooperative banks' objective functions in more details and summarizes the relevant literature.

- *Cooperative banks' soundness and resilience to stress.* We test the hypothesis that cooperative banks are relatively weaker in responding to stress because of the features of their business model.

- *Cooperative banks' impact on other banks.* We test the hypothesis that the presence of cooperative banks reduces the stability of other banks. As explained, this may be, for example, because the cooperative banks use their lower average cost of capital to pursue aggressive expansion plans that may weaken other financial institutions.

The remainder of the paper is structured as follows. Section II introduces the data and variables used in the paper (characterized in more detail in Appendix I), and presents the estimation methodology. Section III presents the empirical results. Section IV sums up the conclusions, and suggests topics for further research.

II. DATA AND METHODOLOGY

A. Data

Our calculations are based on individual bank data drawn from the BankScope database, provided by Bureau van Dijk. We use data on all commercial, cooperative, and savings banks in the database from 29 major advanced economies and emerging markets that are members of the Organization for Economic Cooperation and Development (OECD).[6] In total, we have data on 16,577 banks from 1994 to 2004, comprising 11,090 commercial banks, 3,072 cooperative banks, and 2,415 savings banks.

Several general issues relating to the BankScope data need to be mentioned. First, the database, while being the most comprehensive commercially available database of banking sector data, is not exhaustive. Coverage varies from country to country; for most countries in our sample, the BankScope data cover 80 to 90 percent of the total banking system assets, and the coverage of cooperative banks is lower than for commercial banks (in particular, only a small number of cooperative banks is included in the United States).[7] However, the coverage of our paper is still higher than in most banking studies (and in particular studies that focus on banks with particular features, such as large banks or banks that are listed on stock market), and even for cooperative banks our sample captures a majority in terms of total assets. We therefore believe the sample is comprehensive enough to make reliable inferences.

[6] See Appendix I for a list of the OECD member countries.

[7] Also, our sample does not cover some specialized types of banking institutions, such as development banks or specialized investment companies (even though our analysis covers, for example, investment banking activities carried out by commercial banks on their balance sheet).

Second, BankScope gives the specialization (status) of a bank in the sample (commercial, cooperative, and savings) in the current year. Therefore, it is for instance likely that the commercial bank subset contains some banks that have been cooperative or savings banks in earlier periods. Where information was available, we adjusted the status of a bank accordingly. For example, France was subject to a banking reform in June 1999 in which all savings banks were converted into cooperative banks. The Alliance & Leicester (United Kingdom) as well as First National (Ireland) Building Societies were demutualized and were stock market listed in 1997 and 1998, respectively. Given the large number of banks in the sample, it was not possible to individually check potential changes in specialization over time. However, we do not think that this limitation of the BankScope dataset biases the results.

Third, our analysis is based on unconsolidated bank statements. Ideally, we would have opted for consolidated statements whereby the parent company integrates the statements of its subsidiaries. However, given that about 90 percent of BankScope observations for the selected countries and periods are based on unconsolidated data, we focus on results based on unconsolidated data. Nonetheless, we have also performed the same calculations with consolidated data, and obtained very similar results (available upon request).

In addition to the bank-by-bank data, we also use a number of macroeconomic and other system-wide indicators. Those are described in more detail in Appendix I.

B. Measuring Bank Stability

Our primary dependent variable is the z-score as a measure of individual bank risk. The z-score has become a popular measure of bank soundness (see Boyd and Runkle, 1993; Maechler, Mitra, and Worrell, 2005; Beck and Laeven, 2006; Laeven and Levine, 2006; and Mercieca, Schaeck, and Wolfe, forthcoming). Its popularity stems from the fact that it is directly related to the probability of a bank's insolvency, i.e., the probability that the value of its assets becomes lower than the value of the debt. The z-score can be summarized as $z \equiv (k+\mu)/\sigma$, where k is equity capital as percent of assets, μ is average after-tax return as percent on assets, and σ is standard deviation of the after-tax return on assets, as a proxy for return volatility. The z-score measures the number of standard deviations a return realization has to fall in order to deplete equity, under the assumption of normality of banks' returns. A higher z-score corresponds to a lower upper bound of insolvency risk—a higher z-score therefore implies a lower probability of insolvency risk.[8]

[8] For banks listed in liquid equity markets, a popular version of the z-score is distance-to-default, which uses stock price data to estimate the volatility in the economic capital of the bank (Denmark National Bank, 2004).

(continued…)

One issue relating to the use of z-scores for analyzing cooperative banks is whether the z-scores are a fair measure of soundness across different groups of institutions, in particular given that cooperative banks are much less focused on returns and profitability than commercial banks. We think that the z-score is an objective measure, as all banks (cooperative, commercial, and savings), face the same risk of insolvency in case they run out of capital. This is exactly the risk captured by the z-score, which has the same methodology for any type of bank. If an institution "chooses" to have lower risk-adjusted returns, it can still have the same or higher z-score if it has a higher capitalization.

C. Methodology

We start by two preliminary steps: a decomposition of observed differences in z-scores into the underlying factors (capitalization, returns, and volatility of returns), and a calculation of correlation coefficients between z-scores and other variables of interest.

The main part of our approach is to test the two hypotheses outlined in the introduction (Section I) using regressions of z-scores on a number of explanatory variables. We estimate a general class of panel models of the form

$$z_{i,j,t} = \alpha + \beta B_{i,j,t-1} + \gamma I_{j,t-1} + \sum \delta_s T_s + \sum \phi_s T_s I_{j,t-1} + \sum \varphi_s T_s B_{i,j,t-1} + \varpi M_{j,t-1} + \sum \lambda_j C_j + \sum \pi_t D_t + \varepsilon_{i,j,t}$$

where the dependent variable is the z-score $z_{i,j,t}$ for bank *i* in country *j* and at time *t*; $B_{i,j,t-1}$ is a vector of bank-specific variables; I_{jt-1} are time-varying banking industry-specific variables in country *j*; T_s, $T_s I_{j,t-1}$ and $T_s B_{i,j,t-1}$ are the type of banks and the interaction between the type and some of the industry-specific variables as well as bank-specific variables, respectively; $M_{j,t}$, C_j, and D_t are vectors of macroeconomic variables, country, and yearly dummy variables, respectively; and $\varepsilon_{i,j,t}$ is the residual.

To distinguish the impact of bank type on the z-score, we include two dummy variables. The first dummy variable takes the value of 1 if the bank in question is a commercial bank, and 0 otherwise; the second one takes the value of 1 for savings banks, and 0 otherwise. If cooperative banks are relatively weaker than commercial (or savings) banks, the first (second) dummy variable would have a positive sign in the regression explaining z-scores.

For most cooperative banks, however, market price data are not available. This paper therefore relies on the specification of the z-score that relies only on accounting data.

At the systemic (country) level, we want to examine cooperative banks' impact on other banks and the hypothesis that the presence of cooperative banks lowers systemic stability. For this reason, we have calculated the market share of cooperative banks by assets for each year and country and interacted it with the commercial bank dummy. For example, a negative sign of the sum of the coefficients of the cooperative banks' market share and its interaction with the commercial bank dummy would indicate a decrease in commercial banks' stability (in their z-scores).

In addition to these key variables of interest, the regression includes a number of other control variables, both on individual bank level and on country level. Appendix I provides a description of the variables. To control for bank-level differences in bank size, asset composition, and cost efficiency, we include the bank's asset size in billions of U.S. dollars, loans over assets, and the cost-income ratio. Also, to control for differences in structure of banks' income, we calculate a measure of income diversity that follows Laeven and Levine (forthcoming).[9] The variable measures the degree to which banks diversify from traditional lending activities (those generating net interest income) to other activities. To further capture differences of cooperative banks in their business orientation, we interact the income diversity variable with the cooperative bank dummy. Controlling for these variables is important because there are differences in these variables between cooperative banks and the other groups. For example, commercial banks are on average larger than cooperative banks throughout the sample period. Similarly, the asset size of cooperatives is less volatile than for commercial banks but significantly more volatile than for savings banks. We want to adjust for the differences in these variables to ensure that we capture the "pure" impact of the bank's legal form (commercial, cooperative, or savings) on stability.[10] Table 1 shows the summary statistics of the bank-specific variables by type of bank.

On the country level, we also adjust for the impact of the macroeconomic cycle by including a number of macroeconomic variables (GDP growth rate, inflation, the real long-term interest rate, and exchange rate appreciation). To account for cross-country variation in z-scores caused by differences in market concentration, we include the Herfindahl index, defined as the sum of squared market shares (in terms of total assets) of all banks in the country.[11]

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[9] The income diversity measure is defined as $1 - \left| \frac{(\textit{Net interest income} - \textit{Other operating income})}{\textit{Total operating income}} \right|$. Higher values of the variable correspond to a higher degree of diversification.

[10] For completeness, we have also tested whether the impact of bank-specific variables such as asset size is different for the different types of banks (by multiplying the asset size with the relevant dummy variables), but this has not led to any significantly robust results.

[11] We do not have a strong prior on the impact of the Herfindahl index, because the existing literature contains two contrasting views on the relationship between concentration and stability. For example, Allen and Gale (2004) put forth theoretical arguments why more concentrated markets are likely to be more stable, and Beck,

(continued…)

In separate regressions, we account for the quality of corporate governance in a country, using a popular indicator by Kaufmann, Kraay, and Mastruzzi (2005). The authors provide six governance measures (voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption). We average the six measures across the available years (2004, 2002, 2000, 1998, and 1996) into one single index per country. The governance indicator should capture cross-country differences in institutional developments that might have an effect on banking risk.

All bank-specific and macroeconomic variables, the Herfindahl index, and the cooperatives' market share and its interaction with the commercial bank dummy are lagged to capture possible past effects of these variables on the banks' risk. We also test for the robustness of the lagged effects by restricting the explanatory variables to contemporaneous effects.

Across the whole sample, most observations of the z-score are found in the 20–80 range; however, there are some extreme observations, resulting in the sample range being from -81 to 14,811 with an average of 57. This leads to the question whether to eliminate observations at the extreme end of the z-score distribution. On one hand, we are interested in situations of instability, and therefore would like to include extreme observations; on the other hand, some of the extreme observations may be due to very specific, one-off events, or sometimes data errors. To assess the robustness of our results with respect to the outliers, we have done all the calculations both for the full sample and for a sample that excludes the most extreme outliers. To keep the presentation succinct, this paper presents results for a sample that eliminates the 1st and 99th percentile from the distribution of the z-score. The results for the full sample including those extreme outliers are available from the authors; the main conclusions are the same for both approaches.

To further assess the robustness of the results with respect to the selected sample, we estimate the same regression for different country samples, and different bank size samples. We start with the widest sample that includes all OECD countries (except Slovakia, for which the BankScope contains no data on cooperative banks). We then estimate the same regression for the Euro area (EU12),[12] and for countries where the cooperatives' market share

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Demirgüc-Kunt, and Levine (2005) provide empirical results consistent with the view that more concentration is associated with more financial stability. Contrary to these findings, for example, Boyd and de Nicoló (forthcoming) and Mishkin (1999) suggest that too concentrated systems can be characterized by increased risk-taking behavior by banks.

[12] We have also carried out all the estimates for EU15 countries (EU12, Denmark, Sweden, and the United Kingdom). The results have not been substantially different from those for EU12 and are therefore not reported here. Nonetheless, they are available from authors upon request.

exceeds 5 percent in our sample (Coop5).[13] As regards the robustness with respect to bank size, we estimate the regressions separately for large and small banks.

We also test the robustness of our results with respect to the estimation methods. We start by pooled ordinary least squares (OLS) and fixed effects estimates, followed by a robust estimation technique, and a quantile regression. The robust estimation technique assigns, through an iterative process, lower weights to observations with large residuals, thereby making the estimation less sensitive to outliers. The quantile regression allows to address the question whether the factors that cause high fragility are systematically different from the factors that cause medium or low fragility.

We would like to stress that our analysis is based on individual banks' z-scores. The impacts calculated from the estimated regressions are average impacts per bank. This approach provides a baseline assessment of stability and is frequent in the literature. However, to arrive at a more complete assessment of systemic stability, one needs to look also at correlation of losses across defaults and losses given default—a topic for further research.

III. RESULTS

A. Decomposition of Z-Scores and Correlation Analysis

A preliminary analysis shows that the cooperative banks' z-scores are on average significantly higher than for commercial banks (and slightly, but insignificantly, higher than for savings banks), suggesting that cooperative banks are more stable than commercial banks. Interestingly, this is not because of capitalization or profitability—those two are on average weaker for cooperative banks than for commercial banks. The result is driven by the fact that the cooperative banks' standard deviation of returns is much lower, resulting in the high z-score (Tables 2 and 3).

Why do we find the low volatility of returns over time in cooperative banks? A plausible explanation is that the cooperative banks use the customer surplus as a first line of defense in weaker times. Cooperative banks pass on an important part of their returns to customers in the form of surplus. Indeed, their stated objective is not maximization of profits, but rather maximization of the consumer surplus. This leaves the cooperative banks with relatively low average return ratios in normal years. However, in weaker years, they are able to extract some of the consumer surplus, thereby mitigating the negative impact of stress on returns.

[13] The Coop 5 countries are Austria, France, Germany, Italy, Japan, Netherlands and the United Kingdom.

We are therefore observing a lower variability of returns in cooperative banks than in commercial banks (and about the same as in savings banks).[14]

In other words, our calculations suggest that the consumer surplus can be viewed as the first line of defense for cooperative banks, in a similar way as profits are the first line of defense for commercial banks. However, there are some important differences. First, consumer surplus is a very complex concept to measure. We are not able to observe consumers' surplus on a consistent basis; even though we can make inferences about it from the pattern of returns. Second, while undistributed profits can be relatively easily used to replenish capital, extracting consumer surplus is one more step removed from capital and requires time.

To address the idea that cooperative banks are less able to raise capital in situations of stress, we have also examined volatility in cooperative banks' capitalization compared with commercial banks' capitalization (even though volatility in capitalization is not a part of the z-score calculation). The results only confirm our findings about z-scores, because cooperative banks also have a significantly lower volatility of capitalization.

The finding that cooperative banks have higher z-scores is novel, but not inconsistent with the existing literature. The empirical papers on the subject note that cooperative banks have lower reported returns, but they find no compelling evidence that the lower returns would be due to a less effective management of revenues and costs than in commercial banks (e.g., Brunner and others, 2004; and Altunbas, Evans, and Molyneux, 2001).[15] If the lower returns were due to inefficiencies in cooperative banks' operation, then it would be difficult to argue that there are cushions that can be used in weak times. However, the finding that cooperative banks have lower returns with the same efficiency suggest that there are cushions that can be used in situation of stress, an idea that is consistent with our finding.[16] We also find no evidence for our sample that cooperative banks are less efficient than commercial banks in terms of the cost-income ratio (Table 1).

To assess the robustness of our findings, we have also tried some alternatives to the standard definition of the z-score (Table 4). The underlying idea behind these alternative approaches (which have to our knowledge not yet been discussed in the literature) is that the standard

[14] An additional explanation of the lower volatility of returns can be the networks that cooperative banks form to provide a safety net. However, these support mechanisms are typically triggered only in extreme stress, and are therefore likely to explain only a small part of the observed difference in the volatility of returns.

[15] The finding about lower returns is in contrast with previous observation by Valnek (1999), who finds that mutual building societies in the United Kingdom have higher returns and risk-adjusted returns on assets than commercial banks.

[16] In a recent paper, Mercieca, Schaeck, and Wolfe (forthcoming) estimate an equation for z-scores in a sample of small European banks, including small cooperative banks, but their estimated slope coefficient for a cooperative bank dummy is insignificant.

deviation underlying the z-score gives only a part of the information about the behavior of z-scores. In particular, when assessing stability, we are much more interested in the downward spikes in returns on assets (ROAs) and z-scores than in the upticks. Table 3 has four panels, corresponding to four alternative variables that we have investigated, in particular:

- We have defined downward (upward) volatility of ROA as the sample average of the difference between the bank-specific ROA per year and its mean of ROA if the ROA is below (above) the bank-specific mean. Table 4 indicates that both downward and upward volatility of ROA are higher for commercial banks than for cooperative and savings banks. Comparing the absolute values within each bank type shows that the commercial banks' downward volatility of ROA is higher than its upward volatility. This finding does not hold for cooperative and savings banks.
- Similarly, we have defined the downward (upward) volatility of the z-scores as the sample average of the difference between the bank-specific z-score per year and its mean of the z-score if the z-score is below (above) the bank-specific mean. We cannot observe any statistical difference in the downward (upward) volatility of the z-scores.
- Furthermore, the downward (upward) volatility of the capitalization is defined as the sample average of the difference between the bank-specific equity-to-assets ratio per year and its mean of the capitalization if the equity-to-assets ratio is below (above) the bank-specific mean. The downward (upward) volatility of capitalization is lower for cooperatives than for commercial and savings banks.
- Commercial banks' z-scores have a higher frequency in the lower distribution of the z-scores than cooperative and savings banks. This supports the previous results of lower average z-scores for commercial banks during the sample period.

Overall, the above robustness checks support the findings for the simple z-scores.[17] To further assess the robustness of our findings, we can also look at measures of financial soundness that are alternative to the z-scores. An obvious alternative are ratings by rating agencies. Table 5 presents a distribution of long-term credit ratings by the Fitch Ratings for cooperative banks and commercial banks in the 29 advanced economies and emerging markets. The overall conclusion is that at least on the first look there does not seem to be a major difference between the ratings for cooperative banks and commercial banks. For both groups, for example, about 90 percent of institutions have investment grade long-term credit

[17] We have also calculated a modified z-score, defined as capitalization plus the ROA over the absolute value of the downward volatility of ROA. Results for this modified z-score confirm that on average, cooperative banks are more stable than commercial banks, reinforcing the findings from the above robustness tests. The results do not change qualitatively whether we use the absolute value of downward/upward deviation from the mean for the volatilities of the ROA, z-score and capitalization measures, or whether we use the squared downward/upward deviation from the mean.

rating (defined as BBB- or higher). It should be noted, however, that the distribution of ratings for cooperative banks is highly influenced by the ratings for German cooperative banks, all of which were given the same (A+) rating. This limits the usefulness of ratings for further, econometric analysis. In the next section, we will therefore focus on the z-scores.

Before discussing the regression results, we provide correlation coefficients between the z-score and selected key variables in Table 6. Here, we differentiate between all the banks in the sample and large (small) banks that have assets larger (smaller) than US$1 billion. Similar to the findings from the decomposition of the z-score in Table 1, commercial banks tend to have lower z-scores than cooperative and savings banks in all model specifications. Also, both the cooperative bank dummy and the z-score are positively correlated across the different samples.

While there is no evidence that the cooperative market share per country and year is negatively correlated with the z-scores of all commercial, cooperative and savings banks, we do find a significantly negative correlation between the z-scores and the interaction term of the share of cooperatives and commercial bank dummy in all models as hypothesized previously. A stronger cooperative sector is associated with higher commercial banks' risk. Since correlation findings do not necessarily reflect causal relationships and do not account for other control factors, we now turn to the panel regressions.

B. Regression Analysis

Table 7 presents pooled OLS and fixed effects estimates for the z-scores in the full sample of banks in OECD countries, in the Euro zone (EU12), and the countries where the cooperatives' market share exceeds 5 percent (Coop5).[18] All panel regressions include clustered standard errors (by bank), year and country dummy variables. Our main focus in discussing the results is on the two hypotheses outlined in the introduction, namely that cooperative banks are weaker and that their presence reduces the stability of other banks.

All the pooled OLS regressions provide strong evidence that cooperative banks have higher z-scores than commercial and savings banks. The estimated signs of the commercial bank dummy and savings bank dummy are negative in all the pooled OLS and fixed effects regressions (and significant at the 10 percent level in all but one the regressions). That is, cooperative banks appear less likely to become insolvent than the other two bank types. This

[18] In general, it is not possible to identify the commercial and savings bank dummies in the fixed effects regressions since they are not time-varying. Since we have changed the status of a few banks as discussed before, we could in principle identify the bank dummies. But we do omit the commercial and savings bank dummies in the fixed effects estimations, as only a few dummies are time-varying, and therefore the coefficients and p-values might not be very meaningful.

is in line with the findings from the decomposition of the z-score in the previous section. It strengthens the previous findings, because the conclusion about higher z-scores in cooperative banks holds even if we adjust for other explanatory factors, such as the fact that cooperative banks are typically more retail-oriented than commercial banks.

As regard the impact of a higher presence of cooperative banks on banking stability, the first approximation is provided by the estimated slope coefficient of the "share of cooperatives" variable, which is positive and significant in all but one specification. Based on this estimated slope coefficient, we can say that a higher share of cooperative banks increases stability (measured by z-score) of an average bank in the same banking system. It is important to stress, however, that this is only an *average* effect based on all the commercial, cooperative, and savings banks in the sample.[19]

To analyze in more detail the cooperative banks' impact on other (e.g., commercial) banks, one needs to analyze the sum of the coefficients of (i) the share of cooperative banks and (ii) the interaction of the share of cooperative banks with the other bank (e.g., commercial bank) dummy. Looking again at the estimates in Table 7, and focusing on commercial banks, we find that a higher market share of cooperative banks has a significantly negative effect on commercial banks' risk in the pooled OLS model for OECD countries. This would be consistent with the hypothesis that a higher presence of not-profit-maximizing cooperative banks could pull down the soundness of commercial banks. This could be because cooperative banks "over-pay" for deposits or "under-charge" for assets, or because the commercial banks get crowded out of the retail market and have to turn to markets that are more volatile.[20] However, this finding does not hold for the other model specifications. There is thus some, but limited, evidence in support of Goodhart's (2004) hypothesis in the full sample.[21]

The other explanatory variables have the expected signs. In particular, we find that larger banks tend to have lower z-scores, perhaps because they engage in riskier activities than smaller banks (and reflecting a relatively higher risk aversion of small banks). Also, banks with higher loan-to-asset ratios tend to be riskier (even though this result is valid only for the

[19] If we measured a "portfolio z-score" of the banking system, it would increase even more than the average z-score, due to the simple fact that a higher market share of cooperative banks means a higher share of banks with higher z-scores. However, our approach in this analysis is derived from individual bank z-scores.

[20] To examine the hypothesis that cooperative banks over-pay for deposits or under-charge for loans, we have calculated the implicit deposit and lending rates for the commercial and cooperative banks, defining the implicit deposit rate as total interest rate expenses over deposits and the lending rate as interest rate income over loans. Based on this calculation, there is no significant difference for deposit rates, but there is some evidence that cooperative banks charge lower lending rates than commercial banks (9.4 percent compared with 13.2 percent).

[21] For savings banks, the impact of a higher cooperative bank share is insignificant and not reported in Table 7.

OECD sample as a whole, but not necessarily in the EU12 and Coop5 sub-samples). Banks with higher loan portfolios on their balance sheets relative to their total assets might be more likely to experience problems with non-performing loans and thus be riskier. Finally, inefficient banks in terms of their cost-to-income ratio are less likely to cover their costs when hit by adverse shocks, so they tend to be riskier. The evidence on the effect of bank concentration on individual bank risk is mixed and unclear in the pooled OLS and fixed effects regressions.

The results from the income diversity variable and its interaction with the cooperative bank dummy support the above hypothesis. Overall, an increase in diversity (which could be interpreted as less focus on the traditional lending business) tends to increase banks' risk; however, cooperative banks tend to become more stable if they diversify their activities (sum of the coefficients of the income diversity variable and its interaction with the cooperative bank dummy). This result can be explained by the fact that commercial banks are about 30–40 percent more diversified than cooperative banks (both in the whole OECD sample and the EU12 and Coop5 sub-samples—see Table 1). Because of their stronger focus on the lending (retail) business, cooperative banks' stability improves from an increase in diversification of their activities; in contrast, a further move away from retail business in commercial banks, which have already a relatively higher share of other (wholesale) activities, results in decreasing stability (z-scores).

Table 8 presents the OECD pooled regressions with the governance indicator constructed by Kaufmann, Kraay, and Mastruzzi (2005). As expected, banks in countries with a higher level of institutional development are on average less risky than banks in countries which lack the same governance quality. From a comparison of Tables 7 and 8, the governance indicator does not have a significant impact on the estimated slope coefficients for the commercial and savings bank dummies, suggesting that cooperative banks are not more or less sensitive to governance problems than the other types of banks. However, this finding has to be taken with a grain of salt, because we use the overall quality of governance in the country as a proxy for corporate governance in the individual banks, on which there are unfortunately no direct cross-country data.

To assess the robustness of our results, we have also estimated models for large and small banks, n addition to the full sample regressions.[22] Table 9 replicates the previous regressions on the OECD, EU12, and Coop5 countries only with large banks, defined as those that have assets larger than US$1 billion. The commercial bank dummy is significantly negative in the

[22] In addition, to account for systemic importance, we have also estimated a weighted regression, weighting the different observations by total assets. The results, which were not substantially different from those for large banks in Table 8, are available from the authors upon request.

pooled OLS estimations (except the OECD sample). The previous result that a strong cooperative banking sector on average does not weaken the commercial banking sector is strongly supported in the regressions with large banks for all model specifications except the OLS OECD model.

Table 10 gives the model findings for small banks (those with assets below US$1 billion). Small commercial banks tend to be riskier than small cooperative banks but there is no substantial evidence that an increase in the cooperative market share has a consistently and significantly negative effect on the smaller commercial banks' individual risk.

As a further sensitivity test, we estimated the models with the robust estimation technique, which assigns lower weights to observations with large residuals, to avoid the impact of outliers (Beck, Cull, and Jerome, 2005). The results in Table 11 support the main conclusion from the previous discussion.

Finally, to address the question whether the factors that cause high fragility are systematically different from the factors that cause medium or low fragility, we adopt quantile regression techniques. Table 12 gives the regression results at the 25th, 50th, and 75th percentiles of the OECD, EU12, and Coop5 countries.[23] The model setup is the same as for the full sample with the same variables included and the same outliers excluded (1st and 99th percentile of the distribution of the z-score).

Based on the coefficients of the commercial bank dummy, the gap between the z-scores of commercial and cooperative banks tends to widen with the quantiles in the OECD, EU12, and Coop5 models, which suggests that the distribution of z-scores in cooperatives is much more skewed to the right: if one compares strong cooperative banks and strong commercial banks, the difference in z-scores is much bigger than for weak cooperative banks and weak commercial banks. A similar conclusion is valid also for the comparison of cooperative banks and savings banks, even though the differences in their z-scores are generally smaller.

Upon inspecting the sum of the coefficients of the cooperative share and its interaction with the commercial bank dummy, it appears that an increased presence of cooperative banks per country and year has a negative effect on the weakest commercial banks. In other words, commercial banks that already have low z-scores suffer more from a stronger cooperative sector than commercial banks with higher z-scores. Whereas the previous estimations did not provide any substantial evidence for a negative effect of a higher presence of cooperative

[23] The 50th percentile gives the median least square estimator which minimizes the median square of residuals rather than the average. In the generalized quantile regression, we estimate an equation describing a quantile other than the median. Specifically, we estimate the first quartile (25th percentile) as well as the 75th percentile.

banks on the average commercial bank's stability, instead there appears to be some (negative) effect on the weaker commercial banks.

In all the regressions, restricting the explanatory variables to only contemporaneous effects does not change the main findings (tables available upon request). We also defined alternative z-scores as $ln(1+(z/100))$, but this did not affect the main conclusions.

IV. Conclusions and Topics for Further Research

The findings in this paper indicate that cooperative banks in advanced economies and emerging markets have higher z-scores than commercial banks and (to a smaller extent) savings banks, suggesting that cooperative banks are more stable. This finding, perhaps somewhat surprising at first, is due to much lower volatility of the cooperative banks' returns, which more than offsets their relatively lower profitability and capitalization. We suggest that this observed lower variability of returns, and therefore the higher z-scores, may be caused by the fact that cooperative banks in normal times pass on most of their returns to customers, but are able to recoup that surplus in weaker periods. To some extent, this result can also reflect the mutual support mechanisms that many cooperative banks have created.

The finding about the higher z-scores in cooperative banks is quite robust with respect to modifications in the measurement of volatility and z-scores. It also remains valid if one distills the "pure" impact of the cooperative nature of a bank, by using regression analysis and adjusting for differences in bank size, loan to asset ratios, income diversity, and other factors with potential impact on individual bank's stability.

Using the regression analysis, we also find that a higher share of cooperative banks increases stability (measured by z-score) of an average bank in the same banking system. The impacts differ by the groups of banks, however. High presence of cooperative banks appears to weaken commercial banks, in particular those commercial banks that are already weak to start with. This finding is consistent with Goodhart's (2004) hypothesis that the presence of non-profit-maximizing entities can pull down stability of other financial institutions. This empirical result can be explained by the fact that a higher cooperative bank presence means less space for weak commercial banks in the retail market and therefore their greater reliance on less stable revenue sources such as corporate banking or investment banking.

When interpreting the results, one needs to bear in mind some caveats relating to the z-score, such as its reliance on accounting data and its focus on capital and profits rather than, say, liquidity or asset quality. As a robustness test, we have therefore tried to include some possible alternatives to the z-scores, such as ratings. The available data suggest that the ratings of cooperative banks are not substantially worse than those for commercial banks;

however, the dominance of observations from one country (Germany) in the ratings database does not allow for a full-fledged cross-country analysis.

Several issues not addressed in this paper could be analyzed in future research. One of them is corporate governance issues. As discussed in Fonteyne (forthcoming) or Cuevas and Fischer (2006), corporate governance issues in cooperatives are often more prominent than in commercial banks. Among these issues is the presence of an owner-less endowment, since members of cooperatives are only invested with the notional value of their shares and have no right to the accumulated capital. Furthermore, there is a collective action problem that might lead to empire-building by management. BankScope and similar databases do not contain institution-specific data on the quality of the corporate governance, but with a more detailed database, perhaps on a smaller sample, it may be possible to analyze this issue.

Another issue for further research is the impact of networks on cooperative banks' stability. Cooperative banks can realize important benefits by forming networks, as it allows the pursuit of economies of scale and scope, and the provision of a safety net or mutual support mechanism. However, a more complex structure can also create new challenges for stability. For example, Desrochers and Fischer (2005), in a cross-country survey on the level of integration of cooperatives, note that lateral contracts between cooperatives involve risks that counterparts will behave opportunistically to appropriate the rent generated by the alliance.

The analysis based on individual banks' z-scores, presented in this paper, provides a baseline assessment of systemic stability. To arrive at a more complex assessment, one should look also at losses given default and correlation of losses across defaults (Čihák, 2007). This issue goes beyond the scope of this paper, and is an important topic for further research.

Finally, we have treated the share of cooperative banks as an exogenous variable that impacts the z-scores. When longer time series become available, it might be possible and useful to test whether the share of cooperative banks is in fact endogenous with respect to the z-scores, i.e., whether this measure of stability affects the share of cooperatives in a system.

Table 1. Summary Statistics of Bank-Specific Variables in the Sample, 1994–2004
(In percent, unless indicated otherwise)

	Assets (Billion USD)		Loans to Assets		Cost-Income Ratio		Income Diversity	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
OECD								
Commercial	3.78	32.52	0.57	0.21	70.27	44.47	0.33	0.25
Cooperative	1.90	14.41	0.59	0.14	72.26	16.91	0.24	0.19
Savings	1.90	6.93	0.63	0.18	70.03	32.86	0.24	0.20
EU12								
Commercial	8.94	43.06	0.43	0.28	70.10	42.23	0.39	0.49
Cooperative	1.22	8.14	0.59	0.14	71.99	14.30	0.28	0.19
Savings	2.65	6.64	0.58	0.13	67.09	13.22	0.23	0.12
Coop5								
Commercial	18.06	79.75	0.50	0.28	71.79	43.43	0.34	0.54
Cooperative	1.87	14.47	0.59	0.14	72.52	16.87	0.25	0.18
Savings	2.02	4.11	0.58	0.13	67.55	10.07	0.24	0.08

Source: Authors' calculation based on BankScope Data.

Note: The 1st and 99th percentile of the distribution of the z-score variable is excluded.

Table 2. Decomposition of Z-Scores for the Full Sample 1994–2004

	Z-score	Equity to Assets (percent)	ROA (percent)	Standard deviation of ROA (% points)
All banks				
Commercial	46.5	11.21	0.90	0.65
Cooperative	56.9	6.84	0.37	0.31
Savings	55.4	7.99	0.53	0.35
Large banks				
Commercial	29.6	7.06	0.69	0.71
Cooperative	46.6	5.62	0.28	0.37
Savings	47.3	5.91	0.48	0.35
Small banks				
Commercial	50.0	12.13	0.94	0.59
Cooperative	60.8	7.19	0.39	0.28
Savings	60.1	9.29	0.55	0.35

Source: Authors' calculations based on BankScope data.

Note: To avoid possible outliers in this sample, the 1st and 99th percentile of the distribution of each variable is excluded. Large (Small) banks are defined as having assets larger (smaller) than 1 billion USD.

Table 3. Decomposition of Z-Scores for Selected Countries, 1994–2004

	Z-score	Equity to Assets (percent)	ROA (percent)	Standard deviation of ROA (percent)
Austria				
Commercial	33.8	11.20	0.70	0.846
Cooperative	34.3	6.02	0.39	0.407
France				
Commercial	17.8	10.69	0.39	2.088
Cooperative	42.1	6.64	0.58	0.223
Germany				
Commercial	37.3	12.05	0.48	1.197
Cooperative	78.8	5.08	0.28	0.124
Italy				
Commercial	30.7	11.44	0.43	1.246
Cooperative	40.3	12.89	0.88	0.465
Japan				
Commercial	25.8	4.47	-0.16	0.949
Cooperative	33.5	5.43	-0.04	1.001
Netherlands				
Commercial	44.4	13.31	1.07	0.471
Cooperative	82.2	5.44	0.29	0.067
UK				
Commercial	28.3	15.95	1.01	1.708
Cooperative	70.9	6.83	0.45	0.122

Source: Authors' calculations based on BankScope data.

Note: To avoid possible outliers in this sample, the 1st and 99th percentile of the distribution of each variable is excluded. All selected countries have a market share of cooperative banks higher than 5%.

Table 4. Sensitivity of the Z-score Decomposition

Bank type	Commercial	Cooperative	Savings
Return on assets			
Downward volatility (percentage points)	-0.46	-0.19	-0.21
Upward volatility (percentage points)	0.38	0.20	0.21
Z-scores			
Downward volatility (percentage points)	-3.79	-3.47	-3.78
Upward volatility (percentage points)	3.99	3.85	4.12
Equity to assets			
Downward volatility (percentage points)	-1.53	-0.53	-0.78
Upward volatility (percentage points)	1.69	0.58	0.81
Distribution of Z-scores (% of observations in banks of the same type)			
Less than 0	0.37	0.62	0.13
0 to 10	13.65	9.20	6.38
10 to 20	14.74	10.72	9.85
20 to 30	13.72	13.04	14.80
More than 30	57.52	66.42	68.84

Source: Authors' calculation based on BankScope data.

Note: To eliminate outliers, the 1st and and 99th percentiles of the distribution of the downward (upward) volatility variables were excluded.

Table 5. Fitch's Long-Term Ratings of the Banks in Sample

	All Banks		Commercial		Cooperative	
	No.	Percent	No.	Percent	No.	Percent
AAA	2	0.17	2	0.54	0	0.00
AA+	16	1.36	14	3.75	1	0.15
AA	26	2.21	23	6.17	2	0.29
AA-	72	6.11	66	17.69	2	0.29
A+	781	66.30	53	14.21	664	96.37
A	77	6.54	54	14.48	9	1.31
A-	64	5.43	39	10.46	7	1.02
BBB+	40	3.40	38	10.19	0	0.00
BBB	35	2.97	28	7.51	2	0.29
BBB-	29	2.46	24	6.43	1	0.15
BB+	10	0.85	7	1.88	0	0.00
BB	2	0.17	2	0.54	0	0.00
BB-	15	1.27	14	3.75	1	0.15
B+	4	0.34	4	1.07	0	0.00
B	3	0.25	3	0.80	0	0.00
B-	2	0.17	2	0.54	0	0.00
Total	1,178	100.00	373	100	689	100.00

Note: All 637 cooperative banks in Germany have a Fitch rating of A+.

Table 6. Correlation Coefficients between the Z-Score and Selected Key Variables, 1994–2004

	Full Sample		
	OECD	EU12	Coop5
Commercial Bank Dummy	-0.060***	-0.244***	-0.221***
Cooperative Bank Dummy	0.026***	0.178***	0.137***
Savings Bank Dummy	0.051***	0.041***	0.066***
Share Coop	-0.041***	0.128***	0.068***
Share Coop* Commercial	-0.138***	-0.184***	-0.195***
	Large Banks		
	OECD	EU12	Coop5
Commercial Bank Dummy	-0.225***	-0.340***	-0.288***
Cooperative Bank Dummy	0.115***	0.115***	0.091***
Savings Bank Dummy	0.147***	0.236***	0.208***
Share Coop	0.100***	0.130***	0.085***
Share Coop* Commercial	-0.168***	-0.241***	-0.245***
	Small Banks		
	OECD	EU12	Coop5
Commercial Bank Dummy	-0.047***	-0.179***	-0.155***
Cooperative Bank Dummy	0.013***	0.160***	0.119***
Savings Bank Dummy	0.050***	-0.008***	0.001
Share Coop	-0.034***	0.098***	0.052***
Share Coop* Commercial	-0.105***	-0.144***	-0.141***

Note: * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 7. Regression Results (Full Sample)

	OECD		EU12		Coop5	
	(1)	(2)	(3)	(4)	(5)	(6)
Assets (-1)	-0.026	-0.013	-0.027	-0.043	-0.019	-0.015
	(0.000)***	(0.023)**	(0.073)*	(0.000)***	(0.001)***	(0.028)**
Loans/ Assets (-1)	-13.123	-3.225	3.802	-1.996	3.461	0.882
	(0.000)***	(0.000)***	(0.318)	(0.347)	(0.349)	(0.705)
Cost-Income Ratio (-1)	-0.185	-0.001	-0.044	-0.009	-0.078	-0.008
	(0.000)***	(0.572)	(0.038)**	(0.076)*	(0.000)***	(0.032)**
Income Diversity (-1)	-19.299	-1.132	-3.4	-0.742	-4.12	-0.858
	(0.000)***	(0.004)***	(0.155)	(0.184)	(0.107)	(0.077)*
Income Diversity*	23.107	3.67	6.877	4.534	13.418	2.585
Cooperative Bank Dummy (-1)	(0.000)***	(0.000)***	(0.184)	(0.000)***	(0.004)***	(0.001)***
Herfindahl Index (-1)	-0.005	0.001	-0.005	-0.0004	0.001	0.005
	(0.000)***	(0.002)***	(0.005)***	(0.537)	(0.643)	(0.000)***
Commercial Bank Dummy	-4.79		-22.685		-17.143	
	(0.029)**		(0.000)***		(0.000)***	
Savings Bank Dummy	-2.547		-7.437		-4.314	
	(0.196)		(0.003)***		(0.080)*	
Share of Cooperatives (-1)	-0.094	0.114	0.278	0.127	0.086	0.128
	(0.324)	(0.001)***	(0.033)**	(0.007)***	(0.557)	(0.004)***
Share of Cooperatives *	-0.386	0.019	-0.027	-0.101	-0.003	-0.099
Commercial Bank Dummy (-1)	(0.000)***	(0.699)	(0.866)	(0.093)*	(0.989)	(0.080)*
GDP Growth (-1)	-0.246	-0.14	-0.081	0.012	1.002	-0.841
	(0.037)**	(0.001)***	(0.786)	(0.924)	(0.000)***	(0.000)***
Inflation (-1)	0.44	0.133	-1.901	-0.427	0.091	0.325
	(0.006)***	(0.009)***	(0.000)***	(0.048)**	(0.789)	(0.004)***
Exchange Rate Appreciation (-1)	0.043	0.068	0.234	0.014	0.061	0.045
	(0.009)***	(0.000)***	(0.096)*	(0.813)	(0.015)**	(0.000)***
Real Long-Term Interest Rate (-1)	-0.398	0.184	0.597	0.533	-0.006	-0.516
	(0.004)***	(0.000)***	(0.145)	(0.001)***	(0.987)	(0.001)***
Constant	39.898	46.652	55.966	50.142	22.558	50.429
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Observations	78,298	78,298	22,665	22,665	25,241	25,241
R-squared	0.103	0.058	0.112	0.124	0.106	0.145
Clustered by Banks	14,025	14,025	3,239	3,239	3,723	3,723
Type	OLS	FE	OLS	FE	OLS	FE

Note: Robust p-values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; OLS = ordinary least squares estimate; FE = fixed effect estimate.

Table 8. OECD Regressions with Governance Variable

	Full-sample (1)	Large Banks (2)	Small Banks (3)
Assets (-1)	-0.026	-0.028	1.846
	(0.000)***	(0.000)***	(0.225)
Loans/ Assets (-1)	-13.123	0.626	-19.675
	(0.000)***	(0.849)	(0.000)***
Cost-Income Ratio (-1)	-0.185	-0.114	-0.2
	(0.000)***	(0.000)***	(0.000)***
Income Diversity (-1)	-19.299	-5.371	-23.168
	(0.000)***	(0.051)*	(0.000)***
Income Diversity*	23.107	6.424	21.488
Cooperative Bank Dummy (-1)	(0.000)***	(0.218)	(0.001)***
Herfindahl Index (-1)	-0.005	-0.004	-0.004
	(0.000)***	(0.017)**	(0.000)***
Commercial Bank Dummy	-4.79	2.507	-12.956
	(0.029)**	(0.455)	(0.000)***
Savings Bank Dummy	-2.547	0.813	-8.596
	(0.196)	(0.779)	(0.002)***
Share of Cooperatives (-1)	-0.094	0.519	0.133
	(0.324)	(0.000)***	(0.295)
Share of Cooperatives *	-0.386	-0.932	-0.233
Commercial Bank Dummy (-1)	(0.000)***	(0.000)***	(0.106)
GDP Growth (-1)	-0.246	-0.456	-0.613
	(0.037)**	(0.003)***	(0.002)***
Inflation (-1)	0.44	0.126	0.131
	(0.006)***	(0.372)	(0.658)
Exchange Rate Appreciation (-1)	0.043	-0.036	0.066
	(0.009)***	(0.148)	(0.028)**
Real Long-Term Interest Rate (-1)	-0.398	-0.58	-0.194
	(0.004)***	(0.000)***	(0.368)
Governance	21.577	16.784	21.918
	(0.000)***	(0.002)***	(0.032)**
Constant	15.955	20.509	28.425
	(0.037)**	(0.006)***	(0.152)
Observations	78298	17401	60889
R-squared	0.103	0.135	0.091
Clustered by Banks	14,025	2,866	12,119
Type	OLS	OLS	OLS

Note: Robust p values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%; OLS = ordinary least square estimate; FE = fixed effect estimate.

Table 9. Regression Results (Large Banks)

	OECD		EU12		Coop5	
	(1)	(2)	(3)	(4)	(5)	(6)
Assets (-1)	-0.028	-0.013	-0.006	-0.036	-0.025	-0.013
	(0.000)***	(0.024)**	(0.616)	(0.000)***	(0.000)***	(0.042)**
Loans/ Assets (-1)	0.626	1.997	9.023	2.741	3.94	9.284
	(0.849)	(0.143)	(0.042)**	(0.316)	(0.415)	(0.001)***
Cost-Income Ratio (-1)	-0.114	-0.004	-0.074	-0.007	-0.11	-0.006
	(0.000)***	(0.302)	(0.058)*	(0.300)	(0.001)***	(0.405)
Income Diversity (-1)	-5.371	-0.229	-2.806	-0.125	-3.971	-0.677
	(0.051)*	(0.479)	(0.362)	(0.771)	(0.210)	(0.191)
Income Diversity*	6.424	3.286	0.596	4.306	10.608	2.392
Cooperative Bank Dummy (-1)	(0.218)	(0.002)***	(0.915)	(0.017)**	(0.066)*	(0.018)**
Herfindahl Index (-1)	-0.004	0.0004	-0.004	0.001	0.002	0.002
	(0.017)**	(0.500)	(0.053)*	(0.364)	(0.481)	(0.115)
Commercial Bank Dummy	2.507		-17.7		-18.798	
	(0.455)		(0.000)***		(0.001)***	
Savings Bank Dummy	0.813		-0.033		6.615	
	(0.779)		(0.992)		(0.051)*	
Share of Cooperatives (-1)	0.519	0.257	0.342	0.342	-0.126	0.223
	(0.000)***	(0.000)***	(0.037)**	(0.000)***	(0.537)	(0.000)***
Share of Cooperatives *	-0.932	-0.13	-0.259	-0.335	0.168	-0.195
Commercial Bank Dummy (-1)	(0.000)***	(0.050)*	(0.219)	(0.000)***	(0.536)	(0.004)***
GDP Growth (-1)	-0.456	-0.324	0.1	0.025	0.207	-0.745
	(0.003)***	(0.000)***	(0.749)	(0.852)	(0.541)	(0.000)***
Inflation (-1)	0.126	0.074	-0.854	-0.084	1.031	0.35
	(0.372)	(0.192)	(0.094)*	(0.716)	(0.028)**	(0.023)**
Exchange Rate Appreciation (-1)	-0.036	0.049	0.123	0.09	0.045	0.049
	(0.148)	(0.000)***	(0.323)	(0.135)	(0.189)	(0.000)***
Real Long-Term Interest Rate (-1)	-0.58	0.001	0.459	0.658	-1.319	-0.76
	(0.000)***	(0.988)	(0.321)	(0.000)***	(0.019)**	(0.000)***
Constant	16.768	38.753	25.412	38.004	20.537	31.185
	(0.030)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Observations	17,401	17,401	8,267	8,267	9,914	9,914
R-squared	0.135	0.123	0.176	0.188	0.126	0.226
Clustered by Banks	2,866	2,866	1,267	1,267	1,549	1,549
Type	OLS	FE	OLS	FE	OLS	FE

Note: Robust p-values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Large banks are defined as having assets larger than 1 billion USD. OLS = ordinary least squares estimate; FE = fixed effect estimate.

Table 10. Regression Results (Small Banks)

	OECD		EU12		Coop5	
	(1)	(2)	(3)	(4)	(5)	(6)
Assets (-1)	1.846	-7.53	-12.505	-10.278	-2.284	-11.696
	(0.225)	(0.000)***	(0.002)***	(0.000)***	(0.188)	(0.000)***
Loans/ Assets (-1)	-19.675	-4.83	-3.05	-3.88	-6.963	-3.547
	(0.000)***	(0.000)***	(0.598)	(0.207)	(0.211)	(0.270)
Cost-Income Ratio (-1)	-0.2	-0.002	-0.06	-0.014	-0.076	-0.012
	(0.000)***	(0.017)**	(0.014)**	(0.030)**	(0.001)***	(0.026)**
Income Diversity (-1)	-23.168	-1.398	-7.211	-0.689	-4.65	-0.182
	(0.000)***	(0.015)**	(0.018)**	(0.525)	(0.074)*	(0.851)
Income Diversity*	21.488	3.265	11.578	3.331	9.686	1.512
Cooperative Bank Dummy (-1)	(0.001)***	(0.002)***	(0.114)	(0.034)**	(0.153)	(0.250)
Herfindahl Index (-1)	-0.004	0.001	-0.005	-0.002	-0.002	0.006
	(0.000)***	(0.006)***	(0.123)	(0.063)*	(0.444)	(0.000)***
Commercial Bank Dummy	-12.956		-23.742		-27.044	
	(0.000)***		(0.000)***		(0.000)***	
Savings Bank Dummy	-8.596		-7.616		-10.321	
	(0.002)***		(0.041)**		(0.005)***	
Share of Cooperatives (-1)	0.133	-0.02	0.239	-0.053	0.236	0.062
	(0.295)	(0.572)	(0.239)	(0.412)	(0.261)	(0.315)
Share of Cooperatives *	-0.233	0.135	0.156	0.067	0.168	-0.026
Commercial Bank Dummy (-1)	(0.106)	(0.017)**	(0.572)	(0.454)	(0.505)	(0.774)
GDP Growth (-1)	-0.613	-0.171	0.212	-0.125	0.508	-1.098
	(0.002)***	(0.010)***	(0.732)	(0.537)	(0.268)	(0.000)***
Inflation (-1)	0.131	0.058	-3.421	-0.912	-2.085	0.204
	(0.658)	(0.494)	(0.003)***	(0.027)**	(0.000)***	(0.217)
Exchange Rate Appreciation (-1)	0.066	0.078	0.572	-0.018	0.012	0.063
	(0.028)**	(0.000)***	(0.099)*	(0.894)	(0.837)	(0.000)***
Real Long-Term Interest Rate (-1)	-0.194	0.344	1.375	0.426	0.679	-0.036
	(0.368)	(0.003)***	(0.094)*	(0.124)	(0.277)	(0.869)
Constant	23.541	52.14	47.784	66.506	41.537	63.946
	-0.284	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Observations	60,889	60,889	14,368	14,368	15,301	15,301
R-squared	0.091	0.051	0.079	0.101	0.088	0.107
Clustered by Banks	12,119	12,119	2,424	2,424	2,651	2,651
Type	OLS	FE	OLS	FE	OLS	FE

Note: Robust p-values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. Small banks are defined as having assets less than 1 billion USD. OLS = ordinary least squares estimate; FE = fixed effect estimate.

Table 11. Robust Regressions

	Full Sample			Large Banks			Small Banks		
	OECD	EU12	Coop5	OECD	EU12	Coop5	OECD	EU12	Coop5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Assets (-1)	-0.01	-0.012	-0.006	-0.007	0.002	-0.008	5.137	-5.317	-4.981
	(0.007)***	(0.115)	(0.085)*	(0.015)**	(0.744)	(0.013)**	(0.000)***	(0.000)***	(0.000)***
Loans/ Assets (-1)	-9.17	3.551	3.515	0.961	5.568	2.574	-15.268	2.472	-1.917
	(0.000)***	(0.000)***	(0.000)***	(0.332)	(0.000)***	(0.058)*	(0.000)***	(0.091)*	(0.182)
Cost-Income Ratio (-1)	-0.168	-0.048	-0.074	-0.093	-0.048	-0.101	-0.187	-0.055	-0.065
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Income Diversity (-1)	-18.008	-1.934	-3.139	-7.552	-0.536	-1.966	-19.748	-4.772	-3.124
	(0.000)***	(0.007)***	(0.000)***	(0.000)***	(0.484)	(0.010)**	(0.000)***	(0.000)***	(0.014)**
Income Diversity*	20.102	-1.153	7.47	10.426	-2.97	9.859	16.111	0.701	0.411
Cooperative Bank Dummy (-1)	(0.000)***	(0.433)	(0.000)***	(0.000)***	(0.103)	(0.000)***	(0.000)***	(0.753)	(0.850)
Herfindahl Index (-1)	-0.001	-0.001	0.005	-0.001	-0.001	0.006	-0.001	0	0.002
	(0.095)*	(0.654)	(0.009)***	(0.575)	(0.368)	(0.032)**	(0.377)	(0.889)	(0.392)
Commercial Bank Dummy	-4.027	-19.6	-12.015	4.002	-16.31	-8.45	-11.96	-15.631	-22.035
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Savings Bank Dummy	-1.609	-6.062	-2.61	2.922	-1.886	6.226	-7.691	-6.922	-7.287
	(0.005)***	(0.000)***	(0.000)***	(0.000)***	(0.016)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Share of Cooperatives (-1)	-0.094	0.248	0.082	0.36	0.4	0.044	0.085	0.238	0.133
	(0.090)*	(0.001)***	(0.293)	(0.000)***	(0.000)***	(0.655)	(0.362)	(0.073)*	(0.296)
Share of Cooperatives *	-0.327	-0.115	-0.166	-0.894	-0.379	-0.293	-0.152	-0.117	0.095
Commercial Bank Dummy (-1)	(0.000)***	(0.059)*	(0.038)**	(0.000)***	(0.000)***	(0.004)***	(0.002)***	(0.276)	(0.434)
GDP Growth (-1)	0.058	0.077	1.165	0.002	0.196	0.522	-0.369	0.057	0.166
	(0.697)	(0.788)	(0.000)***	(0.989)	(0.545)	(0.107)	(0.115)	(0.902)	(0.756)
Inflation (-1)	0.404	-0.61	0.88	0.173	-0.212	1.287	0.338	-0.943	-1.037
	(0.017)**	(0.281)	(0.040)**	(0.346)	(0.724)	(0.015)**	(0.208)	(0.358)	(0.146)
Exchange Rate Appreciation (-1)	0.043	0.006	0.078	0.004	0.081	0.097	0.034	-0.215	0.019
	(0.053)*	(0.976)	(0.050)**	(0.899)	(0.673)	(0.043)**	(0.307)	(0.572)	(0.771)
Real Long-Term Interest Rate (-1)	-0.095	0.314	-0.074	-0.396	0.283	-1.13	0.246	0.272	0.047
	(0.470)	(0.399)	(0.866)	(0.006)***	(0.475)	(0.052)*	(0.232)	(0.692)	(0.944)
Constant	63.618	32.467	15.782	5.597	20.814	13.572	14.398	24.462	31.398
	(1.000)	(0.000)***	(0.065)*	(0.529)	(0.062)*	(0.214)	(0.348)	(0.107)	(0.033)**
Observations	78,298	22,665	25,241	17,401	8,267	9,914	60,888	14,368	15,300
R-squared	0.134	0.189	0.175	0.197	0.273	0.215	0.121	0.147	0.163

Note: Robust p-values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

'Table 12. Quantile Regressions (Full Sample)

	OECD			EU12			Coop5		
Quantiles	0.25	0.5	0.75	0.25	0.5	0.75	0.25	0.5	0.75
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Assets (-1)	0.004	-0.002	-0.018	-0.00001	-0.009	-0.01	0.006	-0.0003	-0.018
	(0.194)	(0.615)	(0.037)**	(0.998)	(0.257)	(0.398)	(0.049)**	(0.937)	(0.047)**
Loans/ Assets (-1)	-3.602	-10.572	-22.495	3.139	2.018	2.213	5.862	2.872	-3.147
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.048)**	(0.169)	(0.000)***	(0.010)***	(0.133)
Cost-Income Ratio (-1)	-0.166	-0.18	-0.181	-0.041	-0.04	-0.058	-0.053	-0.075	-0.081
	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Income Diversity (-1)	-9.362	-20.281	-37.481	-0.525	-3.899	-8.886	-0.721	-6.677	-16.611
	(0.000)***	(0.000)***	(0.000)***	(0.440)	(0.000)***	(0.000)***	(0.316)	(0.000)***	(0.000)***
Income Diversity*	12.751	25.496	38.299	1.841	-1.366	3.941	8.642	12.412	20.061
Cooperative Bank Dummy (-1)	(0.000)***	(0.000)***	(0.000)***	(0.200)	(0.373)	(0.047)**	(0.000)***	(0.000)***	(0.000)***
Herfindahl Index (-1)	-0.002	-0.002	-0.003	-0.001	-0.001	-0.003	0.003	0.003	0.006
	(0.030)**	(0.049)**	(0.048)**	(0.356)	(0.549)	(0.112)	(0.050)**	(0.130)	(0.127)
Commercial Bank Dummy	-0.953	-3.638	-6.78	-13.478	-23.103	-23.421	-11.906	-10.78	-15.274
	(0.079)*	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Savings Bank Dummy	1.583	-1.419	-5.734	-1.14	-8.603	-13.437	2.767	-3.465	-8.682
	(0.001)***	(0.036)**	(0.000)***	(0.017)**	(0.000)***	(0.000)***	(0.000)***	(0.000)***	(0.000)***
Share of Cooperatives (-1)	-0.069	-0.076	-0.102	0.177	0.323	0.408	-0.139	0.183	0.301
	(0.122)	(0.243)	(0.335)	(0.001)***	(0.000)***	(0.001)***	(0.010)***	(0.039)**	(0.068)*
Share of Cooperatives *	-0.416	-0.357	-0.142	-0.2	-0.135	-0.182	0.034	-0.253	-0.163
Commercial Bank Dummy (-1)	(0.000)***	(0.000)***	(0.022)**	(0.000)***	(0.033)**	(0.071)*	(0.515)	(0.005)***	(0.344)
GDP Growth (-1)	0.403	0.057	-0.418	0.136	0.063	-0.043	1.148	1.059	0.439
	(0.001)***	(0.746)	(0.133)	(0.513)	(0.832)	(0.928)	(0.000)***	(0.001)***	(0.472)
Inflation (-1)	0.292	0.271	0.162	-0.33	-0.819	-1.852	0.602	0.836	0.084
	(0.032)**	(0.168)	(0.617)	(0.417)	(0.164)	(0.054)*	(0.047)**	(0.083)*	(0.928)
Exchange Rate Appreciation (-1)	0.052	0.028	0.023	-0.024	-0.054	0.111	0.077	0.082	0.103
	(0.006)***	(0.294)	(0.573)	(0.860)	(0.785)	(0.728)	(0.007)***	(0.065)*	(0.223)
Real Long-Term Interest Rate (-1)	0.025	-0.137	-0.22	-0.02	0.134	1.096	0.138	-0.039	0.585
	(0.832)	(0.367)	(0.335)	(0.940)	(0.729)	(0.078)*	(0.662)	(0.937)	(0.538)
Constant	-0.208	18.028	45.06	16.16	28.453	45.228	12.887	21.727	43.003
	(0.974)	(0.077)*	(0.009)***	(0.008)***	(0.003)***	(0.001)***	(0.018)**	(0.018)**	(0.008)***
Observations	78,298	78,298	78,298	22,665	22,665	22,665	25,241	25,241	25,241

Note: P-values in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

APPENDIX I. DATA ISSUES

Our sample covers banks in the following Organization for Economic Cooperation and Development (OECD) member countries: Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom, and the United States. The Slovak Republic, an OECD member country, is not included because the BankScope does not include data on cooperative banks in the country.

Our calculations are based on individual bank data drawn from the BankScope database, provided by Bureau van Dijk. We use data on all commercial, cooperative, and savings banks in the database from 29 major advanced economies and emerging markets that are members of the OECD. In total, we have data on 16,577 banks from 1994 to 2004, comprising 11,090 commercial banks, 3,072 cooperative banks, and 2,415 savings banks.

As regards bank status (commercial, cooperative, and savings), we have used the information contained in BankScope as default, but where additional information was available (e.g., for France, United Kingdom, and Ireland), we changed the status of a given bank.

The data are based on unconsolidated statements, because about 90 percent of BankScope observations for the selected countries and periods are based on unconsolidated data.

Mergers are treated as usual in the literature, i.e. as three banks: the two original bank with no observations after the merger, and the merged one with no observations before the merger.

The following table describes the individual variables used in the paper and their sources.

Variable	Description	Source
Z-score	Defined as $z \equiv (k+\mu)/\sigma$, where k is equity capital as percent of assets, μ is average return as percent on assets, and σ is standard deviation of return on assets as a proxy for return volatility. Measures the number of standard deviations a return realization has to fall in order to deplete equity, under the assumption of normality of banks' returns.	Authors' calculations based on BankScope data.
Assets	Total assets of a bank (In US$ billion)	BankScope

Variable	Description	Source
Loans/ Assets	Ratio of loans to assets (percent)	BankScope
Cost/Income Ratio	Ratio of cost to income (percent)	BankScope
Income Diversity	$1 - \left\| \frac{(Net\ interest\ income - Other\ operating\ income)}{Total\ operating\ income} \right\|$	Authors' calculations based on Laeven and Levine (forthcoming) and BankScope.
Income Diversity* Cooperative Bank Dummy	Interaction of income diversity and cooperative bank dummy	Authors' calculations based on BankScope.
Herfindahl Index	Sum of squared market shares of banks in the system.	Authors' calculations based on BankScope.
GDP Growth	Growth rate of nominal GDP volume (at 2000 PPP, in US$)	OECD
Inflation	Year-on-year change of the CPI index	OECD
Exch. Rate Appreciation	Year-on-year change in the nominal exchange rate, US$ per local currency (percent)	OECD
Real LT Interest Rate	Nominal long-term interest rate, adjusted for lagged GDP deflator (percent)	OECD
Commercial Bank Dummy	Equals 1 for commercial banks; 0 otherwise.	Authors' calculations based on BankScope.
Savings Bank Dummy	Equals 1 for savings banks; 0 otherwise.	Authors' calculations based on BankScope.
Share of Cooperatives	Market share of cooperative banks in a country per year	Authors' calculations based on BankScope.
Share of Cooperatives * Commercial Bank Dummy	Interaction of share of cooperatives and the commercial bank dummy	Authors' calculations based on BankScope.

Variable	Description	Source
Governance	Average of the six governance measures- voice & accountability, political stability, government effectiveness, regulatory quality, rule of law and control of corruption- across the available years 2004, 2002, 2000, 1998 and 1996 into one single index per country.	Authors' calculations based on Kaufmann, Kraay, and Mastruzzi (2005)

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