CrossMark

Depositors Discipline through Interest Costs during Good and Bad Times: the Role of the Guarantor of Last Resort[1]

Krzysztof Jackowicz[1,2] · **Oskar Kowalewski**[3] · **Łukasz Kozłowski**[1]

Abstract We investigate whether the public sector's ability as the guarantor of last resort (GLR) to help banks or to guarantee banks' liabilities affects the sensitivity of interest costs to bank fundamentals. We use a global bank sample and find that the sensitivity is an increasing function of GLR risk, regardless of the method applied to describe this risk. Therefore, our results indicate that increased levels of GLR risk might foster market monitoring by depositors.

1 Introduction

The world economy witnessed almost 150 banking crises from 1970 to 2011 (Laeven and Valencia 2012). These crises affected developed and emerging economies with similar frequency (Reinhart and Rogoff 2013). The synchronicity and number of banking crises strongly increased during the late twentieth and early twenty-first centuries (Dungey et al. 2015). The

✉ Krzysztof Jackowicz
    kjtrist@kozminski.edu.pl

    Oskar Kowalewski
    o.kowalewski@ieseg.fr

    Łukasz Kozłowski
    lkozlowski@kozminski.edu.pl

¹ Department of Banking and Insurance, Kozminski University, Warsaw, Poland

² Department of Banking and Insurance, Kozminski University, Jagiellonska 57/59, 03-301 Warsaw, Poland

³ IESEG School of Management, Lille, France

task of designing and implementing crisis management polices was almost exclusively shouldered by government and other public sector institutions that acted together as the guarantor of last resort (GLR). The crisis containment and resolution policies turned out to be extremely costly. Laeven and Valencia (2012) estimate that the median fiscal cost of financial system overhauls during the last 40 years was 6.8 % of GDP. The public sector's involvement as the GLR in expensive rehabilitation programs resulted in a median increase in public debt of 12.1 % of GDP in the same period. Reinhart and Rogoff (2013) document that since the early nineteenth century, banking crises have led almost invariably to a sharp decline in tax revenues and significant increases in government spending. Consequently, government debt has risen, on average, by 86 % during the three years following a banking crisis. These facts raise an interesting question regarding whether market participants consider GLR risk in addition to deposit insurance when monitoring banks. We understand GLR risk as the danger that the government and other public sector institutions will not be able to help banks in different ways or to guarantee banks' liabilities because of the limited resources or low credibility in the financial markets. We hypothesize that under the assumption of market participants' rationality, the sensitivity of their decisions to bank fundamentals should be an increasing function of GLR risk because the good standing of the GLR constitutes the ultimate line of defense against losses for the providers of bank capital after the banks' capital buffers and deposit insurance. Conversely, when a GLR's risk is high, it limits the GLR's potential ability to act through blanket guarantees, liquidity provisions, capital injections, and debt-restructuring mechanisms. Consequently, we conjecture that bank fundamentals thus gain in significance for capital providers. The similar shift in significance in the favor of deposit insurance schemes should be less pronounced because the GLR's standing usually influences their credibility.

To investigate the influence of GLR risk on market discipline, we focus on its most universal type, i.e., depositor discipline. In our study, we use a global sample of banks from almost 100 countries between 1991 and 2012. We combine the banks' financial statements with information on banking crises and safety nets. We apply several different measures to describe GLR risk, thus ensuring that the choice of risk measure does not drive our results. In particular, we measure GLR risk by using sovereign credit ratings, credit default swap spreads, and government bond yields. Additionally, we assume that systemic banking crises weaken a GLR's standing. Regardless of our methodological choices, the results indicate that the sensitivity of the banks' interest costs to fundamentals, particularly equity levels, is an increasing function of the risk associated with the GLR. The identified regularity is present in both developed and emerging economies and occurs both in economies with and without explicit deposit insurance. Moreover, during and after crisis periods, particularly those that involve losses for depositors, the sensitivity of the interest costs to fundamentals increases for equity levels and decreases for the return on assets. This result might be expected because the current profitability is not informative about the future financial results during difficult economic times. Our results are statistically robust and economically important.

Although we are not aware of any studies that closely resemble our investigation in terms of its scope and aims, our study is related to four groups of previously published works. First, Kane (1987) and Cook and Spellman (1991, 1994, and 1996) analyze the impact of deposit insurers' financial problems on depositor discipline in the US economy. These studies are important because they show that there is a link between market discipline and the financial stability of an institution that guarantees deposits. Second, several authors use cross-country samples to provide evidence of monitoring by depositors (Demirgüç-Kunt and Huizinga 2004,

2013; Berger and Turk-Ariss 2010; Cubillas et al. 2012; Hasan et al. 2013) and market influence on banks' decisions (Nier and Baumann 2006; Fonseca and González 2010; Forssbæck 2011; Distinguin et al. 2013). These studies constitute a natural basis for comparisons because we also use a cross-country setting. Furthermore, because we study the periods after banking crises, we analyze papers that examine depositor discipline in the context of financial turmoil (see, e.g., Martinez Peria and Schmukler 2001; Hosono et al. 2005; Levy-Yeyati et al. 2010; Beyhaghi et al. 2014). Fourth, Demirgüç-Kunt and Huizinga (2013) find that the banks' valuations are positively related to the country's fiscal balance. They also provide some evidence that banks' CDS spreads are negatively related to fiscal variables. As a result, Demirgüç-Kunt and Huizinga (2013) argue that a country's public finances impose limits on the generosity of the safety net, and that the banks' valuations and CDS spreads reflect these limits.

Our research contributes to the literature in three ways. First, this study directly examines the influence of GLR risk on the strength of depositor discipline and more precisely on the sensitivity of interest costs to bank fundamentals. The literature on changes in the depositors' sensitivity to bank fundamentals has focused exclusively on the effect of the establishment and modification of deposit insurance or the influence of crises. We thus concentrate on a potentially important but ignored aspect of market discipline in the contemporary world. Second, although we do not adjudicate the issue of the desirability of depositor discipline, we formulate some policy recommendations concerning the possibility of entrusting this type of market discipline with the task of promoting financial stability. We believe that such a solution may be difficult to implement during favorable economic times and in countries with a good GLR financial standing. Third, we use a large sample to shed new light on previously studied phenomena, such as the sheer existence of market monitoring in an international context and the so-called wake-up-call effect.

The remainder of the paper is organized as follows. In Section 2, we review the literature relevant to our investigation, and then, we formulate hypotheses. Section 3 describes our empirical strategy and presents the various data sources that we use. Section 4 presents the results and their interpretation. Section 5 discusses briefly the results of robustness checks. In Section 6, we conclude and provide some policy recommendations.

2 Literature review and hypotheses

Numerous works address the discipline imposed on banks by depositors, subordinated debtholders, shareholders, and specialized information firms. Therefore, we apply two criteria to select those studies that are most relevant to our investigation. First, we concentrate only on research regarding depositor discipline. Second, we choose works that are related in scope or aim to our study. Consequently, we discuss the findings regarding the role of deposit insurers in the depositors' decisions, the functioning of depositor discipline in an international context, and the impact of crises on depositor discipline.

2.1 Depositors' behavior and a deposit insurer's risk

The first strand of relevant literature focuses on the depositors' sensitivity to the risk of deposit insurance institutions. Kane (1987) describes the events that followed the failure of the Ohio Deposit Guarantee Fund in 1985. He observes unusual deposit withdrawals from thrift

institutions that the failing fund had insured and no extraordinary withdrawals from federally insured institutions. Cook and Spellman (1991, 1994, and 1996) present similar conclusions in their papers. They show that the market response to a decline in the financial condition of the Federal Savings & Loan Insurance Corp. in the late 1980s affected the value of insured certificates of deposits by raising their rates.

Because the literature does not investigate the GLR's role in shaping depositor discipline, our main hypothesis, H1, indirectly stems from two sources. First, the hypothesis is based on the empirical evidence that depositors seem to evaluate risk in deposit insurance institutions. Second, it considers that governments and various public organizations play a key role as the GLR in containment and resolution of banking crises (Honohan and Klingebiel 2003; Hryckiewicz 2014). As a result, we conjecture that the depositors' incentives to monitor bank fundamentals should be stronger when the GLR's standing is threatened. Hence, we formulate H1 as:

H1:   *The strength of depositor discipline is an increasing function of GLR risk.*

2.2 Depositor discipline in an international context

The second strand of literature on which we base our research encompasses cross-country studies. For presentational purposes, we distinguish between analyses of market monitoring and market influence (Bliss and Flannery 2000). Demirgüç-Kunt and Huizinga (2004) contribute to the former category of studies for OECD and developing countries. They show that explicit insurance—as well as higher coverage, coverage of interbank funds, ex-ante funding, government provision of funds, and the exclusively public management of insurance schemes—makes interest payments less sensitive to the banks' risk. However, co-insurance, coverage of foreign currency deposits, and the private and joint management of insurance schemes might improve market discipline. Berger and Turk-Ariss (2010) also analyze the monitoring abilities of depositors in a study that covers banks and bank holding companies from the United States and the European Union. First, the authors find stronger depositor discipline in the United States than in the European Union, which is consistent with the conjecture that government bailouts are considered more likely in the European Union. Second, the authors determine that depositors believe in the protection of too-big-to-fail for large organizations. However, Bertay et al. (2013) do not confirm this observation and find that large international banks are subject to greater market discipline. More recently, Hasan et al. (2013) examine depositor discipline in Central and Eastern European countries and find that the recent crisis did not alter the sensitivity of deposit growth rates to accounting risk measures.

Several cross-country studies on market discipline concentrate on the depositors' influence on banks' risk taking. These studies typically construct proxies for the strength of market discipline and then analyze their impact on the banks' capital buffers or other risk measures. For example, Nier and Baumann (2006) note the general effectiveness of market discipline mechanisms. However, this effectiveness was negatively influenced by implicit government safety nets and strengthened by a bank's accounting disclosures and by a high degree of funding through uninsured liabilities. For a worldwide sample of banks, Forssbæck (2011) confirms the negative effect of market discipline on the banks' risk. Similarly, Fonseca and González (2010) provide evidence supporting Nier and Baumann's (2006) observations of higher effects from market discipline in cases of weaker safety nets and better accounting

disclosures. In line with the aforementioned findings, Distinguin et al. (2013) indicate that the market discipline in Central and Eastern European countries is effective only when a deposit insurer's power is low.

Angkinand and Wihlborg (2010) contribute to the literature with a country-level study. Their results suggest that the relationship between the depositors' ability to influence banks' risk-taking and explicit deposit insurance coverage is U-shaped. Thus, high insurance coverage weakens market discipline. However, low coverage also reduces the incentives of market participants to monitor banks because depositors expect high implicit insurance.

In summary, the cross-country studies of market discipline generally confirm its existence. Nevertheless, because our study provides such an opportunity, we re-test the traditional hypothesis on market monitoring with H2. This hypothesis considers only one channel of depositor discipline of special importance to our investigation, that is, the cost of capital. However, we treat H2 only as an auxiliary hypothesis in relation to our main hypothesis, H1.

H2:   *Interest rate costs are positively related to a bank's risk.*

The studies in the second strand of the literature also highlight three important features of depositor discipline. First, the characteristics of discipline exercised through prices (interest costs) and volumes (deposit growth ratios) might significantly differ (Demirgüç-Kunt and Huizinga 2004; Bertay et al. 2013). Second, both uninsured and insured depositors exert market discipline (Davenport and McDill 2006). Third, the intensity of market monitoring and influence depends on a complex interplay among safety net arrangements, banks' traits, and crisis experience. Thus, the third strand of literature that we regard as particularly relevant to our investigation examines depositor discipline in the context of financial crises.

2.3 Crises and depositor discipline

In their seminal study, Martinez Peria and Schmukler (2001) describe the experience of Argentina, Chile, and Mexico during the 1980s and 1990s. These authors show that after a crisis, market discipline is likely to increase because traumatic episodes might act as "wake-up calls" for depositors. Hosono et al. (2005) observe the phenomenon in Indonesia but cannot find it in Korea, Malaysia, or Thailand. In contrast, Ungan and Caner (2004) argue that depositor discipline even relaxed in Turkey after the 2001 crisis due to the announcement of a blanket guarantee for uninsured bank debts and the shift of the responsibility to monitor the banking system to the government and regulatory authorities. Beyhaghi et al. (2014) show that a shift in monitoring responsibilities is also evident in developed economies, such as Canada, with an implicit government guarantee. Levy-Yeyati et al. (2010) raise the issue of the impact of macroeconomic risk on depositor discipline in their study of bank runs in Argentina and Uruguay. They establish that a bank's exposure to macroeconomic factors explains differences in deposit withdrawals and overshadows the importance of bank-specific factors during crises.

A few studies on the influence of crises involve the Japanese economy. Murata and Hori (2006) and Hori et al. (2009) observe an increase in depositors' risk sensitivities in 1995 after the failure of Hyogo Bank and two large credit cooperatives. In addition, Fueda and Konishi (2007) find that depositor discipline was most significant after the collapse of two long-term credit banks and one city bank in 1997 and 1998 despite the government's blanket guarantee.

Several studies indirectly analyze the wake-up-call effect when primarily examining the impact of the introduction of explicit deposit insurance on the incentives to monitor banks.

This methodological approach is evident in the study by Karas et al. (2013), who use Russian data from 1995 to 2007 and find that both households and firms reacted to the banking crisis that struck at roughly the same time that the insurance scheme was installed. Nevertheless, the wake-up-call effect on household depositors was substantially muted by the numbing effect of deposit insurance. These results contradict the research from Ungan et al. (2008), who conclude that establishing a deposit insurance system in 2004 in Russia did not influence depositors' behavior. In a more recent study, Yan et al. (2014) find that household depositors no longer responded to the banks' risk taking after the establishment of explicit insurance in Australia in 2008. However, the changes in the safety net raised the risk sensitivity of non-household depositors in the case of banks not participating in the insurance scheme. The authors conclude that the wake-up-call effect, if present, is not strong and is offset by the weakening effect of the explicit guarantees.

In summary, the evidence that pertains to the wake-up-call effect that results from a crisis experience is not conclusive. Some studies confirm its existence (Martinez Peria and Schmukler 2001; Fueda and Konishi 2007; Hori et al. 2009), some deny it (Cubillas et al. 2012; Ungan and Caner 2004), and some provide mixed or conditional results (Hosono et al. 2005; Karas et al. 2013; Yan et al. 2014). Consequently, we test one more auxiliary hypothesis, H3:

H3:   *The sensitivity of interest costs to bank fundamentals increases after a crisis.*

The veracity of H3 might stem both from the wake-up-call effect and from the reduced credibility of the GLR during a post-crisis period. The reduced sensitivity to fundamentals after a crisis can, in turn, indicate that the strengthening of the formal safety net and the tightening of regulatory discipline have a stronger impact on the depositors' decisions than their newly "awakened" awareness of bank-specific risk and risks related to the GLR's standing.

3 Empirical strategy and data

3.1 Econometric model and variables

To test our hypotheses and to determine the role of GLR risk in shaping depositor discipline worldwide, we estimate static panel models. Equation (1) illustrates their general construction:

$$\text{INT.COST}_{itk} = f\left(\begin{array}{l} \text{MD}_{it-1k}; \text{GLR.RISK}_{tk}; \text{MD}_{it-1k} \text{xGLR.RISK}_{tk}; \text{SAFETY.NET}_{tk}; \\ \text{SAFETY.NET}_{tk} \text{x MD}_{it-1k}; \text{CTRL}_{itk}; \text{MACRO.CTRL}_{tk}; \text{TIME}; \text{BFE}_i \end{array} \right) \tag{1}$$

where INT.COST_{itk} is the dependent variable that denotes the value of the interest cost ratio for bank i in year t and country k. The INT.COST variable is calculated as the quotient of interest costs incurred by a bank over total liabilities and is adjusted for inflation. The set of independent variables consists of nine groups. The first, MD, is designed to test the traditional hypothesis on market monitoring, that is, H2. The second, GLR.RISK, contains different measures of the GLR's credibility. The third group includes interaction terms between the variables that illustrate the banks' risk and the GLR's financial standing (MD x GLR.RISK), which allow for the verification of our main hypothesis, H1, and the auxiliary hypothesis concerning the wake-up-call effect, H3. The fourth group describes the safety nets (SAFETY.NET). Because safety net arrangements, as highlighted by several empirical studies,

shape the depositors' sensitivity to bank fundamentals, we also use the interaction term SAFETY.NET x MD. The fifth group of explanatory variables controls for other than risk-related bank-level factors (CTRL). Moreover, we add macroeconomic variables (MACRO.CTRL) to our models to control for those common factors that affect the dependent variable in all banks in a given country and year, and we add a time trend (TIME) to capture the changes over time in the general level of the interest costs. Furthermore, to ensure that our results are not driven by unobserved bank characteristics, we estimate static panel models with bank fixed effects (BFE).

We describe a bank's risk profile and test for the presence of market monitoring using two variables: EQUITY and ROA. The former is calculated as a ratio of equity to total assets and the latter as a ratio of profit before taxes to average assets in a financial year. EQUITY and ROA thus reflect a bank's capital position and current profitability, respectively. We expect that a solid capital base and high profitability will be rewarded by lower interest rate costs.

To investigate the veracity of H1, we need a reliable measure of GLR risk. However, there is no singly and widely accepted measure of this type. Therefore, we use several measures to avoid a situation in which our empirical findings are sensitive to this critical choice. In general, we measure GLR risk by applying direct and indirect methods.

The direct measures are forward looking and summarize all available information on a GLR's potential ability to support and rehabilitate banks and to guarantee deposits. We use three direct measures: the country's credit rating, CDS spreads, and government bond yields. The last two measures are determined by the market participants' behavior. Credit ratings are instead assigned by specialized agencies. These agencies might suffer a conflict of interest that is linked to their business model, which consists of collecting fees from their rated issuers. Consequently, the ratings are prone to an upward bias (Becker and Milbourn 2011; Kraft 2015). Moreover, credit rating agencies improved their performance only recently because the possibility of regulatory intervention threatened their market power and reputational capital (Cheng and Neamtiu 2009). Despite those shortcomings, we use credit ratings for sovereigns as a measure of the GLR's standing for two reasons. First, the average number of country-level yearly observations in our sample for ratings is higher by 20 compared to CDS spreads and by 27 compared to bond yields. Considering that we analyze the impact of the GLR's standing on the interest costs' sensitivity to fundamentals, the large number of country-level observations for a GLR risk measure constitutes an important advantage from a statistical inference point of view. Second, CDS spreads, bond yields, and credit ratings largely agree in country classifications according to GLR risk. The Kendall's W coefficient for our entire sample is 0.771. Therefore, all three measures likely portray the same economic phenomenon but do so in slightly different ways.

The indirect approach to GLR risk measurement concentrates on situations in which the GLR's standing is potentially threatened. We study the depositors' sensitivity to bank fundamentals during periods following systemic banking crises when the GLR's financial resources are usually depleted (Reinhart and Rogoff 2013; Ureche-Rangau and Burietz 2013). Additionally, we differentiate between crisis episodes in which depositors suffer losses and those that do not involve such losses.

We interact all of the direct and indirect measures of GLR risk with variables from the MD group. Regardless of the type of bank risk measure (EQUITY or ROA) used, a negative and significant coefficient obtained for the interaction term, MD x GLR.RISK supports our main hypothesis. Such an empirical outcome means that the depositors' sensitivity to bank fundamentals increases with GLR risk.

The fourth group of variables—SAFETY.NET—comprises three variables. EXPICIT and NO.EXPLICIT are binary variables that equal one for the years in which explicit deposit insurance is in place or absent, respectively, in a given country. The third (COVERAGE) reflects the amount of insured deposits in relation to a country's GDP per capita. To control for the changes in the market discipline's strength caused by the functioning of the deposit insurance schemes, we apply the interaction term SAFETY.NET x MD.

With regard to the bank-level control variables (CTRL), we include four variables in each model. The first variable (LOANS) is a ratio of loans to total assets, and it illustrates the composition of a bank's asset portfolio. The second (SIZE) is calculated as a quotient of a bank's assets and the assets of the largest bank in a country and controls for the impact of the too-big-to-fail phenomenon (Jacewitz and Pogach 2016). The third (C/I) is the ratio of overhead to operating income, and it shows the cost control and, indirectly, the quality of management. The fourth bank-level control variable (NON.INT) relates to the total non-interest income to operating profit, and it is designed to describe the dominant component of a bank's business.

There are two variables in the group of macroeconomic control variables. The first is GDP per capita in constant US$ prices (GDP.PC) that reflects the country's economic development and, to a certain degree, the sophistication of its financial market participants. The second variable is the market capitalization of listed companies as a percentage of GDP (MARKET.CAP). It describes the structure of the country's financial system and, to some extent, its current economic situation.

There is a double constraint in our choice of variables from the groups MD, SAFETY.NET, CTRL, and MACRO.CTRL. On the one hand, we follow the standard set by the literature. On the other hand, to test our main hypothesis, we need as many countries as possible in our sample. Therefore, we refrain from introducing variables with little information. For example, studying the role of loan quality, bond portfolio compositions, and ownership structures in shaping depositor discipline or analyzing the difference between funded and unfunded deposit insurance might be interesting. However, considering the aim of our study, we cannot afford to drop too many countries and observations from the sample. Table 1 summarizes the information on the variables used in our study.

3.2 Data, weighting schemes and descriptive statistics

To perform our study, we combine several data sources. The financial statements for banks worldwide are retrieved from the Bankscope database. The macroeconomic indicators are derived from the World Bank's World Development Indicators. The vast majority of the information on deposit insurance comes from Demirgüç-Kunt et al. (2005, 2014). However, we update and supplement these data with Al-Ja'fari and Walker (2011), the Association of Supervisors of Banks of the Americas (2006), the International Association of Deposit Insurers (2012), the Financial Stability Board (2009, 2010, 2012), and KPMG (2012). We also use information that is available over the Internet. We gather the information on banking crises and the depositors' losses from Laeven and Valencia (2008, 2010, 2012). We reconstruct the history of foreign currency sovereign credit ratings from Standard and Poor's Sovereign Rating and Country T&C Assessment Histories (2013). Deutsche Bank Poland provides the data on CDS spreads on sovereign and government bond yields.

As Eq. (1) shows, we introduce both bank- and country-level variables in each regression. Because the data sources do not overlap perfectly with respect to the years and countries covered, the number of observations is lower than the number of annual financial statements. Therefore, to

Table 1 Variables and their definitions

Variable	Construction
INT.COST	Ratio of interest cost incurred by a bank to total liabilities; the variable is adjusted for inflation
LOANS	Ratio of loans to total assets
SIZE	Total assets of a bank to total assets of the largest bank in a country in a given year
C/I	Overhead to operating income
NON.INT	Total non-interest operating income to operating profit
ROA	Profit before tax to average assets in a financial year
EQUITY	Equity to total assets
EXPLICIT, NO.EXPLICIT	Binary variables that equal 1 if explicit deposit insurance exists or does not exist in a country in a given year, respectively
COVERAGE	Ratio of the amount of deposit insurance coverage to GDP per capita (in case of full coverage, we assign the maximum coverage observed in a given year among all countries with limited coverage)
GDP.PC	GDP per capita in constant US$ prices (in hundreds of US$)
MAKET.CAP	Market capitalization of listed companies (% of GDP)
FCU	Ten-year default rate (in percent) implied by the long-term rating of a country's foreign currency (worst S&P rating valid in a given year)
CDS_Q	Ratio of a country's average CDS quotation in a given year to Germany's average quotation in a given year
YLD	Ratio of a country's sovereign bond yield to Germany's sovereign bond YLD (as measured by the year-end generic 5-year YLD to maturities)
FCU.WORST50, FCU.WORST25	Two binary variables that each equal 1 if the FCU variable belongs to the group of the highest 50 % and 25 % country-level values observed in the total sample over the entire time horizon, respectively
CDS_Q.WORST50, CDS_Q.WORST25	Two binary variables that each equal 1 if the CDS_Q variable belongs to the group of the highest 50 % and 25 % country-level values observed in the total sample over the entire time horizon, respectively
YLD.WORST50, YLD.WORST25	Two binary variables that each equal 1 if the YLD variable belongs to the group of the highest 50 % and 25 % country-level values observed in the total sample over the entire time horizon, respectively
CRISIS, CRISIS3, CRISIS5	Three binary variables that each equal 1 for (a) years of a banking crisis in a given country, (b) 3 years following each crisis, and (c) 5 years following each crisis, respectively
DEPLOSS, DEPLOSS3, DEPLOSS5	Three binary variables that each equal 1 for (a) years of a banking crisis with depositors' losses, (b) 3 years following each crisis if the crisis generated depositors' losses, and (c) 5 years following each crisis if the crisis generated depositors' losses, respectively
DEVELOPING, ADVANCED	Binary variables that equal 1 if a country in a given year is among the 50 % of the poorest or richest countries, respectively, as measured by GDP per capita in constant US$ prices

illustrate the real sample size and its diversity, we use specification (2) in Table 5 as our reference point. In Table 2, we describe the distribution of the observations by year and number of countries as well as the concentration of observations within one, three, and five of the largest banking sectors. We have 98,394 observations for the period from 1991 to 2012. Moreover, the yearly number of observations and countries increases steadily over time. The 265 observations for 1991 come from 26 countries; in 2011, 10,264 observations originate from 95 countries.

Table 2 The distribution of observations by year and country and the concentration of observations within the largest banking systems. The table describes the effective number of observations used in our baseline specification (2) in Table 5

Year	Observations	Countries	Observations in the largest banking system	Observations in three largest banking systems	Observations in five largest banking systems
1991	265	26	92	129	159
1992	549	32	127	286	371
1993	689	37	136	313	424
1994	1027	52	163	419	580
1995	1720	60	431	814	1050
1996	2057	62	561	950	1207
1997	2209	65	629	1051	1310
1998	2646	74	955	1398	1658
1999	3866	76	1400	2046	2428
2000	4134	78	1267	2198	2639
2001	4370	80	1044	2228	2879
2002	4358	83	929	2138	2779
2003	4789	90	1113	2310	2962
2004	5007	88	1143	2335	3026
2005	5220	90	1107	2279	3040
2006	5536	91	1125	2269	3098
2007	5807	88	1257	2342	3264
2008	4990	89	1154	2152	2814
2009	10,055	90	5404	7228	7858
2010	10,256	94	5424	7282	7929
2011	10,264	95	5437	7303	7966
2012	8580	93	5410	6445	6840
Total	98,394	-	36,308	55,915	66,281

From an econometric point of view, our sample has one undesirable feature, that is, a high concentration of observations within the first- to fifth-largest banking systems in the world. Consequently, to draw valid conclusions about the role of GLR risk, we apply the fixed effect estimator with weights. A straightforward approach would be to create a vector of weights that equals one divided by the total number of observations from a given country. Such a weighting would cause each country to have the same importance; thus, our estimation results might be driven by numerous small markets with undeveloped banking systems. Therefore, we decide to transform the importance of the countries so that each observation has a weight that equals one divided by the natural logarithm of the total number of banks from a given country.[1]

The data on GLR risk are the most important to our study and for testing H1. Table 3 provides the number of countries for which we have values of the GLR risk measures in each year of the sample period. All values contained in this table concern only the subgroup of countries with non-missing values for bank- and country-level

---

[1] The results are robust to the modifications in the weighting procedures.

Table 3 The coverage for GLR risk measures. The table shows the number of countries for which information on GLR risk or the crisis phenomenon is available. We consider only those countries with non-missing values for the bank-level and country-level control variables

Year	Ratings	CDS spreads	Bond yields	Information on systemic banking crises	
				All countries	Countries in crisis
1991	19			24	4
1992	24			30	5
1993	29			34	7
1994	38		14	46	6
1995	42		15	52	6
1996	46		15	56	4
1997	55		17	58	9
1998	61		20	62	16
1999	62		24	66	12
2000	65		23	67	9
2001	68	9	26	68	7
2002	71	15	32	70	3
2003	76	27	35	73	2
2004	76	36	38	72	1
2005	79	39	40	73	1
2006	81	46	43	74	0
2007	79	46	48	71	2
2008	81	51	52	71	24
2009	82	60	52	72	24
2010	86	60	55	76	25
2011	87	60	55	77	25
2012	86	59	59	77	25
Mean	63.3	42.3	34.9	62.2	9.9

control variables. With regard to the sovereign credit ratings, the mean yearly number of countries in our sample is 63.3. The time series of observations of CDS spreads on sovereigns and government bond yields are shorter, beginning in 2001 and 1993, respectively. The mean number of countries for which we have CDS quotes is 42.3, whereas the respective mean in the case of bond yields amounts to 34.9. We calculate both means only for the period of data availability. The indirect method of inferring the GLR's standing involves identifying systemic banking crises. Table 3 shows that there were 217 country-year crisis episodes from 1991 to 2012.

Finally, Panel A in Table 4 presents the descriptive statistics for the bank-level variables. Panel B characterizes the distribution of the variables from the GLR.RISK and SAFETY.NET groups and that of the macroeconomic control variables. The mean interest cost ratio, expressed in real terms, is close to zero (0.3 %). The median value is almost identical at 0.5 %. The descriptive statistics for the explanatory variables make good economic sense. For example, the mean cost-to-income ratio equals 54.9 %, whereas the median of the ROA is 0.9 %.

Table 4 The descriptive statistics. All statistics in Panel A are only calculated for the observations effectively used in our baseline specification (2) in Table 5. The INT.COST variable is expressed in real terms; therefore, a significant portion of its values are negative. Descriptive statistics in Panel B are calculated with country-level observations. It should be noted that we eliminate outliers and observations with clearly erroneous values from the sample, that is, values lying outside the theoretically allowable ranges

Variable name	Average	Standard deviation	Minimum	5th percentile	Median	95th percentile	Maximum
Panel A Bank-level variables							
C/I	0.549	0.207	0.000	0.273	0.529	0.933	2.000
EQUITY	0.089	0.044	-0.237	0.031	0.083	0.176	0.250
INT.COST	0.003	0.037	-0.895	-0.032	0.005	0.037	0.957
SIZE	0.051	0.161	0.000	0.000	0.001	0.329	1.000
LOANS	0.596	0.191	0.000	0.224	0.621	0.873	1.000
NON.INT	1.003	1.038	-1.000	-0.176	0.866	3.000	5.000
ROA	0.010	0.018	-0.651	-0.011	0.009	0.031	0.598
Panel B Country-level variables							
EXPLICIT	0.706	0.456	0	0	1	1	1
COVERAGE	7.169	18.028	0	0	1.549	31.800	94.669
GDP.PC	155.353	169.717	2.088	5.583	69.086	482.341	877.167
MARKET.CAP	0.539	0.625	0	0.029	0.332	1.662	6.060
FCU	9.209	14.677	0	0	2.170	31.330	1
CDS_Q	13.782	25.821	0.384	0.781	4.625	66.906	284.314
YLD	3.350	6.074	0.093	0.613	1.332	14.173	51.404

4 Results

4.1 Baseline results concerning market monitoring

We begin our analysis with a traditional test for the existence of market monitoring. Table 5 presents the baseline results regarding depositor discipline through interest costs. These results support H2 in that the interest costs are related to a bank's risk. As expected, ROA and EQUITY negatively and significantly affect the interest-cost levels. In the case of ROA, we can reject the null hypothesis about the equality of the appropriate coefficients to zero in all specifications at the 1 % level. The coefficients for EQUITY are significant at the 5 % level. The depositor discipline is not stronger in countries without explicit deposit insurance because the interaction terms ROA x NO.EXPLICIT and EQUITY x NO.EXPLICIT are insignificant in specifications (2) and (4). This outcome may be linked to the fact that the absence of explicit deposit insurance is frequently accompanied by the presence of broad implicit guarantees (Angkinand and Wihlborg 2010; Yan et al. 2014). The high coverages of deposits in specifications (3) and (4) unexpectedly increase the sensitivity of the depositors to EQUITY. We hypothesize that the increased sensitivity stems from the fact that periods of a high coverage of deposits and blanket guarantees correspond to periods of financial crises, which awaken the risk awareness of depositors. The empirical evidence presented in Section 4.4 supports this claim.

Table 5 The baseline results of the market monitoring hypothesis. The variables testing for market monitoring (ROA and EQUITY) are lagged by one period

Dependent variable:	(1) INT.COST	(2) INT.COST	(3) INT.COST	(4) INT.COST
LOANS	0.0180***	0.0174***	0.0219***	0.0218***
	(0.00272)	(0.00271)	(0.00307)	(0.00307)
SIZE	0.00518	0.00550	0.00630	0.00673
	(0.00665)	(0.00681)	(0.00735)	(0.00742)
C/I	0.00656***	0.00643***	0.00724***	0.00709***
	(0.00135)	(0.00134)	(0.00141)	(0.00141)
NON.INT	0.00138***	0.00136***	0.00134***	0.00135***
	(0.000231)	(0.000229)	(0.000245)	(0.000244)
GDP.PC	-0.000161***	-0.000166***	-0.000198***	-0.000197***
	(1.41e-05)	(1.42e-05)	(1.60e-05)	(1.61e-05)
MARKET.CAP	0.00321***	0.00295***	0.00431***	0.00399***
	(0.000613)	(0.000604)	(0.000703)	(0.000686)
NO.EXPLICIT		-0.00994*		-0.00860
		(0.00534)		(0.00538)
COVERAGE			0.000118***	0.000122***
			(1.26e-05)	(1.28e-05)
ROA	-0.0967***	-0.0993***	-0.0873***	-0.0881***
	(0.0253)	(0.0261)	(0.0290)	(0.0302)
EQUITY	-0.0227**	-0.0217**	-0.0233**	-0.0207**
	(0.00941)	(0.00980)	(0.00997)	(0.0104)
ROA x NO.EXPLICIT		0.0276		0.0184
		(0.0826)		(0.0834)
EQUITY x NO.EXPLICIT		-0.00867		-0.0124
		(0.0306)		(0.0309)
ROA x COVERAGE			-0.000920	-0.00105
			(0.000845)	(0.000833)
EQUITY x COVERAGE			-0.000682***	-0.000785***
			(0.000208)	(0.000212)
TIME	-0.000934***	-0.000923***	-0.000806***	-0.000841***
	(8.98e-05)	(8.67e-05)	(0.000104)	(0.000102)
Constant	0.0518***	0.0548***	0.0570***	0.0583***
	(0.00378)	(0.00383)	(0.00422)	(0.00429)
No. of observations	98,630	98,394	92,657	92,657
No. of banks	16,939	16,927	16,623	16,623

The ***, **, and * indicate statistical significance at 1 %, 5 %, and 10 %, respectively. Robust standard errors clustered at the bank level are in the parentheses

The bank-specific control variables influence the dependent variable in the expected directions. Wholesale banks, which show high values for NON.INT and LOANS, are obligated to pay more for deposits because of their dependence on money market financing. Well-run banks that have relatively modest cost-to-income ratios incur lower interest costs.

With regard to the country-level control variables, we establish that MARKET.CAP influences the dependent variable positively. This result suggests that disintermediation within financial systems might increase banks' interest costs for competitive reasons. Because MARKET.CAP controls, to some degree, for the relative roles of the financial market and banks in the economy, the negative coefficients for GDP.PC indicate that when GDP per capita goes up and savings become more abundant, banks simply pay less to attract deposits. The results for the variables describing the safety net arrangements are ambiguous. The non-existence of an explicit deposit insurance system does not correlate with the interest cost level. However, COVERAGE, prima facie surprisingly influences the dependent variable positively and significantly. We offer two explanations for this outcome. First, the analysis of the countries from the sample with the most generous deposit insurance discloses that such systems frequently function in less developed and less stable economies. Consequently, we hypothesize that at least some generous (in comparison with the GDP per capita) coverage limits might be regarded by depositors as not fully credible. Second, the values of COVERAGE usually increase during crises, when the cost of debt capital is also augmented. The negative coefficient for a time trend likely reflects the expansionary monetary policy prevailing toward the end of the sample period.

4.2 Direct method of assessing GLR risk and its impact on depositor discipline

In this subsection, we test whether the GLR risk that is approximated by sovereign credit ratings, CDS spreads on sovereigns, and government bond yields influences the depositors' sensitivity to bank fundamentals. Table 6 shows the results when we use binary variables to illustrate the GLR risk. Panel A presents the main results, and Panel B contains additional tests on the significance of the coefficients' sums. We introduce two dummy variables for each measure of GLR risk. They are equal to one for the top 25 % and 50 % of country-year observations in the entire sample, with the highest default rates implied by the worst yearly ratings for the 10-year debt in foreign currency (FCU.WORST25 and FCU.WORST50), with the highest CDS spreads (CDS_Q.WORST25, CDS_Q.WORST50), or with the highest government bond yields (YIELD.WORST25, and YIELD.WORST50) in comparison to Germany. To verify H1, we interact these dummies with variables that describe a bank's capital base and current profitability. As Panel A demonstrates, all interaction terms including EQUITY are statistically significant at the 1 % or 5 % levels and influence the dependent variable negatively. As Panel B shows, the sums of the coefficients obtained for EQUITY and the relevant interaction terms are also negative and statistically significant, predominantly at the 1 % level. The observed empirical pattern indicates that the sensitivity of interest costs to the banks' capital base increases when the sovereign credit ratings worsen or when the CDS and government bond spreads increase, that is, in circumstances in which the ability of the GLR to repay banks' liabilities or to help banks diminishes. In contrast, the evidence regarding the sensitivity to ROA is less conclusive. Only the three interaction terms with ROA are significant at the 5 % or 10 % levels. Moreover, the sums of the coefficients for ROA and the appropriate interaction terms differ significantly from zero in four out of six specifications. Therefore, our empirical evidence supports H1, but particularly for EQUITY.

The increase in the sensitivity of the interest costs to the banks' capital base in countries with increasing GLR risk is not only statistically significant, but also important in economic terms. For example, specifications (5), (7), and (9) indicate that when we move a hypothetical bank from the first to third quartile in the distribution of EQUITY, this change results in the

Table 6 GLR risk and interest costs' sensitivity to banks' fundamentals (binary variables describing GLR risk). The table reports only the variables and interaction terms that are relevant for hypothesis testing. The models also contain continuous GLR risk measures (FCU, CDS_Q and YLD) and all variables and interaction terms included in specification (2) of Table 5, all of which are not shown for brevity. The ROA and EQUITY variables are lagged by one period

	(5)	(6)	(7)	(8)	(9)	(10)
Dependent variable:	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST
GLR risk measure as a regressor:	FCU.WORST50	FCU.WORST25	CDS_Q.WORST50	CDS_Q.WORST25	YLD.WORST50	YLD.WORST25
Panel A Estimation results						
ROA	-0.0506***	-0.0789***	0.0114	-0.0133	-0.00504	-0.0260***
	(0.0127)	(0.0163)	(0.0150)	(0.0152)	(0.00789)	(0.00933)
EQUITY	-0.00120	-0.00126	0.0321***	0.0434***	0.0145***	-0.00255
	(0.00718)	(0.00893)	(0.00827)	(0.00899)	(0.00482)	(0.00466)
ROA x GLR risk measure	-0.131**	-0.0732	-0.0839**	-0.0286	-0.0381*	-0.00304
	(0.0526)	(0.0681)	(0.0411)	(0.0524)	(0.0203)	(0.0313)
EQUITY x GLR risk measure	-0.0594***	-0.164***	-0.0581***	-0.124***	-0.0482***	-0.0149**
	(0.0184)	(0.0292)	(0.00800)	(0.0125)	(0.00278)	(0.00639)
Number of observations	96,977	96,977	59,706	59,706	84,877	84,877
Number of banks	16,738	16,738	13,718	13,718	15,422	15,422
Panel B Tests of coefficients' sums						
ROA + ROA x GLR risk measure	-0.181***	-0.152**	-0.0724*	-0.0419	-0.0432**	-0.0290
F-statistic	11.589	4.884	3.0552	0.617	4.106	0.795
EQUITY + EQUITY x GLR risk measure	-0.0606***	-0.165***	-0.0260**	-0.0801***	-0.0337***	-0.0175**
F-statistic	8.288	28.850	5.271	31.275	33.448	5.0976

The ***, **, and * indicate statistical significance at 1 %, 5 %, and 10 %, respectively. Robust standard errors clustered at the bank level are in the parentheses

reduction of the interest cost ratio by 0.33, 0.32, and 0.27 percentage points larger, respectively, when a country has the GLR risk measure above the median than otherwise. Those differences are equivalent to 9.0 %, 8.8 %, and 7.3 %, respectively, of the standard deviation of the dependent variable in the entire sample.

We have based our results on the binary variables that identify periods of increased GLR risk to this point. This approach has two advantages. First, the use of binary variables protects against the possibility that the empirical results are driven by only a limited number of outlying observations. Second, it reduces the problem of a high correlation among the regressors when the variables for bank fundamentals are simultaneously introduced into the equations with the interaction terms that include these variables. However, the chosen solution is not perfect. On the one hand, we lose some information by discretizing the continuous variables that reflect the default rates or spreads. On the other hand, adopting continuous variables enables us to study directly the nonlinear nature of the relationships among interest costs, banks' fundamentals, and GLR risk. Consequently, although we prefer binary variables for the discussed reasons, we report in Table 7 the results obtained using three continuous variables to illustrate GLR risk. These variables are the following: FCU is the 10-year default rate expressed in percentage and implied by a country's foreign currency rating assigned by S&P, CDS_Q is the ratio of a country's average quotation for credit default swaps in a given year in comparison with Germany, and YIELD is the ratio of a country's sovereign 5-year bond yield in comparison with the bond yield for Germany. The literature provides no guidance on the appropriate nonlinear function linking the GLR risk and the interest costs' sensitivity to bank fundamentals. Therefore, we decide to use simple solutions—specifically, logarithmic and power functions.

All of the interaction terms in Table 7 including EQUITY and the nonlinearly transformed continuous GLR risk measures are statistically significant at the 1 % level and influence the dependent variable negatively. In contrast, none of the interactions terms containing ROA is significant. To facilitate the interpretation of the estimation results for the models in Table 7, we plot the interest costs' overall sensitivity to the banks' equity against the measures of GLR risk in Graph 1. The overall sensitivity to EQUITY is calculated using the coefficients from specifications (11) to (16) for this variable and for the appropriate interaction terms. On the x-axis, we present the GLR risk measures up to the 90th percentile of the real range in our sample. In Part A of Graph 1, we apply the default rates implied by the sovereign ratings, whereas in Parts 2 and 3, we use the CDS spreads and bond yields, respectively. Graph 1 shows that the overall sensitivity of interest costs to the banks' capital base becomes negative once measures of GLR risk become significant and that this sensitivity surges (in absolute terms) with increasing values in the default rates, CDS spreads, and bond yields.

In sum, the results in Table 7 corroborate our previous findings that the GLR risk influences, in a statistically stable manner, the interest cost's sensitivity to the banks' capital base. The evidence concerning the sensitivity to the current profitability is ambiguous. Our conclusions regarding the impact of GLR risk on the sensitivity of interest costs to fundamentals do not depend on the choice of the variables that describe GLR risk.

4.3 The universality of the GLR risk effect

In this subsection, we ask whether the influence of GLR risk on the interest costs' sensitivity to bank fundamentals is universal or appears only under certain conditions. To answer the question, we investigate how features of deposit insurance schemes and the economic advancement of different countries affect the relationship identified so far.

Table 7 GLR risk and interest costs' sensitivity to banks' fundamentals (continuous variables describing GLR risk). The table reports only the variables and interaction terms that are relevant for hypothesis testing. The models also contain continuous GLR risk measures (FCU, CDS_Q and YLD) and all variables and interaction terms included in specification (2) of Table 5, all of which are not shown for brevity. The ROA and EQUITY variables are lagged by one period

	(11)	(12)	(13)	(14)	(15)	(16)
Dependent variable:	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST
GLR risk measure as a regressor:	FCU	CDS_Q	YLD	FCU	CDS_Q	YLD
ROA	-0.0599*	-0.0102	-0.0192**	-0.0639***	-0.0150	-0.0411*
	(0.0308)	(0.0212)	(0.00862)	(0.0214)	(0.0273)	(0.0250)
EQUITY	0.0391***	0.0608***	0.0113**	0.0549***	0.0769***	0.0351***
	(0.0120)	(0.00844)	(0.00490)	(0.00820)	(0.0111)	(0.00787)
ROA x ln (GLR risk measure)	-0.0296	-0.00910	-0.0110			
	(0.0191)	(0.0191)	(0.0154)			
EQUITY x ln (GLR risk measure)	-0.0384***	-0.0342***	-0.0425***			
	(0.00847)	(0.00462)	(0.00350)			
ROA x (GLR risk measure)$^{1/2}$				-0.00991	-0.00213	0.0108
				(0.00926)	(0.0115)	(0.0211)
EQUITY x (GLR risk measure)$^{1/2}$				-0.0402***	-0.0234***	-0.0303***
				(0.00559)	(0.00423)	(0.00589)
Number of observations	43,751	59,706	84,877	96,977	59,706	84,877
Number of banks	11,349	13,718	15,422	16,738	13,718	15,422

The ***, **, and * indicate statistical significance at 1 %, 5 %, and 10 %, respectively. Robust standard errors clustered at the bank level are in the parentheses. Due to the logarithmic transformation in use, specification (11) does not cover bank-year observations with an FCU equal to zero (i.e., with an AAA country rating)

The capital buffers of banks, deposit insurance schemes, and the GLR constitute three consecutive lines of defense against losses for depositors during financial troubles within a banking system. Therefore, the existence of an explicit deposit insurance scheme may modify the effect of GLR risk on depositor discipline. Theoretically, three scenarios are possible. First, when depositors treat an explicit deposit insurance system as fully credible on its own, the GLR risk effect should be present only in countries without such a system. Second, the GLR risk effect should be weaker when depositors regard explicit deposit insurance as partially credible compared to countries without an explicit deposit insurance system. Third, when depositors assume that the GLR's standing determines the explicit deposit insurance's credibility, the GLR risk effect should be comparable in economies that possess an explicit deposit insurance system and in those devoid of such a system. In Table 8, we check which scenario best describes the economic reality in our sample. We introduce triple interaction terms that comprise the variables that illustrate a bank's risk (ROA, EQUITY), variables regarding the existence of an explicit deposit insurance system (EXPLICIT, NO.EXPLICIT), and the binary variables that identify countries and periods when the GLR risk is elevated (FCU.WORST50, FCU.WORST25, CDS_Q.WORST50, CDS_Q.WORST25, YLD.WORST50, and YLD.WORST25). Our evidence shows that the GLR risk influences the interest costs' sensitivity to fundamentals in countries with an explicit deposit insurance system as well as in those without such a system. All of the coefficients estimated for the triple interaction terms

A

GLR risk measured with FCU

B

GLR risk measured with CDS_Q

C

GLR risk measured with YLD
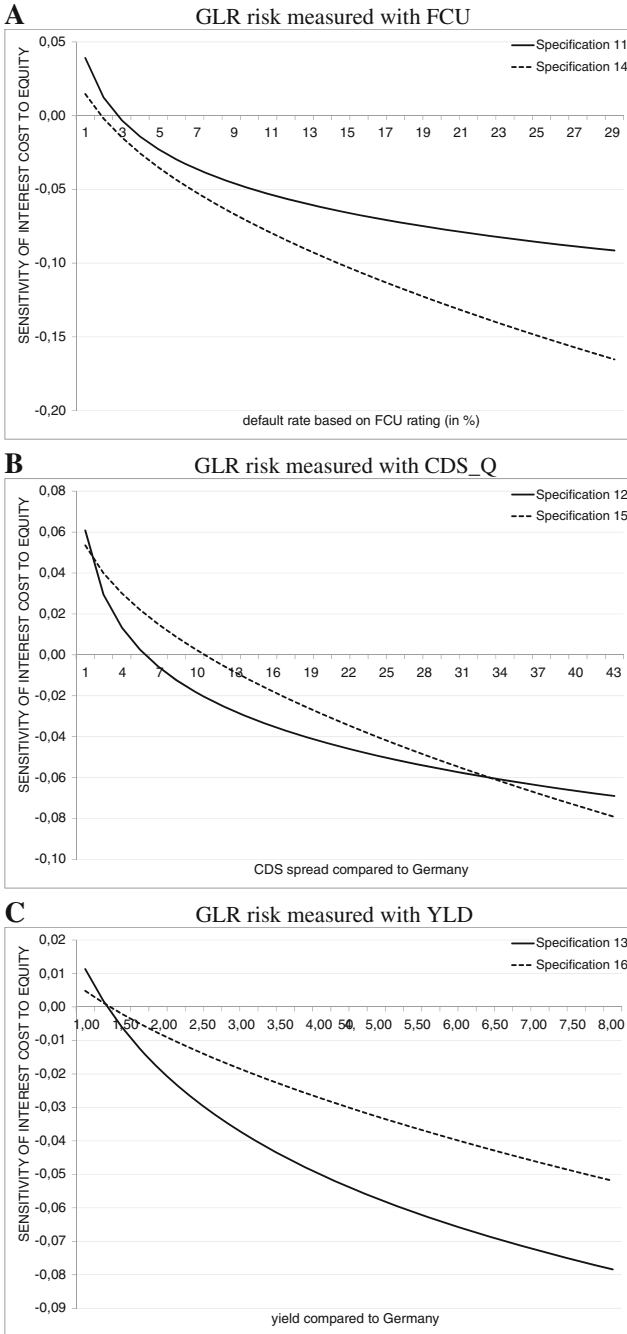
Note: The curves are plotted by using the estimation results from Table 7.

Graph 1 The overall sensitivity of interest costs to capital base as a function of GLR risk

Table 8 GLR risk, different deposit insurance schemes, and interest costs' sensitivity to banks' fundamentals. The table reports only the variables and interaction terms that are relevant for hypothesis testing. The models also contain respective continuous GLR risk measures (FCU, CDS_Q and YLD) and all variables and interaction terms included in specification (2) of Table 5, all of which are not shown for brevity. The ROA and EQUITY variables are lagged by one period

Dependent variable:	(17) INT.COST	(18) INT.COST	(19) INT.COST	(20) INT.COST	(21) INT.COST	(22) INT.COST
GLR risk measure as a regressor:	FCU.WORST50	FCU.WORST25	CDS_Q.WORST50	CDS_Q.WORST25	YLD.WORST50	YLD.WORST25
Panel A Estimation results						
ROA	-0.0433***	-0.0677***	0.0112	-0.0134	-0.00598	-0.0265***
	(0.0120)	(0.0151)	(0.0148)	(0.0149)	(0.00784)	(0.00927)
EQUITY	-0.00100	0.00141	0.0294***	0.0408***	0.0157***	-0.00188
	(0.00697)	(0.00859)	(0.00801)	(0.00881)	(0.00475)	(0.00460)
ROA x GLR risk measure x NO.EXPLICIT	0.167	0.288**	-0.0386	0.00894	-0.116	0.287***
	(0.105)	(0.135)	(0.0382)	(0.0407)	(0.0935)	(0.0896)
ROA x GLR risk measure x EXPLICIT	-0.153***	-0.139*	-0.0852**	-0.0373	-0.0337	-0.00639
	(0.0565)	(0.0802)	(0.0420)	(0.0563)	(0.0207)	(0.0317)
EQUITY x GLR risk measure x NO.EXPLICIT	-0.189***	-0.386***	-0.0713***	-0.0960***	-0.0845***	-0.110***
	(0.0403)	(0.0585)	(0.0256)	(0.0252)	(0.0253)	(0.0259)
EQUITY x GLR risk measure x EXPLICIT	-0.0392**	-0.113***	-0.0582***	-0.127***	-0.0479***	-0.0124*
	(0.0196)	(0.0350)	(0.00806)	(0.0134)	(0.00279)	(0.00647)
Number of observations	96,977	96,977	59,706	59,706	84,877	84,877
Number of banks	16,738	16,738	13,718	13,718	15,422	15,422
Panel B Tests of coefficients' sums						
ROA + ROA x GLR risk measure x NO.EXPLICIT	0.123	0.220	-0.0274	-0.00450	-0.122	0.261***
F-statistic	1.368	2.650	0.593	0.0139	1.721	8.504
ROA + ROA x GLR risk measure x EXPLICIT	-0.196***	-0.207***	-0.0740*	-0.0507	-0.0396*	-0.0329
F-statistic	12.300	6.819	3.119	0.814	3.377	1.00620
EQUITY + EQUITY x GLR risk measure x NO.EXPLICIT	-0.190***	-0.385***	-0.0419	-0.0552**	-0.0688***	-0.111***
F-statistic	22.0229	42.222	2.540	4.469	7.323	18.0276
EQUITY + EQUITY x GLR risk measure x EXPLICIT	-0.0402*	-0.112***	-0.0288**	-0.0864***	-0.0322***	-0.0143*
F-statistic	3.432	9.707	6.477	34.0436	31.190	3.401

The ***, **, and * indicate statistical significance at 1 %, 5 %, and 10 %, respectively. Robust standard errors clustered at the bank level are in the parentheses

including EQUITY are negative and statistically significant. The sums of the coefficients for EQUITY and the appropriate triple interaction terms are also all negative. Moreover, they are significant in all six specifications for countries possessing explicit deposit insurance and in five out of six specifications for countries without such a system. With respect to ROA, we obtain weak evidence that the sensitivity of interest costs to the current profitability is an increasing function of the GLR risk in countries with explicit deposit insurance. In sum, the results falsify the first scenario. Considering the absolute values of the coefficients estimated for triple interaction terms including EQUITY and the absolute values of the appropriated sums of coefficients, we conclude that the second scenario seems to best fit the regularities observed in our sample. The presence of explicit deposit insurance attenuates the GLR risk effect on the interest costs' sensitivity to the banks' equity levels; however, the GLR's standing remains an important determinant of the strength of depositor discipline in all countries.

The second dimension through which we study the universality of the GLR effect is the degree of economic development. We introduce two binary variables, DEVELOPING and ADVANCED, that are equal to one if a country in a given year is among the 50 % poorest or wealthiest countries, respectively, according to the criterion of GDP per capita. Next, we construct triple interaction terms with these variables, variables illustrating bank fundamentals, and GLR risk. Table 9 contains the results. The GLR risk increases the sensitivity of interest costs to EQUITY in both developing and advanced economies. Notably, for the first time, we also obtain stable evidence on the interest costs' sensitivity to ROA. This sensitivity is an increasing function of GLR risk but only in developing countries. We explain the difference between advanced and developing economies by the distinct levels of the depositors' sophistication. We hypothesize that depositors in advanced economies are better prepared to understand the role of equity capital and pay less attention to current profitability, which may be a poor predictor of future performance during difficult economic times.

4.4 Indirect method of assessing GLR risk and its impact on depositor discipline

To this point, we identify the periods of weakened GLR standing by examining sovereign ratings, CDS spreads, and bond yields. However, indirect inferences are also possible using information on banking crises. We assume that banking crises typically reduce, particularly in the short run, a GLR's ability to withstand subsequent shocks. The literature demonstrates that banking crises are extremely costly in terms of both fiscal outlays and output losses (Hoggarth et al. 2002; Honohan and Klingebiel 2003; Angkinand 2009; Laeven and Valencia 2012; Reinhart and Rogoff 2013). Therefore, we study the sensitivity of interest costs to bank fundamentals during and after crisis periods. We introduce three binary variables: CRISIS, CRISIS3, and CRISIS5. They equal one for crisis periods, three consecutive years after a crisis, and five consecutive years after a crisis, respectively. Additionally, we differentiate between crises involving depositor losses and crises without such losses. We again define three binary variables: DEPLOSS, DEPLOSS3, and DEPLOSS5. They identify the crisis episodes during which depositors suffered losses and the three- and five-year periods following the crises in which depositors have losses, respectively. Next, we interact crisis dummies with variables that describe the banks' financial health. Table 10 provides the results.

The findings show that changes in the interest costs' sensitivity to fundamentals are mainly provoked by crises involving depositors' losses. In specifications (30), (32) and (34), the interaction terms with ROA and EQUITY are significant, predominantly at the 1% level. However, the directions of influence for ROA and EQUITY are opposite. The coefficients

Table 9 GLR risk, economic advancement, and interest costs' sensitivity to banks' fundamentals. The table reports only the variables and interaction terms that are relevant for hypothesis testing. The models also contain continuous GLR risk measures (FCU, CDS_Q and YLD) and all variables and interaction terms included in specification (2) of Table 5, all of which are not shown for brevity. The ROA and EQUITY variables are lagged by one period

	(23)	(24)	(25)	(26)	(27)	(28)
Dependent variable:	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST
GLR risk measure as a regressor:	FCU.WORST50	FCU.WORST25	CDS_Q.WORST50	CDS_Q.WORST25	YLD.WORST50	YLD.WORST25
Panel A Estimation results						
ROA	-0.0509***	-0.0794***	0.0134	-0.0129	-0.00541	-0.0278***
	(0.0128)	(0.0164)	(0.0152)	(0.0153)	(0.00798)	(0.00941)
EQUITY	-0.00204	-0.00195	0.0322***	0.0430***	0.0167***	-0.00137
	(0.00766)	(0.00889)	(0.00837)	(0.00894)	(0.00467)	(0.00462)
ROA x GLR risk measure x DEVELOPING	-0.139***	-0.0954**	-0.222***	-0.138*	-0.112**	-0.144**
	(0.0363)	(0.0457)	(0.0700)	(0.0754)	(0.0539)	(0.0674)
ROA x GLR risk measure x ADVANCED	-0.125	-0.0655	-0.0452	0.00139	-0.0269	0.0452
	(0.0769)	(0.0993)	(0.0475)	(0.0642)	(0.0223)	(0.0397)
EQUITY x GLR risk measure x DEVELOPING	-0.0441*	-0.0857***	-0.0138	-0.151***	-0.0895***	-0.0566***
	(0.0228)	(0.0310)	(0.0205)	(0.0212)	(0.0189)	(0.0169)
EQUITY x GLR risk measure x ADVANCED	-0.0652***	-0.207***	-0.0677***	-0.118***	-0.0473***	-0.00314
	(0.0240)	(0.0403)	(0.00883)	(0.0146)	(0.00293)	(0.00700)
Number of observations	96,977	96,977	59,706	59,706	84,877	84,877
Number of banks	16,738	16,738	13,718	13,718	15,422	15,422
Panel B Tests of coefficients' sums						
ROA + ROA x GLR risk measure x DEVELOPING	-0.190***	-0.175***	-0.209***	-0.151**	-0.118**	-0.172**
F-statistic	29.209	15.514	9.0866	4.00270	4.760	6.465
ROA + ROA x GLR risk measure x ADVANCED	-0.176***	-0.145	-0.0318	-0.0115	-0.0323	0.0174
F-statistic	5.0315	2.0713	0.430	0.0311	1.905	0.178
EQUITY + EQUITY x GLR risk measure x DEVELOPING	-0.0462**	-0.0877***	0.0184	-0.108***	-0.0729***	-0.0579***
F-statistic	4.325	7.341	0.680	25.638	13.812	10.907
EQUITY + EQUITY x GLR risk measure x ADVANCED	-0.0672**	-0.209***	-0.0354***	-0.0748***	-0.0306***	-0.00450
F-statistic	5.921	25.499	8.871	21.0718	28.674	0.309

The ***, **, and * indicate statistical significance at 1 %, 5 %, and 10 %, respectively. Robust standard errors clustered at the bank level are in the parentheses

Table 10 The crisis phenomena and interest costs' sensitivity to banks' fundamentals. The table reports only the variables and interaction terms that are relevant for hypothesis testing. The models also contain respective crisis-reflecting variables and all variables and interaction terms included in specification (2) of Table 5, all of which are not shown for brevity. The ROA and EQUITY variables are lagged by one period

	(29)	(30)	(31)	(32)	(33)	(34)
Dependent variable:	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST	INT.COST
Crisis-reflecting variable as a regressor:	CRISIS	DEPLOSS	CRISIS3	DEPLOSS3	CRISIS5	DEPLOSS5
Panel A Estimation results						
ROA	-0.115***	-0.124***	-0.142***	-0.133***	-0.138***	-0.132***
	(0.0285)	(0.0317)	(0.0314)	(0.0323)	(0.0321)	(0.0325)
EQUITY	-0.0188*	-0.0228**	-0.0124	-0.0155	-0.0151	-0.0132
	(0.00979)	(0.0116)	(0.0102)	(0.0117)	(0.0104)	(0.0119)
ROA x Crisis-reflecting variable	0.0469	0.274***	0.0755*	0.301***	0.0658	0.285***
	(0.0457)	(0.0927)	(0.0445)	(0.0905)	(0.0439)	(0.0843)
EQUITY x Crisis-reflecting variable	-0.00928	-0.163**	-0.0230*	-0.236***	-0.0143	-0.159***
	(0.0129)	(0.0731)	(0.0118)	(0.0609)	(0.0109)	(0.0483)
Number of observations	96,121	83,996	96,121	83,729	96,121	83,499
Number of banks	16,492	16,199	16,492	16,183	16,492	16,176
Panel B Tests of coefficients' sums						
ROA + ROA x Crisis-reflecting variable	-0.0681*	0.150*	-0.0662*	0.168*	-0.0726**	0.153*
F-statistic	2.838	2.920	3.412	3.761	4.335	3.666
EQUITY + EQUITY x Crisis-reflecting variable	-0.0281*	-0.186**	-0.0354***	-0.251***	-0.0295**	-0.172***
F-statistic	3.645	6.513	7.137	17.440	5.562	13.0832

The ***, **, and * indicate statistical significance at 1 %, 5 %, and 10 %, respectively. Robust standard errors clustered at the bank level are in the parentheses

estimated for the interactions terms between EQUITY and crisis-reflecting variables are negative. Therefore, during and after crises with depositors' losses, well-capitalized banks gain a greater competitive edge in terms of interest costs than they do in other periods. In contrast, during a crisis with depositors' losses and for the three and five years afterwards, the interest costs become less sensitive to ROA than they do in other periods. Furthermore, the positive sums of the coefficients for ROA and ROA x DEPLOSS in specifications (30), (32), and (34) indicate that during the analyzed periods, depositors may judge high current profitability as suspicious.

Similar changes in the interest costs' sensitivity to bank fundamentals in the case of all crisis episodes are detectable only during the 3-year period following a crisis. However, the interaction terms with ROA and EQUITY in specification (31) are statistically significant only at the 10% level. In contrast to crises involving depositors' losses, the sums of the coefficients for ROA and ROA x CRISIS are negative in specifications (29), (31), and (33) and significant at the 5 % or 10% levels. Therefore, when we disregard depositors' losses, higher profitability during and after crises is rewarded in terms of lower interest costs.

The modifications in the sensitivity of interest costs to the capital base during and after crises where depositors suffer losses are relevant in economic terms. For example,

specification (34) indicates that during the 5-year periods following such crises, an increase in EQUITY's value from the first quartile to the third quartile results in the reduction of the interest costs' ratio by 0.89 percentage points more than in other periods. For the 3-year period after a crisis where depositors suffer losses, according to specification (32), the change in the interest costs' sensitivity to a bank's capital base is 50 % greater than the change for the 5-year period.

Our results concerning the impact of crisis phenomena on the interest costs' sensitivity to bank fundamentals are intuitively appealing and suggest that the behavior of depositors is in general rational. During crises, particularly severe crises and their subsequent periods, current profitability constitutes a poor predictor of future performance because it is strongly affected by the loan-loss provisioning policy and an unstable economic environment. By contrast, banks with a strong capital base are always better prepared to weather difficult times (Berger et al. 2009). Therefore, we obtain some support for H3 concerning the existence of the wake-up-call effect. This effect is conditional on depositors' losses, which may explain some ambiguities encountered in the relevant literature signaled in Section 2 (Martinez Peria and Schmukler 2001; Ungan and Caner 2004; Fueda and Konishi 2007; Hori et al. 2009; Cubillas et al. 2012). In more general terms, our results support the claim that depositors learn from a crisis experience. However, this learning process appears to be insufficient to prevent subsequent crises because Aizenman and Noy (2013) report that countries that have already passed through one banking crisis have a higher likelihood of experiencing another crisis.

5 Robustness checks

In Section 4, we test to some degree the robustness of the findings by demonstrating that regardless of the method used to measure the GLR's ability to guarantee deposits or help banks, the interest cost's sensitivity to the banks' capital base is an increasing function of GLR risk. However, we also run several additional types of robustness checks. The detailed results of all checks are available from the authors on request.

First, we estimate dynamic panel models that include the lagged dependent variable and the country dummies. The results are similar in economic terms; however, the dynamic panel models possess some unfavorable econometric properties (there are grounds for the rejection of the null hypotheses in the AR(2) and the Hansen tests). Consequently, we use the static panel models with BFE as the main econometric tool in the paper.

Second, our sample displays significant skewness across both countries and years. In Section 4, we account for the skewness relative to the number of observations for different countries by applying a weighting scheme. However, with regard to weighting, there is no obvious best solution. Therefore, we apply several procedures to the data set, including different weighting schemes or the removal of observations from the countries with the highest number of banks. All of those robustness checks do not change our results.

Third, we substitute the variable COVERAGE for the binary variables that describe the existence or not of explicit deposit insurance in a given year and country. In this way, we check whether our results hold when we control for the relative generosity of the explicit deposit insurances. As in the previous cases, our research outcomes turn out to be stable.

Fourth, we winsorize additionally the dependent variable at the 1% and the 2% levels and reestimate the static panel models. This exercise shows that our results are not driven by outliers.

Fifth, to further study the economic meaning of our results, we reestimate our models with the interaction terms between the GLR risk measures and the crisis variables. We find that the positive relationship between the GLR risk measures and the interest costs' sensitivity to fundamentals is present during both crisis periods and non-crisis periods. This outcome suggests that our results are not driven by a general fear about the banks' health that is accidentally picked up by the GLR risk measures.

Sixth, the depositor discipline in banking can manifest itself through different channels, such as prices, volumes, and the structure of deposits. In the present study, we concentrate on the price channel. Specifically, we use the interest cost ratios calculated from the balance sheet and the profit and loss account. The alternative solutions encountered in the literature that use the interest rates offered by certificates of deposit (e.g., Hannan and Hanweck 1988; Ellis and Flannery 1992) or the proportion of insured and uninsured deposits (e.g., Billett et al. 1998; Maechler and McDill 2006) are not applicable in a broad cross-country study due to a lack of appropriate data. With regard to the volumes of deposits, we construct models that explain the real dynamics of the deposits in our sample. Although these models confirm that deposit growth is positively related to the banks' capital base, we do not identify any stable and robust pattern regarding the relationship between the deposit growth rate's sensitivity to fundamentals and GLR risk. Consequently, there are two possibilities. First, the strength of the depositor discipline as a function of GLR risk might be the trait of only one depositor discipline channel. The literature describes cases in which certain results apply only to discipline through prices and not through volumes (Demirgüç-Kunt and Huizinga 2004; Bertay et al. 2013). Second, there may be a factor obscuring the influence of the GLR risk on the deposit volumes' sensitivity to fundamentals. After testing dozens of different hypotheses, we obtain weak evidence that moral hazard may play such a role. We observe that in our sample, the sensitivity of deposit growth to interest costs changes for only 5 % of the critically undercapitalized banks. Because of the data limitations, we are not able to study this important issue in more detail in our broad international study.

6 Conclusions

In our cross-country study of depositor discipline, we find support for all three of our hypotheses. With regard to auxiliary hypothesis H2, we find that the banks' interest costs are associated with their fundamentals in the expected direction. Therefore, our empirical results are consistent with the conjecture that depositors monitor banks. In line with Martinez Peria and Schmukler (2001), Fueda and Konishi (2007), and Hori et al. (2009), we find that the sensitivity of interest costs to the capital base increases during and after crises, particularly those in which depositors suffer losses. Consequently, our evidence also supports auxiliary hypothesis H3 regarding the existence of the wake-up-call effect. However, the depositors' learning process, as supported by Aizenman and Noy (2013), seems to be insufficient to prevent further crises.

With regard to our contribution to the literature, the most important are the results for the main hypothesis, H1. Our investigation provides evidence that the GLR risk plays a meaningful role in shaping the sensitivity of interest costs to bank fundamentals—specifically, we demonstrate that this sensitivity is an increasing function of GLR risk. The identified pattern is most stable when we use equity levels to illustrate a bank's ability to withstand financial shocks, as in the study by Berger and Turk-Ariss (2010). In the case of the equity-to-assets

ratio, the results are robust to changes in the GLR risk measures and modifications in the econometric procedures. From a theoretical point of view, the more stable and relevant findings for equity levels than for current profitability are not surprising because high levels of equity reduce the depositors' risk even when a bank's profitability is low. When we use nonlinear functions to describe the relationship between GLR risk and the interest costs' sensitivity to bank fundamentals, we demonstrate that the overall sensitivity to the equity level is low for modest values of the GLR risk measures and then increases as the GLR's standing deteriorates. This last piece of evidence corroborates the findings of Levy-Yeyati et al. (2010) on the influence of country and currency risk exposures on the decisions of depositors. They conclude that depositors are responsive to risk in a broader sense than is typically applied in the literature on market discipline. Finally, we provide evidence that the increased sensitivity of interest costs to equity levels is present in both countries with and without explicit deposit insurance as well as in both advanced and developing economies. In sum, our findings on the role of the banks' equity and GLR risk in shaping depositor discipline support H1. We believe that the empirical pattern we observe occurs because depositors pay more attention to a bank's fundamentals when the GLR's standing is threatened. Possible further tests of the effect of GLR risk on the decisions of depositors might involve an experimental procedure, such as the one applied by Schotter and Yorulmazer (2009) for bank runs.

From a policy-making perspective, our findings highlight three important features of depositor discipline. First, to assess and predict the strength of depositor discipline, the consideration of only bank fundamentals and safety net arrangements is inadequate. Our evidence shows that low GLR risk diminishes the depositors' sensitivity to the fundamentals and weakens market discipline. Second, as a result, it may be difficult to strengthen market discipline in countries with low GLR risk. Third, the depositors' losses during crises induce changes in depositors' behaviors because they start to pay more attention to a bank's capital base than to its current profitability.

When formulating policy conclusions, we do not address the issue of the desirability of depositor discipline. We are interested above all in portraying as faithfully as possible one important but so far neglected feature of this type of market discipline: its dependence on GLR risk. We are fully aware that depositor discipline is as powerful and universal as it may be dangerous from the perspective of financial stability. However, in our opinion, a better understanding of such a powerful weapon is necessary, and our paper serves this purpose.

References

Aizenman J, Noy I (2013) Macroeconomic adjustment and the history of crises in open economies. J Int Money Financ 38:41–58

Al-Ja'fari M, Walker D (2011) Deposit insurance in the MENA region. The World Bank

Angkinand A (2009) Banking regulation and the output cost of banking crises. J Int Financ Mark, Inst Money 19: 240–257

Angkinand A, Wihlborg C (2010) Deposit insurance coverage, ownership, and banks' risk-taking in emerging markets. J Int Money Financ 29:252–275

Association of Supervisors of Banks of the Americas (2006) Effective deposit insurance schemes and bank resolution practices

Becker B, Milbourn T (2011) How did increased competition affect credit ratings? J Financ Econ 101:493–514

Berger A, Turk-Ariss R (2010) Do depositors discipline banks? An international perspective. Wharton Financial Institutions Working Paper 11–25

Berger AN, Klapper LF, Turk-Ariss R (2009) Bank competition and financial stability. J Financ Serv Res 35:99–118

Bertay AC, Demirgüç-Kunt A, Huizinga H (2013) Do we need big banks? Evidence on performance, strategy and market discipline. J Financ Intermed 22:532–558

Beyhaghi M, D'Souza C, Roberts G (2014) Funding advantage and market discipline in the Canadian banking sector. J Bank Financ 48:396–410

Billett MT, Garfinkel JA, O'Neal ES (1998) The cost of market versus regulatory discipline in banking. J Financ Econ 48:333–358

Bliss RR, Flannery M (2000) Market discipline in the governance of US bank holding companies: monitoring vs influencing. Eur Finan Rev 6:361–395

Cheng M, Neamtiu M (2009) An empirical analysis of changes in credit rating properties: timeliness, accuracy and volatility. J Account Econ 47:108–130

Cook D, Spellman L (1991) Federal financial guarantees and the occasional market pricing of default risk: evidence from insured deposits. J Bank Financ 15:1113–1130

Cook D, Spellman L (1994) Repudiation risk and restitution costs: toward understanding premiums on insured deposits. J Money, Credit, Bank 26:439–459

Cook D, Spellman L (1996) Firm and guarantor risk, risk contagion, and the interfirm spread among insured deposits. J Financ Quant Anal 31:265–281

Cubillas E, Fonseca A, Gonzalez F (2012) Banking crises and market discipline: international evidence. J Bank Financ 36:2285–2298

Davenport AM, McDill KM (2006) The depositor behind the discipline: a mircro-level case study of hamilton bank. J Financ Serv Res 30:93–109

Demirgüç-Kunt A, Huizinga H (2004) Market discipline and deposit insurance. J Monet Econ 51:375–399

Demirgüç-Kunt A, Huizinga H (2013) Are banks too big to fail or too big to save? International evidence from equity prices and CDS spreads. J Bank. Finance 37:875–894

Demirgüç-Kunt A, Karacaovali BE, Laeven L (2005) Deposit insurance around the world: a comprehensive database. World Bank Policy Research Working Paper 3628

Demirgüç-Kunt A, Kane E, Laeven L (2014) Deposit insurance database. International Monetary Fund Working Paper WP/14/118

Distinguin I, Kouassi T, Tarazi A (2013) Interbank deposits and market discipline: evidence from Central and Eastern Europe. J Comp Econ 41:544–560

Dungey M, Jacob JPAM, Lestano (2015) The internalization of financial crises: Banking and currency crises 1883–2008. N Am J Econ Financ 32:29–47

Ellis D, Flannery M (1992) Does the debt market assess large banks' risk? Time series evidence from money center CDs. J Monet Econ 30:481–502

Financial Stability Board (2009) Exit from extraordinary financial sector support measures.

Financial Stability Board (2010) Note by the staffs of the international association of deposit insurers and the international monetary fund on update on unwinding temporary deposit insurance arrangements

Financial Stability Board (2012) Thematic review on deposit insurance systems

Fonseca A, González F (2010) How bank capital vary across countries: the influence of cost of deposits, market power and bank regulation. J Bank Financ 34:892–902

Forssbæck J (2011) Ownership structure, market discipline, and banks' risk-taking incentives under deposit insurance. J Bank Financ 35:2666–2678

Fueda I, Konishi M (2007) Depositors' response to deposit insurance reforms: evidence from Japan, 1990–2005. J Financ Serv Res 31:101–122

Hannan T, Hanweck GA (1988) Bank insolvency risk and the market for large certificates of deposit. J Money, Credit, Bank 20:203–211

Hasan I, Jackowicz K, Kowalewski O, Kozłowski Ł (2013) Market discipline during crisis: evidence from bank depositors in transition countries. J Bank Financ 37:5436–5451

Hoggarth G, Reis R, Saporta V (2002) Costs of banking system instability: some empirical evidence. J Bank Financ 26:825–855

Honohan P, Klingebiel D (2003) The fiscal cost implications of an accommodating approach to banking crises. J Bank Financ 27:1539–1560

Hori M, Ito Y, Murata K (2009) Do depositors respond rationally to bank risks? Evidence from Japanese banks during crises. Pac Econ Rev 14:581–592

Hosono K, Iwaki H, Tsuru K (2005) Banking crises, deposit insurance, and market discipline: lessons from the Asian crises. RIETI Discussion Paper Series 05-E-029

Hryckiewicz A (2014) What do we know about the impact of government interventions in the banking system? An assessment of various bailout programs on bank behavior. J Bank Financ 46:246–265

International Association of Deposit Insurers (2012) Problem bank resolution methods and payouts of insurance coverage to depositors of forcibly liquidated banks: comparative analysis of deposit insurance systems in CIS countries

Jacewitz S, Pogach J (2016) Deposit rate advantages at the largest banks. J Financ Serv Res. doi: 10.1007/s10693-016-0261-2

Kane EJ (1987) Who should learn what from the failure and delayed bailout of the ODFG? NBER Working Paper No 2260

Karas A, Pyle W, Schoors K (2013) Deposit insurance, banking crises, and market discipline: evidence from a natural experiment on deposit flows and rates. J Money, Credit, Bank 45:179–200

KPMG (2012) Africa banking survey

Kraft P (2015) Do rating agencies cater? Evidence from rating-based contracts. J Account Econ 59:264–283

Laeven L, Valencia F (2008) Systemic banking crises: a new database. IMF Working Paper WP/08/224

Laeven L, Valencia F (2010) Resolution of banking crises: the good, the bad, and the ugly. IMF Working Paper WP/10/146

Laeven L, Valencia F (2012) Systemic banking crises database: an update. IMF Working Paper WP/12/163

Levy-Yeyati E, Martinez Peria MS, Schmukler SL (2010) Depositor behavior under macroeconomic risk: evidence from bank runs in emerging economies. J Money, Credit, Bank 42:585–614

Maechler AM, McDill KM (2006) Dynamic depositor discipline in US banks. J Bank Financ 30:1871–1898

Martinez Peria MS, Schmukler SL (2001) Do depositors punish banks for bad behavior? J Financ 56:1029–1051

Murata K, Hori M (2006) Do small depositors exit from bad banks? Evidence from small financial institutions in Japan. Jpn Econ Rev 57:260–278

Nier E, Baumann U (2006) Market discipline, disclosure and moral hazard in banking. J Financ Intermed 15:332–361

Reinhart CM, Rogoff K (2013) Banking crises: an equal opportunity menace. J Bank Financ 37:4557–4573

Schotter A, Yorulmazer T (2009) On the dynamics and severity of bank runs: an experimental study. J Financ Intermed 18:217–241

Standard and Poor's (2013) Sovereign rating and country T&C assessment histories

Ungan A, Caner S (2004) Depositor behaviour and market discipline in Turkey. Working paper, http://dxdoiorg/102139/ssrn495122

Ungan E, Caner S, Özyildirim S (2008) Depositors' assessment of bank riskiness in the Russian Federation. J Financ Serv Res 33:77–110

Ureche-Rangau L, Burietz A (2013) One crisis, two crises… the subprime crisis and the European sovereign debt problems. Econ Model 35:35–44

Yan X, Skully M, Avram K, Vu T (2014) Market discipline and deposit guarantee: evidence from Australian banks. Inter Rev Financ 14:431–457