HOW CREDIBLE IS A TOO-BIG-TO-FAIL POLICY? INTERNATIONAL EVIDENCE FROM MARKET DISCIPLINE

ELENA CUBILLAS
ANA I. FERNÁNDEZ
FRANCISCO GONZÁLEZ

FUNDACIÓN DE LAS CAJAS DE AHORROS
DOCUMENTO DE TRABAJO
Nº 732/2013

De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISSN: 1988-8767

HOW CREDIBLE IS A TOO-BIG-TO-FAIL POLICY? INTERNATIONAL EVIDENCE FROM MARKET DISCIPLINE

Elena Cubillas *†
Ana I. Fernández *
Francisco González *

Abstract

This paper analyzes in an international sample of banks from 104 countries if the sensitivity of the cost of deposits to bank risk varies across banks depending on their systemic and absolute size. We analyze a period before the 2007 financial crisis and control for endogeneity of bank size, intervention policies in past banking crises, and soundness of countries' public finances. Our results are consistent with the predominance of the too-big-to-fail hypothesis, although this effect is stronger in countries that have not suffered a banking crisis, not imposed losses on depositors in crises, and countries with sounder public finances.

Keywords: Market discipline, too-big-to-fail, too-big-to-save, banking crisis, public deficit
JEL Classification: E43; G01; G21; G28.

*Elena Cubillas. Department of Finance. CUNEF (Colegio Universitario de Estudios Financieros).
Ana Isabel Fernández. Department of Business Administration, University of Oviedo.
Francisco González. Department of Business Administration, University of Oviedo.

†Corresponding author: Elena Cubillas, Department of Finance. CUNEF (Colegio Universitario de Estudios Financieros). Calle Serrano Anguita 9, 28004. Madrid. Spain. Tel.:+34914480891. e-mail: cubillaselena@cunef.edu.

Acknowledgements: We thank Fernando Gascón, Víctor González, Germán López-Espinosa, Sergio Mayordomo, Susana Menéndez, Antonio Moreno, Rafael Santamaría, and Nuria Suárez; seminar participants at CUNEF, Public University of Navarra, University of Navarra, and University of Oviedo; the FMA European Conference in Luxembourg (2013). Financial support from the Spanish Ministry of Science and Innovation (Project MICINN-09-ECO2009-11758) and the Spanish Ministry of Economy and Competitiveness (ECO2012-31772) is gratefully acknowledged.

1. Introduction

The current global financial crisis with the rescue of some of the largest banks and the creation of larger banks to absorb failed ones revives the debate on the negative consequences of a "too-big-to-fail" (TBTF) policy and on the ability of states to maintain this policy in the future. Expectation of a bailout for systemic banks in case of failure may reduce the incentives of depositors and creditors to exert discipline on banks and may enable banks to increase risk-taking and, ultimately, overall financial fragility. In this scenario, not only would large banks have risk-taking incentives but non-large banks also have incentives to increase their size in order to be considered TBTF. On the other hand, the increase in average bank size in relation to GDP (systemic size) questions the ability of some national public finance systems to credibly commit to rescue some of their largest banks and may make banks "too-big-to-save" (TBTS). The cases of Iceland in 2008, Ireland in 2010, and Cyprus in 2013, where large bank failures triggered national insolvency, are recent examples (Demirgüç-Kunt and Huizinga, 2013).

This paper aims to provide new evidence on the relevance of the TBTF and TBTS effects as determinants of risk-taking incentives in large banks during the period before the 2007 financial crisis. In particular, we focus on market discipline exerted by depositors and analyze three main questions in an international sample of banks: 1) How does market discipline exercised by depositors differ across banks depending on their size? 2) How much do differences in market discipline across bank size depend on the intervention policies adopted in past banking crises? 3) How do country´s public finances shape differences in market discipline across banks of different sizes?

As market discipline can be described as a situation in which depositors penalize riskier banks by requiring higher interest rates or by withdrawing deposits, we analyze differences in the relation between bank risk and the cost of bank deposits across banks of different sizes and how these differences depend on the experience of past banking crises and the soundness of the country's public finances. We use a panel database of 4,351 banks from 104 countries over the 1989-2007 period and proxies for both systemic and absolute bank size.

Several authors have studied how bank market discipline varies across countries depending on their bank regulation, supervision, and institutions (Sironi, 2003; Demirgüç-Kunt and Huizinga, 2004; Nier and Baumann, 2006; Cubillas et al., 2012). Likewise, many studies have analyzed the intensity of the TBTF effect and how it can influence the value and risk-taking of large banks (O´Hara and Shaw, 1990; Boyd and Gertler, 1993; Demsetz and Strahan, 1997; Kane, 2000; Soussa, 2000; Penas and Unal, 2004; Ennis and Malek, 2005; Demirgüç-Kunt and Huizinga, 2013). However, there are few studies relating both these aspects and scarce empirical evidence on how market discipline can differ across banks depending on their size.

Recent exceptions are Pop and Pop (2009), Völz and Wedow (2011), and Bertay et al. (2013). Pop and Pop (2009) find a reduction in the CDS spreads of the largest Japanese banks after the announcement of Resona's bailout in 2003. Wölz and Wedow (2001) find lower CDS spreads for larger banks in an international sample of banks in 24 countries. These two papers therefore suggest weaker market discipline in large banks, providing support for predominance of the TBTF effect. Conversely, Bertay et al. (2013) focus on systemic bank size and find in an international sample of publicly-listed banks in 32 countries that systemically large banks are subject to greater market discipline. This result suggests the predominance of the TBTS effect.

This mixed empirical evidence justifies our empirical study, which aims to provide new insights into the predominance of the TBTF or TBTS effects. Our paper makes several contributions. First, the use of an international database allows us to examine how the relevance of the TBTF problem varies across countries depending on the experience of past banking crises. The intervention policies adopted during a crisis provide a clear measure of a country's implicit safety net. As bank risk-taking incentives are exacerbated by not only explicit but also implicit safety nets, the experience of past banking crises provides a proxy for depositors' real guarantees and may lead to differences in the intensity of a country's TBTF effect. Previous studies show that a more accommodative intervention policy during a banking crisis increases the fiscal costs involved in solving the crisis (Honohan and Klingebiel, 2003), increases the probability of future crises (Hoggart et al., 2005), and reduces market discipline as

depositors anticipate stronger implicit guarantees in the future (Cubillas et al., 2012). Bertay et al. (2013) analyze how the sensitivity of bank interest cost to bank risk varies across banks depending on their systemic and absolute size. However, none of the above studies provide empirical evidence on the influence of the intervention policies adopted during a banking crisis on the relevance of the TBTF effect after the crisis.

Second, we analyze how the status of a country's public finances shapes the influence of systemic bank size on the sensitivity of bank interest cost to bank risk. Brown and Dinç (2011) find in twenty-one emerging countries that a government is less likely to take over or close a failing bank if the banking system is weak (too-many-to-fail effect) and that this effect is stronger when there is a large government budget deficit. Demirgüç-Kunt and Huizinga (2013) find that a bank's market-to-book value is negatively related to the size of its liabilities-to-GDP ratio, especially in countries running large public deficits. However, none of the above papers analyze whether the country's public deficit leads to differences in market discipline across banks of different sizes.

Third, we analyze more countries than previous studies. We include a sample of 4,351 banks in 104 developed and developing countries over the period 1989-2007, compared to 24 emerging countries in Völz and Wedow (2011), 32 countries in Demirgüç-Kunt and Huizinga (2013), and 90 countries in Bertay et al. (2013). We can thus provide information on a greater range of country differences to give us a deeper understanding of how the experience of past crises and the status of public finance influence the TBTF and TBTS effects in systemically and absolutely large banks. Moreover, analysis of a period immediately before the onset of the global financial crisis in 2007 allows us to consider whether higher risk-taking incentives in large banks have contributed to the current financial crisis.

Finally, we account for dynamic processes in deposit interest rates and control for unobserved bank, country, and time specific effects. In particular, we use the generalized-method-of-moments (GMM). We apply a two-step system-GMM and specify the robust estimator of the variance-covariance matrix. GMM estimations in all regressions are specifically designed to address three particular econometric issues: (i)

the presence of unobserved bank-specific effects, eliminated by taking first differences of the bank-level explanatory variables; (ii) the autoregressive process in data regarding the cost of deposits (i.e., the need to use a lagged-dependent-variables model to capture the dynamic nature of the cost of bank deposits); and (iii) the likely endogeneity of all bank explanatory variables using lags as instruments. In particular, we use lags for bank-level variables. The endogeneity of bank size may be especially relevant as TBTF policies may provide incentives to banks to not only increase bank risk but also bank size. Both variables may be determined endogenously and simultaneously. Any empirical analysis using these variables should therefore carefully control for such potential endogeneity problems. Moreover, we control for unobserved country and time effects by including country and year dummy variables in all the estimations. To our knowledge, none of the previous studies analyzing the TBTF or TBTS effects have applied the GMM method.

Our results indicate that on average depositors discipline large banks less than smaller banks, using proxies for both systemic and absolute bank size. The TBTF effect, however, varies across countries. It is greater in countries that have not suffered a banking crisis or countries that did not impose losses on depositors in previous banking crises. However, the TBTF effect decreases when the status of the country's public finances does not allow for the rescue of systemically large banks. This last result provides support for the presence of a TBTS effect. However, the average weaker market discipline on systemically large banks indicates that the TBTF effect dominated the TBTS effect over the period before the current financial crisis (1989-2007). In terms of policy implications, our results raise concerns about the increase in average size and number of large banks after the current global financial crisis, and justify measures aiming to reinforce the control of risk-taking in large banks.

The rest of the paper is organized as follows. Section 2 describes the theoretical background and discusses the hypotheses. Section 3 describes the data, variables, and methodology. Section 4 discusses the empirical results and Section 5 concludes.

2. Theoretical background and hypotheses

A TBTF policy is defended on the basis of systemic risk-based arguments in the short-run. The collapse of a large bank can threaten the stability of a country's whole financial system through further failures as a result of direct credit losses, contagion effects or a general loss of confidence (Diamond and Dybvig, 1983; Chari and Jagannathan, 1988; Michael, 1998). Governments aim to avoid this negative systemic effect when they bail out a failed large bank. The TBTF problem appears when the creditors of large banks expect a public bailout. This expectation exacerbates moral hazard problems in large banks because it reduces depositor's incentives to discipline banks and provides incentives to banks' shareholders for taking higher risks. TBTF policies may exacerbate not only risk-taking incentives but also incentives to increase size. So, the larger the bank, the greater the risk the bank will wish to take and the higher the bank risk, the higher the bank's incentives to increase its size to be more likely to benefit from the possibility of bailout (thus becoming more likely to fail).

The empirical literature mostly focuses on US commercial banks and confirms a TBTF effect using different methodologies. O'Hara and Shaw (1990) analyze equity prices around the announcement by the US government that some banks were TBTF and find positive stock price reactions for banks considered TBTF. There are empirical studies around bank mergers finding evidence consistent with a TBTF effect because they show that bank mergers that create a bank that is TBTF originate a positive wealth both for bank shareholders (Benston et al., 1995; Kane, 2000) and bondholders (Penas and Unal, 2004) after controlling for diversification and synergy gains. The TBTF effect has also been tested by analyzing the pricing of bank subordinated debt over periods when the TBTF policy is supposed to have different validity. Flanery and Sorescu (1996) find that spreads on bank subordinated debentures became more closely correlated with indicators of bank risk as regulatory treatment of failed banks' debentures became harsher. Sironi (2003) finds that the sensitivity of spreads of European banks' subordinated notes and debentures to bank risk diminishes in the second half of the 1990s, when perception of the TBTF guarantees by private investors gradually disappeared.

Literature has recently suggested, as the opposite of the TBTF effect, that depositors might discipline large banks more if they anticipate that states have limited capacity to absorb their losses and that large banks become too-big-to-be-saved (Bertay et al., 2013; Demirgüç-Kunt and Huizinga, 2013). The recent nationalizations of the Irish banks leading to the country's insolvency and the EU bailout, or the difficulties of Iceland to pay back depositors demonstrate the limits of national government interventions. In this case, a TBTS effect may make depositors more sensitive to bank risk and strengthen the discipline exerted by depositors on large banks. However, the bailout of Ireland to recapitalize its banks or the bailouts of the Spanish savings banks and the Cypriot banks by the troika (International Monetary Fund, the European Commission, and the European Central Bank) also indicate that authorities may design new mechanisms to rescue systemically large banks and might even allow a TBTF policy to be maintained in banks initially too-big-to-be-saved by their own country.

The TBTS effect has so far received relatively limited attention. Brown and Dinç (2011) show in banks of 21 emerging countries during the 1990s that the type of intervention in failed banks depends on the country's financial ability. They find that a government is less likely to take over or to close a failing bank if other banks in its country are weak. This "too-many-to-fail" effect is greater for large banks and increases with the government's budget deficit. Völz and Wedow (2011) find evidence consistent with the coexistence of a TBTF and TBTS effects in the CDS market for banks of 24 countries over the 2002-2007 period. Although on average a 1 percentage point increase in size reduces the CDS spread of a bank by about 2 basis points, they also find that some banks reach a size that makes them TBTS. Recent papers by Bertay et al. (2013) and Demirgüç-Kunt and Huizinga (2013) are the first suggesting that the TBTS effect prevails over the TBTF effect for systemically large banks in, respectively, 90 and 32 countries. Bertay et al. (2013) find that the sensitivity of debt interest rates to bank risk increases with the bank's systemic size. Demirgüç-Kunt and Huizinga (2013) find that a bank's market-to-book value is negatively related to the size of its liabilities-to-GDP ratio, especially in countries running large public deficits. Both sets of results support the predominance of the TBTS effect using proxies for systemic bank size.

The contradictory theoretical arguments and mixed empirical evidence lead us to analyze the predominance of TBTF or TBTS effects as an empirical question in our extensive database and how both effects may vary across countries depending on the experience of past banking crises and the soundness of public finances in a country.

The influence of banking crises on the intensity of the TBTF and TBTS effects has not been analyzed yet. To our knowledge, there is only mixed evidence on the effects of banking crises on market discipline. Martinez Peria and Schmukler (2001) find in Argentina, Chile, and Mexico during the 1980s and 1990s that the relative importance of market discipline increases after crises and that deposit insurance does not appear to diminish the extent of market discipline. Hadad et al. (2011) find that adoption of a blanket guarantee scheme and the reduction in minimum capital adequacy ratios weakened market discipline in Indonesia following the 1997-1998 financial crisis. Cubillas et al. (2012) analyze 23 banking crises in 18 countries and find on average a reduction in market discipline after a banking crisis, depending on the type of intervention adopted to manage the crisis. The reduction in market discipline is greater the more accommodative the policy to resolve the crisis. Demirgüç-Kunt and Huizinga (2004), Hoggart et al. (2005), and Nier and Baumann (2006) analyze countries with and without a banking crisis and show that wider safety nets weaken market discipline also. None of the above studies, however, analyze how intervention policies during a banking crisis shape the TBTF effect after the crisis.

Assuming that one condition for market discipline is that depositors bear the losses their risks generate, we expect the type of intervention adopted during a banking crisis to shape market discipline in large banks and create differences across countries regarding the relative importance of the TBTF and TBTS effects. Higher subsidies to unsecured depositors in past banking crises may lead depositors to anticipate a higher probability of bailout of large banks in future crises. In this case, we would expect a stronger TBTF effect in countries where authorities did not impose losses on depositors when there was a banking crisis. In our empirical analysis, we would therefore expect reduced sensitivity of the cost of deposits to bank risk for large banks in these countries. Conversely, we would expect a weaker TBTF effect, measured through greater

discipline exerted by depositors on large banks if the government imposed losses on depositors during a banking crisis in the country. Therefore, our hypothesis is:

H.1.: The TBTF effect is stronger in countries that did not impose losses on depositors during a banking crisis in the past.

The decision by authorities to apply a TBTF policy to avoid negative contagion effects may be limited by the real possibilities of public finances to bail out systemically large banks. The relative importance of a TBTF versus a TBTS effect may thus vary across countries depending on the soundness of the public finances and the systemic size of the failed bank. Brown and Dinç (2011) show that a greater government deficit reduces the likelihood of the government taking over or closing failed banks. Demirgüç-Kunt and Huizinga (2013) also show that the reduction in the market-to-book value of large banks increases with public deficit in a sample of 32 countries.

We analyze if differences in the sensitivity of the cost of deposits to bank risk among large and smaller banks depends on countries' public deficit. An increase in the sensitivity of funding cost to bank risk in large banks when the public deficit increases would be consistent with the presence of a TBTS effect. Moreover, proxies for systemic bank risk would capture better than absolute size proxies the presence of a TBTS effect because a bank may become too large to be saved depending on the relation between bank size and the size of the national economy. Following these arguments, we establish the second hypothesis:

H.2.: The relative importance of the TBTF effect versus the TBTS effect would be lower in systemically large banks, the larger the country's public deficit.

3. Data, variables, and methodology

3.1. Data

We use data from a variety of sources. Bank-level information comes from the Fitch-

IBCA Ltd. BankScope Database. Whenever they are available, we use consolidated bank balance-sheet and income-statement data. All data are expressed in US dollars and in real prices. As the BankScope Database began to provide information in 1989 we confine our analysis to the 1989-2007 period. The analysis ends in 2007 so covers only the period before the current financial crisis. The results do not change when the year 2007 is excluded. Our estimations use a panel data set for a maximum of 4,351 banks in 104 countries.

We use the Laeven and Valencia (2008) database to identify the episodes of banking crises. Information about the status of public finances comes from the World Bank's Doing Business database. Information on bank market concentration and development comes from the Bank Concentration and Financial Structure and Development databases at the World Bank (Beck and Demirgüç-Kunt, 2009). Macroeconomic data are obtained from the International Financial Statistics of the International Monetary Fund (IMF).

3.2. Variables

3.2.1. Dependent variable

We test the presence of market discipline by analyzing whether depositors penalize riskier banks by requiring higher interest rates. The dependent variable is the cost of deposits for bank *i* in country *j* in year *t* ($COSTD_{ijt}$). As BankScope does not provide specific data on the interest paid by banks on different types of deposits, we follow Martinez Peria and Schmukler (2001), Demirgüç-Kunt and Huizinga (2004), Hadad et al. (2011), and Cubillas et al. (2012) using an implicit interest rate. This is measured by the annual ratio of interest expense to interest-bearing debt of the bank minus the average interest rate in the country for that year, i.e., $COSTD_{ijt}$=InterestRatio$_{ijt}$-InterestRatio$_{jt}$, where $\sum_{jt} COSTD_{ijt}$=0. The average rate (InterestRatio$_{jt}$) is calculated as in Lown and Peristiani (1996) as a simple average of the interest expense to the interest-bearing debt ratio for banks in country *j* in year *t* using all the information available in BankScope. Expression of a rate as a deviation from its average in each year and for each country is intended to reveal rate premiums traditionally used in the

literature.

3.2.2. Bank risk

As the bank risk variable, we use a proxy for insolvency risk (ZSCORE). ZSCORE equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A four-year moving window is used to estimate standard deviations for each bank each year. A higher Z-score indicates that a bank is more stable because it is inversely related to the probability of bank insolvency. Because the Z-score is highly skewed, we use the natural logarithm of the Z-score, which is normally distributed. Laeven and Levine (2009), Cubillas et al. (2012) or Bertay et al. (2013), among others, have recently used the Z-score as a proxy for bank insolvency risk.

3.2.3. Size variables

We use several variables as proxies for bank size or larger banks potentially affected by a TBTF policy. We use both systemic and absolute measures of bank size. In systemic bank size proxies, we define bank size in relation to the size of the country. We use the bank`s assets to GDP ratio (SYSSIZE) as a proxy for systemic bank size. We also consider two dummy variables that take a value of one if the bank`s assets to GDP ratio exceeds 0.25 and 0.5, respectively. Otherwise these dummy variables take a value of zero. They are denoted SYSSIZE025 and SYSSIZE05. Moreover, we introduce a dummy variable that takes a value of one if the bank's share in the country's banks' total assets exceeds 5% and zero otherwise (MKSHARE5).

We use three proxies for absolute bank size. We use the natural logarithm of total bank assets (LOGTA). We also define two dummy variables: 3BANKS identifies with value one the three largest banks in terms of assets of each country for each year and zero otherwise; BIG75 takes a value of one if the bank´s size in terms of assets exceeds the 75th percentile of the distribution of the sample and zero otherwise.

An important feature of our approach is that we control for possible endogeneity of the measures of bank size. Endogeneity can arise when a TBTF policy provides incentives to increase bank size in order to make more likely to benefit from a possible bailout. To

address this potential endogeneity, we turn to instrumental variable techniques, using a GMM estimator and lags of all bank-level variables as their instruments. We also check the robustness of the results using alternative instruments to their own lags for our measures of bank size. We have selected as instruments, variables determining bank's efficiency, regulatory and institutional characteristics in a country, and two variables for market size. The traditional efficiency-structure hypothesis suggests that efficiency may be the driver of increases in bank size and market share (Berger, 1995). We therefore use our proxy for bank efficiency (OVERHEAD) as the instrument for bank size. The remaining instruments are defined following Cetorelli and Gambera (2001). The institutional variables are an indicator of the legal origin of a country and the Kaufman et al. (2001) index (KKZ). This index is calculated as the average of six indicators: voice and accountability in the political system, government effectiveness, regulatory quality, rule of law, and control of corruption. In addition to previous factors, market size may also affect bank size. The proxies for market size are the natural logarithm of the country's total population and its per capita Gross Domestic Product.

Table 1 shows the number of banks included by country in our sample and the number of systemically large banks according to our measures of SYSSIZE025, SYSSIZE05, and MKSHARE5. Figure 1 shows the evolution of banks for which four of these size variables take a value of one during 1989-2007 period for all countries in our sample. We can see how the number of banks considered large according to SYSSIZE025, SYSSIZE05, and MKSHARE5 variables increased over the 1989-2007 period.[1]

3.2.4. Control variables

We include country-level, bank-level, industry-level, and macroeconomic variables as control variables. Variables are defined following previous studies on market discipline (Demirgüç-Kunt and Huizinga, 2004; Hadad et al., 2011 or Cubillas et al., 2012).

[1] We do not show evolution of the number of banks for which 3BANKS and BIG75 take a value of 1 because, according to the definition of these variables, the number of banks classified as large does not vary over time.

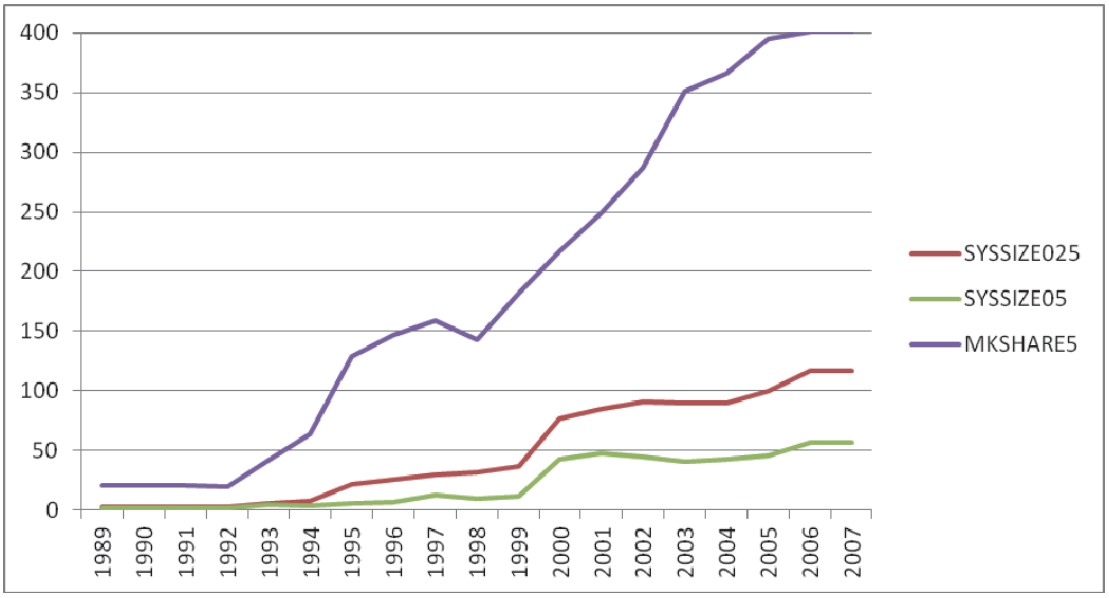
Table 1. Large banks by country

The number of large banks by country in our sample. We consider large banks to be those for which SYSSIZE025, SYSSIZE05, and MKSHARE5take the value of one. SYSSIZE025 and SYSSIZE05 are equal to one if the ratio of total bank assets to GDP exceeds 0.25 and 0.5, respectively. MKSHARE5 takes a value of one if the bank's share in the country's total assets exceeds 5%, and zero otherwise.

COUNTRY	# BANKS	SYSSIZE025	SYSSIZE05	MKSHARE5	COUNTRY	# BANKS	SYSSIZE025	SYSSIZE05	MKSHARE5
ALBANIA	7	0	0	4	KUWAIT	5	0	0	5
ALGERIA	7	0	0	2	KYRGYZSTAN	5	0	0	5
ANGOLA	7	0	0	3	LATVIA	27	0	0	11
ARGENTINA	43	0	0	5	LESOTHO	3	1	0	3
AUSTRALIA	21	4	1	5	LITHUANIA	8	0	0	6
AUSTRIA	64	2	1	5	LUXEMBOURG	108	30	21	8
BAHAMAS	13	3	1	4	MACEDONIA	9	0	0	4
BAHRAIN	13	3	3	6	MADAGASCAR	5	0	0	4
BANGLADESH	31	0	0	3	MALAYSIA	41	1	0	8
BELGIUM	48	6	4	6	MALI	4	0	0	4
BENIN	5	0	0	5	MALTA	8	3	2	4
BOLIVIA	10	0	0	8	MEXICO	19	0	0	7
BOTSWANA	3	0	0	2	MOLDOVA REP.	15	0	0	9
BRAZIL	150	0	0	8	MONGOLIA	6	0	0	5
BULGARIA	23	0	0	6	MOROCCO	9	1	0	9
BURKINA FASO	6	0	0	6	NETHERLANDS	48	4	2	4
BURUNDI	2	0	0	2	NEW ZEALAND	7	4	0	5
CAMBODIA	5	0	0	4	NIGER	2	0	0	2
CAMEROON	2	0	0	1	NIGERIA	24	0	0	7
CANADA	64	4	0	14	NORWAY	13	1	0	4
CAPE VERDE	4	2	1	3	PAKISTAN	22	0	0	7
CHILE	18	0	0	7	PANAMA	26	1	0	5
COLOMBIA	23	0	0	11	PARAGUAY	25	0	0	15
CROATIA	45	2	0	6	PERU	24	0	0	9
CZECH REP.	31	3	1	5	PHILIPPINES	33	0	0	11
DENMARK	62	2	2	5	POLAND	38	0	0	8
DOMINICAN REP.	24	0	0	6	PORTUGAL	30	2	1	7
EL SALVADOR	10	0	0	5	QATAR	5	0	0	4
ESTONIA	9	2	1	5	ROMANIA	23	0	0	6
ETHIOPIA	7	0	0	4	RUSSIAN FED.	710	0	0	3
FINLAND	10	2	1	6	SENEGAL	6	0	0	4
FRANCE	234	5	2	11	SEYCHELLES	2	1	0	2
GEORGIA REP.	12	0	0	7	SIERRA LEONE	4	0	0	4
GERMANY	233	4	2	7	SINGAPORE	14	3	3	6
GHANA	13	0	0	4	SLOVAKIA	15	2	0	4
GREECE	24	3	0	6	SLOVENIA	20	1	1	8
HONDURAS	18	0	0	6	SOUTH AFRICA	24	2	0	4
HONG KONG	36	3	2	4	SPAIN	92	2	2	6
HUNGARY	26	1	0	7	SRI LANKA	12	0	0	7
ICELAND	4	2	0	4	SUDAN	5	0	0	4
INDIA	67	0	0	10	SWAZILAND	4	0	0	4
INDONESIA	104	0	0	11	SWITZERLAND	226	5	4	5
IRAN	7	0	0	3	THAILAND	18	1	0	8
IRELAND	33	5	3	6	TOGO	2	0	0	2
ISRAEL	16	3	2	5	TRINIDAD&TOBAGO	11	2	0	8
ITALY	186	2	1	9	TUNISIA	16	0	0	14
IVORY COAST	8	0	0	7	TURKEY	19	0	0	6
JAMAICA	6	0	0	4	UNITED KINGDOM	134	6	2	8
JORDAN	11	3	2	3	URUGUAY	20	0	0	3
KAZAKHSTAN	18	0	0	9	USA	476	0	0	5
KENYA	33	0	0	7	VENEZUELA	46	0	0	15
KOREA REP.	19	1	0	10	ZAMBIA	8	0	0	7

Figure 1
Evolution of the number of large banks

The lines represent the evolution of number of banks for which SYSSIZE025, SYSSIZE05, and MKSHARE5 take the value of one. SYSSIZE025 and SYSSIZE05 are equal to one if ratio of total bank assets to GDP exceeds 0.25 and 0.5, respectively. MKSHARE5 takes a value of one if the bank's share in the country's total assets exceeds 5%, and zero otherwise.



As country-level variables, we include PASTCRISIS and DEFICIT. PASTCRISIS is a dummy variable that takes a value of one if the country is not currently experiencing a banking crisis but has suffered a banking crisis in any previous year according to the Laeven and Valencia (2008) database. Otherwise, this variable takes a value of zero. In case of a country that did not suffer a banking crisis during this period, PASTCRISIS takes the value of zero for all years. The fact that we did not exclude countries allows us to compare countries that experienced crises with countries that did not in order to test the extent to which a banking crisis may influence the market discipline that depositors exert on big banks.

We define DEFICIT as a dummy variable that takes the value of 1 if the country's budget balance (surplus or deficit) over GDP is above the 65th percentile in our sample, 2 when it is between the 35th and 65th percentile, and 3 when it is below the 35th percentile. Thus, higher values of this variable indicate higher levels of public deficit and, therefore, greater difficulties for governments to bear the costs associated with bank rescues. To construct this variable we take as reference the public cash over GDP

ratio provided by International Monetary Fund statistics. In our sample, the 65th and 35th percentiles are -0.57 and -2.43, respectively, with the minimum value of the variable being -202.70 and the maximum value 40.43.

As bank-specific characteristics we include the percentage of customer deposits (CUSTOMERD), overhead costs (OVERHEAD), and the Lerner index (LERNER). CUSTOMERD is the ratio of customer deposits to total interest-bearing liabilities. As BankScope does not provide information on bank interest expenses by type of deposit, we use this variable to control for the percentage of bank deposits that are generally insured and are less sensitive to market discipline. We do not make a clear forecast for the expected coefficient of CUSTOMERD as differences in maturity also affect interest rates for deposits and this information is not available on BankScope.

As in Demirgüç-Kunt and Huizinga (2004), OVERHEAD is defined as non-interest bank expenses divided by assets. Differences in OVERHEAD may capture differences in employment or wage levels as well as banks' product mixes and quality of service. Higher expenditure may be associated with less efficient banks and thus lower interest rates on deposits, according to the traditional efficient-structure hypothesis (Berger and Hannan, 1989). Higher expenditure to total assets, however, may also be associated with better service to customers. If we could control for quality of service, we would expect an increase in non-interest expenditure to have a positive impact on interest rates. In our case, given that we cannot control for the quality of bank services, the effect of this variable on interest rates is unclear.

LERNER, as a banking competition variable, is a proxy for bank market power, defined as the difference between price and marginal cost expressed as a percentage of price.[2] We do not predict a clear sign for LERNER as banks may use greater market power to pay lower interest rates on their deposits but they may also use it to pay higher interest rates to continue increasing their market power (Hadad et al., 2011; Cubillas et al., 2012).

[2] We estimate a single indicator of the Lerner index using the same procedure as Maudos and Fernández de Guevara (2004) and Fonseca and González (2010).

Table 2. Descriptive statistics and correlations

COSTDEP is the cost of deposits measured as the difference between the ratio of the annual interest expense to interest-bearing debt for each bank and the average interest rate for each country in the respective year. ZSCORE is the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A four-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. SYSSIZE is the ratio of total bank assets to GDP. LOGTA is the natural logarithm of total bank assets. PASTCRISIS is a dummy variable that takes a value of one if the country is not currently experiencing a banking crisis but has experienced a banking crisis in previous years according to the Laeven and Valencia (2008) database. DEFICIT is a dummy variable that takes the value of one if the public cash surplus/deficit over GDP exceeds the 65th percentile of the distribution of the sample, the value of 2 when it is between the 35th and 65th percentile and the value of three when it is less than the 35th percentile. CUSTOMERD is the percentage of customer deposits to total interest-bearing liabilities. OVERHEAD is personnel expenses and other non-interest expenses over total assets. LERNER is the Lerner index and is defined as the difference between price (interest rate) and marginal cost expressed as a percentage of price. CONC is the fraction of assets of the three largest banks as a share of assets of all commercial banks. PRIVATECRED is private credit by deposit money banks and other financial institutions over GDP. GDPGR is the annual growth rate of real GDP per capita. INFLATION is the annual inflation rate from the GDP deflator. Bank data are from the BankScope data base of Fitch IBCA, macro data are from the IMF's International Financial Statistics. The sample period is 1989-2007.

Panel A: Descriptive statistics

	COSTDEP	ZSCORE	SYSSIZE	LOGTA	PASTCRISIS	DEFICIT	CUSTOMERD	OVERHEAD	LERNER	CONC	PRIVATECRED	GDPGR	INFLATION
Mean	-0.0002	1.4095	0.0424	6.0624	0.2873	2.0027	0.5996	0.0386	0.4295	0.5458	0.8937	0.0331	4.7504
Std. Dev.	0.0242	0.4614	0.1902	0.9328	0.4525	0.8406	0.2879	0.0381	0.1503	0.2145	0.5598	0.1092	28.0744
Median	-0.0017	1.4129	0.0019	5.9801	0	2	0.6701	0.0288	0.4369	0.5533	0.8588	0.0200	2.4390
Minimum	-0.1907	-1.4792	1.74E-07	2.2407	0	1	0	0.0001	0.0000	0.1484	0.0170	-0.9600	-11.4310
Maximum	0.3583	4.1019	5.5364	9.3655	1	3	0.9998	1.4745	0.9950	1	1.9473	0.4800	2477.15

Panel B: Correlations

	COSTDEP	ZSCORE	SYSSIZE	LOGTA	PASTCRISIS	DEFICIT	CUSTOMERD	OVERHEAD	LERNER	CONC	PRIVATECRED	GDPGR	INFLATION
ZSCORE	0.0248***												
SYSTEMSIZE	0.0127*	0.0186***											
LOGTA	-0.0156**	0.0169**	0.3651***										
PASTCRISIS	-0.0021	-0.2126***	-0.0215***	-0.2163***									
DEFICIT	-0.0173**	-0.0265***	-0.0717***	0.1394***	-0.0229***								
CUSTOMERD	-0.0773***	0.0221***	-0.0458***	-0.0648***	-0.0006	0.1067***							
OVERHEAD	-0.0103	-0.1751***	-0.1123***	-0.3588***	0.2525***	-0.0516***	0.0191***						
LERNER	-0.2817***	0.0950***	-0.0704***	-0.1638***	0.0884***	-0.0672***	0.2162***	0.1103***					
CONC	0.0031	0.0725***	0.0893***	0.0343***	-0.2527***	-0.0554***	-0.0080	-0.0897***	-0.0641***				
PRIVATECRED	0.0026	0.2786***	0.0207***	0.2591***	-0.6268***	0.0151**	0.0430***	-0.2363***	0.0093	0.0565***			
GDPGR	-0.0061	0.0366***	0.0155**	-0.0436***	0.1451***	-0.1030***	-0.0571***	-0.0041	0.1435***	-0.0749***	-0.0696***		
INFLATION	0.0075	-0.0552***	-0.0145**	-0.0107	0.1104***	-0.0029	-0.0037	0.1955***	0.0161**	-0.0304***	-0.1115***	-0.1811***	1

We use two industry-level variables as control variables following Beck et al. (2006), Hadad et al. (2011), and Cubillas et al. (2012): (1) CONC, as a market structure variable, is a proxy for bank concentration, defined as the fraction of assets of the three largest banks as a share of assets of all commercial banks; and (2) PRIVATECRED, as a proxy for bank development, is the private credit by deposit money banks and other financial institutions over GDP. Finally, we include macroeconomic characteristics as control variables. We follow Demirgüç-Kunt and Huizinga (2004) and Hadad et al. (2011) and control for the real gross domestic product growth (GDPGR) and inflation rate (INFLATION) of country *j* in year *t*.

Table 2 reports descriptive statistics in Panel A and correlations in Panel B for country-level, bank-level, industry-level, and macroeconomic variables.

3.3. Methodology

We apply a two-step system-GMM and specify the robust estimator of the variance-covariance matrix. A system-GMM is a variant of the GMM estimation method originally proposed by Arellano and Bond (1991) and Arellano and Bover (1995) and subsequently improved by Blundell and Bond (1998). The system-GMM estimator combines the difference equation with a level equation to form a system of equations for estimation purposes.[3]

The GMM methodology is specifically designed to address three relevant econometric issues: (1) control of unobservable bank heterogeneity; (2) autoregression in the data regarding the behavior of cost of deposits (i.e., the need to use a lagged dependent variables model to capture the dynamic nature of the cost of deposits); and (3) likely endogeneity in the explanatory variables when we use bank level data. Especially relevant is control for potential endogeneity of bank size because TBTF or TBTS policies not only affect bank risk-taking or market discipline exerted by depositors but also incentives of banks to increase their size. This influence could bias estimates that do not control for endogeneity of bank size or other bank-level explanatory variables.

[3] The presence of heteroskedascity in the error term leads us to use the robust estimator. This estimator allows us to relax the assumption that the error term is identically distributed and also to use standard errors to make valid statistical inference about our coefficients.

The panel estimator controls for this potential endogeneity by using instruments based on lagged values of the explanatory variables.

Besides, the GMM system estimator has two advantages over other dynamic panel data methods, such as the difference-in-difference estimator proposed by Arellano and Bond (1991). First, as long as the instruments are valid, the GMM estimator exhibits higher levels of both consistency and efficiency. Second, unlike the difference estimator, the system GMM estimator allows for the use of time-invariant (or highly persistent) variables in our specifications. Finally, the validity of the GMM system estimator approach rests on two testable assumptions. First, for the instruments to be valid, they need to be uncorrelated with the error term. We use the Hansen J-statistic of over-identifying restrictions to test this assumption (where statistically insignificant values confirm the validity of the instruments). Second, the system GMM estimator requires the absence of second-order serial correlation in the first difference residual. We employ the m_2 statistic developed by Arellano and Bond (1991) to test for a lack of second-order serial correlation in the first-difference residual. An insignificant m_2 statistic indicates that the model is correctly specified.

The basic model is:

$$
\begin{aligned}
COSTDEP_{ijt} = {} & \alpha_0 + \alpha_1\, COSTDEP_{ijt-1} \\
& + \alpha_2\, ZSCORE_{ijt} \\
& + \alpha_3\, SIZE_{ijt} \\
& + \alpha_4\, ZSCORE_{ijt} \times SIZE_{ijt} \\
& + \alpha_5\, PASTCRISIS_{jt} \\
& + \alpha_6\, DEFICIT_{jt} \\
& + \alpha_7\, BANK_{ijt} \\
& + \alpha_8\, INDUSTRY_{jt} \\
& + \alpha_9\, MACRO_{jt} \\
& + \theta_j + \lambda_t + \varphi_{jt} + \mu_i + \varepsilon_{ijt} \qquad [1]
\end{aligned}
$$

where *i*, *j*, *t* refer to the bank, country, and year, respectively. $COSTDEP_{ijt}$ is the cost of deposits of bank *i* in country *j* in year *t*. $ZSCORE_{ijt}$ is our proxy for insolvency risk of bank *i* in country *j* in year t. SIZE is a vector of the alternative dummy variables identifying the bank size or larger banks. It includes four

proxies for systemic bank size (SYSSIZE, SYSSIZE025, SYSSIZE05, and MKSHARE5) and three proxies for absolute bank size (LOGTA, BIG75, and 3BANKS).

In our specification, α_2 measures the importance of market discipline in smaller banks, and α_4 captures how different market discipline is in banks classified as larger banks. As higher values of ZSCORE indicate lower levels of bank risk, the presence of market discipline in banks that are not considered too big to fail would imply a negative value for α_2. Weaker market discipline in larger banks, consistent with the TBTF hypothesis, would imply a positive value for α_4. However, a negative value of α_4 would indicate stronger market discipline in larger banks and would be consistent with the TBTS hypothesis.

PASTCRISIS is a dummy variable that takes a value of one if the country suffered a banking crisis in the past and zero otherwise. DEFICIT is the proxy dummy variable for the public deficit in a country. $BANK_{ijt}$ and $INDUSTRY_{jt}$ are, respectively, the vector of bank-level and industry-level control variables. $MACRO_{jt}$ is the vector of macroeconomic variables. An additional three specific effects - country, year, and bank-specific effects - should control for most shocks affecting the cost of deposits. θ_j is a set of country dummy variables to control for characteristics that are specific to each country, as long as these are persistent over time. λ_t is a set of dummy time variables to capture any unobserved bank-invariant time effects not included in the regression. φ_{jt} is a country-year specific effect. It includes, for instance, the development of financial markets, monetary policy or aggregate country-specific shocks in any particular year. μ_i is an unobservable bank-specific effect, which is assumed to be constant over time. Finally, ε_{ijt} is the white noise error term.

To analyze how differences in market discipline in large and smaller banks varies across countries depending on the TBTF policies adopted in past crises or depending on the status of the country's public finances, we interact ZSCORE and ZSCORE x SIZE alternatively, with PASTCRISIS and DEFICIT dummy variables.

The model is:

$$
\begin{aligned}
COSTDEP_{ijt} &= \beta_0 + \beta_1\, COSTDEP_{ijt-1} \\
&+ \beta_2\, ZSCORE_{ijt} \\
&+ \beta_3\, SIZE_{ijt} \\
&+ \beta_4\, ZSCORE_{ijt} \times SIZE_{ijt} \\
&+ \beta_5\, ZSCORE_{ijt} \times (PASTCRISIS_{jt})/(DEFICIT_{jt}) \\
&+ \beta_6\, ZSCORE_{ijt} \times SIZE_{ijt} \times (PASTCRISIS_{jt})/(DEFICIT_{jt}) \\
&+ \beta_7\, PASTCRISIS_{ijt} \\
&+ \beta_8\, DEFICIT_{ijt} \\
&+ \beta_9\, BANK_{ijt} \\
&+ \beta_{10}\, INDUSTRY_{jt} \\
&+ \beta_{11}\, MACRO_{jt} \\
&+ \theta_j + \lambda_t + \varphi_{jt} + \mu_i + \varepsilon_{ijt} \qquad [2]
\end{aligned}
$$

In this specification, when we interact with PASTCRISIS, β_2 captures the presence of market discipline in smaller banks for countries that have not suffered a banking crisis. β_4 indicates how different market discipline is in large banks for these countries. β_5 captures how different market discipline is for smaller banks in countries that have suffered a banking crisis. β_6 indicates how different market discipline is for large banks when the country has suffered a banking crisis. The same interpretation applies when we interact with DEFICIT, i.e., β_5 and β_6, for instance, would indicate how different market discipline is, respectively, in smaller and large banks when a country has high levels of public deficit.

4. Empirical results

4.1. Market discipline and bank size

Table 3 reports the results of model [1] using proxies for systemic size (columns 1 to 4) and absolute bank size (columns 5 to 7). The m_2 statistic allows us to reject the null hypothesis of the absence of second-order serial correlation in the first-difference residuals. The statistically non-significant values for the Hansen J-statistic of over-identifying restrictions confirm the validity of the instruments in all estimations. The positive and significant coefficients of

$COSTDEP_{ijt-1}$ in all the estimations confirm the convenience of a partial adjustment model to explain the dynamic nature of cost of bank deposits.

The negative and statistically significant coefficients of ZSCORE in six of the seven estimations are consistent with the presence of market discipline in smaller banks. Though negative, the only non-significant coefficient appears in column (5), when we use the natural logarithm of bank assets as proxy for absolute bank size. The coefficients of the interaction term between ZSCORE and the proxy for bank size, ZSCORE x SIZE, are positive and statistically significant in all the estimations. These results suggest that on average depositors exercise weaker market discipline in larger banks, using both absolute and systemic size measures in our international bank database. They are consistent with the TBTF hypothesis and depositors' expectations of a government bailout in case of failure of a large bank.

The change in market discipline across banks depending on their size is also important in economic terms. Using, for instance, the results in column (2) of Table 3, an increase of one standard deviation in the ZSCORE (0.4614) would reduce the interest rate on deposits in banks whose assets are lower than 25% of the country's GDP by a 13% of its standard deviation. For banks whose assets exceed 25% of the country's GDP, however, the cost of deposits would not fall if the ZSCORE increases. Similarly, using measures of absolute bank size, an increase of one standard deviation in bank assets (0.9328) would reduce the sensitivity of the cost of deposits to bank risk by 0.57 times the standard deviation of the cost of deposits.

These findings, consistent with the predominance on average of the TBTF effect, are different to those in Bertay et al. (2013). They find in systemically large banks a stronger sensitivity of funding cost to bank risk, suggesting the predominance of a TBTS effect. Several reasons relating to the sample and the methodology may explain the differences in the results. Bertay et al. (2013) analyze publicly-traded banks in 90 countries whereas we analyze publicly-traded and non- publicly-traded banks in 104 countries. Systemically large banks may thus have a higher relative weight in their sample and lead to the predominance of the TBTS effect. Moreover, their analysis period (1991-2009)

includes part of the current global financial crisis, where the greater difficulties for public finance may increase the importance of a TBTS effect. Moreover, we use a different estimation technique, the GMM system versus their OLS estimations with country and year fixed effects.

Regarding other control variables, the coefficients of SIZE are statistically significant and negative in six of the seven estimations. This indicates that deposit rates are on average lower in systemically and absolute large banks. The negative coefficients of PASTCRISIS are statistically significant in columns (1), (3), and (6). It suggests that banks pay on average lower interest rates for their deposits after suffering a banking crisis in the country. DEFICIT also has negative coefficients, although only the coefficient in column (2) is statistically significant at conventional levels.

The non-significant coefficients of CUSTOMERD indicate that banks do not pay on average lower interest rates for their customer deposits. They suggest that the deposit insurance is not fully credible because even insured deposits exercise market discipline in our sample. Cook and Spellman (1994) for US banks, Martinez Peria and Schmukler (2001) using data from Argentina, Chile, and Mexico, and Cubillas et al. (2012) in an international sample of banks in countries that have suffered a banking crisis, find a similar result. Nor are the coefficients of OVERHEAD significant for explaining the cost of bank deposits. LERNER has statistically negative coefficients in all estimations, consistent with banks with greater market power paying on average lower interest rates for their deposits.

CONC is associated with higher interest rates for bank deposits in five of the seven estimations. The proxy for bank development (PRIVATECRED) has only a statistically negative coefficient in column (5). GDP growth is associated in all the estimations with lower interest rates for deposits. Finally, INFLATION only presents significant and positive coefficients in columns (4) and (6).

Table 3. Market discipline and bank size

Regressions are estimated using the two-step GMM system estimator for panel data with the robust estimator of variance. The dependent variable is the cost of deposits (COSTDEP). As explanatory variables, we include one lag of the dependent variable ($COSTDEP_{t-1}$). ZSCORE is the natural logarithm of Zscore. Zscore equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A four-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. SIZE is a vector of several variables identifying systemic and absolute bank size. SYSSIZE is the ratio of total bank assets to GDP. SYSSIZE025 and SYSSIZE05 are equal to one if ratio of total bank assets to GDP exceeds 0.25 and 0.5, respectively. They are zero otherwise. MKSHARE5 takes a value of one if the bank's share in the country's total assets exceeds 5%, and zero otherwise. LOGTA is the natural logarithm of total bank assets. 3BANKS identifies with the value of one the three largest banks of each country in terms of assets. BIG75 takes a value of one if the bank´s size in terms of assets exceeds the 75th percentile of the distribution of the sample and zero otherwise. PASTCRISIS is a dummy variable that takes a value of one if the country is not currently experiencing a banking crisis but has experienced a banking crisis in previous years according to the Laeven and Valencia (2008) database. DEFICIT is a dummy variable that takes the value of one if the public cash surplus/deficit over GDP exceeds the 65th percentile of the distribution of the sample, the value of 2 when it is between the 35th and 65th percentile and the value of three when it is less than the 35th percentile. CUSTOMERD is the percentage of customer deposits to total interest-bearing liabilities. OVERHEAD is personnel expenses and other non-interest expenses over total assets. LERNER is the Lerner index and is defined as the difference between price (interest rate) and marginal cost expressed as a percentage of price. CONC is the fraction of assets of the three largest banks as a share of assets of all commercial banks. PRIVATECRED is private credit by deposit money banks and other financial institutions over GDP. GDPGR is the annual growth rate of real GDP per capita. INFLATION is the annual inflation rate from the GDP deflator. Bank data are from the BankScope data base of Fitch IBCA and macro data are from the IMF's International Financial Statistics. The sample period is 1989-2007. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable: COSTDEP							
	SYSTEMIC SIZE				ABSOLUTE SIZE		
Size variables (SIZE):	SYSSIZE (1)	SYSSIZE025 (2)	SYSSIZE05 (3)	MKSHARE5 (4)	LOGTA (5)	3BANKS (6)	BIG75 (7)
$COSTDEP_{t-1}$	0.2615*** (7.10)	0.2644*** (7.40)	0.2687*** (7.40)	0.2583*** (7.11)	0.2528*** (7.00)	0.2592*** (7.02)	0.2566*** (7.27)
ZSCORE	-0.0090*** (-3.97)	-0.0068*** (-4.10)	-0.0068*** (-4.20)	-0.0084*** (-4.55)	-0.0608 (-1.58)	-0.0078*** (-4.30)	-0.0118*** (-4.94)
ZSCORE x SIZE	0.0915*** (2.79)	0.0123** (2.53)	0.0240* (1.66)	0.0143*** (3.23)	0.0105* (1.65)	0.0165*** (2.73)	0.0186*** (3.67)
SIZE	-0.1505** (-2.54)	-0.0203** (-2.43)	-0.0395* (-1.74)	-0.0198*** (-2.55)	0.0336 (0.99)	-0.0207* (-1.97)	-0.0274*** (-3.28)
PASTCRISIS	-0.0033* (-1.67)	-0.0023 (-1.20)	-0.0033* (-1.69)	-0.0020 (-1.06)	-0.0003 (-0.13)	-0.0031* (-1.66)	-0.0031 (-1.62)
DEFICIT	-0.0004 (-1.41)	-0.0005* (-1.68)	-0.0004 (-1.26)	-0.0005 (-1.55)	-0.0002 (-0.71)	-0.0005 (-1.48)	-0.0005 (-1.51)
CUSTOMERD	-0.0028 (-0.44)	-0.0044 (-0.70)	-0.0010 (-0.15)	-0.0007 (-0.10)	0.0030 (0.36)	-0.0016 (-0.24)	-0.0024 (-0.37)
OVERHEAD	-0.0337 (-0.48)	-0.0244 (-0.34)	-0.0431 (-0.56)	-0.0658 (-0.83)	-0.0718 (-0.66)	-0.0532 (-0.69)	-0.0183 (-0.22)
LERNER	-0.0548*** (-3.69)	-0.0530*** (-3.62)	-0.0576*** (-3.89)	-0.0588*** (-3.80)	-0.0782*** (-4.66)	-0.0616*** (-4.00)	-0.0653*** (-4.22)
CONC	0.0037 (1.64)	0.0036* (1.80)	0.0037* (1.88)	0.0044** (2.13)	0.0025 (0.99)	0.0044** (2.08)	0.0037* (1.85)
PRIVATECRED	-0.0010 (-0.79)	-0.0009 (-0.68)	-0.0008 (-0.61)	-0.0010 (-0.73)	-0.0065*** (-3.53)	-0.0012 (-0.88)	0.0004 (0.32)
GDPGR	-0.0100** (-2.15)	-0.0100** (-2.16)	-0.0091** (-1.97)	-0.0089** (-1.99)	-0.0113** (-2.11)	-0.0085* (-1.92)	-0.0081* (-1.75)
INFLATION	0.00003 (1.11)	0.00003 (1.25)	0.00004 (1.41)	0.00005* (1.77)	0.00005 (1.62)	0.00004* (1.68)	0.00004 (1.30)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
m_1 statistic	-8.97***	-9.03***	-8.99***	-9.15***	-9.32***	-9.03***	-9.22***
m_2 statistic	-0.45	-0.48	-0.45	-0.47	-0.61	-0.54	-0.53
Hansen J statistic	32.65 (25)	28.52 (25)	27.55 (23)	22.52 (21)	24.98 (23)	20.72 (21)	20.16 (17)
# observations	22,170	22,170	22,170	22,170	22,170	22,170	22,170
# banks	4,351	4,351	4,351	4,351	4,351	4,351	4,351
# countries	104	104	104	104	104	104	104

4.2. Market discipline and bank size after a banking crisis

We now analyze how the experience of a past banking crisis in the country shapes differences in market discipline across banks of different sizes. Table 4 shows the results for model [2], where we add the interactions of ZSCORE x

PASTCRISIS and ZSCORE x SIZE x PASTCRISIS. So, ZSCORE and ZSCORE x SIZE capture, respectively, the presence of market discipline in smaller banks and the difference in large banks but only in countries that have not suffered a banking crisis in the past. ZSCORE x PASTCRISIS and ZSCORE x SIZE x PASTCRISIS would indicate, respectively, how different market discipline is for smaller banks in countries that have suffered a banking crisis and how different market discipline is for systemically and absolute large banks when the country has suffered a banking crisis in the past.

The coefficients of ZSCORE are negative and statistically significant in all the estimations, confirming the presence of market discipline in smaller banks in countries without a banking crisis in the past. The positive and significant coefficients of the interaction term between ZSCORE and SIZE in six estimations indicates a weakening of market discipline in absolute and systemically large banks in countries without a banking crisis in the past. The positive coefficient of ZSCORE x SIZE is only non-statistically significant when we use the ratio of bank assets to country's GDP as the proxy for systemic bank size.

The coefficients of ZSCORE x PASTCRISIS are mostly non-statistically significant. Only the coefficient in column (5) is negative and significant at conventional levels. The non-significant coefficients of ZSCORE x PASTCRISIS indicate that suffering a banking crisis in the past does not change the extent of market discipline exerted by depositors in smaller banks. However, the coefficients of the triple interaction term ZSCORE x SIZE x PASTCRISIS are positive and significant in five of the seven estimations. Though positive, the coefficients of this triple interaction term are non-significant in columns (3) and (7). These positive coefficients indicate that the weakening of market discipline in large banks, compared to smaller ones, is greater after the country suffers a banking crisis. This result is consistent with our H.1. It suggests that depositors have fewer incentives to exercise market discipline if they anticipate that governments will adopt measures to rescue banks considered too-big-to-fail and that accommodative intervention policies are on average applied to resolve a banking crisis. Therefore, if during previous banking crises, governments have adopted TBTF policies, depositors may expect measures along the same lines

to be applied in the future when a new banking crisis occurs. This fact intensifies the weaker market discipline in large banks in countries that have suffered a crisis in the past.

Table 4. Market discipline and bank size after a banking crisis

Regressions are estimated using the two-step GMM system estimator for panel data with the robust estimator of variance. The dependent variable is the cost of deposits (COSTDEP). As explanatory variables, we include one lag of the dependent variable ($COSTDEP_{t-1}$). ZSCORE is the natural logarithm of Zscore. Zscore equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A four-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. SIZE is a vector of several variables identifying systemic and absolute bank size. SYSSIZE is the ratio of total bank assets to GDP. SYSSIZE025 and SYSSIZE05 are equal to one if ratio of total bank assets to GDP exceeds 0.25 and 0.5, respectively. They are zero otherwise. MKSHARE5 takes a value of one if the bank's share in the country's total assets exceeds 5%, and zero otherwise. LOGTA is the natural logarithm of total bank assets. 3BANKS identifies with the value of one the three largest banks of each country in terms of assets. PASTCRISIS is a dummy variable that takes a value of one if the country is not currently experiencing a banking crisis but has experienced a banking crisis in previous years according to the Laeven and Valencia (2008) database. DEFICIT is a dummy variable that takes the value of one if the public cash surplus/deficit over GDP exceeds the 65th percentile of the distribution of the sample, the value of 2 when it is between the 35th and 65th percentile and the value of three when it is less than the 35th percentile CUSTOMERD is the percentage of customer deposits to total interest-bearing liabilities. OVERHEAD is personnel expenses and other non-interest expenses over total assets. LERNER is the Lerner index and is defined as the difference between price (interest rate) and marginal cost expressed as a percentage of price. CONC is the fraction of assets of the three largest banks as a share of assets of all commercial banks. PRIVATECRED is private credit by deposit money banks and other financial institutions over GDP. GDPGR is the annual growth rate of real GDP per capita. INFLATION is the annual inflation rate from the GDP deflator. Bank data are from the BankScope data base of Fitch IBCA and macro data are from the IMF's International Financial Statistics. The sample period is 1989-2007. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable: COSTDEP							
	SYSTEMIC SIZE				ABSOLUTE SIZE		
Size variables (SIZE):	SYSSIZE	SYSSIZE025	SYSSIZE05	MKSHARE5	LOGTA	3BANKS	BIG75
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$COSTDEP_{t-1}$	0.2339***	0.2797***	0.2745***	0.2725***	0.2643***	0.2637***	0.2561***
	(6.59)	(6.83)	(6.94)	(7.41)	(7.55)	(7.13)	(7.29)
ZSCORE	-0.0044*	-0.0060***	-0.0061***	-0.0063***	-0.1716***	-0.0063***	-0.0112***
	(-1.91)	(-3.49)	(-3.30)	(-3.37)	(-2.97)	(-3.34)	(-4.67)
ZSCORE x SIZE	0.0224	0.0106**	0.0229*	0.0092**	0.0268***	0.0127**	0.0183***
	(0.71)	(2.27)	(1.67)	(2.06)	(2.94)	(2.39)	(4.39)
ZSCORE x PASTCRISIS	-0.0035	-0.0016	-0.0027	-0.0095*	-0.0325	-0.0071	-0.0021
	(-0.71)	(-0.32)	(-0.44)	(-1.75)	(-0.98)	(-1.37)	(-0.43)
ZSCORE x SIZE x PASTCRISIS	0.2032***	0.0045*	0.0009	0.0112***	0.0105*	0.0127**	0.0039
	(4.26)	(1.68)	(0.15)	(2.86)	(1.83)	(2.42)	(1.50)
SIZE	-0.2617	-0.0203**	-0.0377*	-0.0188**	0.0032	-0.0207*	-0.0285***
	(-0.39)	(-2.40)	(-1.83)	(-2.43)	(0.10)	(-1.97)	(-4.00)
PASTCRISIS	-0.0063	-0.0010	-0.0004	0.0054	-0.0314**	0.0020	-0.0009
	(-0.97)	(-0.16)	(-0.06)	(0.82)	(-2.37)	(0.32)	(-0.15)
DEFICIT	-0.0005	-0.0003	-0.0003	-0.0004	-0.0004	-0.0004	-0.0005
	(-1.59)	(-1.10)	(-0.71)	(-1.38)	(-1.29)	(-1.21)	(-1.63)
CUSTOMERD	-0.0040	-0.0008	0.0010	-0.0028	-0.0050	-0.0024	-0.0027
	(-0.64)	(-0.13)	(0.10)	(-0.39)	(-0.81)	(-0.34)	(-0.41)
OVERHEAD	0.0581	-0.0862	-0.0910	-0.0609	0.0842	-0.0464	-0.0405
	(0.69)	(-1.38)	(-0.81)	(-0.73)	(0.88)	(-0.57)	(-0.50)
LERNER	-0.0751***	-0.0618***	-0.0505***	-0.0558***	-0.0746***	-0.0601***	-0.0676***
	(-5.06)	(-4.19)	(-2.68)	(-3.44)	(-4.61)	(-3.75)	(-4.34)
CONC	0.0016	0.0039*	0.0036	0.0043**	0.0003	0.0040*	0.0036*
	(0.72)	(2.00)	(1.52)	(2.05)	(0.12)	(1.90)	(1.81)
PRIVATECRED	-0.0039***	-0.0011	-0.0008	-0.0018	-0.0031	-0.0016	-0.00003
	(-2.81)	(-0.83)	(-0.62)	(-1.29)	(-1.65)	(-1.17)	(-0.02)
GDPGR	-0.0058	-0.0069	-0.0068	-0.0083*	-0.0115**	-0.0069	-0.0078*
	(-1.28)	(-1.54)	(-1.30)	(-1.84)	(-2.14)	(-1.56)	(-1.71)
INFLATION	0.00003	0.00005**	0.00005	0.00004	0.00001	0.00004	0.00004
	(1.41)	(2.06)	(1.62)	(1.34)	(0.53)	(1.27)	(1.24)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
m_1 statistic	-8.83***	-8.69***	-8.71***	-9.17***	-9.29***	-8.97***	-9.15***
m_2 statistic	-0.59	-0.34	-0.41	-0.31	-0.73	-0.48	-0.51
Hansen J statistic	48.83** (33)	41.22 (33)	41.17 (33)	26.00 (21)	32.55 (25)	23.95 (21)	25.37 (25)
# observations	22,170	22,170	22,170	22,170	22,170	22,170	22,170
# banks	4,351	4,351	4,351	4,351	4,351	4,351	4,351
# countries	104	104	104	104	104	104	104

The coefficients of the remaining explanatory variables (country-level, bank-level, and industry-level control variables) are similar to those in Table 3. Again, the m_2 statistic allows us to reject the lack of second-order serial correlation in the first-difference residuals. The non-significant values of the Hansen J-statistic confirm the validity of the instruments in six of the seven estimations. Only in column (1), using SYSSIZE as proxy for systemic bank size, we should be cautious when interpreting the effect of past banking crisis on market discipline.

In Table 5 we replicate our basic estimation in four subsamples to analyze the impact of the type of intervention adopted during a past banking crisis on differences in market discipline across banks of different sizes. We analyze separately the following sub-samples: 1) countries that have not suffered a banking crisis; 2) countries that have suffered a banking crisis, in which case the subsample is split into two additional sub-samples: 3) countries that did not impose losses on depositors during the banking crisis; and 4) countries that did impose losses on depositors during the banking crisis. We use information provided by Laeven and Valencia (2008) to classify whether or not governments imposed losses on depositors during the banking crisis. To save space, we only show the results for the main variables of interest (ZSCORE and ZSCORE x SIZE). The coefficients of the remaining variables are similar to those in Table 3.

We report in Panel A the results for the subsample of countries that have not suffered a banking crisis in the past. Coefficients of ZSCORE are negative and statistically significant in six of the seven regressions, confirming that on average depositors exercise market discipline in smaller banks. The coefficients of ZSCORE x SIZE are positive in all the estimations but only statistically significant in columns (2) and (7). The results in Panel B for the subsample of countries that have suffered a banking crisis in the past suggest the presence of a stronger TBTF effect. In this subsample, we find positive and significant coefficients of ZSCORE x SIZE for six proxies for systemic and absolute bank size. Only the coefficient in column (3) is not statistically significant. This result confirms findings in Table 4 suggesting a stronger TBTF effect after a banking crisis in the country as a consequence of the usual extension of the safety nets during the banking crisis.

We specifically analyze the type of intervention during the banking crisis in Panels C and D. We now split the sample of countries that have experienced a banking crisis (Panel B) depending on whether or not governments did not impose (Panel C) or did impose (Panel D) losses on depositors. The results in Panel C are similar to those in Panel B. The negative and significant coefficients of ZSCORE and the positive and significant coefficients of ZSCORE x SIZE in six estimations confirm, respectively, the presence of market discipline in smaller banks and weaker market discipline in large banks compared to smaller banks. The results in Panel D, however, suggest a weaker TBTF effect in countries that experienced a banking crisis in the past in which the government imposed losses on depositors. The negative and significant coefficients of ZSCORE in all the estimations also confirm the presence of market discipline in smaller banks for this subsample of countries. However, the coefficients of ZSCORE x SIZE are positive and significant only in columns (4) and (5), suggesting a lower relevance of the TBTF effect in countries that imposed losses on depositors when a banking crisis occurred. These results suggest that the type of intervention during a banking crisis shapes depositors' expectations for government intervention in the future and is consistent with an increase in moral hazard problems when accommodative intervention policies are applied to solve current banking crises.

Table 5. Market discipline, bank size and depositors losses in banking crises

Regressions are separately estimated in four subsamples. Panel A reports the results of model [2] for banks in countries that have not suffered a banking crisis. Panel B reports the results for banks in countries that have suffered a banking crisis. Panel C reports the results for banks in countries that suffered a banking crisis and did not impose losses on depositors. Panel D reports the results for banks in countries that suffered a banking crisis and imposed losses on depositors. Regressions are estimated using the two-step GMM system estimator for panel data with the robust estimator of variance. The dependent variable is the cost of deposits (COSTDEP). As explanatory variables, we include one lag of the dependent variable ($COSTDEP_{t-1}$). ZSCORE is the natural logarithm of Zscore. Zscore equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A four-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. SIZE is a vector of several variables identifying systemic and absolute bank size. SYSSIZE is the ratio of total bank assets to GDP. SYSSIZE025 and SYSSIZE05 are equal to one if ratio of total bank assets to GDP exceeds 0.25 and 0.5, respectively. They are zero otherwise. MKSHARE5 takes a value of one if the bank's share in the country's total assets exceeds 5%, and zero otherwise. LOGTA is the natural logarithm of total bank assets. 3BANKS identifies with the value of one the three largest banks of each country in terms of assets. Although they are not shown, estimations also include: PASTCRISIS is a dummy variable that takes a value of one if the country is not currently experiencing a banking crisis but has experienced a banking crisis in previous years according to the Laeven and Valencia (2008) database. DEFICIT is a dummy variable that takes the value of one if the public cash surplus/deficit over GDP exceeds the 65th percentile of the distribution of the sample, the value of 2 when it is between the 35th and 65th percentile and the value of three when it is less than the 35th percentile. CUSTOMERD is the percentage of customer deposits to total interest-bearing liabilities. OVERHEAD is personnel expenses and other non-interest expenses over total assets. LERNER is the Lerner index and is defined as the difference between price (interest rate) and marginal cost expressed as a percentage of price. CONC is the fraction of assets of the three largest banks as a share of assets of all commercial banks. PRIVATECRED is private credit by deposit money banks and other financial institutions over GDP. GDPGR is the annual growth rate of real GDP per capita. INFLATION is the annual inflation rate from the GDP deflator. Bank data are from the BankScope data base of Fitch IBCA and macro data are from the IMF's International Financial Statistics. The sample period is 1989-2007. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable: COSTDEP							
	SYSTEMIC SIZE				ABSOLUTE SIZE		
Size variables (SIZE):	SYSSIZE	SYSSIZE025	SYSSIZE05	MKSHARE5	LOGTA	3BANKS	BIG75
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: Countries that have not suffered a banking crisis							

ZSCORE	-0.0051**	-0.0064***	-0.0062***	-0.0058***	-0.0273	-0.0054***	-0.0092***
	(-2.34)	(-3.79)	(-3.62)	(-2.95)	(-0.45)	(-2.88)	(-2.94)
ZSCORE x SIZE	0.0051	0.0117**	0.0238	0.0034	0.0047	0.0036	0.0142*
	(0.17)	(2.35)	(1.22)	(0.58)	(0.47)	(0.53)	(1.71)
SIZE	-0.0170	-0.0181**	-0.0381	0.0037	-0.0289	0.0019	-0.0221
	(-0.26)	(-2.09)	(-1.25)	(0.32)	(-0.40)	(0.14)	(-1.54)
m_1 statistic	-4.44***	-4.41***	-4.30***	-4.40***	-4.57***	-4.43***	-4.51***
m_2 statistic	-0.08	-0.08	-0.06	-0.08	-0.12	-0.05	-0.06
Hansen J statistic	31.93 (25)	29.09 (23)	29.88 (25)	19.37 (21)	31.25 (23)	19.23 (21)	20.32 (17)
# observations	11,833	11,833	11,833	11,833	11,833	11,833	11,833
# banks	1,898	1,898	1,898	1,898	1,898	1,898	1,898
# countries	52	52	52	52	52	52	52
Panel B: Countries that have suffered a banking crisis							
ZSCORE	-0.0110***	-0.0082**	-0.0065*	-0.0137***	-0.0882***	-0.0122***	-0.0137***
	(-2.68)	(-2.49)	(-1.71)	(-3.57)	(-2.61)	(-3.08)	(-2.85)
ZSCORE x SIZE	0.1817***	0.0145*	-0.0080	0.0267***	0.0155***	0.0295***	0.0179**
	(2.73)	(1.75)	(-0.35)	(3.90)	(2.74)	(3.02)	(2.43)
SIZE	-0.2907***	-0.0240**	0.0093	-0.0408***	0.0117	-0.0392***	-0.0239**
	(-2.63)	(-2.13)	(0.25)	(-3.81)	(0.22)	(-2.61)	(-2.17)
m_1 statistic	-8.05***	-7.70***	-7.92***	-7.93***	-8.10***	-7.96***	-7.93***
m_2 statistic	-0.45	-0.49	-0.54	-0.50	-0.92	-0.74	-0.59
Hansen J statistic	22.15 (25)	18.36 (23)	19.81 (25)	17.71 (21)	15.24 (23)	16.83 (21)	16.47 (17)
# observations	10,337	10,337	10,337	10,337	10,337	10,337	10,337
# banks	2,453	2,453	2,453	2,453	2,453	2,453	2,453
# countries	52	52	52	52	52	52	52
Panel C: Countries that have suffered a banking crisis and have not imposed losses on depositors							
ZSCORE	-0.0157**	-0.0055	-0.0083	-0.0104*	-0.1104*	-0.0132**	-0.0174**
	(-2.25)	(-1.11)	(-1.42)	(-1.80)	(-1.77)	(-2.28)	(-2.09)
ZSCORE x SIZE	0.2787*	0.0234***	-0.0095	0.0283**	0.0187*	0.0311**	0.0256**
	(1.93)	(3.04)	(-0.60)	(2.51)	(1.85)	(2.03)	(2.28)
SIZE	-0.4798**	-0.0414***	0.0023	-0.0546***	-0.0304	-0.0470**	-0.0390**
	(-2.14)	(-3.53)	(0.10)	(-2.88)	(-0.57)	(-2.00)	(-2.23)
m_1 statistic	-7.02***	-6.91***	-6.92***	-6.86***	-7.23***	-6.81***	-6.74***
m_2 statistic	-0.75	-0.93	-0.88	-0.84	-1.13	-1.10	-0.97
Hansen J statistic	18.65 (25)	14.99 (23)	14.41 (25)	14.17 (21)	15.03 (23)	13.51 (21)	12.10 (17)
# observations	6,253	6,253	6,253	6,253	6,253	6,253	6,253
# banks	1,227	1,227	1,227	1,227	1,227	1,227	1,227
# countries	20	20	20	20	20	20	20
Panel D: Countries that have suffered a banking crisis and have imposed losses on depositors							
ZSCORE	-0.0107**	-0.0121***	-0.0126***	-0.0185***	-0.4778**	-0.0134**	-0.0142***
	(-2.17)	(-3.12)	(-2.85)	(-3.47)	(-2.53)	(-2.55)	(-2.81)
ZSCORE x SIZE	0.0208	0.0035	-0.0194	0.0234***	0.0861**	0.0094	0.0131
	(0.39)	(0.43)	(-1.17)	(2.98)	(2.54)	(0.93)	(1.63)
SIZE	0.0466	-0.0043	0.0649	-0.0316**	-0.0507	-0.0067	-0.0156
	(0.50)	(-0.31)	(1.59)	(-2.56)	(-0.63)	(-0.42)	(-1.44)
m_1 statistic	-3.94***	-3.84***	-3.99***	-3.77***	-4.16***	-3.94***	-4.00***
m_2 statistic	0.45	0.40	0.41	0.17	0.76	0.52	0.69
Hansen J statistic	31.86 (25)	24.34 (23)	22.67 (25)	21.49 (21)	22.57 (23)	22.60 (21)	18.12 (17)
# observations	4,084	4,084	4,084	4,084	4,084	4,084	4,084
# banks	1,226	1,226	1,226	1,226	1,226	1,226	1,226
# countries	32	32	32	32	32	32	32

4.3. Market discipline, bank size, and public finances

The results in previous sections indicate weaker market discipline on average in large banks and are consistent with a TBTF effect or a TBTF effect dominating a TBTS effect, but do not rule out the presence of a TBTS effect in a subset of countries. The TBTS effect might exist only in countries where some banks have become so large that the country's public finances cannot afford to bail

them out. We therefore introduce an interaction between the proxy for bank size and the country's public deficit to analyze if systemically large banks in countries with large public deficits were considered TBTS over the 1989-2007 period.

Table 6 reports the results for model [2], where we analyze changes in market discipline across banks of different sizes depending on the country's public finance status. The m_2 statistic rejects the lack of second-order serial correlation in the first-difference residuals. The significant values of the Hansen J-statistic in columns (1) and (5) lead us to focus our comments on estimations using dummy variables for bank size in columns (2) to (4) and (6) to (7).

The coefficients of ZSCORE and ZSCORE x SIZE are similar to those reported in Tables 3 and 4. The coefficients of the interaction term ZSCORE x DEFICIT are not significant in any specification, whatever the proxy for bank size is. This shows that a high public deficit does not weaken the stronger market discipline that depositors exercise on smaller banks. It suggests that depositors exercise stronger discipline in smaller banks because they do not anticipate a government bailout in case of failure, even if public finances would allow this.

However, the triple interaction term ZSCORE x SIZE x DEFICIT has a negative and significant coefficient in three of the four where we use proxies for systemic bank size (columns (2) to (4)). This result indicates that the weaker market discipline is reversed in systemically large banks when the country suffers a deterioration in its public finances. In this case, the bailout does not seem to be credible and increases the incentives of depositors to exercise market discipline in systemically large banks. The coefficients of ZSCORE x SIZE x DEFICIT are, however, statistically non-significant when we use proxies for absolute bank size in columns (5) to (7).

The effect of the soundness of public finances is economically significant. Using, for instance, significant coefficients in column (2), an increase of one standard deviation in the ZSCORE (0.4614) would reduce the interest rate on deposits in banks whose assets are lower than 25% of the country's GDP by a 22.7% of the standard deviation of the cost of deposits in countries where the

budget balance is above the 65th percentile in the sample. This market discipline disappears and the sensitivity of the cost of deposits to bank risk is reduced by a 111.17% in these countries for banks whose assets are higher than 25% of the country's GDP. However, in countries where the budget balance is below the 35th percentile (highest public deficit), market discipline in large banks is reduced by a 78.15% compared to smaller banks.

We obtain similar coefficients for the control variables to those reported in previous tables.

Table 6. Market discipline, bank size and public finances

Regressions are estimated using the two-step GMM system estimator for panel data with the robust estimator of variance. The dependent variable is the cost of deposits (COSTDEP). As explanatory variables, we include one lag of the dependent variable ($COSTDEP_{t-1}$). ZSCORE is the natural logarithm of Zscore. Zscore equals the return on assets plus the capital asset ratio divided by the standard deviation of asset returns. A four-year moving window is used to estimate the standard deviation of asset returns for each bank in each year. SIZE is a vector of several variables identifying systemic and absolute bank size. SYSSIZE is the ratio of total bank assets to GDP. SYSSIZE025 and SYSSIZE05 are equal to one if ratio of total bank assets to GDP exceeds 0.25 and 0.5, respectively. They are zero otherwise. MKSHARE5 takes a value of one if the bank's share in the country's total assets exceeds 5%, and zero otherwise. LOGTA is the natural logarithm of total bank assets. 3BANKS identifies with the value of one the three largest banks of each country in terms of assets. PASTCRISIS is a dummy variable that takes a value of one if the country is not currently experiencing a banking crisis but has experienced a banking crisis in previous years according to the Laeven and Valencia (2008) database. DEFICIT is a dummy variable that takes the value of one if the public cash surplus/deficit over GDP exceeds the 65th percentile of the distribution of the sample, the value of 2 when it is between the 35th and 65th percentile and the value of three when it is less than the 35th percentile. CUSTOMERD is the percentage of customer deposits to total interest-bearing liabilities. OVERHEAD is personnel expenses and other non-interest expenses over total assets. LERNER is the Lerner index and is defined as the difference between price (interest rate) and marginal cost expressed as a percentage of price. CONC is the fraction of assets of the three largest banks as a share of assets of all commercial banks. PRIVATECRED is private credit by deposit money banks and other financial institutions over GDP. GDPGR is the annual growth rate of real GDP per capita. INFLATION is the annual inflation rate from the GDP deflator. Bank data are from the BankScope data base of Fitch IBCA and macro data are from the IMF's International Financial Statistics. The sample period is 1989-2007. ***; ** and * indicate statistical significance at 1, 5, and 10 percent, respectively.

Dependent variable: COSTDEP							
	SYSTEMIC SIZE				ABSOLUTE SIZE		
Size variables (SIZE):	SYSSIZE	SYSSIZE025	SYSSIZE05	MKSHARE5	LOGTA	3BANKS	BIG75
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$COSTDEP_{t-1}$	0.2651***	0.2735***	0.2710***	0.2601***	0.2527***	0.2586***	0.2514***
	(7.28)	(7.00)	(7.35)	(6.93)	(7.06)	(6.92)	(7.07)
ZSCORE	-0.0114*	-0.0119**	-0.0114*	-0.0143**	-0.0837**	-0.0158**	-0.0133**
	(-1.83)	(-2.03)	(-2.00)	(-2.32)	(-2.15)	(-2.47)	(-2.14)
ZSCORE x SIZE	0.0772**	0.0153***	0.0201	0.0167***	0.0085	0.0172***	0.0178***
	(1.99)	(2.75)	(1.42)	(3.14)	(1.53)	(2.61)	(3.37)
ZSCORE x DEFICIT	0.0012	0.0023	0.0024	0.0030	0.0180	0.0037	0.0009
	(0.49)	(0.85)	(0.90)	(1.02)	(1.44)	(1.27)	(0.33)
ZSCORE x SIZE x DEFICIT	0.0055	-0.0020*	-0.0021*	-0.0021*	-0.0006	0.0002	-0.00001
	(0.55)	(-1.83)	(-1.76)	(-1.82)	(-0.44)	(0.12)	(-0.03)
SIZE	-0.1528**	-0.0190**	-0.0280	-0.0161**	0.0257	-0.0239**	-0.0277***
	(-2.53)	(-2.13)	(-1.25)	(-2.05)	(0.83)	(-2.29)	(-3.29)
PASTCRISIS	-0.0029	-0.0027	-0.0030	-0.0021	-0.0018	-0.0034*	-0.0035*
	(-1.60)	(-1.40)	(-1.62)	(-1.15)	(-0.68)	(-1.89)	(-1.92)
DEFICIT	-0.0025	-0.0035	-0.0036	-0.0041	-0.0198***	-0.0057	-0.0017
	(-0.69)	(-0.90)	(-0.98)	(-1.00)	(-3.08)	(-1.34)	(-0.44)
CUSTOMERD	-0.0028	0.0024	-0.0007	0.0041	0062	0.0016	0.00001
	(-0.47)	(0.39)	(-0.11)	(0.61)	(0.87)	(0.23)	(0.00)
OVERHEAD	-0.0780	-0.1515**	-0.0655	-0.1082	-0.0835	-0.0915	-0.0799
	(-1.13)	(-2.09)	(-0.90)	(-1.33)	(-0.91)	(-1.13)	(-0.98)
LERNER	-0.0436***	-0.0603***	-0.0578***	-0.0600***	-0.0792***	-0.0648***	-0.0705***
	(-3.45)	(-4.34)	(-4.33)	(-4.11)	(-4.82)	(-4.28)	(-4.84)
CONC	0.0026	0.0047**	0.0040**	0.0047**	0.0019	0.0048**	0.0033*
	(1.26)	(2.43)	(2.11)	(2.31)	(0.74)	(2.26)	(1.67)
PRIVATECRED	-0.0016	-0.0017	-0.0014	-0.0011	-0.0063***	-0.0017	-0.00015
	(-1.22)	(-1.33)	(-1.08)	(-0.78)	(-3.49)	(-1.23)	(-0.11)

GDPGR	-0.0089** (-2.05)	-0.0090** (-2.02)	-0.0090** (-2.08)	-0.0069* (-1.66)	-0.0098* (-1.93)	-0.0065 (-1.51)	-0.0073 (-1.64)
INFLATION	0.00004 (1.31)	0.00006** (2.07)	0.00004 (1.58)	0.00006** (2.33)	0.00005* (1.80)	0.00006** (2.58)	0.00005 (1.57)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
m_1 statistic	-8.76***	-8.83***	-8.64***	-9.09***	-9.55***	-8.98***	-9.10***
m_2 statistic	-0.44	-0.40	-0.42	-0.44	-0.81	-0.55	-0.53
Hansen J statistic	52.35** (33)	39.90 (33)	36.93 (33)	31.35 (25)	38.15** (25)	24.89 (21)	28.82 (21)
# observations	22,170	22,170	22,170	22,170	22,170	22,170	22,170
# banks	4,351	4,351	4,351	4,351	4,351	4,351	4,351
# countries	104	104	104	104	104	104	104

4.4. Robustness checks

In further analysis we check for the robustness of the results. First, we check that the main results do not change when we use alternative proxies for bank risk. In particular, we use the capital buffer in relative terms, measured as the difference between capital and requirements. Nier and Bauman (2006) or Cubillas et al. (2012), among others, have also used this variable for evaluating market discipline.

Second, we check that the results do not change when we use different proxies for systemic and absolute bank size. As the interbank market is one of the main channels through which the failure of a bank may impact other banks, we use as an additional proxy for systemic bank size the interbank deposits to GDP ratio. As an additional proxy for absolute bank value, we use a dummy variable (20B) that takes a value of one when the bank's assets exceed $20 billion and zero otherwise. This variable defines absolute bank size without using each country as a reference. The results for these alternative proxies are similar to those reported in the tables.

Third, we check that the results do not change when we use alternative instruments for systemic and absolute bank size. In particular, we include as an additional instrument the legal restrictions on bank entry, defined following Barth et al. (2004), as tighter restrictions could promote larger banks in a country. The results do not change although the lack of data for 14 countries reduces our sample. For this reason, we report results without including bank entry restrictions as an instrument for bank size.

Fourth, we analyze if the results remain the same when we analyze separately publicly and non-publicly listed banks. We replicate estimations in Tables 3 and 5 introducing two interaction terms of a dummy variable (LISTED) that takes the value of 1 for publicly listed banks with, respectively, ZSCORE and ZSCORE x SIZE. We do not find significant coefficients for these two interaction terms in any estimation.

Finally, we find that the basic results do not change when we apply static panel data procedures, using both fixed (without country dummy variables) and random effects, and when we analyze whether depositors penalize riskier banks by withdrawing deposits. In this case, we use the annual growth in total deposits for bank *i* in country *j* in year *t* as the dependent variable.

5. Conclusions

This paper analyzes the relative importance of the "too-big-to-fail" and "too-big-to-save" effects in an international sample of banks in 104 countries over the period immediately before the current global financial crisis (1989-2007). We find that the sensitivity of cost of deposits to bank risk is on average lower for large banks. This result is consistent with the predominance of a TBTF effect over a TBTS effect and is robust to alternative proxies for both systemic and absolute bank size.

Our results also indicate that the predominance of the TBTF effect varies across countries depending on the intervention policies adopted during past banking crises and the soundness of public finances. The TBTF effect is stronger in countries that have suffered a banking crisis in the past, countries that did not impose losses on depositors during banking crises, and countries with sounder public finances. Large public deficits reduce the TBTF effect only when we use proxies for systemic bank size but not for absolute bank size.

Stronger market discipline in large banks in countries that imposed losses on depositors during banking crises is consistent with depositors using the type of intervention adopted during a banking crisis to establish their expectations on

implicit safety nets for future banking crises. Stronger market discipline in systemically but not absolute large banks in countries with the highest public deficits is consistent with the presence of a TBTS effect in this subset of banks. However, on average the TBTF dominates the TBTS effect in our international sample of banks over the 1989-2007 period.

Our results therefore confirm that there is a trade-off between the systemic consequences of not applying a TBTF policy and the cost that this policy entails in terms of reduction of discipline exerted by depositors to control excessive bank risk-taking by large banks. The predominance of the TBTF effect over the 1989-2007 period indicates that bank size has exacerbated risk-taking incentives and contributed to the current global financial crisis. Our results suggest that the TBTF effect has been only partially mitigated by the real possibilities of public finances to bail out systemically large banks. The current global financial crisis has revealed that some banks may be too large to be saved by national governments but also that new mechanisms may be designed to continue rescuing these large banks. The bailout of Ireland to recapitalize its banks and the direct bailout of the Spanish savings banks by the troika are recent examples of new mechanisms to continue to make a TBTF policy possible in banks too large to be saved by their own national governments.

Finally, our results raise concerns about the increase in the average size and number of large banks after the current global financial crisis and justify measures aiming to reinforce the control of risk-taking in large banks.

References

Arellano, M., Bond, S., 1991. Some test of specification for panel data: Monte Carlo evidence and application to employment equations. *Review of Economic Studies*, 58, 227-297.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29-51.

Barth, J.R., Caprio G., Levine, R., 2004. Bank regulation and supervision: What works best? *Journal of Financial Intermediation,* 13, 205-248.

Beck, T., Demirgüç-Kunt, A., 2009. Financial Institutions and Markets across Countries and over Time - Data and Analysis. Washington, DC: World Bank Policy Research Working Paper No. 4943.

Beck, T., Demirgüç-Kunt, A., Levine, R., 2006. Bank concentration, competition and crises: first results. *Journal of Banking and Finance,* 30, 1581-1603.

Benston G., Hunter, W., Wall, L., 1995. Motivations for Bank Mergers and Adquisitions: Enhancing the Deposit Insurance Put Option versus Earnings Diversification. *Journal of Money, Credit and Banking*, 27 (3), 777-788.

Berger, A.N., 1995. The profit–structure relationship in banking: tests of market power and efficient structure hypotheses. *Journal of Money, Credit and Banking*, 27, 404–431.

Berger, A.N., Hannan T.H., 1989. The price-concentration relationship in banking. *The Review of Economics and Statistics*, 71, 291-299.

Bertay, A.C., Demirguç-Kunt, A., Huizinga, H., 2013. Do we need big banks? Evidence on performance, strategy and market discipline. *Journal of Financial Intermediation*, forthcoming.

Blundell, R., Bond, S., 1998. Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87, 115-143.

Boyd, J., Gertler, M., 1993. U.S. commercial banking: Trends, cycles, and policy. NBER Macroeconomics Annual 1993: 319-68.

Brown, C., Dinç, S., 2011. Too Many to Fail? Evidence of Regulatory Forbearance When the Banking Sector Is Weak. *Review Financial Studies*, 24 (4),1378-1405.

Cetorelli, N., Gambera, M., 2001. Banking market structure, financial dependence and growth: international evidence from industry data. *Journal of Finance*, 56(2), 617-648.

Chari, V., Jagannathan, R., 1988. Banking Panics, Information, and Rational Expectations Equilibrium. *Journal of Finance,* 43, 749-761.

Cook, D., Spellman, L., 1994. Repudiation risk and restitution costs: Toward understanding premiums on insured deposits. *Journal of Money, Credit and Banking*, 26, 439-459.

Cubillas, E., Fonseca, A., González, F., 2012. Banking crises and market discipline: International evidence. *Journal of Banking and Finance*, 36 (8), 2285-2298.

Demirgüç-Kunt, A., Huizinga, H., 2004. Market discipline and deposit insurance. *Journal of Monetary Economics*, 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. *Journal of Banking & Finance*, 37 (3), 875-894.

Demsetz, R. S., Strahan, P. E., 1997. Diversification, size and risk at U.S bank holding companies. *Journal of Money, Credit, and Banking*, 20, 300-313.

Diamond, D., Dybvig, P.H., 1983. Bank runs, deposit insurance and liquidity. *Journal or Political Economy*, 91 (3), 401-419.

Ennis, H. M., Malek, H. S., 2005. Bank risk of failure and the too-big-to-fail policy. Federal Reserve Bank of Richmond Economic Quarterly, 91, 21-44.

Flannery, M., Sorescu., S., 1996. Evidence of bank market discipline in subordinated debenture yields: 1983-1991. *Journal of Finance,* 51, 1347-1377.

Fonseca, A.R., González, F., 2010. How bank capital vary across countries: The influence of cost of deposits, market power and bank regulation. *Journal of Banking and Finance*, 34, 892-902.

Hadad, M.D., Agusman, A., Monroe, G.S., Gasbarro, D., Zumwalt, J.K., 2011. Market discipline, financial crisis and regulatory changes: Evidence from Indonesian banks. *Journal of Banking and Finance*, 35, 1552-1562.

Hoggarth, G., Jackson, P., Nier, E., 2005. Banking crises and the design of safety nets. *Journal of Banking and Finance,* 29, 143-159.

Honohan, P., Klingebiel, D., 2003. The fiscal cost implications of an accommodating approach to banking crises. *Journal of Banking and Finance,* 27, 1539-1560.

Kane, E. J., 2000. Designing financial safety nets to fit country circumstances. Washington, DC : World Bank, Development Research Group, Finance, [2000].

Kaufman, D., Kraay, A., Zoido-Lobaton, P., 2001. Governance matters II: Update indicators for 2000/01. World Bank.

Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. *Journal of Financial Economics*, 93, 259-275.

Laeven, L., Valencia, F., 2008. Systemic banking crises: A new database. IMF Working Paper, No. 08/224.

Lown, C., Peristiani, S., 1996. The behavior of consumer loan rates during the 1990 credit slowdown. *Journal of Banking and Finance*, 20, 1673-1694.

Martinez Peria, M.S., Schmukler, S.L., 2001. Do depositors punish banks for bad behavior? *Journal of Finance*, 56, 1029-1051.

Maudos, J., Fernández de Guevara, J., 2004. Factors explaining the interest margin in the banking sectors of the European Union. *Journal of Banking and Finance*, 28, 2259-2281.

Michael, I., 1998. Financial Interlinkages and Systemic Risk. Bank of England Financial Stability Review, Spring.

Nier, E., Baumann, U., 2006. Market discipline, disclosure and moral hazard in banking. *Journal of Financial Intermediation*, 15, 332-361.

O'Hara, M., Shaw, W., 1990. Deposit insurance and wealth effects: The value of being too big to fail. *Journal of Finance*, 45, 1587-1601.

Penas, M. F., Unal, H., 2004. Gains in bank mergers: Evidence from the bond markets. *Journal of Financial Economics*, 74, 149-179.

Pop, A., Pop, D., 2009. Requiem for market discipline and the specter of TBTF in Japanese banking. T*he Quarterly Review of Economics and Finance*, 49(4), 1429-1459.

Sironi, A., 2003. Testing for market discipline in the European banking industry: Evidence from subordinated debt issues. *Journal of Money, Credit and Banking*, 35, 443–472.

Soussa, F., 2000. Financial stability and central banks, selected issues for financial safety nets and market discipline. Chapter Too Big to Fail: Moral Hazard and Unfair Competition? Centre for Central Banking Studies: 5–31.

Völz, M., Wedow, M., 2011. Market discipline and too-big-to-fail in the CDS market: Does banks' size reduce market discipline? *Journal of Empirical Finance*, 18(2), 195-210.

FUNDACIÓN DE LAS CAJAS DE AHORROS

DOCUMENTOS DE TRABAJO

Últimos números publicados

656/2012 The role of accruals quality in the access to bank debt
Pedro J. García-Teruel, Pedro Martínez-Solano and Juan P. Sánchez-Ballesta

657/2012 Trade Under Uncertainty: Legal Institutions Matter
Lisa Kolovich & Isabel Rodriguez-Tejedo

658/2012 La relación bidireccional entre la rsc y el resultado empresarial: conclusiones de un estudio empírico el sector de las cajas de ahorros
Almudena Martínez Campillo, Laura Cabeza García y Federico Marbella Sánchez

659/2012 Consejos de administración y performance de la empresa: efecto de la pertenencia a múltiples consejos
Félix J. López Iturriaga y Ignacio Morrós Rodríguez

660/2012 Análisis comparado de los sistemas eléctricos en España y Argentina, 1890-1950. Estrategias globales y experiencias divergentes de la electrificación en dos países de industrialización tardía
Isabel Bartolomé y Norma Silvana Lanciotti

661/2012 Leverage and corporate performance: International evidence
Víctor M. González

662/2012 Procesos de prociclicidad crediticia e impacto de la provisión estadística en España
Francisco Jaime Ibáñez Hernández, Miguel Ángel Peña Cerezo y Andrés Araujo de la Mata

663/2012 Policy success or economic slowdown?. Effects of the 80 km•h-1 speed limit on air pollution in the Barcelona metropolitan area
Germà Bel i Queralt & Jordi Rosell i Segura

664/2012 Modelos regulatorios en las telecomunicaciones fijas de banda ancha: competencia en redes frente a competencia en servicios. la evidencia empírica en la OCDE y España
Juan Rubio Martín y César Sánchez Pérez

665/2012 Regional export promotion offices and trade margins
Salvador Gil-Pareja, Rafael Llorca-Vivero, José Antonio Martínez-Serrano & Francisco Requena-Silvente

666/2012 An Experimental Study of Gender Differences in Distributive Justice
Ismael Rodriguez-Lara

667/2012 Spanish savings banks in the credit crunch: could distress have been predicted before the crisis? A multivariate statistical analysis
Martí Sagarra, Cecilio Mar-Molinero & Miguel García-Cestona

668/2012 Cities to live or to work in: an input-output model of migration and commuting
Ana Viñuela & Esteban Fernández-Vázquez

669/2012 Non-linear Dynamics in Discretionary Accruals: An Analysis of Bank Loan-Loss Provisions
Marina Balboa, Germán López-Espinosa & Antonio Rubia

670/2012 Iniciación, persistencia e intensificación en la realización de actividades de I+D en España
Dolores Añón Higón, Juan A. Máñez and y Juan A. Sanchis-Llopis

671/2012 La neutralidad financiera en el impuesto sobre sociedades: microsimulación de las opciones de reforma para España
Lourdes Jerez Barroso y Fidel Picos Sánchez

672/2012 When trains go faster than planes: The strategic reaction of airlines in Spain
Juan Luis Jiménez and Ofelia Betancor

673/2012 Distribución del gasto sanitario público por edad y sexo en España: Análisis de la década 1998-2008
Ángela Blanco Moreno, Rosa Urbanos Garrido y Israel John Thuissard Vasallo

674/2012 Does school ownership matter? An unbiased efficiency comparison for Spain regions
Eva Crespo-Cebada, Francisco Pedraja-Chaparro and Daniel Santín

675/2012 Factores condicionantes de la desigualdad educativa: un análisis para el caso español
Crespo Cebada, Eva, Díaz Caro, Carlos y Jesús Pérez Mayo

676/2012 Integrating network analysis and interregional trade to study the spatial impact of transport infra-structure using production functions
Inmaculada C. Álvarez-Ayuso, Ana M. Condeço-Melhorado, Javier Gutiérrez y Jose L. Zofío

677/2012 An actuarial balance model for DB PAYG pension systems with disability and retirement contingencies
Manuel Ventura-Marco & Carlos Vidal-Meliá

678/2012 Will it last? An assessment of the 2011 Spanish pension reform using the Swedish system as benchmark
Carlos Vidal-Meliá

679/2012 Iniciativas educativas en las universidades mexicanas: un análisis estadístico multivariante
Martí Sagarra, Cecilio Mar-Molinero & Herberto Rodríguez-Regordosa

680/2012 Tributación y política de dividendos de las sociedades no financieras, 2000-2010
Félix Domínguez Barrero y Julio López Laborda

681/2012 Lending relationships and credit rationing: the impact of securitization
Santiago Carbó-Valverde, Hans Degryse & Francisco Rodriguez-Fernandez

682/2012 Percepciones de los ciudadanos sobre las haciendas regionales: quién es y quién debería ser responsable de los servicios e impuestos autonómicos
Julio López Laborda y Fernando Rodrigo

683/2012 Trade credit, the financial crisis, and firm access to finance
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández & Gregory F. Udell

684/2012 Changing market potentials and regional growth in Poland
Jesús López-Rodríguez & Malgorzata Runiewizc-Wardyn

685/2012 Firm boundaries and investments in information technologies in Spanish manufacturing firms
Jaime Gómez, Idana Salazar & Pilar Vargas

686/2012 Movimientos de capital, inserción en el mercado mundial y fluctuaciones financieras de la economía cubana: la bolsa de la habana, 1910-1959
Javier Moreno Lázaro

687/2012 El impacto de la inmigración sobre el crecimiento económico español. un enfoque contable
Rodrigo Madrazo García de Lomana

688/2012 Structural equivalence in the input-output field
Ana Salomé García Muñiz

689/2012 Testing the expectations hypothesis in euro overnight interest swap rates
Lucía Hernandis & Hipòlit Torró

690/2012 Bank asset securitization before the crisis: Liquidity, bank type and risk transfer as determinants
Martí Sagarra, Miguel García-Cestona & Josep Rialp

691/2012 Análisis del riesgo soberano utilizando mapas auto-organizativos. el caso de europa, España y Alemania
Félix J. López Iturriaga e Iván Pastor Sanz

692/2012 Economic forecasting with multivariate models along the business cycle
Carlos Cuerpo & Pilar Poncela

693/2012 Testing opvar accuracy: an empirical back-testing on the loss distribution approach
José Manuel Feria-Domínguez, Enrique J. Jiménez-Rodríguez & Mª Paz Rivera-Pérez

694/2012 Is the boost in oil prices affecting the appreciation of real exchange rate?: Empirical evidence of "Dutch disease" in Colombia
Pilar Poncela, Eva Senra & Lya Paola Sierra

695/2012 Market efficiency and lead-lag relationships between spot, futures and forward prices: The case of the Iberian Electricity Market (MIBEL)
Jose María Ballester, Francisco Climent & Dolores Furió

696/2012 Complementarities in the innovation strategy: do intangibles play a role in enhancing the impact of r&d on firm performance?
Dolores Añón, Jaime Gómez & Pilar Vargas

697/2012 The real effects of bank branch deregulation at various stages of economic development: The European experience
José Manuel Pastor, Lorenzo Serrano & Emili Tortosa-Ausina

698/2012 Effects of the financial crisis on the european integration process: relevance of exchange rate, inflation and domestic risks
Alfredo J. Grau-Grau

699/2012 Las Preferencias por la Redistribución: Teoría y Evidencia para España
Julio López Laborda y Eduardo Sanz Arcega

700/2012 Firm boundaries and investments in information technologies in spanish manufacturing firms
Jaime Gómez, Idana Salazar and Pilar Vargas

701/2012 Oil Prices and Inflation in the Euro Area and its Main Countries: Germany, France, Italy and Spain
César Castro, Pilar Poncela and Eva Senra

702/2012 Oportunismo y sistemas de gestión medioambiental: las certificaciones como cortina de humo ante los grupos de interés
Gustavo Lannelongue Nieto y Javier González Benito

703/2012 Variance Swaps and Gamma Swaps. The Theory and Reality of Model-Free Replication
Jacinto Marabel-Romo

704/2013 Business Ties in Boards: the influence of institutional directors on Financial Policy
Emma García-Meca, Felix López Iturriaga and Fernando Tejerina Gaite

705/2013 Análisis jerárquico de la evolución del desempeño económico de las comunidades españolas en el período 1955-2009
Juan Gabriel Brida, Nicolás Garrido & David Matesanz Gómez

706/2013 Attribution of changes in divisia real energy intensity indices in several european countries from 1995 to 2010
Paula Fernández González, Manuel Landajo & MªJosé Presno

707/2013 El ámbito de aplicación del principio de beneficio: de la teoría a la revelación de preferencias
Julio López Laborda y Eduardo Sanz Arcega

708/2013 Do shareholder coalitions modify dominant owner's control? the impact on dividend policy
Félix López-Iturriaga & Domingo J. Santana-Martín

709/2013 IPO pricing: a maximum likelihood approach
Susana Álvarez Otero

710/2013 City size and household food consumption. An application of the AIDS model to food demand elasticities in Spain
Elena Lasarte Navamuel, Fernando Rubiera Morollón & Dusan Paredes Araya

711/2013 City size and household food consumption an application of the aids model to food demand elasticities in Spain
Pilar Abad Romero, Sonia Benito Muela and Carmen López Martín

712/2013 Fiscal decentralization in specific areas of governments. an empirical evaluation with country panel data
Letelier Saavedra, L. and Sáez Lozano, J. L.

713/2013 Disentangling the relation between ownership structure and board composition
Isabel Acero Fraile and Nuria Alcalde Fradejas

714/2013 Market potential and spatial autocorrelation in the european regions
Andres Faina, Jesus Lopez-Rodriguez and Fernando Bruna

715/2013 Quien calla otorga: la larga sombra de la sociedad de responsabilidad limitada en España (1869-1953).
Susana Martínez-Rodríguez

716/2013 Firm and country determinants of debt maturity. International evidence.
Víctor M. González Méndez

717/2013 Influencia de los distintos países en la determinación de la prima de riesgo exgida a un bono europeo común
Antonio Madera del Pozo

718/2013 La presencia de la banca española, francesa e italiana en el norte de África tras la primavera árabe
Máximo Santos Miranda

719/2013 Offshoring of intermediate production and firm-level innovation: an empirical analysis
Lucía Avella, Francisco García and Sandra Valle

720/2013 Respeto y prosperidad
Domingo Gallego Martínez

721/2013 Factors influencing bank risk in Europe: evidence from the financial crisis
Laura Baselga-Pascual, Antonio Trujillo-Ponce and Clara Cardone-Riportella

722/2013 La moral fiscal de los españoles, revisitada
Julio López Laborda y Eduardo Sanz Arcega

723/2013 An empirical analysis of e-Participation. The role of social networks and e-government over citizens' online engagement
María Rosalía Vicente and Amparo Novo

724/2013 Knowledge creation and knowledge linkages in the us regions
Malgorzata Runiewicz-Wardyn and Jesus López-Rodriguez

725/2013 Do movie majors really collude? Iindirect evidence from release schedules
Fernanda Gutierrez-Navratil, Víctor Fernández-Blanco, Luis Orea and Juan Prieto-Rodríguez

726/2013 Duration and recurrence in unemployment benefits
José María Arranz and Carlos García-Serrano

727/2013 Technological policy and cooperation in innovation: A look through a formal model
Antonio García-Lorenzo and José López-Rodríguez

728/2013 El hueco que deja el diablo: una estimación del fraude en el irpf con microdatos tributarios
Félix Domínguez Barrero, Julio López Laborda y Fernando Rodrigo Sauco

729/2013 What do you do when the binomial cannot value real options? The lsm model
Susana Alonso Bonis, Valentín Azofra Palenzuela and Gabriel de la Fuente Herrero

730/2013 Unión bancaria: origen, fundamentos y efectos reales
Luis Cárdenas del Rey

731/2013 Luchar contra la corrupción y salir de la crisis económica: dos caras de una misma moneda
Juan-José Ganuza

732/2013 How credible is a too-big-to-fail policy? International evidence from market discipline
Elena Cubillas, Ana I. Fernández and Francisco González