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Public bank lending in times of crisis

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ABSTRACT

This paper studies the role of government-owned banks in the event of financial crises. The study takes an empirical perspective focusing on bank lending. We compare the lending responses across government-owned and private banks to financial crises using the balance sheet information of 764 major banks headquartered in 50 countries over the period of 1994–2009. Using a nested panel regression framework that allows for parameter shifts in the bank lending equation, we find robust evidence that government-owned banks increase their lending during crises relative to normal times, while private banks' lending decreases. Government-owned banks thus counteract the lending slowdown of private banks. The findings suggest that governments can play an active counter-cyclical role in their banking systems directly through government-owned banks.

1. Introduction

With the onset of the global financial crisis, the balance sheets of major banks have come under stress as significant write-downs on assets have led to sizable reductions in bank capital. In some countries, these events have caused a credit crunch in which banks cut down lending and firms find it difficult to obtain external financing. Concerns have been raised that these adverse financial conditions will continue to undermine the economic activity; much like shortages in bank capital slowed down the US recession recovery in the early nineties (Bernanke and Lown, 1991). Following the collapse of Lehman Brothers and the subsequent financial turmoil intensification, many central banks and governments responded with unprecedented rescue operations that involved the provision of liquidity, debt guarantees, asset purchases, and recapitalizations of individual banks (Brei et al., 2013; Klomp, in press). The policy responses were aimed at preventing the collapse of the domestic banking system, but they were also implemented with the objective that the injection of liquidity and capital would allow domestic banks to supply more credit to the real economy. The empirical results on the effect of the rescue measures on bank lending, however, are mixed and difficult to elaborate since the counterfactual is unknown (Ivashina and Scharfstein, 2010; Allen and Paligorova, 2011; Brei et al., 2013).

Regarding the academic debate on public sector involvement in the banking sector, there are two major schools of thought. The "development" view promoted by the work of Alexander Gerschenkron is based on the argument that a prerequisite for economic growth is financial development. In Gerschenkron (1962), he pointed out that in a number of industrialized countries private banks have been the main vehicle through which savings were channeled to the industrial sector during the second half of the 19th century. In other countries, however, such as in Russia, economic institutions were not sufficiently developed and private banks did not play a major role in the development process. He therefore argued that governments should step in and foster both financial and economic development. In contrast, the "political economy" view argues that government control over financial institutions tends to be associated with distortions in the allocation of resources, because banks may be used by politicians to soften the budget constraint of governments (Krueger, 1974; Shleifer and Vishny, 1994). Accordingly, government involvement in the banking sector should be kept at a minimum and the role should be left

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to the more efficient private banks. Many governments followed the political economy view and privatized their banking systems during the 1990s, especially in Latin America and the transition economies in Eastern Europe.

The evidence of the recent empirical literature on government involvement in banking is mixed. The work of La Porta et al. (2002) shows evidence – of 92 countries – that the degree of public ownership in banking sectors is negatively related to financial development and economic growth, and positively associated with financial instability. If these relationships were causal, then the privatization of banking systems would lead to an increased financial development and economic growth. Dinç (2005) finds in a cross-sectional investigation of 43 countries that lending by government-owned banks is positively related to the electoral cycle. The results of the two mentioned papers would therefore favor the political economy view and the privatization of banks. The work of Andrianova et al. (2009), however, questions these conclusions as it shows evidence that, once institutional quality is taken into account, the results of La Porta et al. (2002) are insignificant, and it appears that state-owned banks can foster economic growth if they are managed by sound and transparent institutions. Using bank-level data for 119 countries, Micco and Panizza (2006) found that government-owned banks' lending is less sensitive to business cycle fluctuations than that of private banks. The results of these two studies would therefore favor government involvement in banking. A number of empirical studies on the role of state-owned banks emerged in response to the recent financial crisis. While most studies show evidence in favor of the view that lending of state-owned banks has been less sensitive to the business cycle than that of private banks (Calderón, 2012; Cull and Martinez-Peria, 2012; Bertay et al., 2012; De Haas et al., 2012); the work by Iannotta et al. (2011) on the other hand, does not find significant differences in the cyclical pattern of lending across government-owned and private banks.

Against these backdrops, the present paper investigates the lending responses of government-owned and private banks headquartered in Europe and Latin America over the period of 1994–2009. A special focus is set on their lending responses to systemic financial crises. To shed light on this issue we use the annual financial statements of 764 major banks from 50 countries, of which 63 institutions are government-owned. Using a nested panel regression framework that allows for parameter shifts in the bank lending equation, following Gambacorta and Marqués-Ibañez (2011) and Brei et al. (2013), we find robust evidence that government-owned banks have played a countercyclical role in their banking systems. They lend on average at a slower growth rate than private banks in normal times, however, in response to a systemic financial crisis, state-owned banks increase lending. Private banks, on the other hand, shy away from lending. It appears that government-owned banks counteract the slowdown in lending of private banks during crises.

We corroborate our findings with an investigation of the factors that could explain the differential crisis response. There are at least three possible explanations (Brei and Schclarek, in press). Firstly, government-owned banks could tolerate more risks than private banks in the event of a crisis, and increase lending in a turbulent and unstable environment with the objective of counteracting the negative spillovers of the financial shock to the real economy. Secondly, during times of crises, government-owned banks could find it easier to access new capital in the form of equity using government funds, or issuing debt on financial markets at lower costs than private banks, implied by the government's explicit guarantee. And lastly, government-owned banks could suffer less deposit withdrawals than private banks, because the public might perceive them as safer given that they are governmentally owned. While the first hypothesis is more difficult to test empirically, the two latter ones can be tested with our bank-specific information. Using a similar framework than that of the bank lending equation, we do not find robust evidence that government-owned banks experienced significantly higher growth rates of equity and deposits compared to private banks during systemic banking crises. These findings seem to support the view that government-owned banks are more willing to support lending in risky crisis environments.

The paper is organized as follows. The data and descriptive statistics are presented in the next section. The econometric methodology and empirical results are discussed in Section 3. Section 4 provides some robustness checks, and the final section provides the conclusion.

2. Data description

The bank-level data on annual financial statements are taken from the BankScope database complied by the International Bank Credit Analysis Ltd. and the Bureau van Dijk. We have used consolidated statements when available, in line with the view that banks take decisions on their whole spectrum of assets and liabilities including their domestic and foreign subsidiaries. On the other hand we exclude majority-owned subsidiaries. The data covers the period from 1994 year-end to 2009 year-end spanning over periods of economic booms and downturns. Local GAAP statements have been used to reconstruct historically the IFRS statements as many banks switched accounting standards in 2005.

The initial sample of banks included 2119 financial institutions (mostly commercial, savings and cooperative banks, and bank holding companies) headquartered in 69 countries located in three regions: (i) Latin America and the Caribbean, (ii) advanced European countries and (iii) Eastern Europe. Because an important number of banks report only over a short time period in BankScope, we have excluded banks that report less than 4 consecutive years, which is often the case for small banking institutions.[1] Given that we compare pre-crisis and crisis responses on the bank-level, it is important to have a minimum of consecutive financial statements per bank over time. Another selection criterion is to choose those banks per country (beginning with the largest bank) that cover close to 70% of the total banking system.[2] Finally, to avoid the panel being dominated by the huge number of banks in particular banking systems (as in Germany or in Italy), we have removed banks that have average assets below a country-specific threshold.[3] As can be seen in Table 1, the final set of banks includes 764 financial institutions operating in 50 countries. The sample of banks is representative as they account for 41 trillion USD of assets at end-2007, corresponding to close to 50% of the global banking system. Most of these assets (87%) are controlled by 436 European banks headquartered in 19 countries, followed by 281 banks (with 3 trillion USD of assets) from 22 Latin American and Caribbean jurisdictions, and 47 banks from 9 Eastern European countries with a total of 2 trillion USD of assets.

We identified state-owned banks with the criterion that a government or a similar public institution owns more than 50% of the bank's capital. We use BankScope information on the global ultimate owner as the principle source, but we complement the

[1] Bank information for banks with few observations is also more likely to be reported with errors.

[2] The total size of banking systems was calculated with the sum of total assets of domestic banks listed in "The Banker" at end-2008.

[3] For example, in the case of Germany we removed banks with average assets of less than 5 billion USD to reduce the number of German banks from 611 to 90 institutions.

Table 1
Bank characteristics across regions, 1994–2009.[a]

	Advanced Europe	Latin America and the Caribbean	Emerging Europe
Assets at end-2007 (billion USD)	35,595	3,139	2,409
Public bank share			
End-2007	6.24	20.00	24.88
End-2000	8.16	25.63	23.70
End-1995	9.08	38.3	n.a.
Bank-specific characteristics, 1994–2009			
Δloans	10.47	15.19	28.62
Δloans, no crisis	10.75	15.07	29.82
Δloans, crisis	9.27	15.46	25.86
Size (billion, USD)	53.30	8.46	2.84
Liquid assets over assets	11.59	17.92	21.32
Equity over assets	4.90	12.68	15.47
Tier 1 ratio	11.56	14.22	19.28
Market funding over assets	44.33	40.88	38.95
Non-performing loan ratio	2.69	6.33	6.64
Return on equity (ROE)	7.03	9.46	11.33
Loans over assets	57.00	50.70	50.44
Deposits over assets	50.97	52.49	52.83
Securities over assets	21.66	24.50	17.40
Summary statistics			
Number of countries	19	22	9
Number of all banks	436	281	47
Number of public banks	32	23	8
Observations, all banks	4,900	2,856	419
Observations, public banks	314	280	63

Source. BankScope; authors' own calculations.

[a] *Note*. The sample period is 1994–2009. The bank-specific characteristics are unweighted averages per country. 'Public bank share' indicates the share of public bank assets in all banks' assets per region, in percentages. 'Europe' includes AT, BE, CH, DE, DK, ES, FI, FR, GR, IE, IS, IT, LI, LU, NL, NO, PT, SE and SM. 'Latin America' includes AD, AN, AR, BB, BM, BO, BR, BS, CL, CO, CR, CU, DO, EC, GT, HN, JM, KY, MX, PA, PE and SV. And finally, 'Emerging Europe' includes CY, CZ, HU, LV, PL, RO, RS, RU and SI.

information with publicly available information from central banks and related institutions. The complicated issue is that BankScope ownership information is provided only for recent years (starting from 2004), with a bias toward the reporting of the ultimate owners of larger banks only. It is important for our purposes to track changes in the ownership structure over time to account for situations in which private banks have been taken over by a government, or in which government-owned banks have been privatized (as has been the case in the transition economies during the 1990s).[4] For our sample of banks, however, changes of ownership have been limited with most of them occurring during the resolution process of the global financial crisis.[5] As a final check for whether we are missing important information on government-owned banks, we compare their share in the banking sector per country (calculated by the sum of assets controlled by government-owned banks divided by all banks' assets) for 1995, 2000, and 2007 with the shares reported by La Porta et al. (2002) and Micco et al. (2007). In a few smaller countries, we find significant differences due to the non-existence (or non-continuous information) of a large bank in BankScope.

Out of the total of 764 banks, we identified 63 government-owned institutions with a total of 3.1 trillion USD of assets at end-2007 (Table 2, columns 2 and 3) corresponding to 8% of the total of the sample's assets. In advanced Europe, government-owned banks are less important, where 32 public banks (7% of banks) account for 6% of bank assets in 2007 (being the highest in Germany and France). In Latin America and the Caribbean and in Emerging Europe, government-owned banks are more involved in banking with a share of 20% and 25% of assets, respectively (Table 1). Especially in Latin America and the Caribbean, government-owned banks are on average larger than their private competitors since 23 public banks (8% of banks) hold 20% of assets. This could be a result of the different policies pursued across these regions, as the advanced European economies have put more importance on the privatization of their banking industry.

Our dependent variable – bank loans – comprises retail lending (residential mortgages and other consumer loans), corporate loans, and commercial loans measured by the BankScope item gross loans. To avoid exchange rate valuation effects, we measure loans in constant 2009-USD. We exclude observations with extremely low and high growth rates (below the first percentile and above the 99th percentile) to avoid the impact of mergers and acquisitions on the growth rate of lending and other noise in the data.

The crisis periods are identified with the systemic banking crisis indicator of Laeven and Valencia (2008).[6] In total, our sample covers 37 systemic banking crises that occurred in 33 countries over the period of 1994–2009. With the onset of the global financial crisis in 2007, 17 countries have experienced a systemic banking crisis most of which affected advanced European countries and, to a lesser extent, Emerging Europe countries. Although the other countries did not experience a systemic banking crisis during 2007–09, we assigned a crisis period to all countries during that period. The reason is that we would like to capture public bank lending in response to the recent crisis as well, even though it did not materialize in every country as a systemic financial crisis, but rather as milder slowdowns.[7]

Table 2 provides a description of the dataset using summary statistics across different types of banks. It compares private and government-owned banks, small and large banks, less and highly liquid banks, and low and highly capitalized banks. With regards to private and state-owned banks an important finding is that, during normal times, private banks lend on average at a higher annual growth rate than public banks (11% compared to 10%). Conversely, the growth rate of lending is higher for government-owned banks during crises (13% compared to 9%). This first piece of evidence does not imply that all public banks supply more credit during a crisis, or that it is a causal relationship, and we have to control for other determinants of bank lending (see below). A similar countercyclical lending response can be observed for small banks and highly capitalized banks, as they increase lending during periods of financial turmoil relative to normal times, as opposed to large and less capitalized banks which cut down on lending in times of crisis. These findings could be explained by the higher involvement in relationship lending of small banks, as they continue lending to their customers even in risky environments. The findings, with regards to capital, point at the critical role of capital as a buffer against large and unexpected financial shocks (Brei et al., 2013).

There is an important heterogeneity in bank lending across the three regions (Table 1). In Emerging Europe, lending and

[4] To gather information on government ownership, we combined historically different versions of BankScope CDs, as each one contains information on the ultimate owner at the time of publication.

[5] In a number of advanced economies, banking institutions have been intervened (or rescued) by governments. Most interventions took the form of capital injections. In the extreme case, private banks have even been nationalized (such as Bradford & Bingley in England or Anglo Irish Bank in Ireland).

[6] Under their definition, a systemic banking crisis occurs when a country's corporate and financial sectors experience a large number of defaults, and financial institutions and corporations face difficulties in repaying debt on time. The authors combine quantitative data with some subjective assessments by economists.

[7] We experiment with different definitions of the crisis window in the robustness checks.

Table 2
Description of the dataset.[a]

	Private banks	Government-owned banks	Small banks	Large banks	Low liquid banks	High liquid banks	Low capital banks	High capital banks	All banks
Annual growth rates, weighted averages									
Δloans (1994–2009)	10.46	11.50	14.40	10.61	6.98	11.35	9.19	16.91	10.56
Δloans, crisis	9.24	13.41	16.59	9.54	5.45	12.64	8.23	20.08	9.65
Δloans, no crisis	11.32	10.03	13.02	11.39	7.52	10.26	9.86	13.53	11.21
Volumes, at end-2007									
Total assets (bil. USD)	36,737	3,070	253	37,115	1,858	17,581	31,068	2,072	39,807
Percentage of total assets	92.3%	7.7%	0.6%	93.2%	4.7%	44.2%	78.0%	5.2%	100%
Deposits (bil. USD)	11,449	976	126	11,140	716	4,980	9,210	530	12,425
Percentage of deposits	92.1%	7.9%	1.0%	89.7%	5.8%	40.1%	74.1%	4.3%	100%
Loans (bil. USD)	15,180	1,215	145	14,857	1,039	4,723	11,655	976	16,395
Percentage of loans	92.6%	7.4%	0.9%	90.6%	6.3%	28.8%	71.1%	6.0%	100%
Net income (bil. USD)	233	12	4	206	11	89	112	35	245
Percentage of net income	95.1%	4.9%	1.6%	84.1%	4.5%	36.3%	45.7%	14.3%	100%
Ratios, weighted averages 1994–2009									
Liquid assets over assets	22.78	15.18***	15.74	23.09**	1.58	34.55***	23.23	22.22	22.09
Equity over assets	4.36	4.73	12.80	4.18***	6.90	3.93***	3.00	14.77***	4.39
Tier 1 ratio	9.13	8.70	15.79	9.00***	9.16	9.64	8.80	12.88***	9.09
Market funding over assets	62.67	69.31***	38.52	64.67***	20.53	66.36***	65.51	67.17	63.28
Non-performing loan ratio	2.96	4.68***	5.36	3.02***	5.25	3.17***	2.82	3.31*	3.09
Return on equity (ROE)	6.41	9.86***	8.02	6.06	4.24	6.57*	5.88	4.02	6.73
Loans over assets	43.72	42.12**	56.09	42.36***	57.16	29.80***	40.60	52.14***	43.57
Deposits over assets	35.29	28.92***	54.18	33.55***	41.92	32.06***	33.07	28.37***	34.71
Securities over assets	34.07	27.94***	19.85	34.59***	19.07	46.03***	35.90	30.22***	33.51
Number of banks	701	63	191	191	191	191	191	191	764
Number of observations	7,508	667	1,752	2,009	1,976	2,123	2,228	1,858	8,175

Source. BankScope; authors' own calculations.

[a] *Note*. The sample period is 1994–2009. The distinction between small/large or low/high refers to banks from the 1st quartile and the 4th quartile, respectively, of the distribution of each variable.

Asterisks indicate whether the weighted averages between two contiguous columns (public/private banks, small/large banks, low liquid/high liquid banks and low capital/high capital banks) are significantly different based on a t-test.

* Significance at the 10% level.

** Significance at the 5% level.

*** Significance at the 1% level.

profitability growth rates (the latter being measured by ROE) have been the highest reflecting their catching up during the transition period in the 1990s. Latin America and the Caribbean also recorded a higher growth of bank lending than the advanced European economies, where non-financial firms not only rely on the traditional lending intermediated by banks but also on funds from more developed financial markets. Nevertheless, the higher growth of lending in these regions has been associated with a higher fraction of non-performing loans (6% of loans compared to 3% in advanced Europe). The higher profitability in these regions points to the higher intermediation margin in the less-developed banking systems. On the funding side, banks from the emerging regions have operated with higher capital ratios and they relied less on market funding making them less vulnerable to financial market disruptions.

3. Bank lending in times of crisis

To take into account other bank-specific characteristics that determine individual bank lending, we utilize a specification that has been used before in the bank lending channel literature (Ehrmann et al., 2003). The model controls for aggregate conditions using country- and time-fixed effects and for bank-specific conditions that have been shown to be important determinants of bank lending. Given that financial crises are systemic extreme events, we need to differentiate the functioning of the bank lending channel in normal times and during crisis periods. Following Gambacorta and Marqués-Ibañez (2011) and Brei et al. (2013), we solve the problem by interacting a crisis dummy C_{jt} with the bank-specific variables X_{ijt} in the regression, thus allowing for a parameter shift in the estimated relation between lending and the explanatory variables. To make a difference between private and government-owned banks, we introduce a public bank dummy variable, G_{ijt}, that is equal to one when a government owns more than 50% of the bank's capital and zero otherwise. This dummy variable is interacted with the other bank-specific variables and their crisis interactions allowing for differential lending responses across private and government-owned banks in normal and crisis times.

The approach can be summarized using the following nested regression:

$$\Delta L_{ijt} = \alpha_1 \Delta L_{ijt-1} + \alpha_1^* \Delta L_{ijt-1} C_{jt} + (\alpha + \alpha^* C_{jt}) + (\alpha_G + \alpha_G^* C_{jt}) G_{ijt} + [\gamma + \gamma^* C_{jt} + (\gamma_G + \gamma_G^* C_{jt}) G_{ijt}]^* X_{ijt} + \beta Z_j + \delta Y_t + u_i + \varepsilon_{ijt}$$

where ΔL_{ijt} denotes the annual loan growth of bank i that is headquartered in country j in year t, C_{jt} the crisis dummy, G_{ijt} the dummy for government-owned banks, and X_{ijt} the vector of bank-specific characteristics. The time-invariant country dummies Z_j are intended to control for unobserved differences in accounting standards and other country-specific factors and the time-fixed effects Y_t control for aggregate loan demand. The error term is allowed to include individual fixed-effects or random-effects, u_i, based on the Hausman test. The model is estimated in growth rates, because lending in levels is non-stationary as confirmed by the Im–Pesaran–Shin test.[8] We estimate a dynamic specification by including the growth rate of lending of the previous year. The

[8] We experiment as well with the loan-to-asset ratio as a dependent variable (discussed in the robustness checks). We prefer, however, working with the growth rate of lending and follow the literature on the bank lending channel (Kashyap and

Table 3
Summary statistics of the regression variables.[a]

	Number of observations	Mean	Standard deviation	Min	Max
ΔL_{ijt-1}	7,068	13.53	22.09	−87.66	99.21
Size_{ijt-1}	7,997	1.43	1.74	−4.46	8.03
$\text{Liquid assets}_{ijt-1}$	7,650	13.68	14.26	0.001	99.64
Capital_{ijt-1}	7,964	10.49	11.71	0.001	100
$\text{Capital}^2{}_{ijt-1}$	7,964	247.21	947.59	0.00001	10,000
$\text{Market funding}_{ijt-1}$	7,518	45.42	27.07	0.54	100
IFRS dummy_{ijt}	7,997	0.11	0.31	0	1
C_{jt}	7,997	0.20	0.40	0	1
G_{ijt}	7,997	0.08	0.27	0	1

Source. BankScope; authors' own calculations.
[a] *Note*. The sample period is 1994–2009.

lagged dependent variable is also interacted with the crisis dummy to allow for a shift in the persistence of lending in times of crisis.

The vector X_{ijt} includes the main bank-specific variables that have been highlighted in the empirical literature as important determinants of loan supply, notably *bank size*, *liquid assets*, *capitalization* and *market funding*. We lag bank-specific characteristics once $(t-1)$ in order to mitigate a possible endogeneity problem. The variables are demeaned for estimation and as such the results can be interpreted in terms of the average bank (for which the bank-specific characteristics are equal to zero).

Bank size is measured by the logarithm of total assets. Its expected coefficient is ambiguous, since large banks could be in a better position to withstand adverse shocks due to their global scope and diversification and thus increase lending in adverse times. On the other hand, small banks tend to engage more in relationship lending (Ehrmann and Worms, 2004; Gambacorta, 2005) and they could provide a more stable lending to borrowers in times of crisis.

Liquidity is measured by the share of liquid assets (cash and due from banks, available-for-sale securities, and trading securities) in total assets. The bank lending channel literature tends to find a positive relation between bank lending and liquidity (Kashyap and Stein, 1995; Kishan and Opiela, 2000; Brei et al., 2013), favoring the view that banks tend to transform liquid assets into more (profitable) customer loans. During a crisis, however, the expected sign is ambiguous, as liquid banks could shy away selling assets in an extremely risky environment and decide to hold these liquid assets until the turmoil calms down and market prices recover.

As a measure for *capitalization*, we use the ratio of equity over total assets (the inverse of leverage). We expect banks with higher capital ratios to have more funds available to increase lending, especially during a crisis. Following Brei et al. (2013), we have included in addition the square of capital to allow for the possibility of a non-linear relation between lending and capital. For instance, Calem and Robb (1999) find that banks take larger risks in lending at low levels of capital (to exploit expected transfers from the deposit insurance) and at high levels (because funding costs are not sensitive to additional risk-taking implied by the low default probability). Moreover the evidence shows that the increase in bank competition, as a result of bank deregulation and globalization, encouraged (undercapitalized) banks to take on more risks (Matutes and Vives, 2000; Salas and Saurina, 2003).

Banks' reliance on *market funding* could be another important determinant of bank lending during times of crises, since banks with a larger dependence on market funding are more exposed to shocks in money and bond markets (Huang and Ratnovski, 2011; Stein, 1995; Kishan and Opiela, 2000; Gambacorta and Marqués-Ibañez, 2011; Brei et al., 2013). It has been shown in the empirical literature that deposits tend to be a relatively stable source of funds and less dependent on market conditions, vis-à-vis tradable instruments implied by their deposit insurance (Ivashina and Scharfstein, 2010; Shleifer and Vishny, 2009). Following Brei et al. (2013), we measure market funding by total liabilities excluding equity minus deposits over total assets and expect a negative sign, especially in times of crises. Finally, we control for changes in accounting standards using a dummy variable that takes a value of 1 when a bank reports under the International Financial Reporting Standards (IFRS) and 0 otherwise.[9] Table 3 provides summary statistics of the regression variables.

Regarding the nested regression model, the key coefficients are α, α^*, α_G and α_G^* (note that the explanatory variables are equal to zero for the average bank due to the demeaning). The short-run coefficient α measures the lending growth rate of average private banks in normal times (see Table 4 below). The coefficient α^* measures the change in the lending responses of private banks during a crisis relative to their lending standards in normal times. If it is significantly negative, this means that the average private bank's growth rate of lending during a crisis, $\alpha+\alpha^*$, is lower compared to normal times. The coefficient α_G measures the difference in lending across government-owned and private banks in normal times. If this coefficient is significantly negative, it implies that the average public bank's growth rate of lending during normal times, $\alpha+\alpha_G$, is lower than that of a private bank. During crises, the loan growth of the average public bank is equal to $\alpha+\alpha^*+\alpha_G+\alpha_G^*$. If α_G^* is significant and positive the average public bank lends more during a crisis than in normal times. Whether a public bank lends more during crises than a private bank is determined by the sum of the coefficients, $\alpha_G+\alpha_G^*$. If this sum is significantly positive, the average public bank lends at a higher growth rate than the average private bank during a crisis.

The differential effects of the bank-specific variables on private bank lending during normal times are summarized by the coefficients in vector γ, whereas the effects during a crisis can be calculated by the sum $\gamma+\gamma^*$. If a coefficient in γ^* is significant, this implies that the relation between the bank-specific characteristic and bank lending of private banks has changed from normal to crisis times. For government-owned banks, the effect of a bank-specific characteristic on lending during normal times is equal to the sum $\gamma+\gamma_G$ and a significant coefficient in γ_G indicates that the relation between lending and the individual characteristic during

[9] In most countries, banks changed accounting standards in 2005 from the local Generally Accepted Accounting Principles (GAAP) to the more harmonized IFRS accounting standards. Compared to local GAAP, IFRS puts more emphasis on fair value accounting and restricts the netting out of derivative positions. Especially the latter modification to the accounting principles tends to increase the balance sheet size and makes a comparison of GAAP and IFRS statements difficult.

Table 4
Lending responses among different types of banks and states of nature.

	Private banks, $G_{ijt} = 0$	Public banks, $G_{ijt} = 1$
No crisis, $C_{jt} = 0$	$\Delta L_{ijt} = \alpha_1 \Delta L_{ijt-1} + \alpha + \gamma X_{ijt}$	$\Delta L_{ijt} = \alpha_1 \Delta L_{ijt-1} + \alpha + \alpha_G + (\gamma + \gamma_G) X_{ijt}$
Crisis, $C_{jt} = 1$	$\Delta L_{ijt} = \alpha_1 \Delta L_{ijt-1} + \alpha + \alpha^* + (\gamma + \gamma^*) X_{ijt}$	$\Delta L_{ijt} = \alpha_1 \Delta L_{ijt-1} + \alpha + \alpha^* + \alpha_G + \alpha_G^* + (\gamma + \gamma^* + \gamma_G + \gamma_G^*) X_{ijt}$

Note. For sake of clarity, the table focuses only on the key coefficients associated with the bank-specific characteristics. It is assumed as well that $\alpha_1^* = 0$.

normal times is different compared to private banks. Finally, in the midst of a crisis, the relation between bank lending and bank characteristics of public banks is given by the sum of the coefficients, $\gamma + \gamma^* + \gamma_G + \gamma_G^*$.

3.1. Econometric results

The bank lending equation above is estimated for four specifications: (1) a baseline model without crisis and public bank interactions, i.e. there is no differentiation of the bank lending relations between normal and crisis times, nor are there differences among private and government-owned banks; (2) the crisis dummy C_{jt}, the public bank dummy G_{ijt}, and their interaction, $C_{jt}G_{ijt}$, are included. In this specification we do not allow for shifts in the relation between lending and its determinants, but rather we focus on the constant terms α, α^*, α_G, and α_G^* that measure differences in bank lending among normal and crisis times and the average private and state-owned banks; (3) all interactions are included allowing for different relations between bank characteristics and lending that depend on the state of nature and the type of ownership; and, in addition, (4) we include an interaction between the lagged loan growth and the crisis dummy to allow for a shift in the persistence of bank lending.

Regarding the estimation method, we employ two commonly used estimators that have been used before in the bank lending channel literature (Ehrmann et al., 2003): the fixed- or random-effects panel estimator and the system GMM estimator. The choice to work with random-effects rather than with the fixed-effects version is based on the Hausman test which rejects that the coefficients are significantly different. Given our dynamic specification and the fact that the random-effects estimates might be biased due to the limited time dimension (Nickell, 1981), we use in addition the system GMM estimator based on the panel GMM estimator proposed by Arellano and Bond (1991).

The estimation results for specifications (1) and (2) are shown in Table 5. Each specification is estimated with the random-effects and the system GMM methodology. In general the results are very similar. Across all specifications and estimators we find that lending is significantly and positively autocorrelated confirming our dynamic specification. The average bank increases lending by about 7% each year (α is 6.9 and 7.3 in columns R1 and R2 for specification (1)). The results show that bank size has no significant effect on lending throughout the sample period, whereas liquidity and capital have a significant positive impact. Dependence on market funding has a significant negative effect. Overall the bank-specific coefficients are robust across the two estimators and robust to the inclusion of the crisis and public bank dummies and their interaction term in specification (2). Across all specifications the coefficients are comparable in terms of magnitude and significance.

Bank size has a negative but not a significant impact on bank lending over the whole sample period which is in line with the literature. To be more precise, the empirical bank lending

Table 5
Regression results – parsimonious specifications.[a]

	R1 Random-effects		R2 System GMM		R3 Random-effects		R4 System GMM	
	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
ΔL_{ijt-1}	0.20***	0.03	0.22***	0.03	0.20***	0.03	0.23***	0.03
Crisis and public bank dummies								
α	6.92***	1.31	7.30***	1.29	11.4***	1.30	11.0***	1.31
α^*					−7.11***	0.94	−5.88***	0.96
α_G					−1.79	1.79	−2.22	2.14
α_G^*					4.86*	2.66	5.87*	3.16
Bank-specific characteristics								
Size_{ijt-1}	−0.27	0.33	−0.35	0.31	−0.08	0.34	−0.24	0.30
$\text{Liquid assets}_{ijt-1}$	0.11***	0.03	0.10***	0.04	0.09***	0.02	0.10***	0.04
Capital_{ijt-1}	0.43***	0.09	0.59***	0.15	0.44***	0.08	0.57***	0.15
Capital^2_{ijt-1}	−0.01***	0.001	−0.01***	0.002	−0.01***	0.001	−0.01***	0.002
$\text{Market funding}_{ijt-1}$	−0.05**	0.02	−0.05**	0.02	−0.05**	0.02	−0.05**	0.02
IFRS dummy_{ijt}	−1.10	1.65	−0.98	0.91	−0.54	1.53	−0.61	0.89
Other statistics								
Time dummy	*In*		*In*		*In*		*In*	
Country dummy	*In*		*In*		*In*		*In*	
Observations	6,151		6,151		6,151		6,151	
Overall R^2	0.15				0.16			
AR(2) test (p-value)			0.87				0.82	
Hansen test (p-value)			0.13				0.11	

[a] *Note*. The sample period is 1994–2009. "System GMM" refers to estimations using the Arellano and Bover (1995) system GMM estimator and "Random effects" to the random effects panel estimator. Robust standard errors are reported for GMM and are clustered at the country level in the case of random effects. "Hansen test": p-value of the Hansen J test for over-identifying restrictions with the null of validity (only System GMM). "Overall R^2": overall coefficient of determination (only random effects). "AR(2)": p-value of the Arellano–Bond test on absence of autocorrelation in residuals of order 2 (only System GMM).

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

channel literature typically tends to find a negative relation which is explained by the fact that small banks are more active in the traditional lending business and engage more in relationship lending (Ehrmann and Worms, 2004; Gambacorta, 2005). Similarly they might have a larger trading book and engage more in the securitization of their loan portfolio (Altunbaş et al., 2009). Once other factors are taken into account, however, the information content of bank size is rather limited (Gambacorta, 2005; Brei et al., 2013).

In line with the literature we find that capital and liquidity have a significant and positive impact on bank lending (Kashyap and Stein, 1995, 2000; Kishan and Opiela, 2000; Brei et al., 2013). Banks with higher capital ratios tend to increase lending in the following period, i.e. an additional percentage of equity relative to assets increases the growth rate of lending by 0.6% in the short run. Similar to Brei et al. (2013) we find a non-linear relation between capital and lending pointing to the decreasing effectiveness of capitalization in supporting new loans. Banks tend to transform higher liquidity into higher lending, which could indicate that liquid banks invest their liquid, low-yielding assets in higher-yielding loans. More precisely, a 1 percentage point higher ratio of liquid assets is associated with an increase of bank loan growth by 0.1%. Our conjecture is that relatively solvent and liquid banks have more resources available to increase lending than others.

Market funding is another significant determinant of lending over the whole sample in line with the empirical literature (Kashyap and Stein, 1995; Brei et al., 2013). Banks that rely more on deposit funding (and less on bond and money markets) tend to lend more on average. This finding could be due to the fact that deposits are a more stable source of funding. As such, banks could find it less risky to finance a relatively illiquid loan portfolio with this type of funding. Similarly deposit-taking institutions could have closer relationships to their customers and lend out more per unit of deposits than banks that rely on market funding. There is certainly a size factor involved as well, as larger banks typically find it easier to access non-deposit funding on financial markets (Kashyap and Stein, 1995). The recent experience with the global financial crisis has shown that market funding can be a very unstable source of funds (Ivashina and Scharfstein, 2010; Huang and Ratnovski, 2011).

It is crucial to distinguish tranquil from crisis times and government-owned from private banks in the bank lending equation. The first piece of evidence for the differential lending response across government-owned and private banks is shown in columns R3 and R4 of Table 5. The results corroborate what Table 2 suggested, that private banks lend more in tranquil times and cut down on lending in crisis times, while government-owned banks expand lending in response to a crisis. Based on column R4, the average private bank increases lending by $\alpha = 11\%$ per annum in normal times. During a crisis, however, private banks decrease significantly their lending growth rate (by $\alpha^* = -5.9\%$) to an annual growth rate of 5.1%. Interestingly, we do not find that lending of public banks grows slower in normal times than lending of private banks, i.e. the coefficient $\alpha_G = -2.2$ is not statistically significant. More importantly, with the onset of a crisis, the average public bank lends at a higher growth rate of $\alpha + \alpha_G + \alpha^* + \alpha_G^* = 8.8\%$ compared to private banks and it counteracts the slowdown of private banks' lending.

The econometric results suggest that private banks tend to lend pro-cyclically while public banks' lending appears more stable over the business cycle. It could be that government-owned banks tolerate more risk than private banks in the event of a systemic banking crisis. They therefore increase lending in a turbulent and unstable environment with the objective of counteracting a credit crunch and negative spillovers to the real sector. Additional lending, however, must be financed with some additional capital for a given stock of liquid assets. It could be that government-owned banks find it easier to access such capital during the financial turmoil in the form of equity or by issuing debt on financial markets at a lower cost than their private competitors (due to the governmental guarantee). It might be as well that the depositors perceive government-owned banks as safer and therefore withdraw deposits from private banks, shifting them to government-owned banks. The observed difference in lending responses is most probably explained by a combination of these factors, which we will investigate in more detail in the next section.

The relation between bank lending and the bank-specific determinants might change in response to a crisis (Brei et al., 2013). For instance, the effectiveness of capital in generating lending could be intensified during a crisis, since crisis-related losses or increases in risk-weighted assets are less likely to push well-capitalized banks below the regulatory minimum. Table 6 shows the regression results for specifications (3) and (4) that allow for time- and type-varying parameters. Our main findings are robust across estimators and specifications: government-owned banks counteract the slowdown in lending of private banks during times of crisis. The average private bank lends at a growth rate of 11% in tranquil times and it decreases its growth rate by −4 to −7 percentage points depending on the specification. Public bank lending during normal times is not consistently lower than that of private banks; only in the case of the system GMM estimator the coefficient α_G is significant and is equal to −3%. In times of crisis, however, public banks show consistently an increase in lending relative to their lending in normal times implied by the positive and significant coefficient α_G^*. Based on regression R8, the growth rate of lending of the average private bank during crises is $\alpha + \alpha_G = 11.1 - 4.4 = 6.7\%$, while government-owned banks lend at $\alpha + \alpha_G + \alpha^* + \alpha_G^* = 6.7 - 3.3 + 5.1 = 8.5\%$.

Bank size was not a significant determinant of lending over the whole sample and across all banks, but it turns now significant (only for the system GMM estimations). While large private banks tend to cut down on lending during crises, large government-owned banks tend to counteract the credit slowdown more than other banks. The difference could be explained by differences in crisis-related losses, risk tolerance, or access to additional funding. It could be that large private banks (due to their implicit bailout guarantee) have taken on excessive risks prior to the crisis, which resulted in large crisis-related losses and impaired their ability to provide new loans.

Bank capital and liquidity remain important determinants of bank lending. Banks with higher capital ratios supply more lending, regardless of the business cycle and the type of ownership. The parameter γ_{CAP} ranges from 0.4 to 0.6 and it indicates that 1 percentage more of equity over assets is associated with a 0.4–0.6% higher growth rate of lending in the following year. This holds true not only in normal times but also in times of turbulence, since the crisis coefficients associated with capital, γ_{CAP}^* and $\gamma_{G,CAP}^*$, are not significant. There are signs of a decreasing effectiveness of capital for private banks, since the coefficient associated with the square of capital, γ_{CAP^*CAP}, is significant and negative (Brei et al., 2013). In the case of public banks, however, the effect is attenuated (the coefficient γ_{G,CAP^*CAP} is significant and positive in specifications R5–R7). Liquidity supports higher lending in normal times only at government-owned financial institutions, but during crises it is an important determinant of lending for all banks (the coefficient γ_{LIQ}^* is significant and positive, while $\gamma_{G,LIQ}^*$ is not significant).

Banks that rely relatively more on market funding lend out at a slower pace than other banks and there are some signs that the effect is intensified during crisis in the case of public banks (the coefficient $\gamma_{G,MFUND}^*$ is significant and negative in regressions R6 and R8 estimated by system GMM). It could be that this finding is related to the more recent experience with the sudden stop in market funding (Ivashina and Scharfstein, 2010). If public banks had less experience on these markets than their private peers, then

Table 6
Regression results – general specifications.[a]

Dependent variable: growth rate of lending	R5 Random-effects		R6 System GMM		R7 Random-effects		R8 System GMM	
	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
ΔL_{ijt-1}	0.20***	0.03	0.22***	0.03	0.24***	0.03	0.23***	0.03
$\Delta L_{ijt-1}{}^{*}C_{jt}$					−0.22***	0.04	−0.21***	0.04
Crisis and public bank dummies								
α	12.1***	1.65	11.7***	1.23	11.0***	1.45	11.1***	1.23
α^{*}	−7.13***	1.74	−5.60***	0.97	−4.84***	1.35	−4.45***	1.00
α_G	−2.05	1.61	−3.32*	2.02	−2.14	1.51	−3.34*	1.94
α^{*}_G	4.76*	2.50	5.03*	3.01	5.48**	2.62	5.10**	2.52
Bank-specific characteristics, private banks								
$Size_{ijt-1}$	0.01	0.40	−0.10	0.32	0.09	0.39	−0.09	0.30
Liquid $assets_{ijt-1}$	0.05*	0.03	0.04	0.04	0.04*	0.03	0.04	0.04
$Capital_{ijt-1}$	0.41***	0.13	0.57***	0.18	0.39***	0.13	0.42**	0.18
$Capital^2_{ijt-1}$	−0.01***	0.002	−0.01***	0.002	−0.01***	0.002	−0.01**	0.002
Market $funding_{ijt-1}$	−0.05**	0.02	−0.04*	0.02	−0.05**	0.02	−0.04*	0.02
$Size_{ijt-1}{}^{*}C_{jt}$	−0.89*	0.48	−1.05**	0.43	−0.96*	0.59	−0.95**	0.45
Liquid $assets_{ijt-1}{}^{*}C_{jt}$	0.13**	0.05	0.16***	0.06	0.15***	0.05	0.14**	0.06
$Capital_{ijt-1}{}^{*}C_{jt}$	0.23	0.30	0.18	0.25	0.32	0.30	0.29	0.25
$Capital^2_{ijt-1}{}^{*}C_{jt}$	−0.002	0.004	−0.001	0.003	−0.004	0.004	−0.003	0.004
Market $funding_{ijt-1}{}^{*}C_{jt}$	0.01	0.03	0.01	0.03	0.01	0.03	−0.01	0.03
Bank-specific characteristics, government-owned banks								
$Size_{ijt-1}{}^{*}G_{ijt}$	0.46	1.40	0.06	1.72	0.46	1.35	0.22	1.77
Liquid $assets_{ijt-1}{}^{*}G_{ijt}$	0.17**	0.08	0.18*	0.10	0.16*	0.08	0.14	0.10
$Capital_{ijt-1}{}^{*}G_{ijt}$	−0.46	0.41	−0.44	0.41	−0.37	0.41	−0.14	0.38
$Capital^2_{ijt-1}{}^{*}G_{ijt}$	0.02**	0.01	0.01*	0.01	0.01*	0.01	0.01	0.01
Market $funding_{ijt-1}{}^{*}G_{ijt}$	0.04	0.07	0.07	0.09	0.05	0.06	0.07	0.08
$Size_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	1.49	1.80	3.99*	2.27	1.59	1.87	4.08*	2.20
Liquid $assets_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.16	0.14	−0.01	0.17	−0.17	0.14	−0.13	0.16
$Capital_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	0.05	0.68	−0.07	0.77	0.02	0.72	0.10	0.73
$Capital^2_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.01	0.01	−0.002	0.01	−0.01	0.01	−0.004	0.01
Market $funding_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.10	0.09	−0.21*	0.11	−0.11	0.10	−0.21*	0.11
IFRS $dummy_{ijt}$	−0.18	1.47	−0.37	0.89	−0.26	1.58	−0.29	0.89
Other statistics								
Time dummy	*In*		*In*		*In*		*In*	
Country dummy	*In*		*In*		*In*		*In*	
Observations	6,151		6,151		6,151		6,151	
Overall R^2	0.16				0.17			
AR(2) test (p-value)			0.86				0.67	
Hansen test (p-value)			0.11				0.53	

[a] *Note*. The sample period is 1994–2009. "System GMM" refers to estimations using the Arellano and Bover (1995) system GMM estimator and "Random effects" to the random effects panel estimator. Robust standard errors are reported for GMM and are clustered at the country level in the case of random effects.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

public banks would have been hit harder by the crisis than the other banks.

3.2. Which factors explain the differential crisis response?

So far the econometric evidence suggests that government-owned banks play a stabilizing role in times of domestic financial crises as they expand lending, whereas private banks shy away from lending. As discussed before, there are at least three possible explanations for the differential lending response. Is it because government-owned banks tolerate more risks than private banks in the event of a systemic banking crisis? Or, do government-owned banks have an advantage in terms of having better access to additional funding in times of financial turmoil, given that depositors and investors perceive them as safer and the government is more likely to recapitalize them than private banks?

There are empirical studies that examine the crisis response of government-owned banks, but most of them are country-specific or are case studies of particular banks. With regards to deposit withdrawals during a crisis, there exists evidence that government- and foreign-owned banks are less affected, presumably, because depositors perceive them as safer due to their foreign or state ownership (for Argentina, see D'Amato et al. (1997) and McCandless et al. (2003)). Recapitalizations have been mainly studied in response to the recent financial crisis with a focus on bank lending and risk taking, but without making a distinction between state-owned and private banks (Black and Hazelwood, in press; Brei and Gadanecz, 2012; Rose and Wieladek, 2012; Brei et al., 2013). There is evidence that recapitalizations can help support lending in times of a systemic financial shock by pushing regulatory capital ratios to levels that allow banks to expand lending again (Brei et al., 2013).

Against these backdrops, we examine two aspects, namely, the impact of financial crises on deposits and equity of government-owned and private banks using a similar framework as that of the bank lending equation. In particular, we estimate the determinants of deposits and equity by dynamic nested regressions which include the crisis dummy C_{jt}, the public bank dummy G_{ijt}, their interaction $C_{jt}G_{ijt}$, and the other bank-specific characteristics in X_{ijt-1} (bank size, liquid assets, capital, square of capital, and market funding). We estimate the model in growth rates using the system GMM methodology and report two specifications for

Table 7
Regression results – deposits and equity.[a]

Dependent variable:	R9		R10		R11		R12	
	Growth rate of deposits				Growth rate of equity			
	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
Δy_{ijt}	0.19***	0.03	0.19***	0.03	0.10***	0.03	0.10***	0.02
$\Delta y_{ijt}{}^{*}C_{jt}$	−0.37***	0.05	−0.37***	0.05	−0.36***	0.07	−0.36***	0.06
Crisis and public bank dummies								
α	22.3***	1.04	22.7***	1.06	23.4***	1.35	23.6***	1.33
α^{*}	−5.96***	1.35	−6.60***	1.41	−8.21***	1.58	−7.99***	1.59
α_G	−3.38	2.16	−2.90*	1.64	−1.42	2.42	−1.87	2.59
α^{*}_G	2.83	4.51	6.41	7.46	−0.82	9.55	−4.63	18.9
Bank-specific characteristics, private banks								
Size_{ijt-1}	−1.18***	0.30	−1.16***	0.29	−1.87***	0.36	−1.67***	0.36
$\text{Liquid assets}_{ijt-1}$	0.01	0.03	0.05	0.04	0.03	0.04	0.03	0.04
Capital_{ijt-1}	0.29*	0.15	0.16	0.14	−1.06***	0.19	−1.00***	0.21
Capital^2_{ijt-1}	−0.003	0.003	0.001	0.002	0.01***	0.003	0.01***	0.003
$\text{Market funding}_{ijt-1}$	0.07***	0.02	0.06**	0.02	−0.003	0.02	0.01	0.02
$\text{Size}_{ijt-1}{}^{*}C_{jt}$			−0.91	0.68			−1.60**	0.77
$\text{Liquid assets}_{ijt-1}{}^{*}C_{jt}$			−0.14	0.09			0.04	0.08
$\text{Capital}_{ijt-1}{}^{*}C_{jt}$			0.60*	0.36			0.11	0.38
$\text{Capital}^2_{ijt-1}{}^{*}C_{jt}$			−0.01**	0.005			−0.001	0.004
$\text{Market funding}_{ijt-1}{}^{*}C_{jt}$			0.12**	0.05			0.009	0.05
Bank-specific characteristics, government-owned banks								
$\text{Size}_{ijt-1}{}^{*}G_{ijt}$			−0.04	0.10			0.03	0.15
$\text{Liquid assets}_{ijt-1}{}^{*}G_{ijt}$			−0.93	0.61			−1.00	0.65
$\text{Capital}_{ijt-1}{}^{*}G_{ijt}$			0.02**	0.01			0.02*	0.01
$\text{Capital}^2_{ijt-1}{}^{*}G_{ijt}$			−0.07	0.11			−0.01	0.09
$\text{Market funding}_{ijt-1}{}^{*}G_{ijt}$			−1.89	3.34			8.37	6.05
$\text{Size}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$			0.30*	0.18			−0.53*	0.31
$\text{Liquid assets}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$			−0.17	1.94			2.73	4.99
$\text{Capital}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$			0.02	0.06			−0.05	0.12
$\text{Capital}^2_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$			−0.08	0.18			−0.60**	0.28
$\text{Market funding}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$			−0.04	0.10			0.03	0.15
IFRS dummy_{ijt}	−2.53**	1.09	−2.40**	1.14	−1.18	1.50	−0.73	1.54
Observations	6,151		6,151		6,151		6,151	

[a] *Note*. The sample period is 1994–2009. The regressions are estimated with the Arellano and Bover (1995) system GMM estimator. Robust standard errors are reported.
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

each dependent variable: (1) a baseline specification in which the bank-specific variables are not interacted with the crisis and public bank dummy, and (2) a complete specification including all interactions. The results are reported in Table 7. The discussion focuses on specification (2), shown in column R10 for deposits and in column R12 for equity.

In normal times, larger banks have a lower growth rate of deposits and equity compared to smaller banks. In response to a crisis, both the growth of deposits and equity of the average banks are significantly and negatively affected in the order of −6 to −8 percentage points. Therefore, we do not find an asymmetric effect of crises on government-owned and private banks. With regards to deposit withdrawals, we do not find that depositors shift their funds from the average private banks to the average state-owned banks. An explanation could be that firms have been keeping cash on their balance sheets instead of depositing it in banks (which would give rise to a demand channel for lending as they will be less likely to demand loans). On the other hand, it could as well be explained by deposit shifts to small banks not covered in our sample or foreign banking systems. There is also no significant evidence that the capital position of the average government-owned banks have been less affected than that of the average private banks and as such both types of banks were facing the same adverse effect on this type of funding.

There is evidence of bank-specific heterogeneity. With regards to deposits, government-owned banks have a slightly lower growth rate than private banks in normal times. Moreover, banks that rely relatively more on market funding have a higher growth rate of deposits in normal times, similar to state-owned banks with higher capitalization. Once a crisis hits, capital is an important determinant and it appears that depositors shift their funds from less to better capitalized banks, regardless of their ownership. This finding is interesting as it indicates that banks do not only benefit from a higher capitalization in terms of a buffer to withstand adverse shocks, but in addition they have an advantage in terms of being perceived as safer, and as such their deposit base is more stable than for other banks. Similar results are found for large government-owned banks that receive as well more deposits than other banks. Again, this could be the reason why large government-owned banks increased lending significantly during crises by more than others (see regressions R6 and R8). With regards to equity, we find that banks with high capital levels have a slower growth rate of equity during normal times, which seems plausible as they have build up already a sufficiently high capital base in the past. Once the crisis hits, large banks face the highest declines in equity, which is possibly related to a higher risk-taking prior to the crisis (implied by the too-big-to-fail distortions) and higher crisis-related asset write-downs and losses. Finally, government-owned banks with very high capital levels (i.e. the public bank coefficient associated with the square of capital is significant and negative) have a lower equity growth than the other banks.

Overall we do not find significant evidence that the average state-owned banks benefited from additional deposits and equity during systemic financial crises compared to private banks. Rather,

Table 8
Robustness checks.[a]

Dependent variable:	R13		R14		R15		R16	
	Growth rate of lending				Loan to assets ratio			
	Random-effects		System GMM		Random-effects		System GMM	
	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error	Coeff.	Std. error
Δy_{ijt}	0.23***	0.03	0.25***	0.03	0.94***	0.01	0.95***	0.02
$\Delta y_{ijt}{}^{*}C_{jt}$	−0.19***	0.04	−0.20***	0.06	−0.03***	0.01	−0.02***	0.01
Crisis and public bank dummies								
α	10.3***	1.43	10.7***	1.22	4.34***	0.94	2.23	4.77
α^{*}	−8.30***	1.75	−7.34***	1.00	−0.19	0.36	−0.45*	0.26
α_G	−2.31	1.63	−3.84	2.36	−0.95**	0.45	−1.09**	0.55
α^{*}_G	10.5***	3.51	11.3***	3.45	1.67***	0.60	2.01**	0.82
Bank-specific characteristics, private banks								
Size_{ijt-1}	−0.03	0.37	−0.30	0.30	−0.02	0.09	0.04	0.20
$\text{Liquid assets}_{ijt-1}$	0.06***	0.02	0.06	0.04	−0.01	0.01	0.01	0.02
Capital_{ijt-1}	0.43***	0.12	0.47***	0.18	−0.03	0.03	−0.03	0.05
$\text{Capital}^2{}_{ijt-1}$	−0.01***	0.001	−0.01***	0.002	0.001	0.001	0.001	0.001
$\text{Market funding}_{ijt-1}$	−0.05**	0.02	−0.04*	0.02	−0.01*	0.005	−0.01**	0.01
$\text{Size}_{ijt-1}{}^{*}C_{jt}$	−0.01	0.70	−0.04	0.53	0.18	0.16	0.02	0.12
$\text{Liquid assets}_{ijt-1}{}^{*}C_{jt}$	0.03	0.09	0.04	0.09	0.04***	0.01	0.04**	0.02
$\text{Capital}_{ijt-1}{}^{*}C_{jt}$	0.06	0.33	−0.06	0.30	−0.04	0.07	−0.06	0.06
$\text{Capital}^2{}_{ijt-1}{}^{*}C_{jt}$	0.002	0.004	0.004	0.004	0.001	0.001	0.001	0.001
$\text{Market funding}_{ijt-1}{}^{*}C_{jt}$	0.02	0.03	0.01	0.04	−0.01	0.01	0.01	0.01
Bank-specific characteristics, government-owned banks								
$\text{Size}_{ijt-1}{}^{*}G_{ijt}$	0.90	1.34	0.54	1.81	0.28	0.29	0.08	0.41
$\text{Liquid assets}_{ijt-1}{}^{*}G_{ijt}$	0.13*	0.08	0.12	0.10	0.04***	0.02	0.04	0.03
$\text{Capital}_{ijt-1}{}^{*}G_{ijt}$	−0.16	0.39	−0.13	0.45	0.03	0.15	0.07	0.14
$\text{Capital}^2{}_{ijt-1}{}^{*}G_{ijt}$	0.01	0.01	0.01	0.01	0.001	0.002	−0.001	0.002
$\text{Market funding}_{ijt-1}{}^{*}G_{ijt}$	0.01	0.06	0.03	0.09	0.02	0.01	0.03	0.02
$\text{Size}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.50	2.72	2.07	3.12	−0.56	0.42	−0.13	0.52
$\text{Liquid assets}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.04	0.23	0.03	0.26	−0.02	0.05	−0.02	0.05
$\text{Capital}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.72	1.17	0.02	1.72	0.16	0.22	0.18	0.23
$\text{Capital}^2{}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	0.01	0.03	−0.003	0.04	−0.003	0.003	−0.003	0.004
$\text{Market funding}_{ijt-1}{}^{*}C_{jt}{}^{*}G_{ijt}$	−0.03	0.12	−0.09	0.17	−0.02	0.03	−0.05*	0.03
IFRS dummy_{ijt}	0.90	1.52	0.54	1.81	0.28	0.32	0.08	0.41
Observations	6151		6151		6843		6843	

[a] *Note*. The sample period is 1994–2009. "System GMM" refers to estimations using the Arellano and Bover (1995) system GMM estimator and "Random effects" to the random effects panel estimator. Robust standard errors are reported for GMM and are clustered at the country level in the case of random effects. Regressions R13 and R14 are estimated with a crisis window of 2008–09, while regressions R15 and R16 are estimated with the original crisis window with the difference that the loan to assets ratio is the dependent variable instead of the growth rate of loans. Robust standard errors are reported.

* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

banks with higher capital ratios regardless of the ownership receive more deposits during crises. This result supports the first explanation for government-owned banks' higher crisis lending mentioned above; they seem tolerating more risk compared to private banks and expand lending to counteract the negative spillovers to the real sector, implied by the slowdown in private bank lending. It might be that government-owned banks give a higher importance to the externalities of their lending in terms of supporting the recovery of the domestic economy after a financial shock.

4. Robustness checks

In this section we provide some robustness checks with regards to the definition of the crisis period and the definition of the dependent variable.

The first robustness checks intend to evaluate whether the previous results on bank lending in times of crisis depend on the definition of the crisis dummy. As described above, we have assigned a value of one to the crisis dummy according to the systemic banking crisis indicator of Laeven and Valencia (2008) and, in addition, during the period of 2007–09, to capture the response of banks to the recent financial crisis. Although financial difficulties in relation to sub-prime lending became already apparent in August 2007, the largest financial shock occurred in 2008–09 in response to the Lehman collapse in September 2008. To test whether our results are robust to the choice of the crisis window, we re-estimate regressions R7 and R8 using 2008–09 as the recent crisis period. The results are reported in Table 8, columns R13 and R14. As it can be seen, the main results hold that the average private bank decreases lending in times of a crisis, while the average government-owned bank increases lending.

The second robustness check involves replacing the dependent variable, the annual growth rate of lending, by the ratio of loans to assets. The robustness check is interesting, because it helps disentangling the effect of the crisis on the level of loans (divided by total assets to ensure stationarity) from that on the growth rate. A shortcoming of using the ratio is, however, that one could observe an increase in this ratio that is not due to a change in lending but instead to a reduction in assets. The estimation results are reported in Table 8, columns R15 and R16. Given the high autocorrelation of the loan to assets ratio, we focus our discussion on the regression R16 estimated by system GMM. The results indicate that the average public bank has a significantly lower loan to asset ratio compared to the average private bank. With the onset of a crisis, however, the loan ratio of the average private bank decreases significantly, while it increases for the average public bank. These results corroborate our previous findings that indicated that government-owned banks counteract the slowdown of private banks' lending in times of crisis.

5. Conclusion

The present paper investigates empirically the lending responses of private and government-owned banks to systemic financial crises. To this purpose, we use a setup proposed by Brei et al. (2013) that allows for structural shifts in the bank lending equation, which we apply to a large dataset on the financial statements of 764 banks from 50 countries over the period of 1994–2009. In addition, we explore the differential impact of the crises on the funding side of banks.

Our main findings are the following. We find robust evidence that government-owned banks increase lending in response to financial crises relative to normal times, while private banks decrease lending relative to their normal lending pattern. It is interesting that the average private bank lends at a higher growth rate than the average government-owned bank in normal times (11% per annum compared to 8%). However, once the crisis hits, government-owned banks lend at a higher rate (9% per annum vis-à-vis 7% for private banks). In addition, the results indicate consistently that capital and liquidity are important determinants of bank lending during crisis, regardless of its ownership. We do not find consistent evidence that the average government-owned banks received more deposits or equity in times of crises and relate their relative increase in lending to a higher willingness (or risk tolerance) to provide lending in an unstable crisis environment. From a policy perspective, the results suggest that governments can play an active counter-cyclical role in their banking systems directly through government-owned banks.

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