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Rescue packages and bank lending

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ABSTRACT

This paper examines whether the rescue measures adopted during the global financial crisis helped to sustain the supply of bank lending. The analysis proposes a setup that allows testing for structural shifts in the bank lending equation, and employs a novel dataset covering large international banks headquartered in 14 major advanced economies for the period 1995–2010. While stronger capitalisation sustains loan growth in normal times, banks during a crisis can turn additional capital into greater lending only once their capitalisation exceeds a critical threshold. This suggests that recapitalisations may not translate into greater credit supply until bank balance sheets are sufficiently strengthened.

1. Introduction

The strains experienced during the global financial crisis crystallised in the banking system, particularly at major international banks. One important lesson that policymakers have now turned into global regulation is that banks should hold more capital to prevent losses from spilling over from the financial sector to the real economy (BCBS, 2010). In many cases, the recapitalisations in the fall of 2008, along with more generalised support measures, averted the outright collapse of major banks under extremely adverse market conditions. More generally, holding sufficient loss-absorbing capital is also thought to help banks maintain their intermediation capacity and avoid contractions of credit to firms and households.

Against this backdrop, this paper analyses whether the rescue measures adopted by the authorities during the global financial crisis of 2008–2009 helped to sustain the supply of bank lending. From a macroeconomic perspective, this would be the most direct contribution of the rescue measures to social welfare, beyond saving the financial system itself. In the bank lending channel literature, the effect of capitalisation on loan supply has been studied mostly in normal times and in terms of the reaction to monetary policy shocks (Kashyap and Stein, 1995, 2000; Kishan and Opiela, 2000; Van den Heuvel, 2002; Berrospide and Edge, 2010).[1] In this paper, we extend the analysis to include the experience of the global financial crisis of 2008–2009. In doing so, we allow for differential behaviour between banks that were rescued and others that were not, before and after the crisis. This analysis is performed by means of nested regressions designed to discriminate between various hypotheses regarding the role of capitalisation in sustaining bank lending.

The paper makes two main contributions. First, it evaluates the effectiveness of rescue packages, in particular recapitalisations, for bank lending in a crisis context, where identification presents serious challenges, and does so by making use of a setup that allows testing for structural shifts in the bank lending equation. One limitation in testing how bank-specific characteristics and macroeconomic variables affect bank lending is that banks' financial condition could also influence the business cycle and monetary policy decisions. We address this issue by employing a dynamic system Generalised Method of Moments (GMM) panel methodology yielding consistent and unbiased estimates of the relationships between the macroeconomic variables, bank-specific characteristics and bank lending. The GMM methodology has been used extensively in the bank lending channel literature.

A second novelty is the use of a unique dataset covering large international banks headquartered in 14 major advanced

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[1] Recent theoretical papers comparing the effectiveness of different rescue measures include Philippon and Schnabl (2009), Bhattacharya and Nyborg (2011), and Hasman et al. (2011).

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economies for the period 1995–2010. This goes beyond existing studies on the effect of bank capital on lending, which typically look at single countries in a domestic context (Berrospide and Edge, 2010, and references therein). To obtain consistent loan growth series for the entire period, we adjust for 159 relevant merger and acquisitions that distort the underlying lending data from BankScope. In addition, we perform adjustments for currency valuation effects and weigh macroeconomic variables in line with banks' extensive international operations, using the BIS international banking statistics. For detail on the measures enacted during the crisis, the paper draws on data on official rescue measures compiled at the Bank for International Settlements.[2]

Our main results are as follows. Bank capitalisation, here the regulatory capital ratio, plays a very important part in supporting bank lending. The importance of capitalisation for loan supply differs in crisis and normal times, with increasing marginal effectiveness observed during a crisis. However, banks can turn additional capital into greater lending only once their capitalisation exceeds a critical threshold; undercapitalised banks seek to restore their regulatory capital ratio without generating new lending. This suggests that recapitalisations help sustain credit in two ways, by helping banks to survive extreme distress, and by moving capital ratios into a territory that allows banks to expand their lending again.

That said, it is important to recognise that a singular focus on recapitalisations and other measures to sustain bank credit may prove insufficient for generating a sustainable recovery from a financial crisis. While the economy needs credit to flow to productive sectors, bank restructuring – to deal with problems such as evergreening and earlier excesses – is also necessary for laying the foundations of a self-sustaining recovery in which the financial system can operate profitably and efficiently without public support (Borio et al., 2010).

2. Bank rescue packages during the financial crisis

The global financial crisis is widely regarded as the worst financial crisis since the Great Depression. While financial distress afflicted the entire financial system, many crisis-related problems crystallised in the banking system, starting with the interbank market freeze in August 2007. Between early 2007 and March 2009, the stock market valuation of the banking sector declined by 79% from peak to trough, losing over 20% relative to the broader equity index (comparing the MSCI World Index and Bank subindex). CDS premia shot up across the board, indicating that the market priced in a greater likelihood of bank defaults. In the United States alone, 165 FDIC-insured banks failed in 2008–2009, although policy actions averted the most critical bank failures – with the notable exception of the Lehman Brothers bankruptcy in September 2008.

Policymakers responded to the ensuing panic with unprecedented policy measures. Prior to the Lehman bankruptcy, the authorities had intervened on a case by case basis, in addition to providing generalised central bank liquidity support. Thereafter, the authorities enacted generalised rescue programmes, and central banks expanded their balance sheets by implementing unconventional monetary policies.[3] The rescue packages adopted to stabilise the banking system can be divided into four categories as shown in Table 1, illustrating the breadth of interventions.

The major countries afflicted by the crisis launched generalised programmes in two or three, sometimes in all four categories. To prevent bank runs, deposit insurance schemes were extended in more than 20 countries, with coverage limits on retail deposits being raised considerably (to become unlimited in some cases). To facilitate banks' continued access to wholesale funding, the authorities also provided official guarantees on newly issued bank debt. Both types of programme that addressed bank funding were generalised in nature, i.e. available to all banks in a given jurisdiction on standardised terms. By contrast, recapitalisations and asset purchase or insurance schemes were in most cases tailored to individual institutions, and thus bank-specific forms of support.

In this paper, we focus on bank recapitalisations for several reasons. First, recapitalisations were at the core of most rescue packages, and represented the element without which many banks could not have withstood market pressure in the fall of 2008. Other prominent forms of support, notably deposit insurance and debt guarantees, addressed funding needs, rather than solvency problems, and were generalised programmes with standardised terms. Empirically, the institution-specific nature of recapitalisations helps to identify their effectiveness in a cross-sectional analysis, in contrast to generalised programmes available to all banks in a given jurisdiction (which we control for by interacting country dummies with the crisis dummy).

A second reason for focusing on recapitalisations is the fact that, in the presence of binding capital regulation, adequate capitalisation is a necessary condition for lending. Recapitalisations can also be more effective than other forms of rescue in many circumstances (Philippon and Schnabl, 2009; Hasman et al., 2011). The remaining category in Table 1, called asset support, was deployed to very few institutions up to 2010, mostly to those entities for which recapitalisations alone proved insufficient. Indeed, the banks receiving asset insurance and/or asset purchases were a strict subset of those receiving public capital injections. This makes it difficult to net out the singular effect of asset support measures. Moreover, each instance of asset support implies a certain amount of regulatory capital relief as the tail risk on asset values is removed. Thus, our bank-specific results can be understood as compounding the effects of capital injections and the capital relief contained in asset support on the capitalisation ratio and thereby on the supply of lending.

Since the beginning of the financial crisis, total recapitalisations reached $1285 billion, primarily within G10 economies (Fig. 1, left panel). The time profile of recapitalisations shows that their volume peaked in 2008 Q4, driven by injections from the public sector in the context of broader rescue packages (Fig. 1, right panel). Before that quarter, banks had sought to match early losses on their mortgage-related structured products by issuing similar amounts of equity (Fig. 2, left panel). But following the Lehman bankruptcy in September 2008, private investors largely retreated and the authorities intervened to prevent the collapse of major banks by providing substantial capital injections from public sources.

As the crisis proceeded, total credit losses eventually outpaced recapitalisations. Through end-2009, combined credit losses of $1528 billion ($816 billion in the Americas, $664 billion in Europe) exceeded total recapitalisations of $1285 billion ($515 billion in the Americas, $618 billion in Europe). However, there is substantial heterogeneity across banks, as shown in Fig. 2 (right panel). Each dot represents a bank's total credit losses (*x*-axis) and recapitalisations (*y*-axis) since mid-2007. The banks clustered around zero suffered losses but raised no significant amounts of new capital. The banks above the 45° line managed to raise capital in excess of their reported credit losses. As most banks fall below that line, the extent of recapitalisations typically fell short of credit losses, thus reducing capitalisation.[4]

[2] The data were collected by BIS staff between 2008 and 2010, subject to voluntary fact-checking by member central banks. The database comprises detailed information on rescue measures from primary (mostly public) sources in four main categories: deposit insurance schemes, bank debt guarantees, recapitalisations as well as asset purchase and insurance measures.

[3] Detailed analyses of bank rescue packages are provided in Panetta et al. (2009), Petrovic and Tutsch (2009), and Borio et al. (2010).

[4] These figures include realised and reported mark to market losses on credit instruments at those banks and brokerage houses quoted on Bloomberg that posted overall losses exceeding $1 billion (=$10^9$ in Fig. 2).

Table 1
Bank rescue packages.

	AT	AU	BE	CA	CH	DE	ES	FR	IT	JP	NL	SE	UK	US
Deposit insurance														
Capital injections	✓		✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Debt guarantees[1]	✓	✓+	✓			✓	✓	✓			✓	✓	✓	✓
Asset support[2]		(✓)	✓	(✓)	✓	✓	(✓)	✓–		(✓)	✓–		✓–	✓+

Note: Shaded areas represent generalised bank rescue packages (or expanded deposit insurance schemes, respectively). Ticks indicate actual usage, i.e. specific actions taken either under the programme or as standalone actions. Example: the recapitalisation of UBS is shown as a tick in an unshaded area in the column CH, since it was a standalone action (there was no generalised recapitalisation programme). AT = Austria; AU = Australia; BE = Belgium; CA = Canada; CH = Switzerland; DE = Germany; ES = Spain; FR = France; IT = Italy; JP = Japan; NL = Netherlands; SE = Sweden; UK = United Kingdom; and US = United States.
[1] ✓ = Guarantee on new issuance and ✓+ = guarantee also covers outstanding stock of debt.
[2] ✓ = Actual asset purchases or insurance; ✓– = asset insurance only; ✓+ = actual purchases and insurance; and (✓) = asset purchases conducted as part of a programme for supporting key credit markets (rather than specific banks).
Sources: Central banks; government sources; press reports.

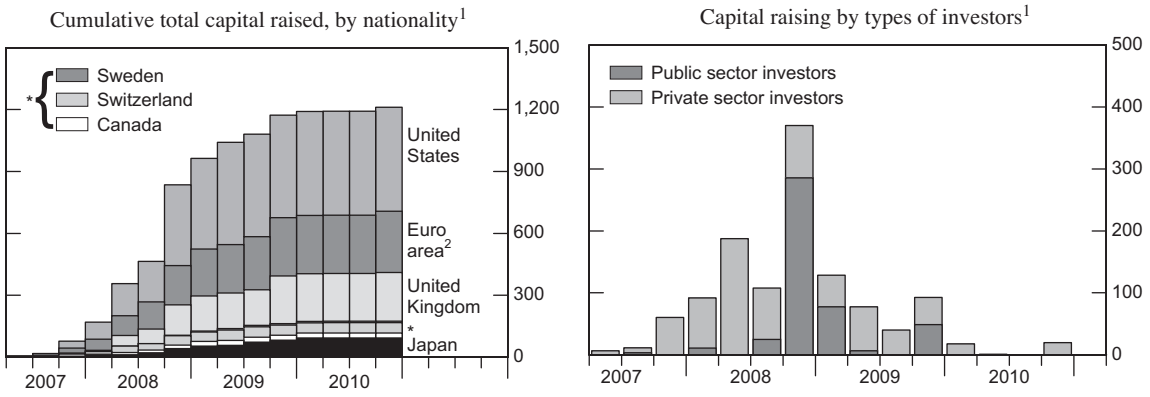

Fig. 1. Capital raising among banks headquartered in G10 economies. *Note*: [1]In billions of US dollars; data up to 17 June 2011. [2] Belgium, France, Germany, Italy, Luxembourg and the Netherlands.
Sources: Central banks; Bloomberg; BIS calculations.

What this might mean for bank lending can be foreshadowed by a simple graph based on the dataset constructed below. Among the banks that were eventually rescued, loan growth (controlling for mergers) had been higher on average than for other banks, although not in the immediate run-up to the crisis. At the height of the crisis in 2008, loan growth among rescued banks collapsed from the pre-crisis average of nearly 10% per annum to below 2%, whereas that of non-rescued banks visibly held up.[5] The latter group had entered the year with a higher level of capitalisation (the regulatory capital ratio stood at 11.6% at end-2007, compared to 10.9% among rescued banks). By 2009, the year in which most recapitalisations were concluded, the difference in average lending between the two groups became indistinguishable, both showing a contraction of 3%. The subsequent recovery path into 2010 appears identical across the two groups. In other words, rescued banks on average were not worse (nor better) placed than other banks to operate in the difficult economic environment of 2009 and 2010.

Whether it was the recapitalisations that put distressed banks at par with the remaining banks is an empirical issue that we address with the econometric approach proposed below. It is worth noting that market evidence, as well as visual inspection of Fig. 3, suggests that the crisis period is centred on the years 2008–2009; the subsequent difficulties encountered by banks since 2010 are related to the effects of sovereign risk and therefore more country-specific in nature, depending on a bank's exposure to the home country sovereign in particular (CGFS, 2011).

The research question this paper asks is whether bank capital supports lending and, in particular, whether recapitalisations were effective in sustaining credit supply during the crisis. A bank recapitalisation helps to support the supply of credit in two related ways. An addition to loss-absorbing capital enables a bank to expand lending while improving (or maintaining) its capital adequacy ratio. An improved capital position also reduces the probability of failure and thereby helps to secure funding.[6] In the context of a *systemic* crisis, however, the effectiveness of recapitalisations is more difficult to establish than for isolated instances of banking distress, since credit outstanding declines in part due to falling demand and generalised funding stress. On the other hand, recapitalisations arguably averted the collapse of the banking system, which can be taken as evidence that they were effective – even though the counterfactual cannot be observed. We seek to address this problem below by exploiting cross-sectional heterogeneity (not all banks received public recapitalisations) and by allowing for parameter shifts during the crisis. In particular, this allows us to estimate the relation between capitalisation and bank lending and test whether this relationship differs systematically between crisis and normal times, as well as for rescued and non-rescued banks, respectively.

The analysis is further complicated by the fact that the banks examined in this paper are major global banks. This requires some

[5] The decline in bank lending in 2008 has been contained somewhat by the use of pre-committed credit lines. Using flows of funds data from the United States, Cohen-Cole et al. (2008) show that the stock of lending did not decline during the first quarters of the crisis, not because of "new" lending, but mainly due to the use of loan commitments and securitisation activity returning to banks' balance sheets.

[6] Capital injections during the crisis were associated with a decline in CDS spreads on announcement (King, 2009).

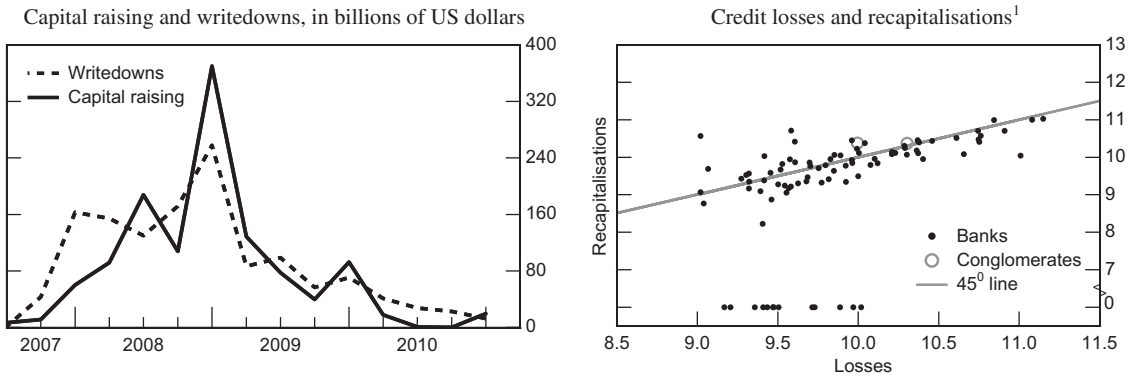

Fig. 2. Credit losses and capital raising. [1] The panel shows banks and broker-dealers with total credit losses exceeding $1 billion since mid-2007, as reported on Bloomberg. Each dot represents one institution's total credit losses (*x*-axis) and recapitalisations (*y*-axis), both from private and public sources, all expressed in logarithms (where 9 represents $1 billion). The banks quoted on Bloomberg booked total credit losses of $1528 billion, and recapitalisations of $1285 billion between from 2007 to end-2009 (data retrieved 2 May 2012). Conglomerates are banking groups with substantial insurance business. *Sources:* Bloomberg; BIS calculations.

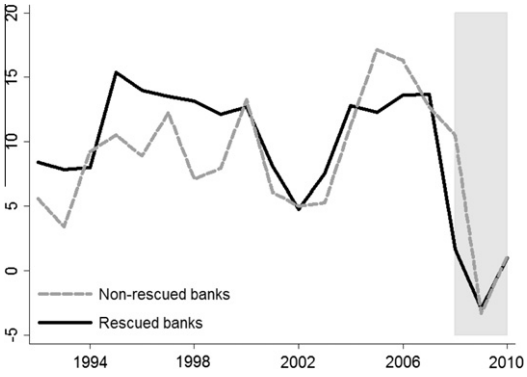

Fig. 3. Loan growth of rescued and non-rescued banks compared, in%. *Note*: The shaded area indicates the period (2008–10). Unweighted averages are shown. The 2010 averages are based on a subsample of 93 banks for which loan growth information was available at the time of writing. Source: BankScope; BIS calculations.

adjustments that would be unnecessary in a purely domestic context. The major banks run large international operations (Goodhart and Schoenmaker, 2009; McCauley et al., 2012); this implies that economic conditions in various countries are relevant to the lending decisions of the typical bank in the sample. The same banks engage in substantial amounts of currency transformation (McGuire and von Peter, 2012),[7] which means that credit extended in currencies other than the dollar must be adjusted for valuation effects. The paper implements these adjustments for the first time in addition to correcting for mergers and acquisitions.

3. Construction of the dataset

Bank-level data are obtained from BankScope, a commercial database maintained by International Bank Credit Analysis Ltd. (IBCA) and Bureau van Dijk. We consider consolidated bank statements, in line with the view that the relevant economic unit is the internationally active bank taking decisions on its worldwide consolidated assets and liabilities. This is a natural choice, since capitalisation is measured at the group level and official recapitalisations have typically been given to the consolidated entity rather than to subsidiaries (e.g. to *Citigroup* rather than to *Citibank National Association*). Our sample adopts an annual frequency and includes all major international banks.[8] It covers the 16 years from 1995 to end-2010, a period spanning different economic cycles, a wave of consolidation, and the global financial crisis.

Against this background, it is essential to control for mergers and acquisitions (M&A). Doing so serves to exclude spurious bursts of credit growth that only reflect mergers between banks.[9] The magnitude of this problem is such that it could introduce substantial noise into the regressions. Fig. 4 illustrates the problem by showing reported growth rates in bank lending for two banks undergoing mergers. The huge spike in each raw loan series simply reflects the fact that the consolidated balance sheet of the acquiring bank suddenly includes a large loan portfolio from its acquisition. This discontinuity disappears when the financial statements are adjusted backwards by aggregating the reported positions of acquirer and target into a combined pro-forma bank.

We adjust for 159 mergers and acquisitions over the sample period by constructing pro-forma entities at the bank holding level.[10] This procedure obviously limits the number of banks in the sample. To ensure consistently broad coverage, we select banks by country in descending order of size to cover at least 80% of the size of the domestic banking systems in the G10 plus Austria, Australia and Spain. The merger-adjusted sample comprises a final set of 108 pro-forma banks, including the acquisitions in each banks'

[7] Indeed, extensive cross-currency funding among European banks led to the US dollar shortage at the height of the crisis (McGuire and von Peter, 2012).

[8] The quarterly frequency could in principle give better insight into the effect of capitalisation on credit supply, but coverage suffers when including only those banks that consistently report quarterly results, especially in the 1990s. For major banks, quarterly data from other providers are available largely for the most recent years. However, the bias in the results obtained using annual data instead of quarterly data should not be significant: Gambacorta (2005) compares the two frequencies using a very rich database for Italian banks with no significant differences (see columns III and IV of Table 3 in Gambacorta, 2005).

[9] The same holds for accounting changes that introduce discontinuities in certain reported bank positions. Accounts reported under IFRS are appended to the earlier accounts reported under local GAAP, and reporting jumps are controlled for by a bank-specific dummy at the time of a bank's accounting change (occurring mostly in 2005).

[10] We construct individual bank histories by drawing on merger and acquisition (M&A) dates of large banking institutions from Bureau van Dijk's Zephyr database on M&A activity, complemented by information provided to us by central banks. Starting with 267 consolidated banking groups, we adjust banks' financial statements backwards by aggregating the reported positions of the acquirer and the target bank prior to the merger or acquisition. This procedure creates a single pro-forma bank for each pair of banks prior to their merger. Further details are provided in the working paper version of the study: http://www.bis.org/publ/work357.htm.

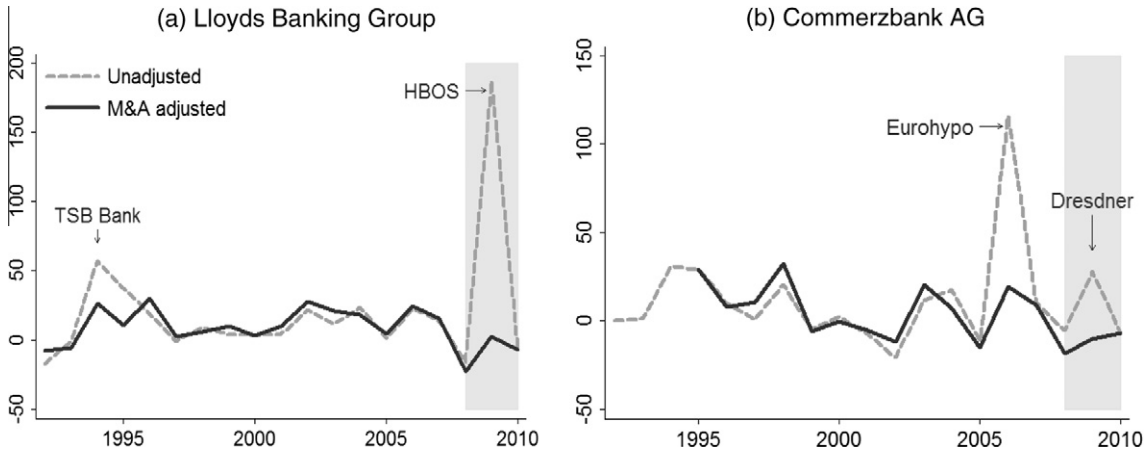

Fig. 4. Examples of M&A adjustment and the growth rate in lending. *Note*: The dashed line in Fig. 4(a) shows the growth rate of lending for the British bank *Lloyds Banking Group*, while the solid line indicates lending growth of the M&A-adjusted pro-forma bank of Lloyds. The hikes in the original series indicate the impact of the acquisitions of *TSB Bank* and *HBOS* by *Lloyds* on its growth rate of lending. The same logic applies to the example of the German *Commerzbank AG* and its acquisitions of *Eurohypo* and *Dresdner Bank. Source:* BankScope and Zephyr (Bureau van Dijk); central banks.

Table 2
Average bank features, by home country (1995–2010).[a]

Country	Δln (loans)	SIZE	LIQ	CAP	MFUND	ASSETS	Currency composition			No. of banks	No. of M&A	No. of rescued banks
	(Annual growth rate)	(Logarithm of assets)	(% of total assets)	(% of risk assets)	(% of total assets)	(2009, bil. USD)	USD	EUR	Other			
Austria	12.8	3.8	23.5	10.9	65.8	691	0.07	0.92	0.01	5	5	5
Australia	14.5	3.9	9.3	10.8	41.3	2163	0.21	0.01	0.78	7	4	0
Belgium	10.1	5.9	18.2	12.3	52.3	1926	0.16	0.84	0.00	3	7	3
Canada	5.9	5.2	28.1	12.0	35.4	2381	0.29	0.03	0.68	6	3	0
Switzerland	5.4	4.7	37.8	16.3	45.0	2455	0.60	0.23	0.17	5	5	1
Germany	5.1	5.2	29.6	11.4	65.9	6319	0.15	0.84	0.01	15	6	2
Spain	14.9	4.0	12.1	12.6	42.6	3958	0.20	0.80	0.00	14	14	2
France	9.3	6.6	36.9	11.2	60.8	6281	0.19	0.79	0.02	6	13	5
Italy	11.3	4.1	21.9	10.8	52.3	3345	0.08	0.92	0.00	12	35	6
Japan	−3.1	5.9	11.9	12.1	43.8	3087	0.19	0.05	0.76	5	7	0
Netherlands	12.5	5.3	15.8	11.9	53.8	2011	0.19	0.80	0.01	4	1	3
Sweden	8.9	5.2	14.7	11.0	64.1	1606	0.08	0.40	0.52	4	5	1
UK	9.1	6.4	22.9	12.2	43.7	9515	0.20	0.15	0.65	6	15	2
USA	7.8	5.1	14.5	12.9	28.5	9185	0.93	0.05	0.02	16	39	14
Average/ sum[b]	8.9	5.1	21.2	12.0	49.7	3923	0.25	0.49	0.26	108	159	44

Note: Sources: BankScope; BIS locational banking statistics by nationality.
[a] Unweighted averages across banks per country.
[b] Average/sum indicates unweighted averages or sums (b) over countries. Currency composition refers to the share of total assets denominated in a particular currency, estimated by merging BankScope data with data from the BIS international banking statistics, and No. of M&A to the number of mergers and acquisitions that have been taken into account in the construction of pro-forma banks.

merger history based on 267 banks in total. The sample covers over 70% of worldwide banking assets reported in *The Banker Magazine* for the Top 1000 banks for end-2008. For each country, Table 2 shows the number of sample banks that are headquartered in this jurisdiction, along with their combined asset size.

The international setting of this paper calls for another important adjustment to remove valuation effects. The banks in our sample run major international operations, often involving multiple currencies. However, BankScope reports financial statements in current US dollars, regardless of the original currency in which the loans were denominated. This introduces a valuation effect for positions denominated in currencies other than the dollar. For instance, the rapid appreciation of the dollar in late 2008 made euro-denominated positions shrink when expressed in dollars. This results in spurious credit contractions even for loan portfolios that remained constant in terms of euros. The columns on "currency composition" in Table 2 show, unsurprisingly, that banks headquartered in different countries also differ in the currency composition of their assets, ranging from Austrian and Italian banks (with over 90% of total assets in euros) to Australian, Canadian and US banks (with less than 5% in euros).[11]

The potential valuation effect thus varies systematically across banks in the raw data. We reduce this potential bias by converting each bank's loan series to *constant* US dollars, using the currency composition of bank assets for banks headquartered in the respective country, estimated from the BIS international banking statistics. The loan growth series used in the paper are thus partly purged of exchange rate-driven contractions and expansions. The average growth rates in lending nonetheless differ widely across banks (Table 2). Banks headquartered in Japan contracted throughout the sample period in line with the decade-long decline of the

[11] The currency composition refers to the share of total assets denominated in a particular currency. This information is not available at the individual bank level and it has been estimated by merging BankScope data with data from the BIS international banking statistics.

home market, while banks headquartered in Australia and Spain expanded by 15% per annum partly due to their foreign operations. Time-invariant differences will be picked up by country dummies in the econometric specification below; others relate to the macroeconomic environment in which banks operate. In that context it is again important to take into account the international nature of banking. Whereas US banks are mostly invested at home, Swiss bank assets largely consist of claims on borrowers abroad, a quarter on US entities alone. As a result, US economic conditions are arguably as important to Swiss banks' lending behaviour as Swiss economic conditions. In our empirical work, we thus include macroeconomic indicators constructed as a weighted average across the jurisdictions in which banks operate, using foreign claims data from the BIS consolidated banking statistics.[12] This seeks to ensure that we control for both domestic and international macroeconomic conditions, by having the regressors capture macroeconomic conditions in the major countries to which banks lend.

The main bank-specific variables are chosen in the light of the bank lending channel literature and the recent crisis experience. These point to bank size as a potentially important factor in lending decisions; it is measured here by the natural logarithm of total assets (*SIZE*). Similarly, liquid asset holdings play an important role both in the lending channel literature and in the crisis experience, especially during the panic following the Lehman bankruptcy.

The liquidity ratio is given by a BankScope memo item "liquid assets", which includes cash, trading securities and interbank lending of maturities less than 3 months, divided by total assets (*LIQ*, in %). Banks' reliance on wholesale market funding, as opposed to stable customer deposits, could also be an important determinant of bank lending. Greater reliance on market funding makes banks more vulnerable to the type of wholesale market dislocation seen in the recent crisis (Shin, 2009). We measure market funding as the share of assets funded by non-deposit liabilities, i.e. total liabilities (excluding equity) minus total deposits, divided by total balance sheet (*MFUND*, in%). Finally, capitalisation can be measured in various ways, and regulators recognise leverage ratios and risk-based capital requirements as useful complements (BCBS, 2010). However, the standard equity-to-asset ratio typically used in the bank lending channel literature does not properly capture the capital adequacy of banks (Gambacorta and Mistrulli, 2004), nor was it the subject of regulation in most countries at the time of the crisis. We therefore opt for the regulatory capital ratio, defined as eligible regulatory capital, including both Tier 1 and Tier 2 capital, over risk-weighted assets (*CAP*, in%).[13]

Slicing the dataset of 108 banks along these dimensions suggests a number of stylised facts (Table 3). Larger banks on average grew their loan book more slowly both prior to (1995–2007) and during the crisis (2008–2009). During the crisis, large banks were particularly affected by their lower deposit funding ratio (and thus higher market funding share) that exposed them more to wholesale funding shocks. Larger banks also received more support in the form of official recapitalisations (0.86% of total assets) than smaller banks did (0.51%).

Table 3 also illustrates some of the characteristics of rescued versus non-rescued banks. Size certainly plays a role. Rescued banks were on average twice the size of the remaining banks in the sample, although there clearly are examples of rescued small banks and non-rescued large banks. Unsurprisingly, the capitalisation ratio of rescued banks was lower on average than that of non-rescued banks, not only pre-crisis (end-2007) but also over the entire sample period. In many cases, however, official support was provided to avert a funding crisis at a critical time, even as the troubled bank was not particularly close to technical insolvency (Borio et al., 2010). Thus indicators of liquidity, ideally in real time, should also help to identify banks in need of a rescue. The reliance on market funding among rescued banks was generally higher, both before and during the crisis (Table 3). Overall, injections of public capital were provided to 44 banks (41% of banks accounting for 56% of total assets in the sample). For these banks, the average official recapitalisation amounted to 1.43% of their total balance sheet.[14]

In spite of official support, rescued banks reported lower credit growth than other banks during the crisis (−0.46% versus 4.18%). Yet this need not imply that recapitalisations were ineffective, since rescued banks presumably faced more distress and the interventions helped them survive. It is not surprising to observe a contraction of loan supply among rescued banks. Yet in 2009 and 2010, the growth rate of lending was similar across the groups, as shown in Fig. 3.

This illustrates that descriptive statistics alone do not admit firm conclusions on the impact of rescue plans on bank lending. It is obvious that rescued banks were those facing serious financial distress. They were likely to undergo a far greater contraction of lending if they had not been rescued. In principle, these banks could have gone bankrupt with the potential loss of their entire lending portfolio. Since such counterfactuals are not observed, it is impossible to quantify the exact benefits of the rescue packages. What we can observe, however, is whether capitalisation helped banks to sustain loan supply prior to and during the crisis, and whether the positive impact of capitalisation on lending differed between rescued and non-rescued banks. This helps to assess the effectiveness of interventions, since official recapitalisations raise bank capitalisation.[15]

4. The econometric model

The empirical specification is designed to test whether the rescue measures adopted by the authorities during the global financial crisis helped to sustain the supply of bank lending. In performing this policy exercise, we need to differentiate the functioning of the bank lending channel in normal times and during the crisis. Following Gambacorta and Marques-Ibanez (2011), we address this problem by interacting a crisis dummy C_t with all bank-specific characteristics in the regression, thus allowing for a parameter shift in the estimated response of a bank depending on the state of the economy. Furthermore, we allow for differential behaviour between banks that were rescued and those that were not, by introducing a bank-specific rescue dummy R_{ij}. We therefore estimate the following dynamic panel regression with bank-specific variables (X) and macroeconomic controls (Z):

$$L_{ijt} = (\alpha_i + \phi C_t) + \beta L_{ijt-1} + \gamma Z_{jt} + [\chi + \chi^* C_t] R_{ij} + [\delta + \delta^* C_t + (\varpi + \varpi^* C_t) R_{ij}] X_{ijt-1} + \varepsilon_{ijt}, \quad (1)$$

where L_{ijt} denotes the *growth rate* of lending in period t of bank i headquartered in country j.

[12] Since the consolidated banking statistics are aggregated, the weighting scheme applied to macroeconomic variables is identical for all banks headquartered in the same country. It only differs across groups of banks headquartered in different countries. Further details are provided in the working paper version of the study: http://www.bis.org/publ/work357.htm.

[13] The definition of regulatory capital is important, and has been strengthened in subsequent steps of regulation (BCBS, 2010). The sample average of the Tier 1 ratio equals 8.6%, while that of CAP equals 12.0%.

[14] Among the group of "low liquid" banks (see Table 3), the official recapitalisations amounted to 1.35% of assets, highlighting that it is important to control for a possible relationship between illiquidity and capital support.

[15] This holds other things being equal since banks can raise their capitalisation in other ways: through private recapitalisations or retained earnings, or by reducing their risk-weighted assets. The choice between these options depends on various considerations, e.g., shareholder preferences (Hyun and Rhee, 2011).

Table 3
Description of the dataset.[a]

	Number of banks								
	Large 27	Small 81	High liquid 11	Low liquid 11	High capitalised 11	Low capitalised 11	Rescued banks 44	Non-rescued banks 64	Total 108
Mean growth rate of lending (2008–2009)	0.15	2.81	3.73	2.47	3.30	2.49	-0.46	4.18	2.16
Mean growth rate of lending (1995–2007)	8.98	11.48	7.89	13.03	13.55	11.32	11.54	10.39	10.86
Mean recapitalisation (2008–2009) Percentage of total assets	0.86	0.51	0.24	1.35	0.98	0.36	1.43	0.00	0.60
Bank-specific characteristics (end-2007)									
Mean assets (bil. USD)	1686.44	221.22	1132.09	115.06	212.88	417.09	812.39	432.93	587.52
In percent of system assets	71.76	28.24	19.63	1.99	3.69	7.23	56.30	43.70	100.00
Mean deposits (bil. USD)	616.84	93.75	304.28	61.61	77.97	130.57	289.94	179.55	224.52
In percent of system deposits	68.68	31.32	13.80	2.79	3.54	5.93	52.61	47.29	100.00
Mean loans (bil. USD)	671.73	119.42	302.93	84.40	55.65	156.91	349.02	194.58	257.49
In percent of system lending	65.22	34.78	11.99	3.34	2.20	6.21	55.22	44.78	100.00
Mean net income (bil. USD)	7.82	1.54	2.75	1.09	1.88	1.43	3.77	2.66	3.11
In percent of system net income	62.86	37.14	9.01	3.57	6.16	4.68	49.39	50.61	100.00
Ratios (average 1995–2010)									
Liquidity/total assets	26.58	18.62	49.20	3.42	25.42	19.22	21.35	20.03	20.58
Loans/total assets	46.58	58.89	29.85	73.46	48.20	60.08	53.82	57.32	55.80
Deposits/total assets	42.69	47.27	35.34	58.07	47.00	39.47	45.31	46.66	46.13
Loans/deposits	113.79	156.50	111.20	169.98	129.03	172.53	137.61	151.92	145.89
Equity/total assets	4.42	6.05	4.16	7.84	7.95	5.23	5.67	5.63	5.65
Regulatory capital ratio	11.96	11.99	12.94	12.31	16.64	9.68	11.78	12.09	11.98
Market funding/total assets	52.19	46.51	61.15	35.75	44.09	57.68	48.77	47.34	47.90
Total securities/total assets	29.40	21.80	31.06	15.43	28.69	18.22	23.82	22.18	22.89
Impaired loans/total lending	2.58	2.25	2.20	1.43	2.53	3.59	2.18	2.41	2.32
Return on equity	9.36	10.88	9.23	11.35	9.27	10.14	10.09	10.82	10.51

Note: *Source*: BankScope; national data.

[a] The sample period goes from 1995 to 2010 and includes 108 banks and 1616 observations. A small bank, as of end-2007, is equal in size or smaller than the third quartile of bank size (logarithm of assets), while a large bank, as of end-2007, lies within the fourth quartile of bank size. A low liquid bank has an average liquidity ratio that is equal to or less than the 10th percentile of the liquidity ratio (liquid assets over total assets) and a high liquid bank has an average liquidity ratio equal to or above the 90th percentile. The same distinction applies to low capitalised and high capitalised banks (measured by lagged capital adequacy ratios). Rescued banks indicates whether a bank received a public recapitalisation in 2008 and/or 2009, while non-rescued banks indicates that a bank did not receive such a support.

Table 4
Short-term effect of an increase of bank-specific characteristic x_1 on loan supply.

Value of $\Delta L_{ijt}/\Delta x_{1ijt-1}$	Non-rescued banks	Rescued banks
Normal times	δ_1	$\delta_1 + \varpi_1$
Crisis period	$\delta_1 + \delta_1^*$	$\delta_1 + \delta_1^* + \varpi_1 + \varpi_1^*$

We chose a model in growth rates because variables in levels are typically integrated of order one (as confirmed by the Im–Pesaran–Shin test for cross sectional variables and a standard Dickey Fuller test for the time series). This is also the approach Kashyap and Stein (1995) used to mitigate spurious correlation.

The vector of controls, Z_{jt}, includes country- and time-specific variables. Country dummies control for time-invariant differences in regulation, accounting standards across countries, and fiscal differences (Albertazzi and Gambacorta, 2010), while country-level time series (nominal GDP growth, ΔGDP; change in the 3-month interbank rate, ΔIB) account for macroeconomic conditions and thereby for credit demand (Ehrmann et al., 2003; Gambacorta, 2005). The parameters in γ may be broadly interpreted as the average effects of ΔGDP and monetary policy on lending for an average bank after demeaning bank-specific characteristics (see below). For banks operating in different jurisdictions, macroeconomic variables have been weighted as described in Section 3. We also estimate specifications in which the macroeconomic controls are replaced by time-fixed effects.

The variable ΔIB represents changes in the monetary policy rate. Central banks also took unconventional monetary policy measures during the crisis (Borio and Disyatat, 2010). To disentangle the effects of such measures on bank lending from those determined by changes in the policy rate, we add to the regressors a rough proxy for unconventional policy measures, namely the growth rate of the ratio between each central bank's total assets and nominal GDP ($\Delta CB/GDP$). We do not weigh this last variable for banks operating in different jurisdictions since unconventional policy measures were mainly directed towards domestic markets.

Bank-specific characteristics included in vector X_{ijt-1} are: bank size (*SIZE*), liquidity (*LIQ*), regulatory capital ratio (*CAP*), and market funding (*MFUND*), as defined before.[16] Bank-specific characteristics are lagged once $(t-1)$ in order to mitigate a possible endogeneity problem. All bank-specific characteristics, except the dummies, are normalised with respect to their annual averages across all banks in the sample in order to obtain regressors that average to zero within years. This means that the coefficients on vector X in Eq. (1) can be interpreted as the effects on the average bank.

To test various hypotheses we employ two dummy variables. The crisis dummy C_t equals 1 in 2008–2009 and zero otherwise,[17] and is interacted with bank characteristics X_{ijt-1}. This 2-year window captures the most severe crisis years, centred on the Lehman bankruptcy.[18] The second dummy variable, R_{ij}, identifies rescued banks. Banks supported by direct official interventions, whether standalone or under a programme, are associated with the dummy $R_{ij} = 1$ (0 elsewhere).[19]

The interaction between dummies and other variables thus allows for differential behaviour of rescued banks prior to and during the crisis (R_{ij} and $R_{ij}C_t$), as well as a differential effect of bank-specific characteristics on loan supply ($R_{ij}X_{ijt-1}$ and $R_{ij}C_tX_{ijt-1}$). The *generalised* rescue packages enacted at the country level are instead part of the country dummies in Z_{jt}, as they affect all banks in jurisdiction j (e.g., the extension of deposit insurance, see Table 1).

There are three main hypotheses that Eq. (1) seeks to test: (i) Do certain bank-specific characteristics (including a bank's capitalisation) affect loan supply in normal times? (ii) Have these effects changed in magnitude during the financial crisis? (iii) Do effects (i) and (ii) differ systematically across rescued and non-rescued banks? Table 4 below illustrates how the nested parameter shifts estimated by means of the dummy variables help distinguish four states in the response of lending to bank characteristics (including capitalisation).

The first test examines the statistical significance of the coefficients in the $\delta-$ vector in Eq. (1). For example, the short-term impact on lending in response to a change in the variable in vector X is expressed by: $\Delta L_{ijt}/\Delta x_{1ijt-1} = \delta_1$ (where δ_1 is the coefficient for the first bank-specific characteristic in δ, e.g. bank capitalisation). In contrast, the long-term impact equals $\Delta L_{ijt}/\Delta x_{1ijt-1} = \delta_1/(1-\beta)$. In other words, $\delta_1 > 0$ is evidence of banks with a higher value of x_1 providing more loans in normal times.

The second test looks at the statistical significance of the coefficients in the vector δ^*. That is, we test for a structural shift related to the crisis which is directly attributable to the impact of the bank-specific characteristic x_1 on bank lending (see point (ii) above) by analysing the coefficient δ_1^*. During the crisis period, the short-term impact of lending in response to changes in characteristic x_1 at $t-1$ equals $\Delta L_{ijt}/\Delta x_{1ijt-1} = \delta_1 + \delta_1^*$, with a long-term impact of $\Delta L_{ijt}/\Delta x_{1ijt-1} = (\delta_1 + \delta_1^*)/(1-\beta)$. If no structural shift in the effect of x_1 on lending is detected ($\delta_1^* = 0$) then the two effects are equivalent to those analysed under (i).

The third test considers the behaviour of rescued banks, both in normal times and during the crisis period. As for normal times, the test hinges on the statistical significance of ϖ. If a bank that has been subsequently rescued in the crisis shows greater responsiveness in its lending to bank capitalisation (variable 1), then $\Delta L_{ijt}/\Delta x_{1ijt-1} = \delta_1 + \varpi_1$ significantly differs from δ_1. This can be used to test whether banks that were subsequently rescued expanded lending more aggressively prior to the crisis. Finally, any further structural shift during the crisis is picked up by the coefficients ϖ^*, with long-term impact $\Delta L_{ijt}/\Delta x_{1ijt-1} = (\delta_1 + \delta_1^* + \varpi_1 + \varpi_1^*)/(1-\beta)$. Insignificance ($\varpi_1^* = 0$) would suggest that rescued and non-rescued banks change their behaviour the same way when the world shifts to a crisis state (by $+\delta_1^*$). By contrast, if $\varpi_1^* < 0$, then lending growth among rescued banks falls relative to that of non-rescued banks upon entering a crisis.

The relationship between bank lending and capitalisation may be non-linear due to various possible attitudes towards risk-taking. For example, using banking data from 1984 to 1993, Calem and Rob (1999) find a U-shaped relationship between equity capital and risk: undercapitalised banks take larger risks because of the

[16] The model also includes a one-off dummy that takes into account changes in accounting practices. Most countries (except Canada, Japan and the US) have changed accounting standards from local Generally Accepted Accounting Practices (GAAPs) to International Financial Reporting Standards (IFRSs) in 2005. To account for changes in the measurement of certain balance sheet items and other differences in accounting (grossing up of derivatives), we include a dummy variable that takes on a value of 1 when a bank starts to report under IFRS.

[17] For Japanese banks only, the crisis dummy is equal to 1 in the period 1997–2001 as well. In this way, we can also control how bank-specific characteristics influenced bank lending during the Japanese crisis (Giannetti and Simonov (2011)). On the other hand, since no Japanese bank has been rescued during the recent crisis (R_{ij} remains zero for Japanese banks over the entire sample), the introduction of the additional 1 in the dummy C_t for Japanese banks does not alter the results for the interaction variables $R_{ij}C_t$, $R_{ij}X_{ijt-1}$ and $R_{ij}C_tX_{ijt-1}$. This is also confirmed by the fact that results do not change if we introduce in the specifications a separate crisis dummy for Japan that is equal to 1 in the period 1997–2001 and 0 elsewhere. The first solution is preferable because it is more parsimonious.

[18] The robustness section confirms that results remain unchanged for alternative crisis windows.

[19] Direct bank interventions in our dataset consist of official recapitalisations. Other bank-specific interventions, notably asset purchases or insurance, were provided only to a strict subset of the set of recapitalised banks.

Table 5
Summary statistics of the variables used in the regressions.[a]

Variable name	Variable description	Number of observations	Mean	Std. Dev.	Min.	Max.
Endogenous variable						
L_t (loans USD)	Annual growth rate of lending in current USD	1616	9.26	13.65	−43.26	83.78
L_t	Annual growth rate of lending, adjusted	1616	10.23	16.25	−38.19	95.54
Bank-specific characteristics in vector X						
$SIZE_{t-1}$	Logarithm of total assets	1554	4.91	1.49	0.48	8.24
LIQ_{t-1}	Liquidity ratio	1554	20.57	13.80	0.15	69.85
CAP_{t-1}	Regulatory capital ratio	1255	11.97	2.53	3.00	28.50
CAP^2_{t-1}	Square of regulatory capital ratio	1255	149.72	73.84	9.00	812.25
$MFUND_{t-1}$	Market funding ratio	1531	47.93	18.10	9.91	96.25
Macroeconomic controls						
ΔIB_{t-1}	Change in the 3-month interbank rate adjusted	1616	−0.32	1.20	−3.88	1.76
ΔGDP_{t-1}	Growth rate of GDP adjusted	1616	4.19	2.51	−5.43	8.84
$\Delta(CB/GDP)_t$	Growth rate of central bank assets over GDP	1611	6.27	28.98	−51.89	222.27
Other controls						
R_{ij}	Dummy that takes the value of 1 if a bank has been rescued and 0 otherwise	1616	0.41	0.49	0.00	1.00
C_t	Dummy that takes the value of 1 in the years 2008–2009 and 0 otherwise. For Japanese banks, the dummy also takes the value of 1 in 1997–2001	1616	0.14	0.34	0.00	1.00
$IFRS_t$	Dummy that takes the value of 1 if a bank changed from GAAP to IFRS and 0 elsewhere	1616	0.30	0.46	0.00	1.00

Note: *Source*: BankScope; national data.
[a] The sample period goes from 1995 to 2010. Annual growth rate of lending, adjusted refers to the adjustment of loans for their currency composition based on the location of international claims of banks per country on a consolidated basis (see Table 2). Change in the 3-month interbank rate adjusted and Growth rate of GDP adjusted refers to the adjustment of the macroeconomic variables for the location of international claims on a locational basis.

coverage of bankruptcy costs by deposit insurance.[20] Bank risk-taking is high at low levels of capitalisation, but then it decreases with better capitalisation up to a critical level from which each additional unit of capitalisation again increases risk-taking. In order to capture this non-linearity, we introduce a quadratic term for capitalisation in Eq. (1).

Summary statistics of the regressors are reported in Table 5. The first part of Table 6 summarises the expected signs of the impact on bank lending of changes in macro controls and bank-specific characteristics including their interaction with the dummy crisis. For instance, the expected coefficient for ΔGDP is positive: better economic conditions increase the number of projects that become profitable in terms of expected net present value, and hence increase the demand for credit (Kashyap et al., 1993).

5. Results

Our first set of regressions is reported in Table 7. In the baseline specification for bank lending, we use two estimators, system GMM and a panel estimator with bank-level fixed effects. In each case we control for demand effects in two alternative ways, namely through the use of time-fixed effects and the inclusion of macroeconomic variables. Experimenting with various macroeconomic variables leads us to include lagged GDP growth and the lagged change in the interbank rate, as these turn out to be the most significant determinants of bank lending. The choice of fixed-effects estimations is based on the view that our sample of banks is not drawn randomly from the population of banks. Rather, our data cover the major banking groups. This suggests that the random effects estimator would not be the appropriate specification, a view confirmed with the Hausman test. The fact that bank lending tends to be correlated over time prescribes the use of a dynamic model. Moreover, an appropriate estimator should also take into account potential heteroskedasticity in lending across banks. In such a setting, the fixed-effects estimator is inefficient and prone to inconsistency, especially when the time dimension is limited (Nickell, 1981; Baltagi, 2005).

We therefore focus on the GMM panel methodology that overcomes the potential consistency problem, even though the results are qualitatively similar in most cases. This methodology was advanced by Arellano and Bond (1991), and further developed by Arellano and Bover (1995) and Blundell and Bond (1998). The GMM estimator ensures efficiency and consistency provided that the models are not subject to serial correlation of order two and that the instruments used are valid. This is confirmed using the Arellano and Bond (1991) test for autocorrelation of order two and Hansen's J test for over-identifying restrictions. The GMM methodology has been used extensively in the bank lending channel literature (see, amongst others, Ehrmann et al., 2003).

The baseline specification neither distinguishes between crisis and normal times, nor between rescued and non-rescued banks. Columns 1–2 of Table 7 show the results using the system GMM estimator. In the first column we control for time-varying aggregate conditions by time-fixed effects and in the second column we use the macroeconomic control variables instead (GDP growth and the change in the interbank rate).

The results show that bank size has a significant negative effect on lending throughout the whole sample period, whereas liquidity and regulatory capital have a significant positive impact. Dependence on market funding also has a significant negative effect. Overall, results on bank-specific characteristics are robust across both ways of controlling for macroeconomic conditions. GDP growth and the change in the interbank rate have the expected signs, and the magnitudes are in line with the existing literature. The results using the panel estimator are reported in columns 3–4, using time fixed effects and macroeconomic variables, respectively. The estimates are comparable in terms of signs and significance only for bank size and, to a lesser extent, for capitalisation; liquidity and market funding become insignificant, possibly reflecting an endogeneity problem. The difference might also be due to the fact that panel fixed effects do not allow us to specify country-fixed effects because of the collinearity with bank-level

[20] The increase in bank competition in most developed countries could encourage undercapitalised banks to take on more risk (Matutes and Vives, 2000 and Salas and Saurina, 2003).

Table 6
Expected signs in the regressions and summary of GMM results.[a]

Variable name	Variable description	Expected sign	Basic argument	R1 Baseline Time FE	R2 Baseline Macro controls	R5 Crisis interaction Time FE	R6 Crisis interaction Macro	R7 Crisis and rescued bank interaction Time FE	R8 Crisis and rescued bank interaction Macro	R9 Unconventional monetary policy
SIZE	Logarithm of total assets	+/−	Large banks might isolate themselves better from adverse shocks (+). The opposite sign would hold for strong lending relationships between small firms and small banks (−)	− − −	− − −	− − −	− − −	− − −	− − −	− − −
SIZE ∗ *C*		+/−	Too big too fail (+) / too large to be saved (−)					++	+	+
LIQ	Liquidity ratio	+	Highly liquid banks more likely to expand supply of loans…	+++	+++	+++	+++	++	+++	+++
LIQ ∗ *C*		+	… Particularly so in the crisis period							
CAP	Regulatory capital ratio	+	Well-capitalised banks more likely to expand supply of loans…	+++	+++	+++	+++	++	++	++
CAP ∗ *C*		+/−	… Particularly so in the crisis period (+)							
CAP^2	Square of regulatory capital ratio	+/−	Banks with capital above the regulatory minimum (buffer) are more likely to expand supply of loans…							
$CAP^2 * C$		+/−	… Particularly so in the crisis period			++	++			
MFUND	Market funding ratio	−	Banks more reliant on market funding (less deposits) are more exposed to shocks in wholesale market funding conditions (−)	− − −	− − −	− − −	− − −	− − −	− − −	− −
MFUND ∗ *C*		−	In crisis periods, market funding disruptions tend to be stronger							
Rescued banks										
SIZE ∗ *R*	Size	+/−	Same as above: this represents the differential impact wrt to non-rescued banks							
SIZE ∗ *R* ∗ *C*		+/−								
LIQ ∗ *R*	Liquidity ratio	+/−								
LIQ ∗ *R* ∗ *C*		+/−								
CAP ∗ *R*	Regulatory capital	+/−						+	+	
CAP ∗ *R* ∗ *C*		+/−						− − −	− − −	− − −
$CAP^2 * R$	Square of reg. capital	+/−								
$CAP^2 * R * C$		+/−						++	+++	+++
MFUND ∗ *R*	Market funding	+/−								
MFUND ∗ *R* ∗ *C*		+/−								
Other controls										
C	Dummy financial crisis	−	Loan supply contracts as a result of increased risk perception and stress in funding markets			− − −	− − −	− − −	− − −	− − −
R	Dummy rescued banks	+/−	Rescued banks might be more prone to take additional risk and supply more loans (+); if more active in buying securitisation products, they could have been less dynamic in traditional intermediation (−)							
C ∗ *R*	Interaction crisis and rescued banks	−	Banks rescued in the crisis have been capital-constrained (−) and faced tighter conditions in funding markets (−)					− − −	− − −	− − −
IFRS	Dummy IFRS	+	IFRS contains stricter requirements for consolidating subsidiaries (+), offsetting derivatives (+), and emphasises fair value accounting	+++	++	++	+++	++	+++	+++
Macroeconomic controls										
ΔGDP	Growth in nominal GDP	+	Growth in GDP boosts loan demand (+)		+++		+++		+++	+++
ΔIB	Change in the interbank market rate (3-month)	−	Higher interbank market rates lead to a decline in lending (−)		− − −		− −		− −	− − −
Δ(CB/GDP)	Growth in central bank assets over GDP	+	Unconventional monetary policies have a positive impact on bank liquidity and on the supply of lending (+)							+++

Note: [a] The sample period runs from 1995 to 2010. Shaded areas in grey indicate the variables that are included in each regression. The symbols + (−), ++ (− −), and +++ (− − −) represent significance levels of 10%, 5%, and 1% respectively. A sign not being reported means that the coefficient is not statistically different from zero.

Table 7
Regression results – Baseline regression.[a]

Dependent variable: Annual growth rate of lending L_t	R1 Time-fixed effects estimator: S-GMM		R2 Macro variables estimator: S-GMM		R3 Time-fixed effects estimator: Panel-FE		R4 Macro variables estimator: Panel-FE	
	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error
L_{t-1}	0.083**	0.040	0.173***	0.041	0.091*	0.055	0.117**	0.058
Macroeconomic controls								
ΔGDP_{t-1}			1.017***	0.231			1.841***	0.263
ΔIB_{t-1}			−0.970***	0.376			−1.382***	0.471
Bank-specific characteristics in vector X								
$SIZE_{t-1}$	−1.444***	0.318	−1.396***	0.311	−7.350***	2.127	−8.047***	2.015
LIQ_{t-1}	0.143***	0.040	0.159***	0.039	−0.023	0.077	−0.025	0.074
CAP_{t-1}	0.730***	0.235	0.700***	0.245	0.673**	0.344	0.491	0.349
CAP^2_{t-1}	−0.005	0.043	0.001	0.042	0.003	0.063	0.018	0.063
$MFUND_{t-1}$	−0.108***	0.029	−0.108***	0.032	−0.072	0.073	−0.065	0.064
Other controls								
IFRS	2.726***	0.029	2.137**	0.849	4.513***	1.643	3.075**	1.197
Time dummies	Yes		No		Yes		No	
Country dummies	Yes		Yes		No		No	
Summary statistics and misspecification tests								
Number of banks and observations	108	1225	108	1225	108	1225	108	1225
Hansen test (p-value); R^2	0.358		0.112		0.151		0.106	
AR(1) and AR(2) test (p-value)	0.000	0.245	0.000	0.154				

Note:
[a] The sample period goes from 1995 to 2010. S-GMM refers to estimations using the Arellano and Bover (1995) system GMM estimator and Panel-FE to the fixed effects panel estimator. Robust standard errors are reported. Hansen test: p-value of the Hansen J test for overidentifying restrictions with the null of validity (only S-GMM). R^2: overall coefficient of determination (only Panel-FE). AR(1) and AR(2): p-value of the Arellano-Bond test on absence of autocorrelation in residuals of order 1 and order 2 (only S-GMM).
* Significance at the 10% level.
** Significance at the 5% level.
*** Significance at the 1% level.

Table 8
Regression results – Crisis and rescue interactions.[a]

Dependent variable: Annual growth rate of lending L_t	R5 Crisis time-fixed effects		R6 Crisis macro variables		R7 Crisis and rescue time-fixed effects		R8 Crisis and rescue macro variables		R9 Crisis and rescue unconventional monetary policy	
	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error
L_{t-1}	0.102***	0.036	0.127***	0.037	0.096***	0.033	0.125***	0.033	0.124***	0.033
Macroeconomic controls										
ΔGDP_{t-1}			1.297***	0.203			1.360***	0.209	1.389***	0.207
ΔIB_{t-1}			−0.687**	0.333			−0.753**	0.343	−0.937***	0.342
$\Delta CB/GDP_t$									0.047***	0.013
Bank-specific characteristics in vector X for non-rescued banks										
$SIZE_{t-1}$	−1.520***	0.358	−1.467***	0.352	−1.600***	0.396	−1.457***	0.388	−1.392***	0.384
$SIZE_{t-1} * C$	1.073	0.943	1.002	0.922	2.296**	1.069	1.880*	1.076	1.867*	1.102
LIQ_{t-1}	0.130***	0.042	0.138***	0.042	0.137**	0.054	0.147***	0.054	0.139***	0.053
$LIQ_{t-1} * C$	0.021	0.084	0.013	0.082	0.037	0.109	0.046	0.105	0.024	0.104
CAP_{t-1}	0.929***	0.275	0.905***	0.276	0.614**	0.307	0.662**	0.319	0.707**	0.323
$CAP_{t-1} * C$	−0.641	0.568	−0.651	0.547	0.338	0.672	0.210	0.664	0.192	0.661
CAP^2_{t-1}	−0.038	0.040	−0.027	0.041	−0.021	0.040	−0.016	0.042	−0.021	0.042
$CAP^2_{t-1} * C$	0.174**	0.085	0.190**	0.886	0.043	0.075	0.047	0.067	0.057	0.065
$MFUND_{t-1}$	−0.099***	0.032	−0.103***	0.033	−0.108***	0.037	−0.113***	0.038	−0.114**	0.037
$MFUND_{t-1} * C$	−0.001	0.080	−0.014	0.081	0.052	0.087	−0.038	0.089	0.049	0.091
Bank-specific characteristics in vector X for rescued banks										
$SIZE_{t-1} * R$					−0.125	0.672	−0.361	0.672	−0.326	0.661
$SIZE_{t-1} * R * C$					−1.682	1.740	−0.987	1.754	−1.640	1.857
$LIQ_{t-1} * R$					−0.053	0.082	−0.059	0.083	−0.076	0.081
$LIQ_{t-1} * R * C$					−0.097	0.168	−0.148	0.161	−0.096	0.159
$CAP_{t-1} * R$					0.955*	0.516	0.773*	0.451	0.803	0.530
$CAP_{t-1} * R * C$					−3.736***	1.192	−3.564***	1.151	−3.305***	1.142
$CAP^2_{t-1} * R$					0.167	0.115	0.147	0.115	0.165	0.114
$CAP^2_{t-1} * R * C$					0.360**	0.171	0.449***	0.162	0.476***	0.154
$MFUND_{t-1} * R$					0.060	0.064	0.068	0.062	0.071	0.061
$MFUND_{t-1} * R * C$					−0.151	0.169	−0.141	0.171	−0.061	0.179
Other controls										
C	−11.020***	1.479	−9.413***	1.366	−8.205***	1.506	−6.638***	1.404	−7.524***	1.436
R					1.506	1.104	1.474	1.107	1.434	1.091
$C * R$					−8.479***	2.733	−8.054***	2.733	−8.553***	2.789
IFRS	2.990**	1.204	4.467***	0.867	2.591**	1.227	4.411***	0.865	4.054***	0.864
Time dummies	Yes		No		Yes		No		No	
Country dummies	Yes		Yes		Yes		Yes		Yes	
Summary statistics and misspecification tests										
Number of banks and observations	108	1225	108	1225	108	1225	108	1225	108	1225
Hansen test (p-value)	0.531		0.638		0.376		0.496		0.505	
AR(1) and AR(2) test (p-value)	0.000	0.078	0.000	0.113	0.000	0.055	0.000	0.078	0.000	0.087

Note:
[a] The sample period goes from 1995 to 2010. All estimations are based on 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.

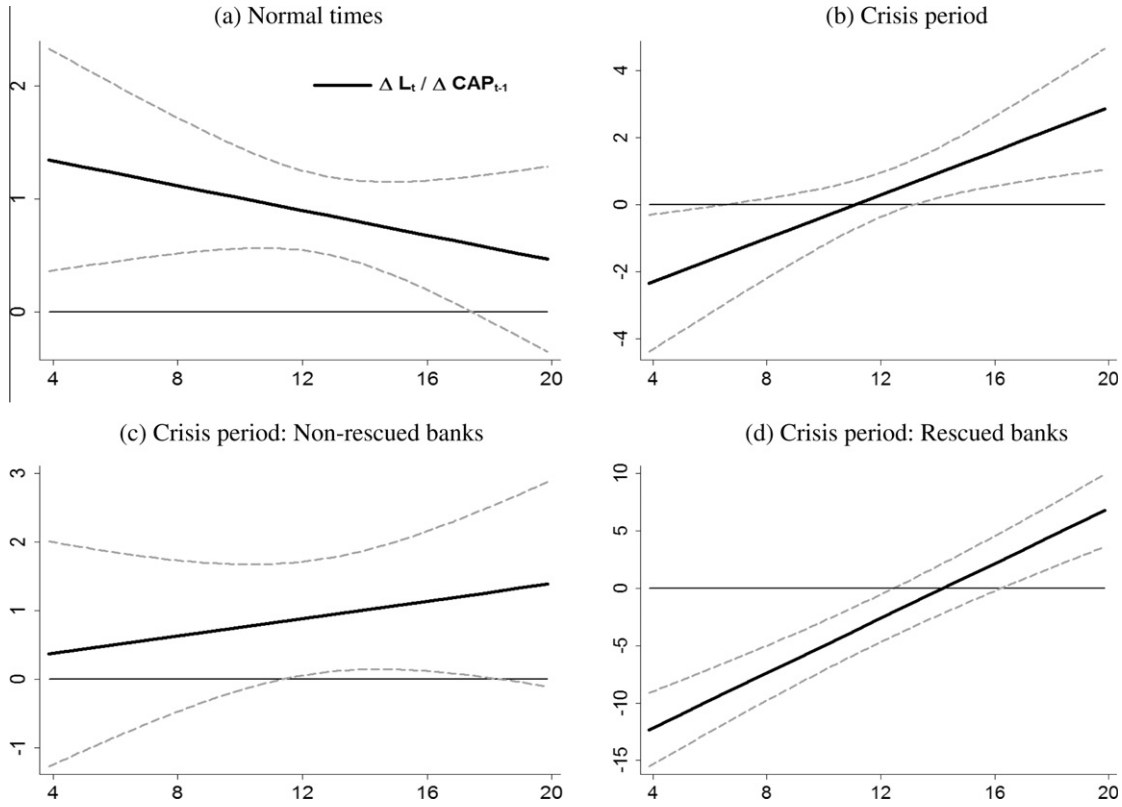

Fig. 5. Bank lending reaction to changes in bank capitalisation. *Note*: vertical axis represents the derivative $\Delta L_{ijt}/\Delta CAP_{ijt-1}$: the change in the growth rate of lending for a 1 percentage point increase in the regulatory capital ratio. The horizontal axis represents CAP_{ijt-1}: the initial capitalisation. Coefficients are taken, respectively, from column R6 and R8 in Table 8. The lines are drawn for actual values of the capital ratios. The dashed lines are 10% and 90% confidence intervals calculated with the delta method.

Table 9
Robustness checks.[a]

Dependent variable: annual growth rate of lending L_t	R6 and R8 Crisis 2008–2009		R10 Crisis 2007–2009		R11 Crisis 2008–2010		R12 Crisis 2007–2010		R13 Country crisis interactions	
	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error	Coeff.	S. Error
(i) Crisis interactions (C = 0 or 1; R = 0)										
CAP_{t-1}	0.905***	0.276	0.851***	0.267	0.883***	0.303	0.801***	0.297	0.703***	0.268
$CAP_{t-1} * C$	−0.651	0.547	−0.336	0.418	−0.556	0.518	−0.266	0.414	0.148	0.632
CAP^2_{t-1}	−0.027	0.041	−0.020	0.042	−0.027	0.042	−0.018	0.043	−0.013	0.040
$CAP^2_{t-1} * C$	0.190**	0.086	0.123*	0.084	0.140*	0.086	0.093	0.086	0.172**	0.084
(ii) Crisis and rescued interactions (C = 0 or 1; R = 0 or 1)										
CAP_{t-1}	0.662**	0.319	0.529*	0.311	0.699**	0.351	0.473	0.347	0.502*	0.305
$CAP_{t-1} * C$	0.210	0.664	0.630	0.459	−0.053	0.659	0.465	0.501	0.804	0.724
CAP^2_{t-1}	−0.016	0.042	−0.005	0.042	−0.017	0.043	−0.001	0.045	−0.008	0.041
$CAP^2_{t-1} * C$	0.047	0.067	0.011	0.077	0.033	0.079	0.006	0.085	0.049	0.074
$CAP_{t-1} * R$	0.773	0.522	0.939*	0.501	0.674	0.574	0.975*	0.561	0.629	0.532
$CAP_{t-1} * C * R$	−3.564***	1.151	−3.454***	0.766	−2.069*	1.080	−2.503***	0.766	−2.332**	1.212
$CAP^2_{t-1} * R$	0.147	0.115	0.144	0.118	0.174	0.112	0.140	0.119	0.192*	0.116
$CAP^2_{t-1} * C * R$	0.449***	0.162	0.354**	0.146	0.174	0.149	0.172	0.153	0.416**	0.182
Observations	1225		1225		1225		1255		1255	
Hansen test										
(i) Crisis interactions	0.638		0.348		0.374		0.205		0.512	
(ii) Crisis and rescue interactions	0.496		0.241		0.432		0.232		0.462	

Note:
[a] The sample period goes from 1995 to 2010. Per column, the table summarises the coefficients associated with the regulatory capital ratio CAP and its square CAP^2 resulting from two specifications: (i) Crisis interactions: includes crisis interactions (as R6) and (ii) Crisis and rescue interactions: includes crisis and rescued banks interactions (as R8). The first column repeats the results from R6 and R8. In specification R10, the crisis dummy is set equal to 1 during 2007–2009, while in specification R11 it is set to 1 for 2008–2010, and in R12 it is set to 1 for 2007–2010. Specification R13 interacts country and crisis dummies to allow for country level differences in (generalised) support measures during the crisis. The Arellano and Bover (1995) system GMM estimator has been used. Robust standard errors are reported.
* Significance at the 10% level.
** Significance at the 5%, level.
*** Significance at the 1%, level.

fixed effects. Results obtained using the GMM methodology are therefore more reliable and what follows will focus on the coefficients obtained in regressions R1 and R2 in Table 7.

The negative size effect is familiar from the literature, as small banks tend to supply relatively more lending to their clients. This can be explained by the strong lending relationship existent between small banks and small firms in many countries (see Ehrmann and Worms, 2004; Gambacorta, 2005). In general, however, the information content of bank size is quite limited, once other factors are controlled for.

The structure of bank funding has also an impact on banks' intermediation function. Banks with a lower reliance on market funding (higher share of deposits) tend to supply more lending, other things being equal. This result has important implications in connection with the recent crisis. As banks become more dependent on market funding, adverse conditions in bond and money markets can compromise banks' ability to refinance. Consequently, banks' incentives and ability to lend are also likely to be more sensitive to investor perceptions and overall financial market conditions than in the past when banks were overwhelmingly funded via bank deposits.[21]

Most importantly, the coefficients on capitalisation and liquidity are both highly significant. Consistent with theory, well capitalised and highly liquid banks supply more lending (Kashyap and Stein, 1995, 2000; Kishan and Opiela, 2000). In particular, the baseline regression suggests that a one percentage point increase in the regulatory capital ratio is associated with 0.7% faster loan growth in the following year for the average bank. The negative coefficient of the square of capitalisation (not significant, however) points to the declining effectiveness of higher capitalisation in supporting loan growth. The non-linearity in the relationship between bank capital and supplied lending is examined in depth below.

In the presence of a crisis, the relationship between bank-specific characteristics and bank lending may well shift. Results in Table 8 therefore include the crisis dummy C_t and the associated bank-specific interaction terms. The results using the system GMM estimator are shown in regressions R5 and R6. The coefficients related to normal times remain unchanged and highly significant. The global financial crisis had a substantial negative impact on the growth rate of bank lending. The estimates suggest that loan growth fell by around 10% for the average bank, after controlling for bank-specific and macroeconomic conditions.

The effectiveness of regulatory capital for bank lending also differs in crisis and normal times. In normal times, a unit increase in capitalisation yields a positive contribution to loan growth; at the same time, this contribution is decreasing in marginal terms (Fig. 5, panel (a)). This means that the positive impact of greater capitalisation on bank lending is higher for less-capitalised banks and lower for those banks already boasting a high capital ratio. It is plausible to think that raising the capitalisation of the best-capitalised banks does not expand their investment set in normal times.

This result changes drastically during a crisis. Raising capitalisation in the crisis state has an increasingly positive effect on bank lending (Fig. 5, panel (b)). A one percentage point increase in capitalisation for the average bank raises lending by around 0.4%, against roughly 0.9% in normal times.[22] This is consistent with the fact that lending standards were tightened during the crisis and credit expansion remained limited in spite of capital injections. The positive slope represents the increasing effectiveness of capital: (only) banks at higher levels of capitalisation can effectively translate additional capital into increased lending. For these banks, extra capitalisation is particularly beneficial when capital overall is scarce.

The next specifications, R7 and R8 in Table 8, further distinguish the behaviour of rescued and non-rescued banks by means of the bank-specific variable R_{ij}. The relationships between bank lending and bank-specific characteristics in normal times remain essentially unaffected by the introduction of the dummy. There are no significant differences across rescued and non-rescued banks in normal times, except for capitalisation: the positive significant impact of capitalisation on lending is more pronounced for banks that end up being rescued. In particular, a unit increase in the regulatory capital ratio for a rescued bank is associated with a 1.6% increase in lending in the following year ($\delta_{CAP} + \varpi_{CAP}$). The effect is 0.6% for the average non-rescued bank (δ_{CAP}).

There is a more significant difference in the behaviour of rescued and non-rescued banks during the crisis period. Loan growth at a rescued bank is, other things being equal, some 8% lower than at non-rescued banks. This is consistent with the view that rescued banks face more imminent pressure to restructure their credit portfolio during a crisis. The need for such action also depends on the level of capitalisation, however. Panels (c) and (d) of Fig. 5 show that the derivative of bank lending with respect to bank capital differs significantly between rescued and non-rescued banks. For those non-rescued banks with a low capital ratio, the effect of a unit increase in capitalisation is not statistically different from zero. Taking this result at face value means that those banks would probably not have expanded lending if they had received a (small) recapitalisation. The effect becomes significantly positive only once their capitalisation exceeds a certain threshold (around 10% in the crisis period).

For rescued banks the effectiveness of capitalisation has an upward-sloping profile. At very low levels of capitalisation, the derivative is negative before turning positive. This means that, for banks in a particularly poor condition when rescued during the crisis, additional capital would only make the growth rate of lending less negative than would have been the case without recapitalisation. At those banks, capital injections do not produce greater lending, although they do help to restore their capitalisation and reduce the extent of adjustment otherwise required in the lending portfolio. Experience suggests that balance sheet repair is often necessary for laying the foundations of a self-sustaining recovery (Borio et al., 2010).

Loan growth turns positive once a bank's capitalisation exceeds a threshold; it is only beyond a certain capital ratio that a bank has restored enough intermediation capacity to turn more capital into increased lending. On theoretical grounds this result is in line with Bhattacharya and Nyborg (2011), who highlight that a recapitalisation, to be effective, should be large enough to overcome banks' debt overhang problem.[23] This view is also supported by microeconomic evidence from Japan's banking crisis of the 1990s: Giannetti and Simonov (2011) find that only capital injections sufficiently large to restore bank capitalisation above regulatory requirements will increase the supply of credit, whereas smaller injections fail to be effective.[24]

The importance of capitalisation for loan supply thus differs in crisis and normal times, with increasing marginal effectiveness

[21] This is mainly because deposits tend to be a relatively "sticky" source of funding and less dependent on financial market conditions than tradable instruments (see Berlin and Mester, 1999; Shleifer and Vishny, 2010).

[22] Recall that all bank-specific characteristics are demeaned, and thus bank capitalisation for the average bank is normalised to zero. From the coefficients reported in regression R6 in Table 8, this implies that a one percentage increase in the regulatory capital ratio for the average bank (from 0 to 1) raises the growth rate of lending by $0.905 * 1 - 0.027 * 1^2 = 0.878$ in normal times and by $(0.905 - 0.651) * 1 + (-0.027 + 0.190) * 1^2 = 0.417$ during a crisis, where each "1" stands for $\Delta CAP_{ijt-1} = 1$.

[23] The aggregate effects of critical capitalisation thresholds are modeled in von Peter (2009).

[24] A related finding in the bank lending channel literature is that expansionary monetary policy may be ineffective in stimulating loan growth among banks with low capitalisation (Kishan and Opiela, 2006).

during a crisis, especially among rescued banks. This important result is unlikely to be driven by the conditions authorities attached to the bank rescue packages. The conditions attached to recapitalisations were few and gentle, largely limited to restrictions on dividends and compensation, neither of which is likely to significantly influence loan growth. In contrast to the resolution of the Nordic banking crises in the 1990s, banks were not required to contract lending, nor to split or divest operations, subsidiaries or assets, with a few exceptions enforced by the European Commission (Borio et al., 2010). Only in France and the United Kingdom were banks receiving public capital encouraged to extend more loans (especially for housing, businesses, and local authorities). While the French banks in our sample did not reduce lending on average, the rescued banks grew less than non-rescued banks. UK banks contracted their loan book, the rescued banks more strongly so than the non-rescued banks. It is thus not apparent that the authorities enforced loan growth targets among rescued banks; the reaction of loan supply to (re)capitalisations was more likely driven by banks' own choices.

The last regression R9 in Table 8 includes, in addition to the macroeconomic control variables, the growth rate of central bank assets as a ratio over GDP to control for the unconventional monetary policies adopted during the crisis. We use the size of central bank balance sheets as the policy instrument since the distinguishing feature of unconventional policies is the active use of the central bank's balance sheet to affect market prices and conditions, so that these policies can also be referred to as balance sheet policies (Borio and Disyatat, 2010).

The provision of additional liquidity to commercial banks should attenuate the negative impact of the crisis on the supply of lending and captures the impact of countercyclical monetary policies on bank lending. Indeed, we find that the adoption of unconventional monetary policies has a positive impact on loan growth. It is worth noting that the inclusion of this additional control seems to properly disentangle the different monetary policy contributions, by increasing the magnitude and significance of the coefficient for the variable ΔIB_{t-1} representing conventional monetary policy via interest rates. The main results remain unaffected by the inclusion of the unconventional monetary policy measure.

6. Robustness

We examine the robustness of the results in several ways. The first test concerns the selection of the crisis period. We considered 2008–2009 above as the 2-year window comprising the most severe crisis years, centred on the bankruptcy of Lehman Brothers in September 2008. Early financial market turmoil started in summer 2007, albeit with a severity well below that of subsequent events. Similarly, in 2010 sovereign risk started to weigh on European banks in particular. We therefore run the regressions for alternative crisis windows.

The first four columns of Table 9 summarise the results, focusing on the specifications that use the macroeconomic control variables ΔGDP_{t-1} and ΔIB_{t-1}. For simplicity, we report only the coefficients associated with capitalisation on which our analysis is centred. Each column shows the results of two specifications: (i) *Crisis interactions* with a distinction between normal and crisis times ($C_t = 0$ or 1; $R_{ij} = 0$) and (ii) *Crisis and rescue interactions* with all possible distinctions ($C_t = 0$ or 1; $R_{ij} = 0$ or 1). For comparison, in the first column we reproduce the results from R6 and R8, where the crisis dummy 2008–2009 is used. The second column of Table 9 (regression R10) reports the results associated with the crisis dummy that spans over 2007–2009, while regressions R11 and R12 show the results for alternative crisis dummies spanning 2008–2010 or 2007–2010, respectively. The regressions overall indicate that our results are robust to the selection of the crisis period, i.e., regulatory capital is an important determinant of banking lending in normal times and, above a certain threshold, supports higher lending during a crisis, independently of the precise length of the crisis period window.

The second test was to check the robustness of the results with respect to different forms of support. As described in Section 2, generalised rescue measures were introduced not to support specific banks but to improve access to market funding for the banking industry as a whole and, as such, are subsumed into country-specific effects. To control for institutional changes at this level, notably the extension of deposit insurance schemes and new debt guarantee programmes, we insert an interaction term between the crisis period dummy and the country dummy in the specifications (Table 9, regression R13). This allows the model to take into account differences in generalised forms of support across countries during the crisis, including the fact that debt guarantee programmes were set up in some countries but not in others. The results in column R13 suggest that changes in generalised rescue measures at the country level leave our results on bank capitalisation unaffected.

Our third test examines whether demand controls are sufficient for insulating supply shifts. Demand conditions possibly changed during the crisis. We specifically control for this possibility only in those models with time-specific dummies (see regressions R5 and R7 in Table 8), whereas in the subsequent models the coefficients on ΔGDP and ΔIB could potentially differ between normal times and the crisis period. To test the reliability of our results on bank-specific characteristics in those models as well, we introduce interaction terms between macroeconomic variables and the dummy crisis. The coefficients on bank-specific characteristics, not reported for the sake of brevity, remain unchanged.

In a final check we investigate whether the results are affected by the composition of rescued banks, as there is a concentration of US entities in the sample (14 out of 44). We thus exclude US banks from the sample and re-run model R9. Even in this case, the results on bank capitalisation remain qualitatively unchanged.[25]

7. Conclusions

This paper examines whether the rescue measures adopted by the authorities during the global financial crisis helped to sustain the supply of bank lending. The analysis proposes a setup that allows us to test for structural shifts in the bank lending equation, and employs a novel dataset covering large international banks headquartered in 14 major advanced economies for the period of 1995–2010. By combining BankScope data with BIS international banking statistics, this approach focuses on the central role of international banks in the recent crisis, and goes beyond existing studies on the effectiveness of recapitalisations that typically look at single countries in a domestic context.

Our main results are as follows. Bank capitalisation plays an important role in supporting bank lending. The importance of capitalisation for loan supply differs in crisis and normal times, with an increasing marginal effectiveness of capital in a crisis. This important result is unlikely to be driven by the conditions authorities attached to the bank rescue packages. However, banks can

[25] The robustness of the results was further examined in a number of other ways not reported here to conserve space. These checks involved: (a) experimenting with different lags and instruments of the explanatory variables, (b) demeaning the bank-specific variables in different ways, (c) using housing and stock prices as additional controls for loan demand, (d) replacing lagged macroeconomic controls by contemporaneous variables, and (e) replacing regulatory capital with the equity ratio. These regressions are available from the authors upon request.

turn additional capital into greater lending only once their capitalisation exceeds a critical threshold; undercapitalised banks instead seek to restore their regulatory capital ratio without generating additional lending. This suggests that recapitalisations may not translate into greater credit supply until bank balance sheets are sufficiently strengthened to boost risk-weighted capital ratios.

References

Albertazzi, U., Gambacorta, L., 2010. Bank profitability and taxation. Journal of Banking and Finance 34, 2801–2810.

Arellano, M., Bond, S., 1991. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. Review of Economic Studies 58, 277–297.

Arellano, M., Bover, O., 1995. Another look at the instrumental-variable estimation of error-component models. Journal of Econometrics 58, 5–28.

Baltagi, B., 2005. Econometric Analysis of Panel Data. J Wiley & Sons, New York.

Basel Committee on Banking Supervision, 2010. Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems.

Bhattacharya, S., Nyborg, K., 2011. Bank Bailout Menus, CEPR Discussion Paper No 7906.

Berlin, M., Mester, L., 1999. Deposits and relationship lending. Review of Financial Studies 12, 579–607.

Berrospide, J., Edge, R., 2010. The effects of bank capital on lending: what do we know? and what does it mean? International Journal of Central Banking 6, 5–54.

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

Borio, C., Disyatat, P., 2010. Unconventional monetary policies – an appraisal. Manchester School 78, 53–89.

Borio, C., Vale, B., von Peter, G., 2010. The financial crisis: lessons from the Nordics. Moneda y Crédito 230, 7–48.

Committee on the Global Financial System (CGFS), 2011. The Impact of Sovereign Credit Risk on Bank Funding Conditions. CGFS Papers No 43.

Calem, P., Rob, R., 1999. The impact of capital-based regulation on bank risk-taking. Journal of Financial Intermediation 8, 317–352.

Cohen-Cole, E., Duygan-Bump, B., Fillat, J., Montoriol-Garriga, J., 2008. Looking Behind the Aggregates: A Reply to Facts and Myths About the Financial Crisis of 2008. Federal Reserve Bank of Boston Working Paper Series No 5.

Ehrmann, M., Gambacorta, L., Martinez Pagés, J., Sevestre, P., Worms, A., 2003. Financial systems and the role of banks in monetary policy. In: Angeloni, I., Kashyap, A., Mojon, B. (Eds.), Monetary Policy Transmission in the Euro Area. Cambridge University Press.

Ehrmann, M., Worms, A., 2004. Bank networks and monetary policy transmission. Journal of the European Economic Association 2, 1148–1171.

Gambacorta, L., 2005. Inside the bank lending channel. European Economic Review 49, 1737–1759.

Gambacorta, L., Mistrulli, P., 2004. Does bank capital affect lending behavior? Journal of Financial Intermediation 13, 436–457.

Gambacorta, L., Marques-Ibanez, D., 2011. Bank lending channel: lessons from the crisis. Economic Policy (April), 135–182.

Giannetti, M., Simonov, A., 2011. On the Real Effects of Bank Bailouts: Micro-Evidence From Japan. September 2011.

Goodhart, C., Schoenmaker, D., 2009. Fiscal burden sharing in cross-border banking crises. International Journal of Central Banking 5, 141–165.

Hasman, A., López, A., Samartín, M., 2011. Government, taxes and banking crises. Journal of Banking and Finance 35, 2761–2770.

Hyun, J., Rhee, B., 2011. Bank capital regulation and credit supply. Journal of Banking and Finance 35, 323–330.

Kashyap, A., Stein, J., 1995. The impact of monetary policy on bank balance sheets. Carnegie Rochester Conference Series on Public Policy 42, 151–195.

Kashyap, A., Stein, J., 2000. What do a million observations on banks say about the transmission of monetary policy. American Economic Review 90, 407–428.

Kashyap, A., Stein, J., Wilcox, D., 1993. Monetary policy and credit conditions: evidence from the composition of external finance. American Economic Review 83, 78–98.

King, M., 2009. Time to Buy or Just Buying Time? The Market Reaction to Bank Rescue Packages. BIS Working Papers No 288.

Kishan, R., Opiela, T., 2000. Bank size, bank capital, and the bank lending channel. Journal of Money, Credit, and Banking 32, 121–141.

Kishan, R., Opiela, T., 2006. Bank capital and loan asymmetry in the transmission of monetary policy. Journal of Banking and Finance 30, 259–285.

Matutes, C., Vives, X., 2000. Imperfect competition, risk taking, and regulation in banking. European Economic Review 44, 1–34.

McCauley, R., McGuire, P., von Peter, G., 2012. After the global financial crisis: from international to multinational banking? Journal of Business and Economics 64, 7–23.

McGuire, P., von Peter, G., 2012. The US dollar shortage in global banking and the international policy response. International Finance 15, 155–178.

Nickell, S., 1981. Biases in dynamic models with fixed effects. Econometrica 49, 1417–1426.

Panetta, F., Faeh, T., Grande, G., Ho, C., King, M., Levy, A., Signoretti, F., Taboga, M., Zaghini, A., 2009. An Assessment of Financial Sector Rescue Programmes. BIS Papers No 48.

Petrovic, A., Tutsch, R., 2009. National Rescue Measures in Response to the Current Financial Crisis. ECB Legal Working Paper No 8.

Philippon, T., Schnabl, P., 2009. Efficient Recapitalisation. NBER Working Papers No 14929.

Salas, V., Saurina, J., 2003. Deregulation, market power and risk behaviour in Spanish banks. European Economic Review 47, 1061–1075.

Shin, H., 2009. Securitisation and monetary policy. Economic Journal Lecture at the Royal Economic Society, Warwick, March 2008.

Shleifer, J., Vishny, R., 2010. Unstable banking. Journal of Financial Economics 97, 306–318.

Van den Heuvel, S., 2002. Does bank capital matter for monetary transmission? Federal Reserve Bank of New York Economic Policy Review, 1–7.

von Peter, G., 2009. Asset prices and banking distress: a macroeconomic approach. Journal of Financial Stability 5, 298–319.