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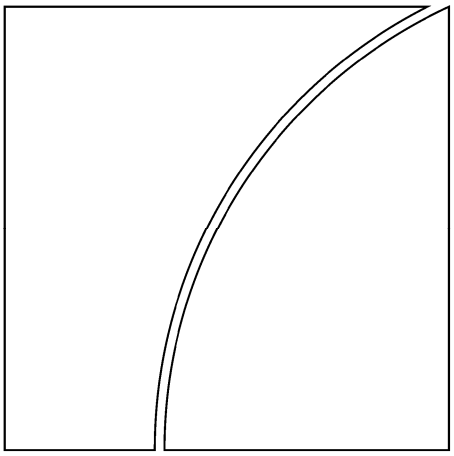

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Michael Brei, Leonardo Gambacorta and Goetz von Peter

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JEL classification: E44, G01, G21

Keywords: bank lending channel, monetary policy, financial crisis, rescue packages, recapitalisation.

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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.

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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 have helped banks maintain their intermediation capacity and avoid a contraction of credit supply to firms and households.

Against this backdrop, this paper analyses whether the rescue measures adopted by the authorities during the recent crisis 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 and 2000); Kishan and Opiela (2000); Van den Heuvel (2002); Berrospide and Edge (2010)).[1] In this paper, we extend the analysis to include the recent financial crisis experience. 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 official recapitalisations and other rescue measures 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 (see Ehrmann et al. 2003).

A second novelty is the use of a unique dataset covering large international banks headquartered in 14 major advanced 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 (2010) and references cited therein). To obtain consistent loan growth series for the entire period, it was necessary to adjust for 159 relevant merger and acquisitions that distort the underlying lending data from BankScope. In addition, we performed adjustments for currency valuation effects and weighed 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]

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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).

[2] The data are collected by BIS staff and subject to voluntary checks by member central banks. They comprise detailed information on rescue measures from primary (mostly public) sources in four main categories: deposit insurance schemes, capital injections, bank debt guarantees, as well as asset purchase and insurance measures.

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 Rescue packages and recapitalisations 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 was pricing in a greater likelihood of bank defaults. In the United States alone, 372 FDIC-insured banks failed, 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 general 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 sheer breadth of interventions.

The major countries afflicted by the crisis launched general 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 (sometimes to become unlimited). 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, ie available to all banks in a given jurisdiction on similar terms. By contrast, recapitalisations and asset purchase or insurance schemes were in most cases tailored to individual institutions.

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

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 programme[2]		(✓)	✓	(✓)	✓	✓	(✓)	✓–		(✓)	✓–		✓–	✓+

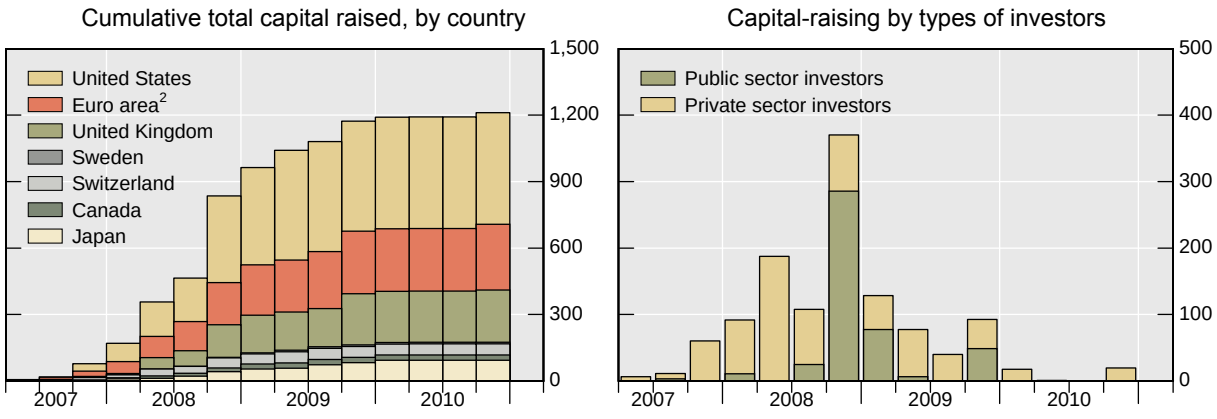
Note: (*) Shaded areas represent general bank rescue packages (or expanded deposit insurance schemes, respectively). Ticks indicate actual usage, ie specific actions taken either under the programme or as standalone actions. Example: the recapitalisation of UBS is shown as a tick in an unshaded area in the column "CH", since it was a standalone action (there was no general recapitalisation programme). AT = Austria; AU = Australia; BE = Belgium; CA = Canada; CH = Switzerland; DE = Germany; ES = Spain; FR = France; IE = Ireland; IT = Italy; JP = Japan; NL = Netherlands; SE=Sweden; UK = United Kingdom; US = United States.

[1] ✓ = guarantee on new issuance; ✓+ = guarantee also covers outstanding stock of debt. [2] ✓ = actual asset purchases or insurance; ✓– = asset insurance only; ✓+ = actual purchases and insurance; (✓) = asset purchases conducted as part of a programme for supporting key credit markets (rather than specific banks).

Sources: Central banks; government sources; press reports.

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 forms of support (deposit insurance and debt guarantees) either did not address solvency problems, or were deployed on very few institutions (asset purchases and insurance). In the presence of binding capital regulation, adequate capitalisation is also a necessary condition for lending. Moreover, recapitalisations can be more effective than other forms of rescue in many circumstances (Philippon and Schnabl (2009), and Hasman et al (2011). And, empirically, the institution-specific nature of recapitalisations helps identify their effectiveness in a cross-sectional analysis, in contrast to generalised deposit insurance and debt guarantee programmes available to all banks in a given jurisdiction (which are controlled for by country dummies below).

Figure 1: Bank capital-raising in the G10 economies



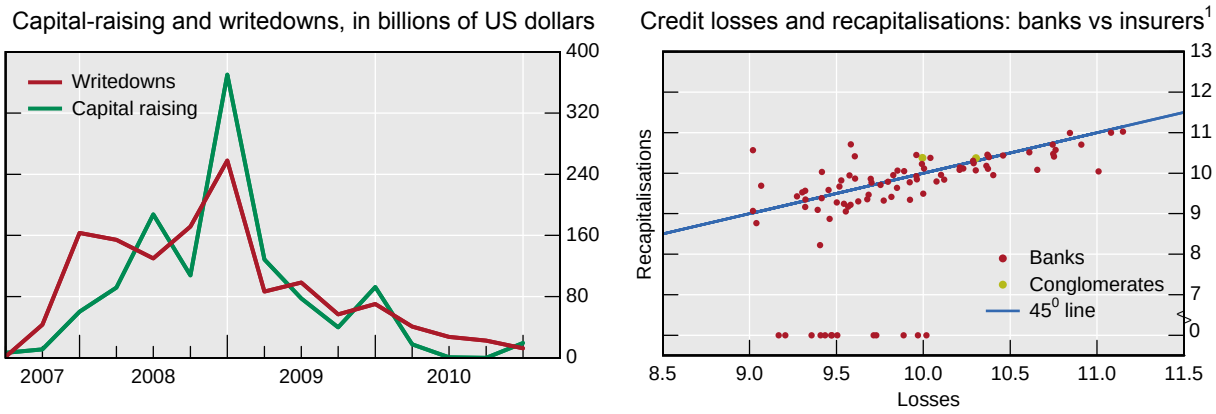
[1] In billions of US dollars; data up to 17 June 2011. [2] Belgium, France, Germany, Italy, Luxembourg and the Netherlands.

Sources: Central banks; Bloomberg; BIS calculations.

Since the beginning of the financial crisis, total recapitalisations have reached $1,380 billion, primarily within G10 economies (Figure 1, left-hand panel). North American banks have raised $515 billion and European banks $651 billion from private and public sources

combined (Bloomberg data). 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 (Figure 1, right-hand panel). Before that, banks had sought to match their early losses on mortgage-related structured products by issuing similar amounts of equity (Figure 2, left-hand panel). But following the Lehman bankruptcy, private investors largely retreated and the authorities intervened to prevent the collapse of major banks by making substantial capital injections from public sources.

Figure 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. The banks quoted on Bloomberg booked total credit losses of $1,508 billion, and recapitalisations of $1,380 billion.

Sources: Bloomberg; BIS calculations.

As the crisis proceeded, total credit losses eventually outpaced recapitalisations. Combined credit losses of $1,508 billion ($801 billion in North America) exceeded total recapitalisations of $1,318 billion ($515 billion in North America). However, there is substantial heterogeneity across banks, as shown in Figure 2 (right-hand 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 45º 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]

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 had been higher on average than for other banks (although not in the immediate build-up phase before 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

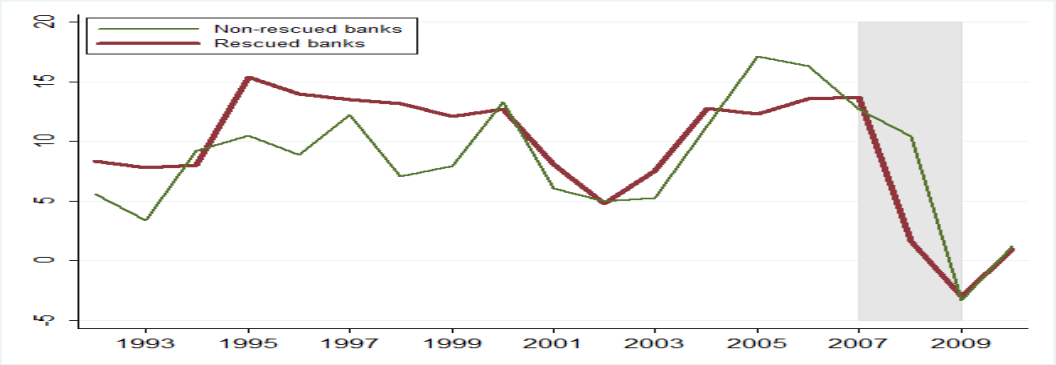
[4] These figures include realised and reported mark to market losses on credit instruments at those banks and brokerage houses quoted on Bloomberg that posted overall losses exceeding $1 billion (=$10^9$ in Figure 1).

[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.

showing a contraction of 3%. The subsequent recovery path into 2010 is identical across the two groups. In other words, rescued banks 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 Figure 3, suggests that the crisis period is centred on the years 2008–09; the subsequent difficulties encountered by banks during parts of 2010 (and 2011) were mostly related to the effects of sovereign risk on banks' funding conditions, and therefore more country-specific in nature, depending on a bank's exposure primarily to the home country sovereign (CGFS (2011)).

Figure 3: Loan growth of rescued and non-rescued banks compared, in %



The shaded area indicates the crisis period (2008–09). 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.

The research question this paper asks is whether bank capital was effective in sustaining bank lending during the crisis and, in particular, if recapitalisations of rescued banks were effective in sustaining credit supply. A bank recapitalisation helps 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 secure funding.[6] In the context of a *generalised* 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. 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 adjustments that would be unnecessary in a purely domestic context. The major banks run large international operations (Goodhart and Schoenmaker (2009); McCauley et al (2011)); 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

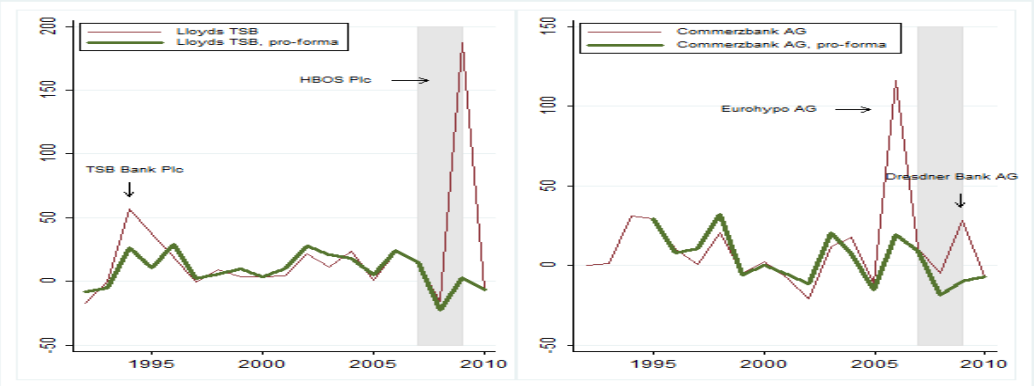
[6] Capital injections during the crisis were associated with a decline in CDS spreads on announcement (King (2009)).

Peter (2009))[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 the Brussels-based 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 as capitalisation is measured at the group level and official recapitalisations have typically been given to the consolidated entity rather than to subsidiaries (eg to Citigroup rather than to Citibank NA). 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.

Figure 4: Examples of M&A adjustment and the growth rate in lending[1]



[1] The line "*Lloyds TSB*" shows the growth rate of lending for the British bank *Lloyds TSB*, while "*Lloyds TSB, pro-forma*" indicates lending growth of the M&A-adjusted pro-forma bank of Lloyds TSB. The hikes in the original series indicate the impact of the acquisitions of *TSB Bank* and *HBOS* by *Lloyds TSB* on its growth rate of lending. The same logic applies to the example of the German *Commerzbank* and its acquisitions of *Eurohypo and Dresdner Bank*.

Source: BankScope; M&A database.

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 take-overs between banks.[9] The magnitude of this problem is such that it could introduce substantial noise into the regressions. Figure 4 illustrates the problem by contrasting growth rates in bank lending

[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 (2009)).

[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 than 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).

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 (see Appendix for details). 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' merger history based on 267 banks in total. The sample thus 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.

Table 2: Average bank features, by home country (1995–2010)[(1)]

Country	*Δln (loans) (Annual growth rate)*	*SIZE (logarithm of assets)*	*LIQ (% of total assets)*	*CAP (% of risk assets)*	*MFUND (% of total assets)*	*ASSETS (2009, bil. USD)*	*CURRENCY COMPOSITION*			*No. of banks*	*No. of M&A*	*No. of rescued banks*
							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	2,163	0.21	0.01	0.78	7	4	0
Belgium	10.1	5.9	18.2	12.3	52.3	1,926	0.16	0.84	0.00	3	7	3
Canada	5.9	5.2	28.1	12.0	35.4	2,381	0.29	0.03	0.68	6	3	0
Switzerland	5.4	4.7	37.8	16.3	45.0	2,455	0.60	0.23	0.17	5	5	1
Germany	5.1	5.2	29.6	11.4	65.9	6,319	0.15	0.84	0.01	15	6	2
Spain	14.9	4.0	12.1	12.6	42.6	3,958	0.20	0.80	0.00	14	14	2
France	9.3	6.6	36.9	11.2	60.8	6,281	0.19	0.79	0.02	6	13	5
Italy	11.3	4.1	21.9	10.8	52.3	3,345	0.08	0.92	0.00	12	35	6
Japan	-3.1	5.9	11.9	12.1	43.8	3,087	0.19	0.05	0.76	5	7	0
Netherlands	12.5	5.3	15.8	11.9	53.8	2,011	0.19	0.80	0.01	4	1	3
Sweden	8.9	5.2	14.7	11.0	64.1	1,606	0.08	0.40	0.52	4	5	1
United Kingdom	9.1	6.4	22.9	12.2	43.7	9,515	0.20	0.15	0.65	6	15	2
United States	7.8	5.1	14.5	12.9	28.5	9,185	0.93	0.05	0.02	16	39	14
*Average/sum**	8.9	5.1	21.2	12.0	49.7	54,923	0.25	0.49	0.26	108*	159*	44*

Note: (1) Unweighted averages across banks per country. "Average/sum*" indicates unweighted averages or sums (*) 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.

Sources: BankScope; BIS locational banking statistics by nationality.

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).[10] 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 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 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 (see Appendix).[11] 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 three 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, ie 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

[10] 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.

[11] Since the consolidated banking statistics are aggregated, the weighing 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.

eligible regulatory capital, including both Tier 1 and Tier 2 capital, over risk-weighted assets (C*AP*, in %).[12]

Table 3: Description of the dataset(1)

	Large	*Small*	*High liquid*	*Low liquid*	*High capitalised*	*Low capitalised*	*Rescued banks*	*Non-rescued banks*	*Total*
Number of banks	27	81	11	11	11	11	44	64	108
Mean growth rate of lending (2008–09)	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 (2008–09) 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)	1,686.44	221.22	1,132.09	115.06	212.88	417.09	812.39	432.93	587.52
Percentage of all 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
Percentage of all 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
Percentage of all 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
Percentage of all 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: (1) The sample period goes from 1995 to 2010 and includes 108 banks and 1,616 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.

Source: BankScope; national data.

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–

[12] 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%.

2007) and during the crisis (2008–09). 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 funding market shocks. Larger banks also received more support in the form of official recapitalisations (0.86% of total assets) than smaller ones did (0.51%). Rescued banks were on average twice the size of the remaining banks in the sample. Injections of public capital were provided to 44 banks (40% of banks in the sample). For these banks, the average official recapitalisation amounted to 1.43% of their total balance sheet.[13]

Even so, 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. Moreover, as shown in Figure 3, the growth rate of lending in 2010 was similar across the groups. This illustrates that descriptive statistics alone do not admit firm conclusions on the impact of rescue plans on bank lending. One might even claim that banks have been rescued *because* their loan portfolio had contracted. However, it is reasonable to assume 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 assess the effectiveness of interventions, since official recapitalisations raise bank capitalisation.[14]

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 (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 consider the following dynamic panel regression with bank-specific variables (X) and macroeconomic controls (Z):

$$\begin{aligned} L_{ijt} &= (\alpha + \alpha_i + \phi C_t) + \beta L_{ijt-1} + \gamma Z_{jt} + \\ &+ [\chi + \chi^* C_t] R_{ij} + \left[\delta + \delta^* C_t + (\varpi + \varpi^* C_t) R_{ij}\right] X_{ijt-1} + \varepsilon_{ijt}, \end{aligned} \tag{1}$$

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

The model in growth rates has been chosen because variables in levels are typically integrated of order one (as confirmed by the Im-Pesaran-Shin (2003) test for cross sectional

[13] 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.

[14] 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)).

variables and a standard Dickey Fuller test for the time series). This was also the approach used in the seminal paper by Kashyap and Stein (1995) to avoid the problem of spurious correlation.

The vector of controls, Z_{jt}, includes country- or 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 (GDP growth, Δ*GDP*; change in the three-month interbank rate, Δ*IB*) 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 (see Appendix). We also estimated specifications in which the macroeconomic controls are replaced by time-fixed effects.

The variable Δ*IB* represents changes in the monetary policy rate. Central banks have also taken 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 added to the regressors a rough proxy for unconventional policy measures, the growth rate of the ratio between each central bank's total assets and nominal GDP (Δ(*CB/GDP)*). We did not weight this variable for banks operating in different jurisdictions, because unconventional policy measures have been mainly directed towards domestic institutions.

Bank-specific characteristics included in matrix X_{ijt-1} are: bank size (*SIZE)*, liquidity (*LIQ)*, regulatory capital ratio (*CAP),* and market funding (*MFUND),* as defined before.[15] Bank-specific characteristics are lagged once (*t-1)* in order to mitigate a possible endogeneity problem. All bank-specific characteristics, except the dummies, have been 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, for model (1), the coefficient of the vector *X* or the dummies can be interpreted as the effects on the average bank.

To help test various hypotheses, the regression equation comprises two dummy variables. The crisis dummy C_t equals 1 in 2008–09 and zero otherwise[16], and is interacted with bank characteristics X_{ijt}. This two-year window comprises the most severe crisis years, centred on the Lehman bankruptcy.[17] The second dummy variable, R_{ij}, identifies rescued banks. Banks

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[15] The model also includes a one-off dummy that takes into account changes in accounting practices. Most countries (excluding Canada, Japan and the US) have changed accounting standards from the local Generally Accepted Accounting Practices (GAAP) to the International Financial Reporting Standards (IFRS) 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.

[16] 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 (Gianetti 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 whole sample) the introduction of the additional 1 in the dummy C_t for Japanese banks do not alter the results for the interaction variables $R_{ij}C_t$, $R_{ij}X_{ijt}$ and $R_{ij}C_tX_{ijt}$. This is also confirmed by the fact that results do not change if we introduce in the specifications a specific 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 and it allows us to increase degrees of freedom.

[17] The robustness section confirms that results remain unchanged for an alternative crisis window.

supported by direct official interventions, whether standalone or under a programme, are associated with the dummy $R_{ij} = 1$ (0 elsewhere).[18] 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 ($R_{ij}X_{ijt}$ and $R_{ij}C_tX_{ijt}$). 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 the jurisdiction *j* (eg extended deposit insurance, see Table 1).

There are three main hypotheses that equation (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), namely crisis versus normal times, as well as rescued versus non-rescued banks, respectively.

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	$\delta_1 + \delta^*_1$	$\delta_1 + \delta^*_1 + \varpi_1 + \varpi^*_1$

The first test involves looking at the statistical significance of the coefficients in the δ vector in equation (1). For example, the short-term impact on lending in response to a change in the first bank-specific characteristic 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). 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 is performed by looking at the statistical significance of the coefficients in the vectors 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 (i) 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 change in the effect of x_1 on lending is detected ($\delta^*_1 = 0$), 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 involves looking at the statistical significance of ϖ. If a bank that has been subsequently rescued in the crisis shows a greater responsiveness in

[18] Direct bank interventions in our dataset consist of official recapitalisations. Other bank-specific interventions, such as asset purchases or insurance, which were given to a strict subset of officially recapitalised banks, also raise capitalisation by reducing risk-weighted assets or by reducing tail risk, respectively.

its lending to bank capitalisation, 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 $\Delta L_{ijt} / \Delta x_{1ijt-1} = (\delta_1 + \delta_1^* + \varpi_1 + \varpi_1^*)/(1-\beta)$. If no structural change is detected (ϖ_1^*=0), then a rescued bank responds to its capitalisation during the crisis much as in normal times (or much as a non-rescued bank would, as under case (ii)).

Table 5: Summary statistics of the variables used in the regressions(1)

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	1,616	9.26	13.65	-43.26	83.78
L_t	Annual growth rate of lending, adjusted	1,616	10.23	16.25	-38.19	95.54
		Bank-specific characteristics in vector X				
$SIZE_{t-1}$	Logarithm of total assets	1,554	4.91	1.49	0.48	8.24
LIQ_{t-1}	Liquidity ratio	1,554	20.57	13.80	0.15	69.85
CAP_{t-1}	Regulatory capital ratio	1,255	11.97	2.53	3.00	28.50
CAP^2_{t-1}	Square of regulatory capital ratio	1,255	149.72	73.84	9.00	812.25
$MFUND_{t-1}$	Market funding ratio	1,531	47.93	18.10	9.91	96.25
		Macroeconomic controls				
ΔIB_{t-1}	Change in the three-month interbank rate adjusted	1,616	-0.32	1.20	-3.88	1.76
ΔGDP_{t-1}	Growth rate of GDP adjusted	1,616	4.19	2.51	-5.43	8.84
$\Delta(CB/GDP)_t$	Growth rate of central bank assets over GDP	1,611	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	1,616	0.41	0.49	0.00	1.00
C_t	Dummy that takes the value of 1 in the years 2008–09 and 0 otherwise. For Japanese banks, dummy also takes the value of 1 in 1997–2001	1,616	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.	1,616	0.30	0.46	0.00	1.00

Note: (1) The sample period goes from 1995 to 2010. "Annual growth rate of lending, adjusted" refers to the adjustment of loans for the currency adjustment based on the location of international claims of banks per country on a consolidated basis (see Table 3). "Change in the three-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.

Source: BankScope; national data.

The relationship between bank lending and capitalisation may be not 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 coverage of bankruptcy costs by deposit insurance.[19] Bank risk-taking is very high for low level of capitalisation, then it decreases as capital increases up to a critical level of capitalisation at which each additional unit of capitalisation again increases risk-taking. In order to capture this non-linearity, we have introduced a quadratic term for capitalisation in equation (1).

Summary statistics of the specific variables used in the regressions are reported in Table 5.

The first part of Table 6 provides a summary of 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, Stein and Wilcox (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 OLS with bank-fixed effects. In each case, we control for demand effects in two alternative ways, 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 for 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 mostly cover the major bank holdings. 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) and 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 Beaver (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 change in the interbank rate).

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

Table 6: Expected signs in the regressions and summary of GMM results(1)

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 & rescued bank interaction Time FE	R8 Crisis & 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 (+)							
CAP²	Square of regulatory capital ratio	+/−	Banks with capital above the regulatory minimum (buffer stock) are more likely to expand supply of loans…							
*CAP²*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 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*		+/−	”					− − −	− − −	− − −
*CAP²*R*	Square of reg. capital	+/−	”							
*CAP²*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 on 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 the traditional intermediation market (−)							
*C*R*	Interaction crisis and rescued banks	−	Banks rescued in the crisis have been capital-constrained (−) and faced tighter conditions on 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: (1) The sample period runs from 1995 to 2010. Shaded areas in grey on the right-hand side of the table 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[1]

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: OLS–FE*		R4 *Macro variables Estimator: OLS–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								
No. banks and obs.	108	1,225	108	1,225	108	1,225	108	1,225
Hansen test (p-val); R^2	0.358		0.112		0.151		0.106	
AR(1). AR(2) (p-val)	0.000	0.245	0.000	0.154				

Note: (1) The sample period goes from 1995 to 2010. "S-GMM" refers to estimations using the Arellano and Bover (1995) system GMM estimator and "OLS-FE" to the OLS-fixed effects 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 OLS-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 1%, 5%, and 10% level.

The results show that bank size has a significant negative effect on lending during 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 OLS-fixed effects are reported in columns 3–4. 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 OLS-fixed effects do not allow us to specify country-fixed effects because of the collinearity with bank-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 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) and Gambacorta (2005)). In general, however, the information content of bank size is quite limited, once other factors are controlled for.

Table 8: Regression results – Crisis and rescue interactions(1)

Dep. variable: annual growth of lending L_t	R5 *Crisis Time-fixed effects*		R6 *Crisis Macro variables*		R7 *Crisis & rescue Time-fixed effects*		R8 *Crisis & rescue Macro variables*		R9 *Crisis & 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										
No. banks and obs.	108	1,225	108	1,225	108	1,225	108	1,225	108	1,225
Hansen	0.531		0.638		0.376		0.496		0.505	
AR(1). AR(2)	0.000	0.078	0.000	0.113	0.000	0.055	0.000	0.078	0.000	0.087

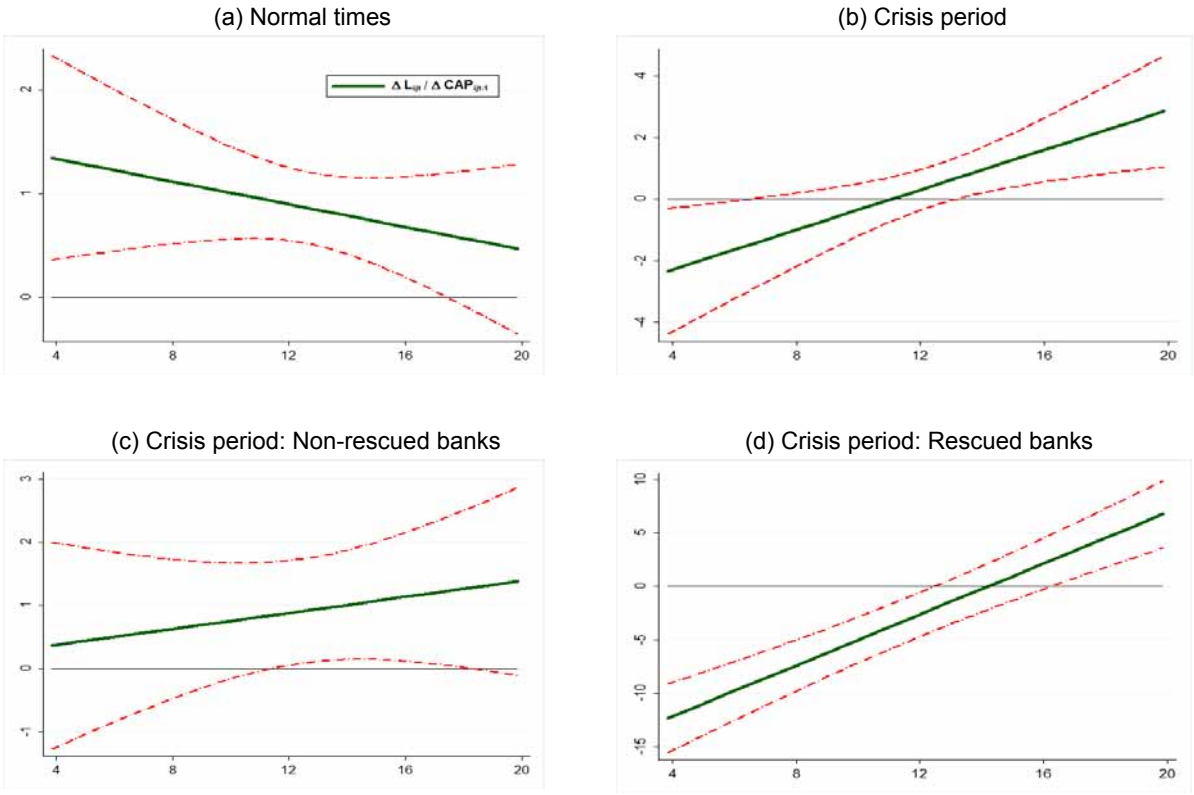
Note: (1) The sample period goes from 1995 to 2010. All estimations are based on the Arellano and Bover (1995) system GMM estimator. Robust standard errors are reported. (***, **, *) indicate significance at the 1%, 5%, and 10% level.

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, other things being equal, more lending. 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 raise funding. Consequently, banks' incentives and ability to lend are also likely to be more sensitive to investors' perceptions and overall financial market conditions than in the past, when banks were overwhelmingly funded via bank deposits.[20]

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 and 1999); Kishan and Opiela (2000)). In particular, the baseline regression suggests that a 1 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 link between bank capital and supplied lending will be investigated in depth below.

Figure 5: Bank lending reaction to changes in bank capitalisation[1]



[1] The 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.

In the presence of a crisis, the link between bank-specific characteristics and bank lending may well change. 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

[20] This is mainly because deposits tend to be a relatively "sticky" source of funding and by definition less dependent on financial market conditions than tradable instruments (see Berlin and Mester (1999); Shleifer and Vishny (2009)).

shown in regressions R5 and R6. The coefficients related to normal times remain unchanged and highly significant. The global financial crisis had a significant 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 (Figure 5, panel (a)). At the same time, this contribution is decreasing in marginal terms. This means that the positive impact of greater capitalisation on bank lending is higher for less-capitalised banks and lower for those banks already reporting a high level of capital. 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 in a crisis. In the crisis state, raising capitalisation has an increasingly positive effect on bank lending (Figure 5, panel (b)). A one percentage point increase in capitalisation for the average bank raises lending by around 0.4% each year, against roughly 0.9% in normal times.[21] 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 additional lending. In that segment, extra capitalisation is particularly beneficial when capital overall is scarce in a crisis.

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 rescued banks. In particular, a 1 percentage point 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. Panel (c) and (d) of Figure 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 positive only once their capitalisation exceeds a threshold (10% in a 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

[21] Recall that all bank-specific characteristics are demeaned, and thus bank capitalisation for the average bank equals zero. From the coefficients reported in regression R6 in Table 8, this implies that a one percentage increase in the capitalisation 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 $\Delta CAP_{ijt-1}=1$.

would only make the growth rate of lending less negative than would have been the case without recapitalisation. Capital injections to those banks 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.[22] On theoretical grounds, this result is in line with Bhattacharya and Nyborg (2011); they highlight that a recapitalisation, to be effective, should be large enough to overcome banks' debt overhang problem. 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.[23]

The importance of capitalisation for loan supply thus differs in crisis and normal times, with increasing marginal effectiveness during a crisis, especially among rescued banks. This important result is unlikely to be driven by the conditions authorities attached to the support packages. The conditions attached to recapitalisations were few and gentle, largely limited to restrictions on dividends and compensation, neither of which is likely to influence substantially 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)). Conversely, only in France and the United Kingdom were banks receiving public capital strongly 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 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 discussed before remain unaffected by the inclusion of the measure for unconventional monetary policy.

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[22] The aggregate effects of such critical capitalisation thresholds are modelled in von Peter (2009).

[23] 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)).

6 Robustness

In this section, we perform a number of robustness checks concerning the selection of the crisis period and the measurement of bank capitalisation. Regarding the selection of the crisis period, we considered 2008–09 above as the two-year window comprising the most severe crisis years, centred on the bankruptcy of Lehman Brothers in September 2008. Early

Table 9: Robustness checks on the definition of the crisis dummy(1)

Dependent variable: Annual growth rate of lending L_t	*R6, R8* *Crisis 2008–09*		*R10* *Crisis 2007–09*		*R11* *Crisis 2008–10*		*R12* *Crisis 2007–10*	
	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
$CAP_{t-1}*C$	-0.651	0.547	-0.336	0.418	-0.556	0.518	-0.266	0.414
CAP^2_{t-1}	-0.027	0.041	-0.020	0.042	-0.027	0.042	-0.018	0.043
$CAP^2_{t-1}*C$	0.190**	0.086	0.123*	0.084	0.140*	0.086	0.093	0.086
(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
$CAP_{t-1}*C$	0.210	0.664	0.630	0.459	-0.053	0.659	0.465	0.501
CAP^2_{t-1}	-0.016	0.042	-0.005	0.042	-0.017	0.043	-0.001	0.045
$CAP^2_{t-1}*C$	0.047	0.067	0.011	0.077	0.033	0.079	0.006	0.085
$CAP_{t-1}*R$	0.773	0.522	0.939*	0.501	0.674	0.574	0.975*	0.561
$CAP_{t-1}*C*R$	-3.564***	1.151	-3.454***	0.766	-2.069*	1.080	-2.503***	0.766
$CAP^2_{t-1}*R$	0.147	0.115	0.144	0.118	0.174	0.112	0.140	0.119
$CAP^2_{t-1}*C*R$	0.449***	0.162	0.354**	0.146	0.174	0.149	0.172	0.153
Summary statistic								
Observations	1,225		1,225		1,255		1,255	
Hansen statistic								
(i) Crisis interactions	0.638		0.348		0.374		0.205	
(ii) Crisis and rescue interactions	0.496		0.241		0.432		0.232	

Note: (1) 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 "*CAP²*" resulting from three 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 the specification R10, the crisis dummy is equal to 1 during 2007–09. In the specification R11 the crisis dummy is equal to 1 during 2008–10. In the specification R12 the crisis dummy is equal to 1 during 2007–10. The Arellano and Bover (1995) system GMM estimator has been used. Robust standard errors are reported. (***, **, *) indicate significance at the 1%, 5%, and 10% level.

financial market turmoil started in summer 2007, albeit with a severity well below that of subsequent events. Similarly, sovereign risk started to weigh on banks in 2010. We therefore check the robustness of our previous results by running the regressions for different crisis windows.

Table 9 summarises 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 2008–09 was used. The second column of Table 9 (regressions R10) reports the results associated with the crisis dummy that spans over 2007–09, while the last two columns (regressions R11 and R12) show the results for crisis dummies that spans over 2008–10 or 2007–10.

The regressions overall suggest that our results are robust to the selection of the crisis period, ie regulatory capital is an important determinant of banking lending in normal times and, above a certain threshold, it supports higher lending during a crisis, independently of the precise length of the crisis period window.[24]

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 impact of capital in a crisis. This is an important result, and one not likely to be driven by the conditions authorities attached to the support packages. However, banks can 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.

[24] The robustness of the results has been demonstrated in a number of other ways not reported here to save space. These checks involve: (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) interacting the macroeconomic variables with the crisis dummy, (e) replacing regulatory capital with the equity ratio, and (f) using different estimators. These regressions are available from the authors upon request.

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Appendix

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. This allows us take into account 159 mergers and acquisitions at the bank holding level. 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.[25] This procedure creates a single pro-forma bank for each pair of banks prior to their merger. This amounts to an assumption that mergers took place at the beginning of the sample period. For example, if bank A is taken over by bank B at time t, bank B is reconstructed backward as the sum of the merging banks prior to the merger. We only took into account mergers and acquisitions involving majority stakes, in line with the requirement for full consolidation, under IFRS, when a bank owns more than 50% of voting shares of another entity.

The merger-adjusted sample includes 108 large banks, comprising commercial and cooperative banks headquartered in the G10 countries plus Austria, Australia and Spain:[26] Australia (7), Austria (5), Belgium (3), Canada (6), France (6), Germany (15), Italy (12), Japan (5), Netherlands (4), Spain (14), Sweden (4), Switzerland (5), United Kingdom (6) and the United States (16). Banks were selected in descending order of size, until coverage reached at least 80% of the domestic banking system in each country. In aggregate, total bank assets sum to $63 trillion at end-2007, covering close to 70% of worldwide banking assets reported in *The Banker magazine* for the Top 1000 banks.

Turning to the macroeconomic variables, the monetary policy rate is the three-month interbank rate. This measure, unlike the interest rate on the main refinancing operations, captures the effects of the recent credit crisis on the actual cost of bank refinancing.[27] GDP is expressed in nominal terms. Both indicators are taken from the IMF's international financial statistics. Given the international scope of the banks in the sample, we performed two further adjustments. The first is to remove spurious loan growth fluctuations arising from valuation effects on positions denominated in currencies other than the dollar, as described in the text. A second adjustment weighs the macroeconomic variables using aggregate country information on the destination of bank credit. For this purpose, we use the BIS consolidated banking statistics on an ultimate borrower basis, which allow us to track the foreign claims of a banking system vis-à-vis other countries. The advantage of using the ultimate borrower concept is that the final credit counterparty is identified regardless of where loans are booked (eg a German bank lending out of London to General Motors is recorded as a German bank's claim on a private US entity). The adjusted series is calculated as an average of the country-specific macroeconomic variables, weighted by the credit a particular banking system directs to the respective countries as a share of its total assets. Table A1 shows the implied weights for the year 2007, where rows indicate bank nationalities, and columns show ultimate borrower countries. Table A2 reports the correlation matrix between the variables included in the regressions.

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[25] When the acquired banks reported only over a short time horizon in BankScope, the aggregation of financial statements has been avoided.

[26] The number of banks per country is indicated in brackets.

[27] We also tried other measures of monetary policy rates with a lower maturity (overnight, one-month) and results remain unchanged.

Appendix Table A1: Bank assets, by banking system and ultimate borrower[1]

Nationality of headquarters	Location of ultimate borrower															
	Austria	*Australia*	*Belgium*	*Canada*	*Switzer-land*	*Germany*	*Spain*	*France*	*Italy*	*Japan*	*Nether-lands*	*Sweden*	*United Kingdom*	*United States*	*Other*	*Sum*
Austria	**78.40**	0.12	0.19	0.07	0.38	2.44	0.33	0.41	1.04	0.05	0.63	0.07	1.08	1.17	13.62	100.00
Australia	0.02	**82.77**	0.08	0.14	0.15	0.50	0.09	0.46	0.12	0.07	0.39	0.01	4.17	1.59	9.44	100.00
Belgium	0.33	0.46	**38.67**	0.29	0.60	3.78	2.00	5.64	2.52	0.21	11.57	0.17	8.22	8.28	17.26	100.00
Canada	0.07	0.64	0.19	**70.25**	0.15	0.71	0.18	0.54	0.14	0.20	0.35	0.09	4.00	16.76	5.73	100.00
Switzerland	0.45	0.99	0.59	0.58	**32.78**	3.78	0.80	2.15	1.00	4.60	1.31	0.22	8.80	26.80	15.15	100.00
Germany	1.09	0.62	0.53	0.41	0.69	**58.69**	2.77	2.16	2.34	0.79	1.62	0.40	7.39	8.05	12.45	100.00
Spain	0.07	0.07	0.35	0.05	0.13	1.17	**73.06**	1.43	0.79	0.09	1.25	0.08	7.57	3.32	10.57	100.00
France	0.32	0.67	1.35	0.34	0.87	3.11	2.27	**57.19**	5.76	1.99	1.74	0.21	4.82	8.32	11.04	100.00
Italy	2.94	0.05	0.24	0.05	0.34	8.96	0.65	1.13	**70.49**	0.12	0.66	0.06	1.47	1.38	11.46	100.00
Japan	0.09	0.60	0.25	0.47	0.26	1.69	0.30	1.37	0.54	**77.99**	0.59	0.15	1.66	8.57	5.47	100.00
Netherlands	0.24	1.93	3.62	0.89	0.56	4.38	2.88	3.78	3.20	1.20	**47.25**	0.33	7.88	11.04	10.82	100.00
Sweden	0.10	0.15	0.18	0.11	0.15	2.98	0.38	0.47	0.16	0.02	0.55	**72.23**	1.98	2.00	18.54	100.00
United Kingdom	0.13	1.56	0.57	1.01	0.55	1.96	1.26	2.94	0.91	1.24	1.49	0.24	**59.85**	12.21	14.08	100.00
United States	0.07	0.51	0.18	0.69	0.24	1.06	0.42	0.72	0.36	1.29	0.61	0.12	3.14	**83.11**	7.48	100.00

Note: (1) Each row shows that banks headquartered in a particular country (nationality) hold claims on borrowers in their home country (diagonal elements) *and* on borrowers in other jurisdictions (columns), and expresses these vis-à-vis country exposures as shares of total assets at end-2007. (For example, the number 3.1 in row *France* and column *Germany* means that 3.1% of French banks' total assets consist of claims on German borrowers). To simplify the construction of the weighted macroeconomic indices, exposures on countries outside the sample (column *Other*) are added to home country exposures.

Source: BankScope; BIS consolidated banking statistics on an ultimate risk basis, own calculations.

Appendix Table A2: Correlation matrix of the regression variables[1]

	L_{t-1}	$SIZE_{t-1}$	LIQ_{t-1}	CAP_{t-1}	$MFUND_{t-1}$	ΔIB_{t-1}	ΔGDP_{t-1}	R	C_t	$IFRS_t$
L_{t-1}	1.00									
$SIZE_{t-1}$	-0.178	1.00								
	0.00									
LIQ_{t-1}	-0.12	0.30	1.00							
	0.00	*0.00*								
CAP_{t-1}	-0.10	-0.16	0.14	1.00						
	0.00	*0.00*	*0.00*							
$MFUND_{t-1}$	-0.03	0.20	0.34	-0.22	1.00					
	0.15	*0.00*	*0.00*	*0.00*						
ΔIB_{t-1}	0.24	0.01	-0.04	-0.04	-0.02	1.00				
	0.00	*0.03*	*0.00*	*0.00*	*0.00*					
ΔGDP_{t-1}	0.36	-0.16	-0.17	-0.01	-0.17	0.60	1.00			
	0.00	*0.03*	*0.00*	*0.00*	*0.00*	*0.00*				
R	-0.01	0.21	0.03	-0.07	-0.01	-0.02	-0.05	1.00		
	0.37	*0.00*	*0.38*	*0.29*	*0.28*	*0.63*	*0.27*			
C_t	-0.16	-0.04	-0.01	0.01	0.03	-0.18	0.45	-0.01	1.00	
	0.00	*0.17*	*0.02*	*0.00*	*0.02*	*0.00*	*0.00*	*0.98*		
$IFRS_t$	0.12	-0.01	0.07	-0.16	0.35	0.06	-0.12	-0.01	0.34	1.00
	0.00	*0.49*	*0.00*	*0.18*	*0.00*	*0.00*	*0.00*	*0.96*	*0.00*	

Note: (1) The sample period goes from 1995 to 2010. The numbers in Italics indicate p-values of a significance test associated with the correlation coefficient of the two respective variables.